

# Manual

## Software SI-LCC-Scope V5.0

(PC software for Microsoft® Windows® 7, 8, 10)

for Laser Copy Counters

LCC-30

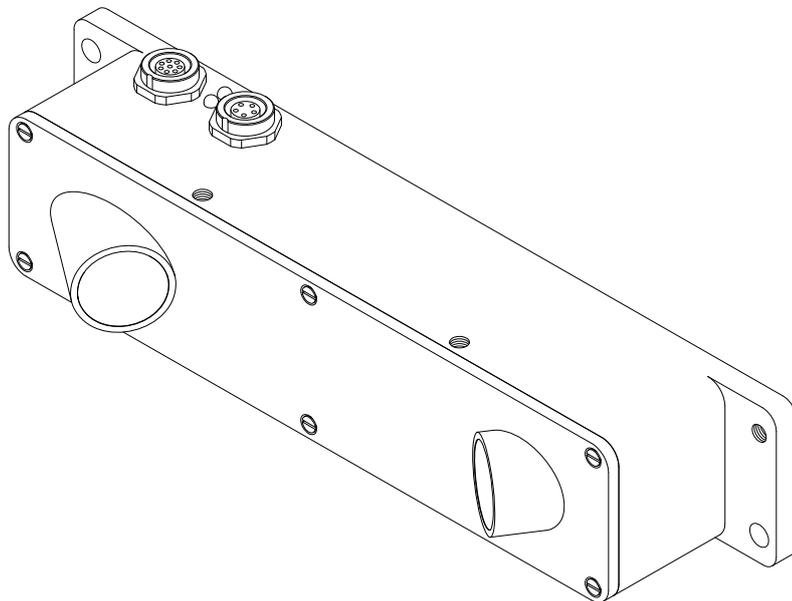
LCC-40

LCC-80

LCC-90

LCC-130

LCC-CON1



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**Shortcuts:**

GETBUFF	F8
SEND	F9
GET	F10
GO	F11
STOP	F12

## 1. Introduction

The Laser Copy Counter LCC-... (LCC-30, LCC-40, LCC-80, LCC-90, LCC-130, LCC-CON1) primarily is designed for detecting and counting magazines or single sheets in imbricated arrangement.

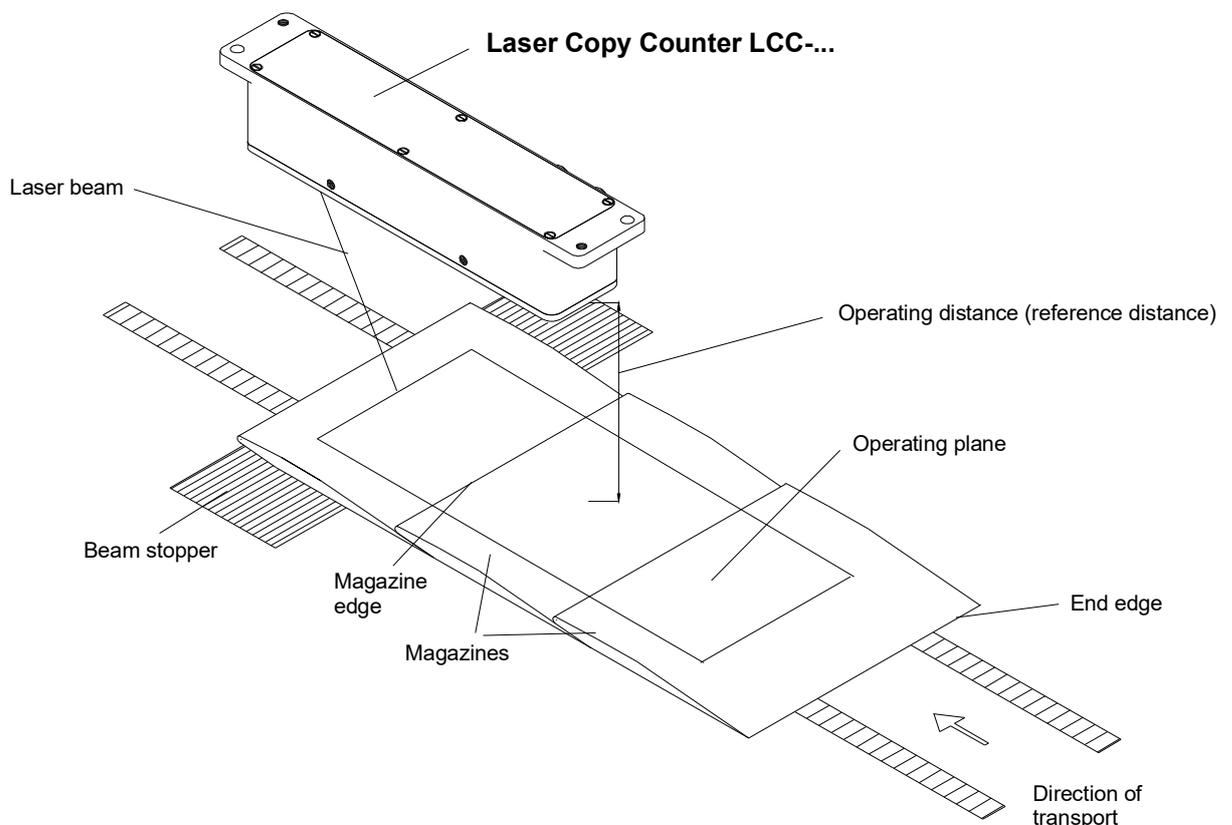
In its optimum operating range (e.g. 30 mm when LCC-30) sheet edges starting from 0.1 mm are reliably detected.

In the sensor design great importance was attached not only to reliable operation, but also to ease of operation and installation.

The sensor is characterised by a high scanning frequency and by its ability to automatically adjust itself to differently bright and dark, as well as slow and fast objects; with a minimally set output pulse length (adjustable via software) it reaches a copy rate of approx. 500,000 pieces/hour!

Furthermore the sensor can be used for almost all conceivable applications by selecting optimised software algorithms.

The user is provided with a Windows® user interface that displays the sensor signals in numerical and graphical form; it also allows a comfortable selection of different software algorithms and easy parameter input.



**Picture 1: Application example for the Laser Copy Counter**

## 2. Installation

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### 2.1 Mounting

- The sensor should be mounted in such a way that – as shown in pic. 1 – the operating distance is approx. the reference distance in mm on average! The longitudinal axis of the sensor is parallel to the direction of magazine transport; the laser beam must be aligned opposite to the direction of feed in such a way that it faces the magazine or single sheet edges that are to be counted.
- A copy is counted when an edge facing the laser beam is moved through the beam. End edges (edges facing away from the laser beam) are not counted.

Mounting recommendations:

Mounting distance:	LCC-30	30 mm
(object <-> sensor)	LCC-40	40 mm
	LCC-80	80 mm
	LCC-90	90 mm
	LCC-130	130 mm
	LCC-CON1	individually adjustable (max. 200 mm to the object)

Inclination tolerance: Max.  $\pm 5^\circ$  with respect to the operating plane  
(The operating plane lies parallel to the direction of feed of the magazines).

Beam stopper: Should be mounted close to the conveyor belt and parallel to the operating plane. When there is no object, the laser beam should impinge on a bright, dull background (white paper or dull metal surface).

In sophisticated applications with edge jumps  $< 0.1$  mm, or when thin, transparent foils are to be detected, the beam stopper / background and the sensor must not be subject to any machine-related vibrations. For such applications non-vibrating and sturdy mounting is of special importance.

## 2.2 Electrical connection

...0V (GND)	Pin1 (white)	at 8-pole circular connector (series 712)
+24VDC ±10%	Pin2 (brown)	at 8-pole circular connector (series 712)

Assignment of the 8-pole circular connector type Binder series 712:

Pin No.	Colour	Assignment	Description
1	white	0V (GND)	Ground, 0V
2	brown	+24VDC ± 10%	Supply voltage
3	green	IN0	Synchronisation input
4	yellow	IN1	Synchronisation input
5	grey	OUTØ	Counting pulse
6	pink	OUT1	Dead time / active window
7	blue	n.c.	Not connected
8	red	n.c.	Not connected

When the +24VDC ± 10% supply voltage and 0V are applied to the corresponding cable colours, the laser beam should become visible, and a supply current of 150 mA should not be exceeded.

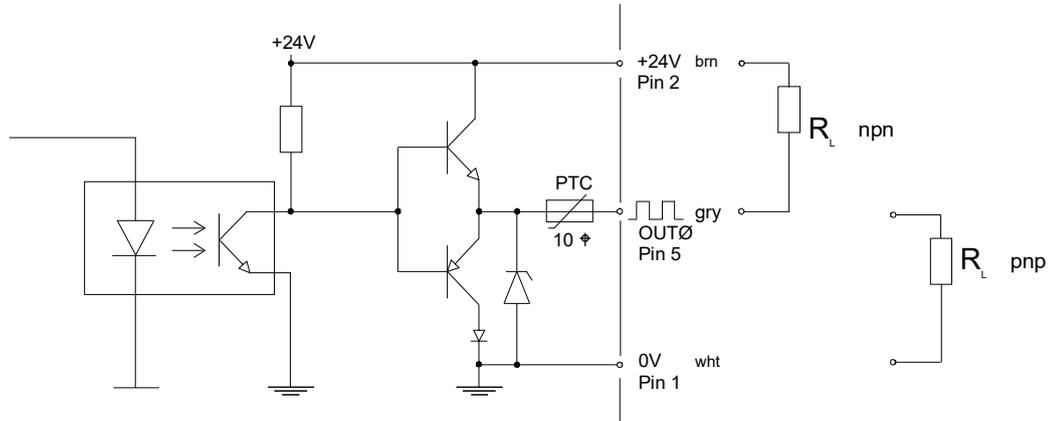
The yellow light emitting diode displays the status of the counting pulse output:  
 Yellow LED lights up: output OUT0 = +24V, yellow LED is off: OUT0 = 0V.

When mechanical installation and electrical commissioning are finished, please make sure that the viewing windows (red glass covers) are clean. If there should be finger prints, remove them with a soft and clean cloth; if the glass covers are very dirty, clean them with alcohol.

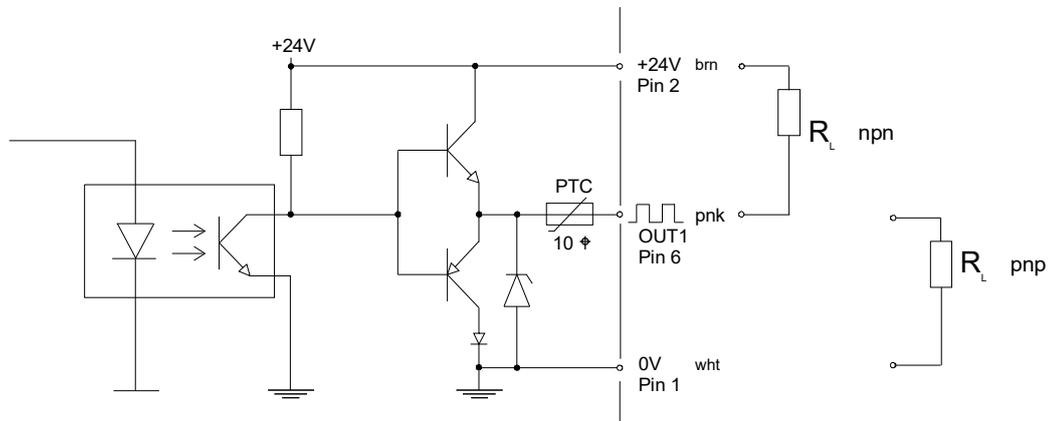
Since the laser is operating and emits light when the electrical connection has been established, please take care not to look into the beam!

### 2.3 Outputs

OUTØ Counting pulse    Pin5 (grey) at 8-pole circular connector (series 712)  
 OUT1 Opt. output        Pin6 (pink) at 8-pole circular connector (series 712)



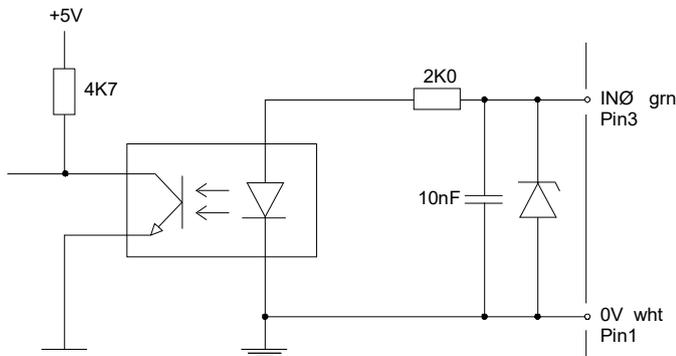
**Picture 2: Output OUTØ, max. 100mA (counting pulse)**



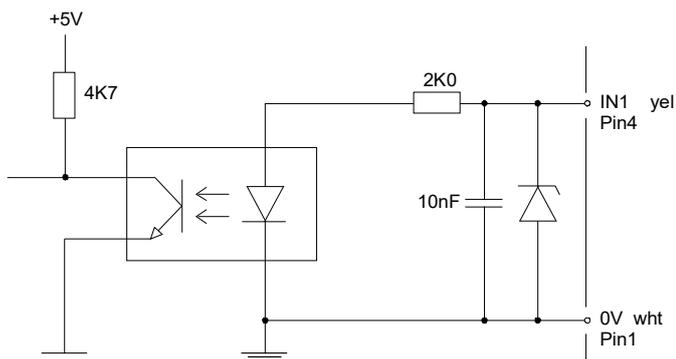
**Picture 3: Output OUT1, max 100 mA (dead time)**

## 2.4 Inputs

INØ	Synchronisation input	Pin3 (green)	at 8-pole circular connector (series 712)
IN1	Synchronisation input	Pin4 (yellow)	at 8-pole circular connector (series 712)



**Picture 4: Synchronisation input INØ for TRIGGER measurement (see software manual)**

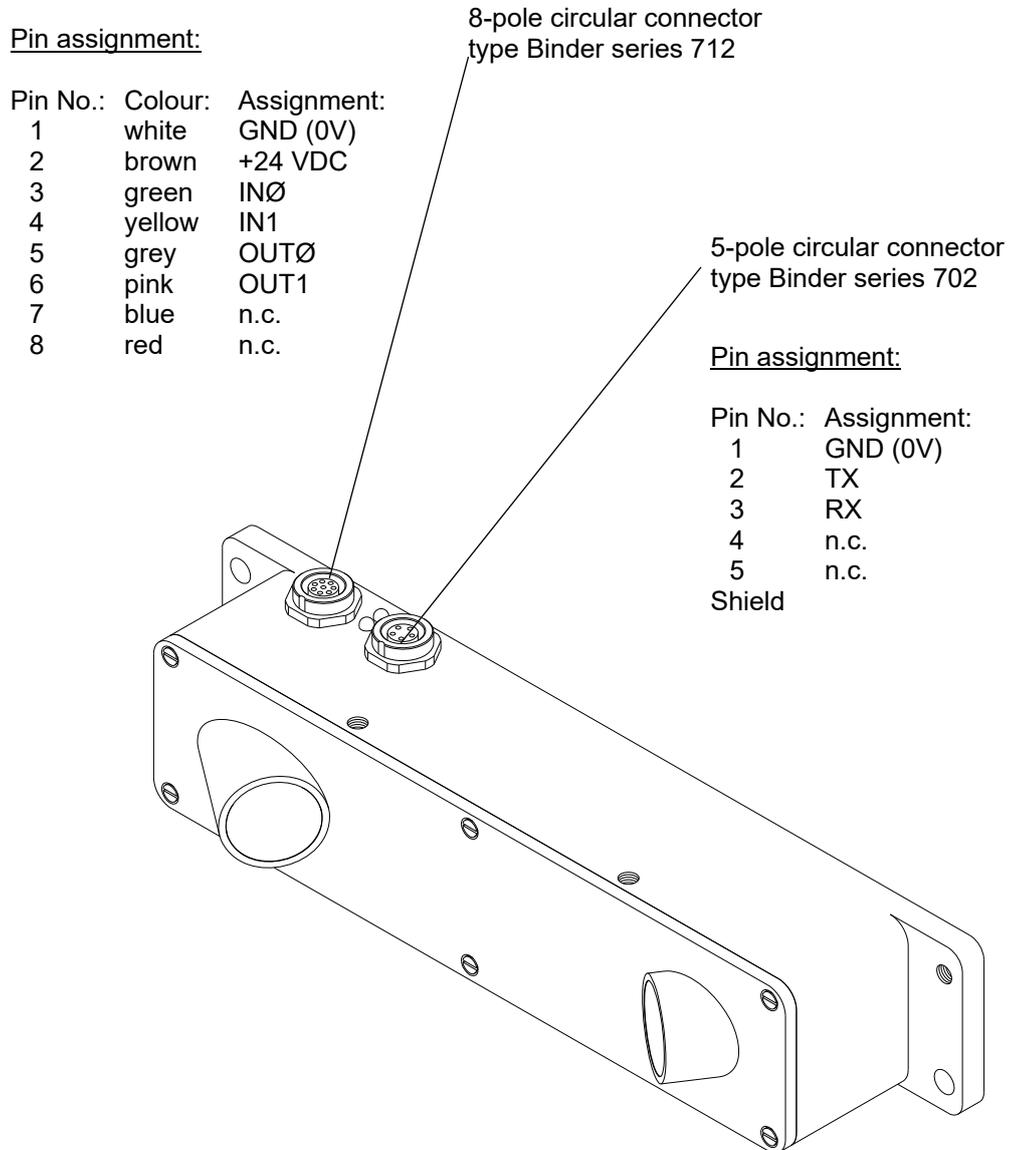


**Picture 5: Synchronisation input IN1 for TRIGGER measurement (see software manual)**

## 2.5 Cleaning the optical unit

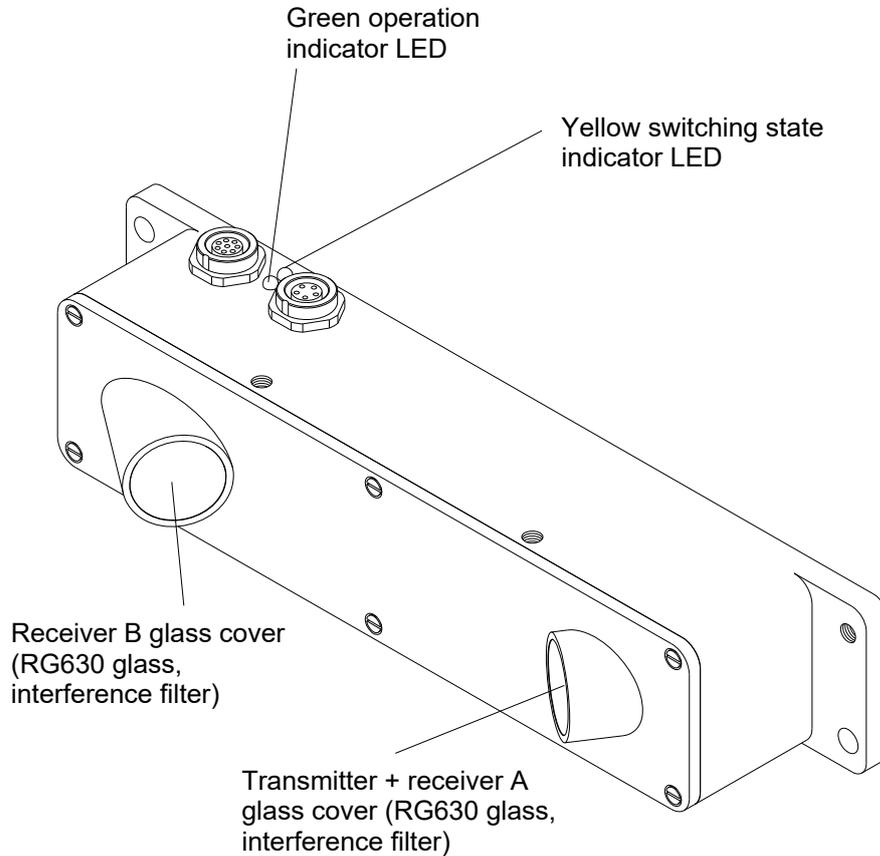
A reliable detection of smallest object edges can only be guaranteed, if the two openings of the optical unit are kept free of finger prints and other dirt accumulations. It is recommended to use lens or spectacles cleaning cloths!

### 3. Connector assignment



**Picture 6: Connector assignment**

## 4. Control elements



Picture 7: Control elements

### 4.1 Switching state indicator LED

The yellow LED provides information about the switching state at output OUTØ; when an edge is detected, the switching state at output OUTØ changes from LOW (0V) to HIGH (+24V) or vice versa, in accordance with software parameter OUTMODE, for a preset time (adjustable by means of DIP switches); the LED accordingly changes from OFF to YELLOW or from YELLOW to OFF.

OUTØ = HIGH → LED = YELLOW

The green LED is for operation indication.

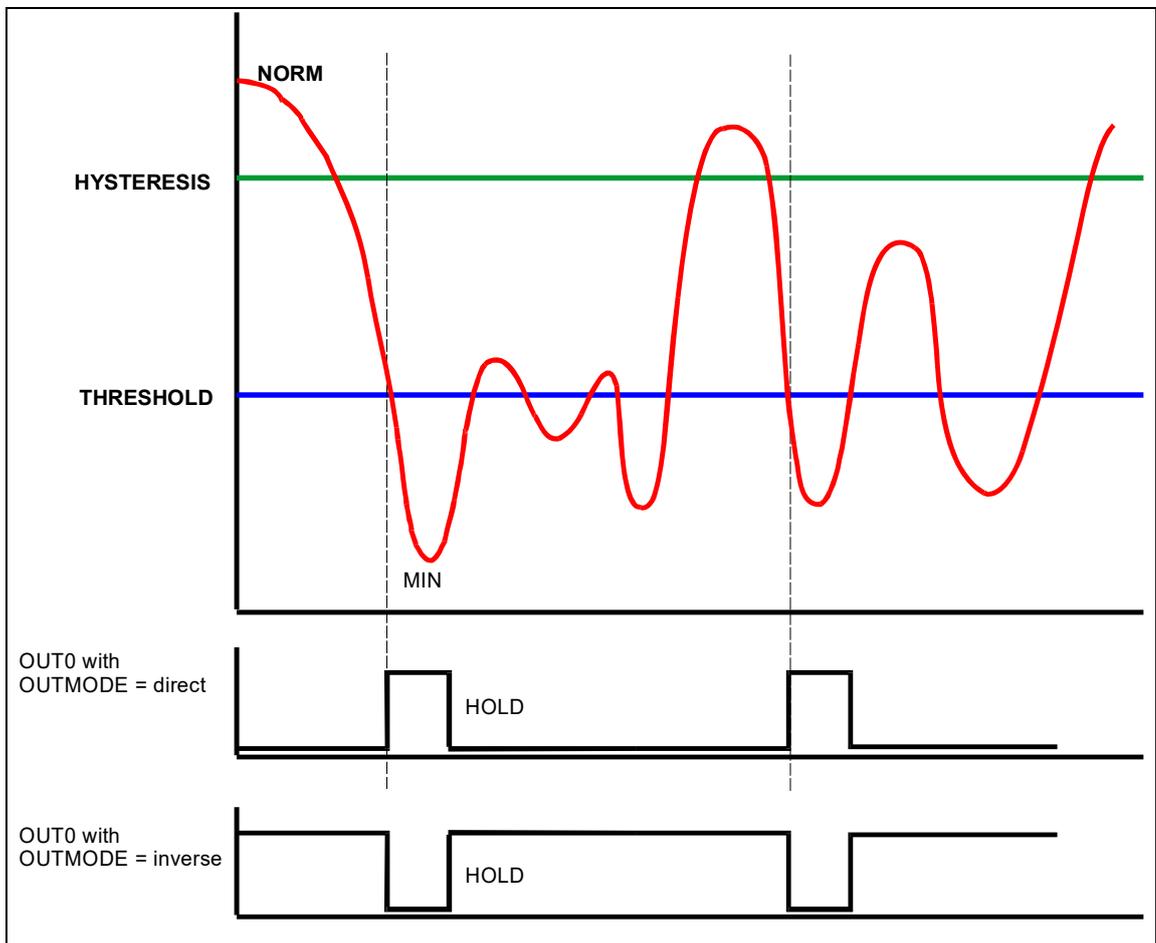
## 4.2 Basic terms

### 4.3.1 Sensitivity

The software parameter THRESHOLD is used to set the sensor's edge detection sensitivity. For detecting an edge, the NORM VALUE of the two RAW SIGNALS must drop below a certain THRESHOLD during measurement to initiate a counting event. The sensor sensitivity increases with a higher THRESHOLD value.

After the value has dropped below a THRESHOLD, the NORM VALUE must again lie above a second threshold (HYSTERESIS), to allow renewed edge detection. This is an additional safety feature to suppress multiple counting around the THRESHOLD.

ATTENTION! In order to use this effect, HYSTERESIS must be higher than THRESHOLD.

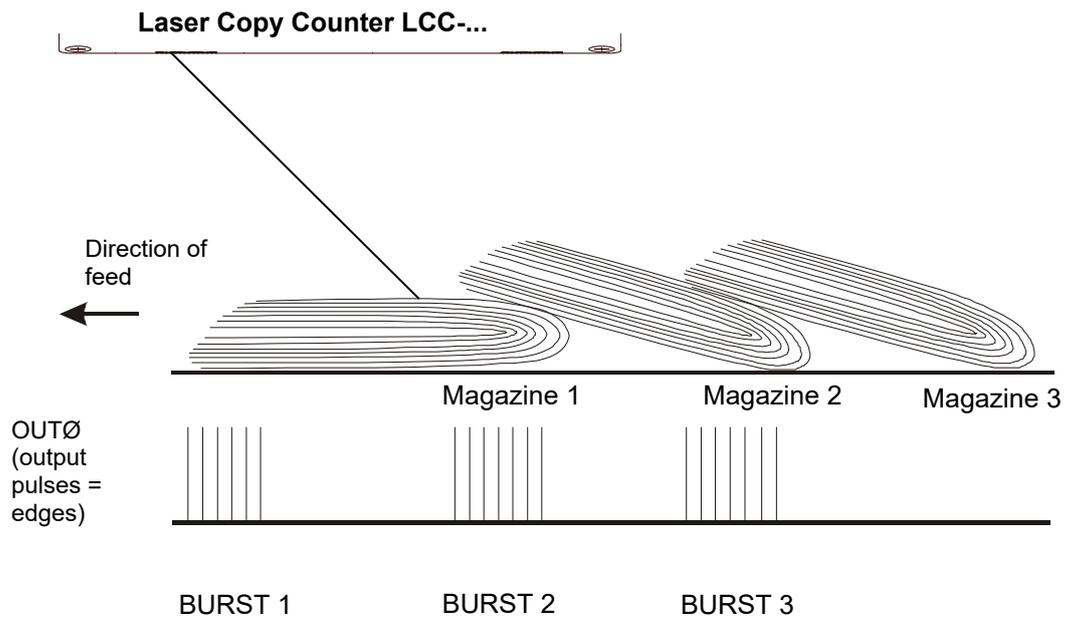


Picture 8: Measuring principle of edge detection

#### 4.2.1 Dead time

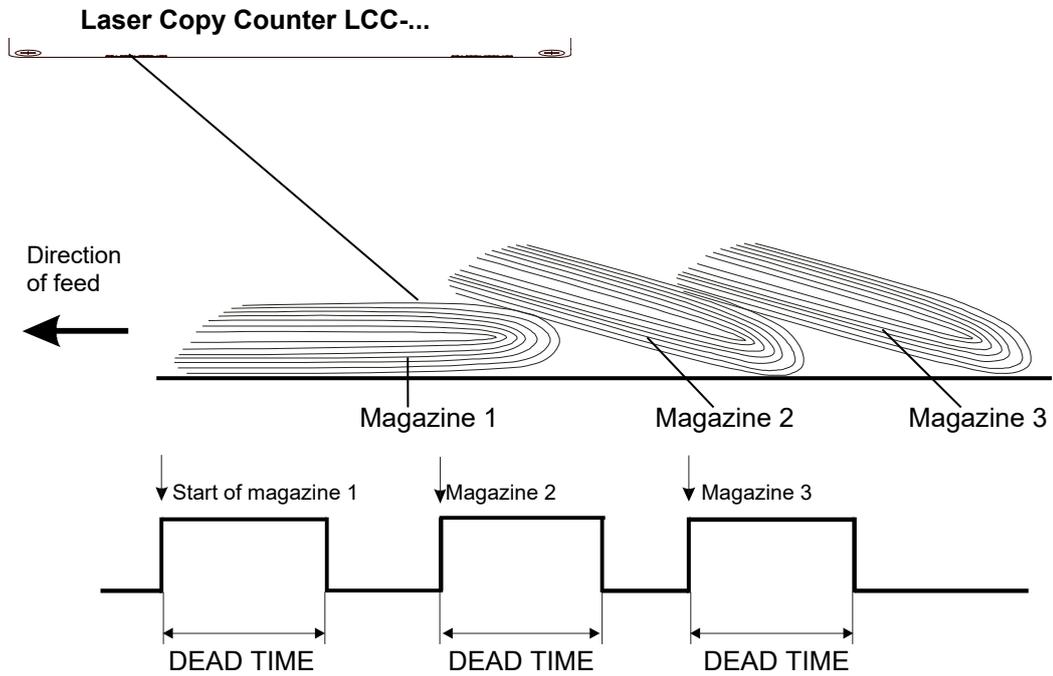
Explanation of the term DEAD TIME:

In practice it is possible that the open side of the magazine, and not the closed side, lies in the direction of feed. In this special case the laser beam passes a whole series of "mini edges" that are formed by the individual pages (sheets) of a magazine. The Laser Copy Counter therefore would not generate a single pulse per magazine, but a whole series of pulses ("bursts"), which would lead to an incorrect counting result.



Picture 9: Generation of multiple pulses (bursts)

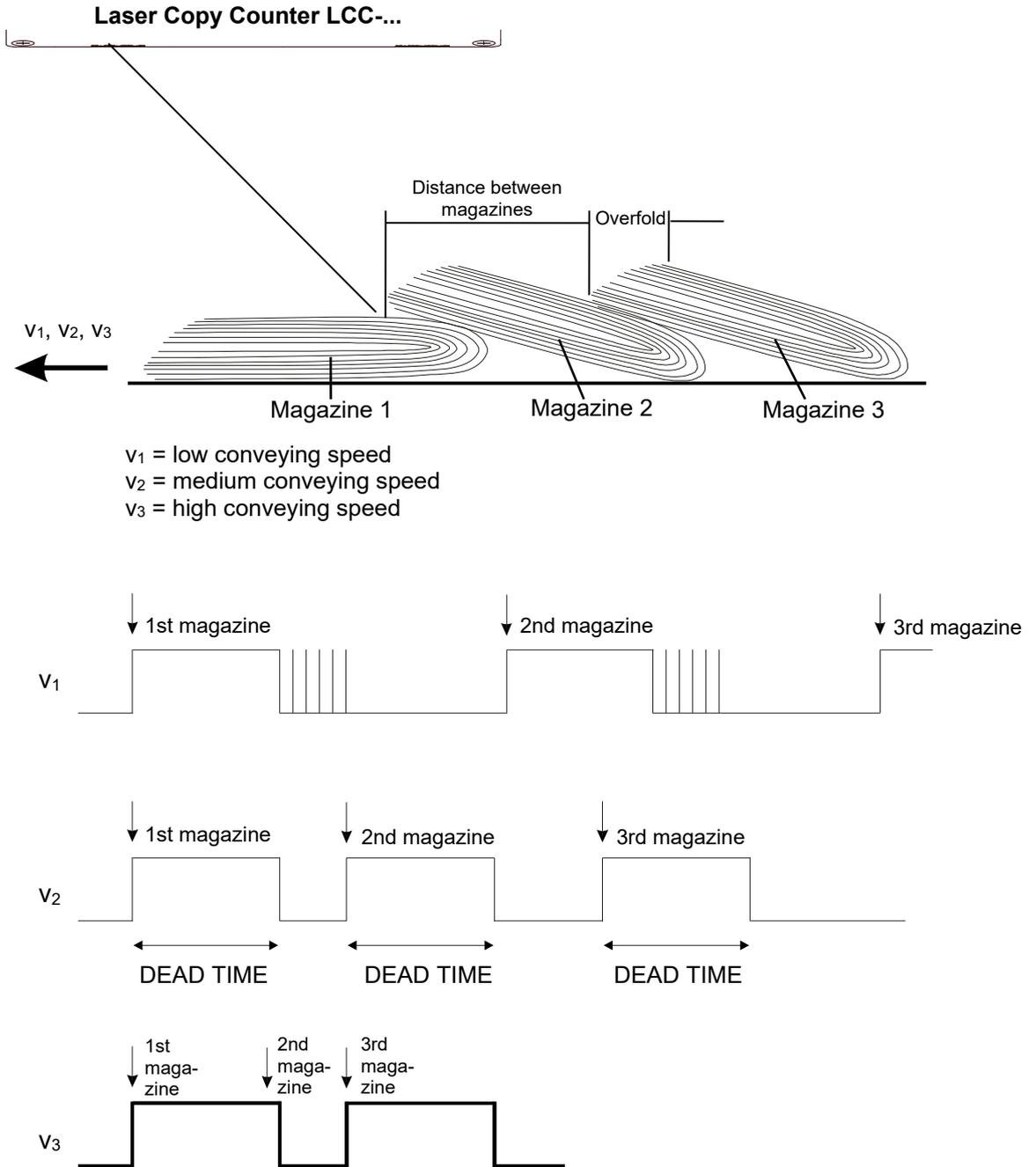
This problem is remedied by means of a software algorithm which sets the sensor to "blind" for a certain time after the detection of the first edge of a burst; this time is also referred to as the DEAD TIME.



**Picture 10: Suppression of multiple pulses by introducing a suitable dead time**

**Explanation of the term DYNAMIC DEAD TIME:**

Practice also shows that the conveying speed is not constant in most cases (system start-up, etc.). In case of higher or extremely slow conveying speeds a constant DEAD TIME (fixed preset pulse duration) may lead to inaccurate counting results:

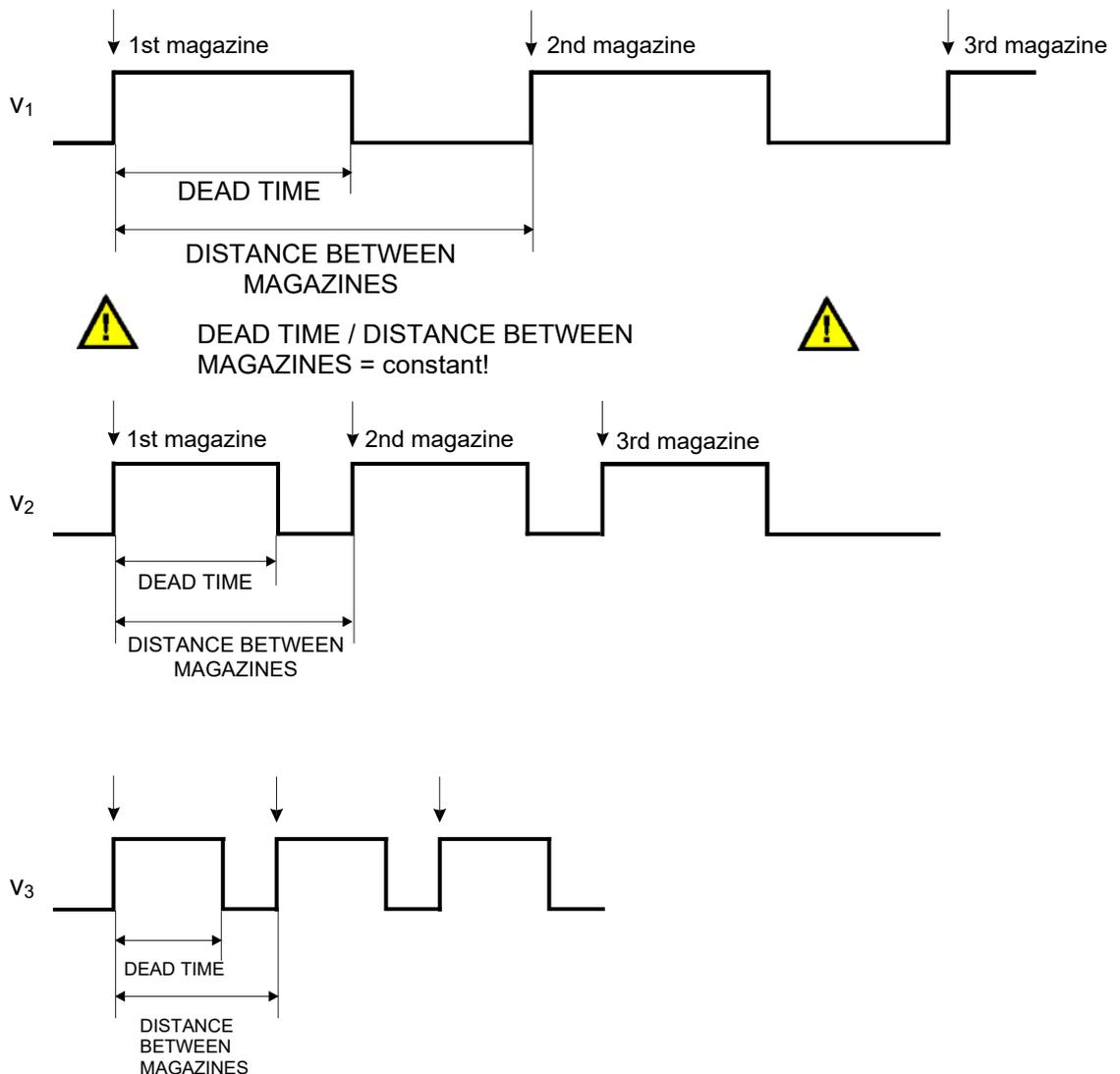


**Picture 11: Constant dead time**

As can be seen in picture 11, the dead time ends too soon in case of a low conveying speed (v1), i.e. following paper edges are detected after the dead time is over, which leads to an incorrect counting result (copy count is too high).

When the conveying speed is too high (v3), however, individual magazines are not detected because the first edge of a magazine (in this example the 2nd magazine) appears before the dead time that is triggered by the first edge of the advancing magazine is over; this "skipping" of counting pulses also leads to a deviation from the actual copy count (copy count is too low).

With dynamic dead time the length of the dead time is determined by the respective current distance between magazines; this avoids speed problems and guarantees that the counting result is correct!



**Picture 12: Dynamic dead time**

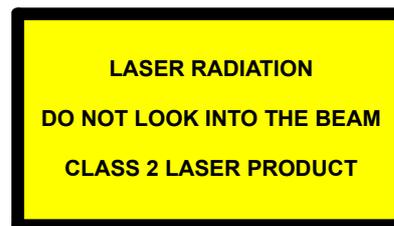
## 5. Laser safety regulations

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The LCC-... laser sensor (LCC-30, LCC-40, LCC-80, LCC-90, LCC-130, LCC-CON1) is categorised as laser class II according to EN 60825.

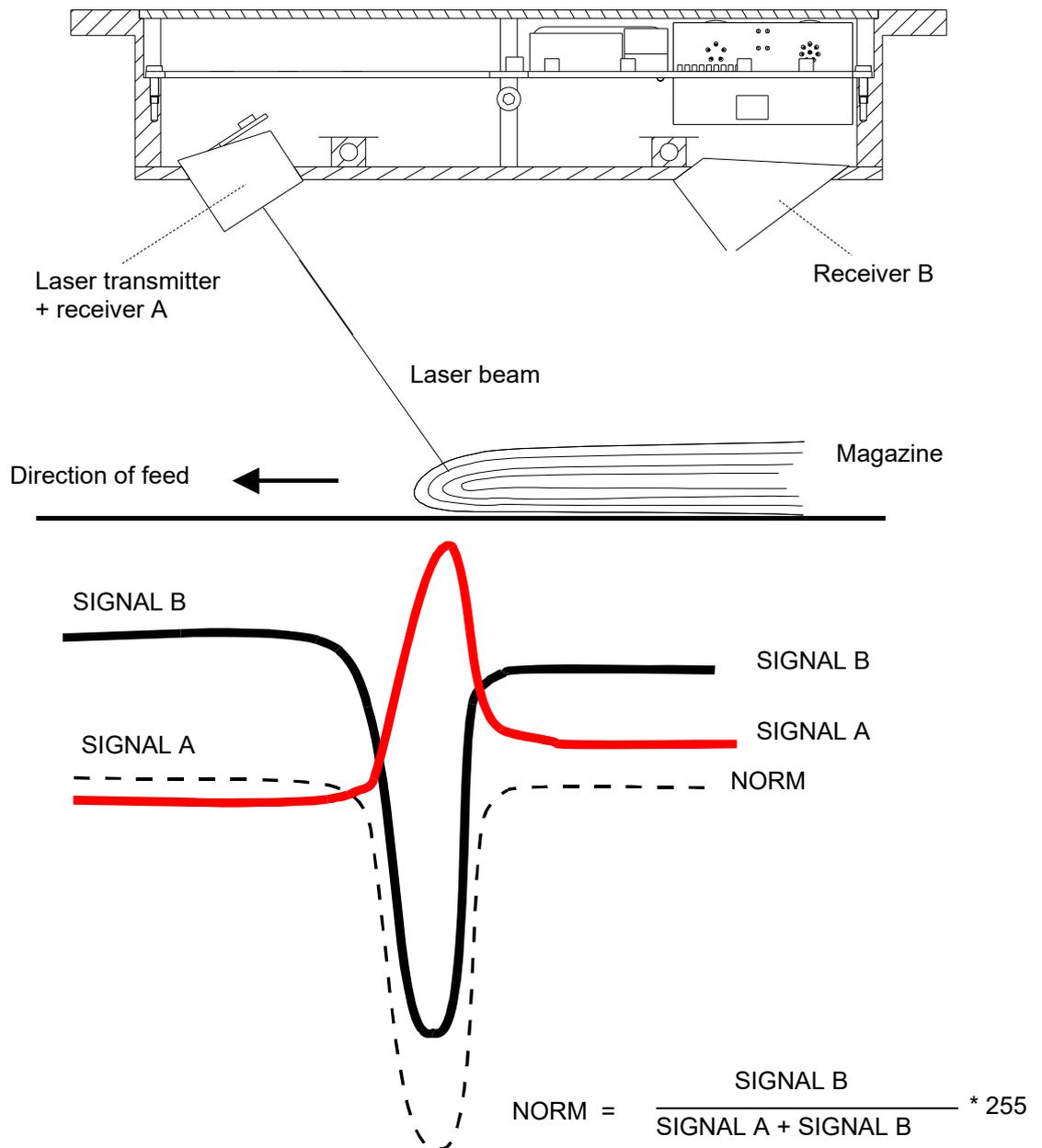
Therefore no additional safety measures are required for the use of this laser sensor.

The laser sensor is supplied with laser warning labels.



## 6. Functional principle of the sensor

The LCC-... (LCC-30, LCC-40, LCC-80, LCC-90, LCC-130, LCC-CON1) laser sensor comprises a laser transmitter (laser diode,  $\lambda=670\text{ nm}$ ) and two receivers. As shown in pic. 13, the laser beam is focussed at an angle onto the magazine opposite to the direction of feed. When an edge arrives, it blocks the beam path to receiver 2, whereas the signal at receiver 1 slightly increases due to the more favourable angle of impingement! The standardised (NORM) value of SIGNALS A and B is used as the starting signal for all the further algorithms of the Laser Copy Counter! (see software manual).



Picture 13. Functional principle

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## 7. Help on operating mode selection and settings

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### 7.1 Factory settings and dynamic modes

As already described above, the Laser Copy Counter is delivered with a basic factory setting. This factory setting allows good results with most applications, because the dynamic correction features ensure that the system automatically adapts itself to the respective application conditions.

The size of the detectable jump depends on the sheet thickness, on the form of the edge of newspapers/magazines, on the surface conditions, and on the speed.

Special measures were taken for each of these influencing factors:

- Form of the edge of newspapers/magazines, such as overfold and bent up edges of multiple sheets: The dead time after edge detection prevents multiple counting. The essential assumption here is that the distance of individual jumps is small compared to the regular distance between magazines. In case of strongly differing regular distances between magazines the length of the dead time must be matched to the smallest distances. This must be done with utmost care.  
In dynamic mode the system automatically adjusts itself to the conveying speed.
- The light backscattering power of different surfaces (shiny, dull, porous, black, multi-coloured) fluctuates almost by a factor of 100. Most of this very wide fluctuation range is eliminated by automatic light power correction, which ensures that the optical detectors have a sufficient quantity of light. This guarantees that the signal is sufficiently high for reliable evaluation. As a side effect, automatic light power correction also compensates dirtying of the system's glass covers.
- For adaptation to different conditions in connection with the conveying speed of the products the following measures were taken:  
Very high modulation frequency of the light source; this ensures a stable signal and a wide dynamic range also in case of signal changes in the 15kHz range. Simultaneous reading of the signals by the micro-processor, and high repeat rate in scanning.  
The above described dynamic dead time mode ensures matching to the conveying speed and to the average distance between magazines.  
With constant conveying speed, the only remaining problem are irregular distances between magazines, which in most cases can be successfully solved by matching the dead time.

Comment on high copy rates: The maximum achievable counting frequency is mainly determined by the output hold time. If there are counting errors at high conveying rates, the output hold time must be shortened (if possible).

The basic scanning frequency is 15kHz with AVERAGE=1.

Deviations from the factory settings should only be made for one of the following reasons.

## 7.2 Sensitivity selection

If there are defects in the paper's surface structure, such as washboard marks or trunks, the sensor will detect such defects as edges when it is set to factory settings with highest sensitivity. In this case it is recommended to reduce the sensitivity, until the defects are not detected any more.

This can be achieved by reducing the software parameter THRESHOLD.

The counting result must always be checked in such cases, because the sensitivity may only be reduced to such an extent that the regular edges are reliably detected. The PC program with its graphical representation of the last 16 detected edges provides valuable support for this task, because the disturbance ratio between regular edges and structural defects can be visualised. However, if the edge to be detected is very large compared to the structural defects, the sensitivity can be reduced without any problems.

With special applications, such as foil edge detection, the disturbance ratio must always be checked with the PC program, because this makes long-lasting setting tests unnecessary. With special applications the sensor/product distance also should not deviate very much from the setpoint range.

## 7.3 Multiple pulse suppression by way of dead time selection

In case of openly fed thick newspapers a whole series of individual sheets in the area of the main edge may lead to unwanted counting pulses also in high sensitivity mode. If the distance between the individual copies is not too irregular and of sufficient length, lengthening of the dead time is preferable to reducing the sensitivity.

Dead time means:

After a detected edge the micro-controller ignores the product flow for the set time, it only automatically corrects the light power. When this "dead time" is over, it takes up the task of detecting edges again. With dynamic dead time, the micro-controller measures the time between successive edges and evaluates this time as 100%. DIP switches DIP5 to DIP8 are used to preset this "percentage" dead time. In dynamic dead time mode the micro-controller waits for this percentage time before edge detection is started again. In fixed mode it simply waits for a number of milliseconds.

## 7.4 TRIGGER and static measurement

Measurement for edge detection is performed with the static measuring principle.

This means that no absolute jumps are detected, but that an edge is detected when the calculated NORM drops below a certain THRESHOLD. For renewed object detection, the value must rise above a certain preset value (HYSTERESIS) again.

Synchronisation to external trigger signals can be done by selecting TRIGGER = EXT (user interface). The two inputs IN0 and IN1 are needed for this purpose. The principle idea is that an ACTIVE WINDOW is opened for the sensor, during which an edge is to be expected. This window is opened with a positive signal edge at IN0, and closed with a positive signal edge at IN1. Measurement during this ACTIVE TIME is performed statically. If the sensor detects an edge during this time, the output pulse is output after the window is closed (positive signal edge at IN1). For renewed edge detection the two inputs must detect a negative signal edge.

Application example:

Objects that are transported by means of mechanical or other kinds of grippers. The trigger signals can be supplied to the sensor by means of inductive sensors or light barriers, etc. The advantage of this measuring method is that the sensor is completely independent of the speed (for details on this see software manual).

## **7.5 Special parameters**

Some important parameters can furthermore be set with the PC program. For a description of these parameters and their meaning please refer to the SI-LCC-Scope V5.0 software manual in the appendix.

For example, it is possible to change the frequency of automatic laser power correction. Another parameter serves for presetting an intensity limit for evaluation (which is important if there is no beam stopper!)

## 8. Appendix

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### 8.1 Technical data - table

<b>Type</b>	<b>LCC-...</b>
Laser	Solid-state laser, $\lambda=670\text{nm}$ , DC operation, max. opt. power 1mW, laser class 2 acc. to DIN EN 60825. Therefore no additional protective measures are required for the use of the laser.
Optical filter	Red light filter RG630
Digital output	Type Q: pnp-bright-switching, npn-dark-switching (OUTØ) OUT1 is an optional "open-collector" output
Supply voltage	+24VDC $\pm$ 10%
Sensitivity setting	Adjustable via software under Windows®
Autom. laser power correction	Adjustable via software under Windows®
Current consumption	Typ. 150mA
Dead time	Adjustable via software under Windows®
Dead time mode	Static or dynamic, adjustable via software under Windows®
Type of protection	IP54
Operating temperature range	-20°C ... +50°C
Storage temperature range	-20°C ... +85°C
Housing	Aluminium, anodized in blue (or black)
Dimensions	Approx. 175mm x 85mm x 32mm
Connector type	8-pole circular connector type Binder 712 5-pole circular connector type Binder 702
EMC testing acc. to	DIN EN 60947-5-2 
Scan frequency	Max. 15kHz
Switching state indicator	Visualisation by means of a yellow LED
Dyn. switching output (pulse lengthening)	Adjustable via software under Windows®
Max. switching current	100mA, short-circuit-proof
Interface	RS232, can be parameterised under Windows®
Connecting cable	Connection to PC: cab-las5/PC (2m) Connection to PLC: cab-las8/SPS (2m)

## 8.2 SI-LCC-Scope V5.0 software manual

### 8.2.1 Software installation

The following requirements must be fulfilled for successful installation of the software:

- Microsoft® Windows® 7, 8, 10
- IBM PC AT or compatible
- VGA graphics
- Microsoft-compatible mouse
- Serial RS232 interface at the PC or USB slot or RJ45 connector
- Cable ***cab-las4/PC*** for the RS232 interface or ***cab-4/USB*** USB converter or ***cab-4/ETH*** Ethernet converter

Please install the software as described below:

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

Windows™ is a registered trademark of Microsoft Corp.  
VGA™ is a trademark of International Business Machines Corp.

## 8.2.2 Software operation

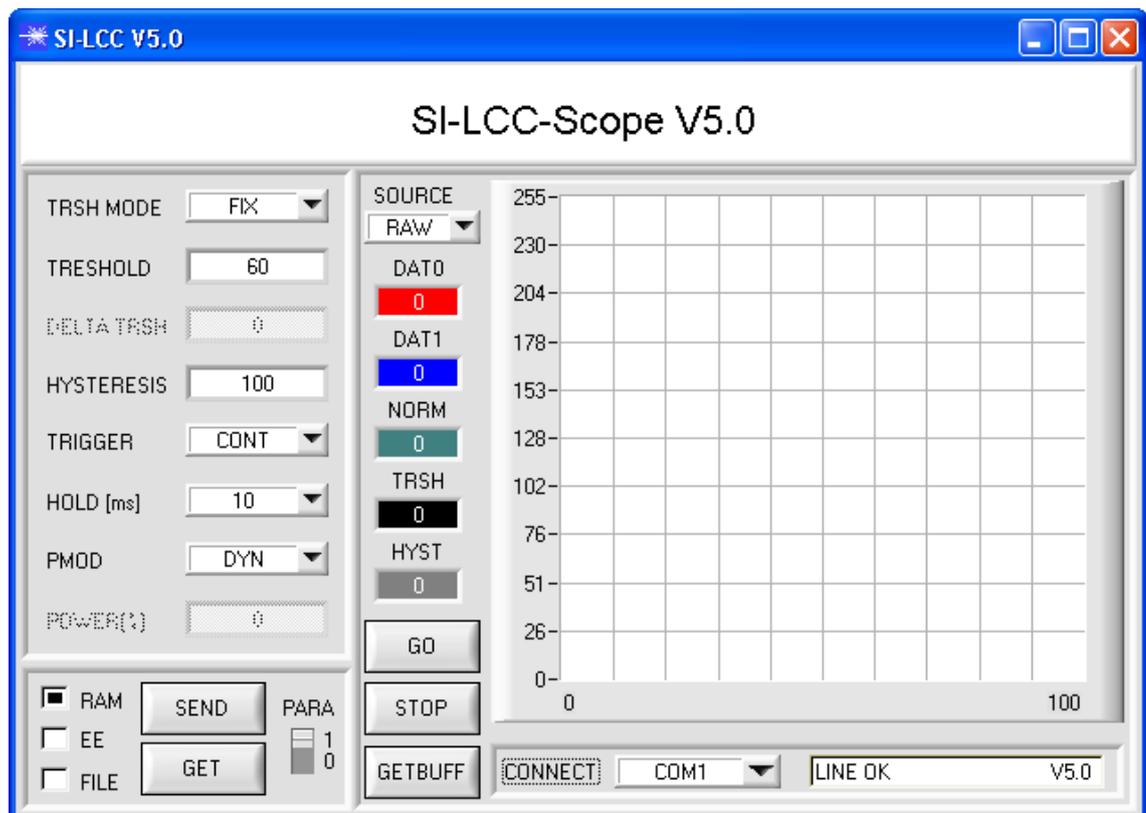
### ATTENTION !

Please read this chapter first before you start to adjust and parameterise the sensor system.

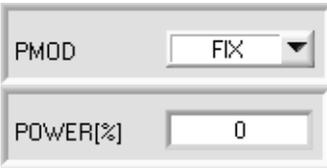
Pressing the right mouse button on an individual element will call up a short help text.

When the software is started the following window appears on the Windows interface:

**TIP!** To avoid problems with the handling of the file path, it is advisable to run the software as administrator. You can either set this in the **Properties** under **Compatibility** or you start the software with a right click and choose **"Run as administrator"**.



The following pages provide explanations of the functions of the individual control elements:

	<p><b>PMOD:</b> In this function field the operating mode of automatic power correction at the transmitter unit (laser) can be set.</p> <p><b>FIX:</b> In this operating mode the POWER function field is <i>enabled</i> for setting purposes.</p> <p>The laser transmission power is kept constant at the value set with the POWER function field.</p>
	<p><b>DYN:</b> In this operating mode the POWER function field is <i>disabled</i> for setting purposes.</p> <p>The laser transmission power is automatically and dynamically controlled in accordance with the amount of radiation that is diffusely reflected from the object. By using the intensities measured at the receiver the automatic control circuit attempts to adjust the transmission power in such a way that the dynamic range is not exceeded.</p> <p><a href="#">Recommended standard adjustment:</a> PMOD = DYN</p>

	<p><b>POWER[%]:</b> In this function field the intensity of the laser diode can be set by entering a value in the edit-box.</p> <p>0 = Laser OFF 100 = Full laser diode intensity</p> <p>(The POWER function field only is effective in PMOD FIX.)</p>
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	<p><b>HOLD:</b> In this function field the output hold pulse length in ms (after detection of edge) can be set.</p> <p><a href="#">Recommended standard adjustment:</a> HOLD = 10ms</p>
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TRIGGER
CONT

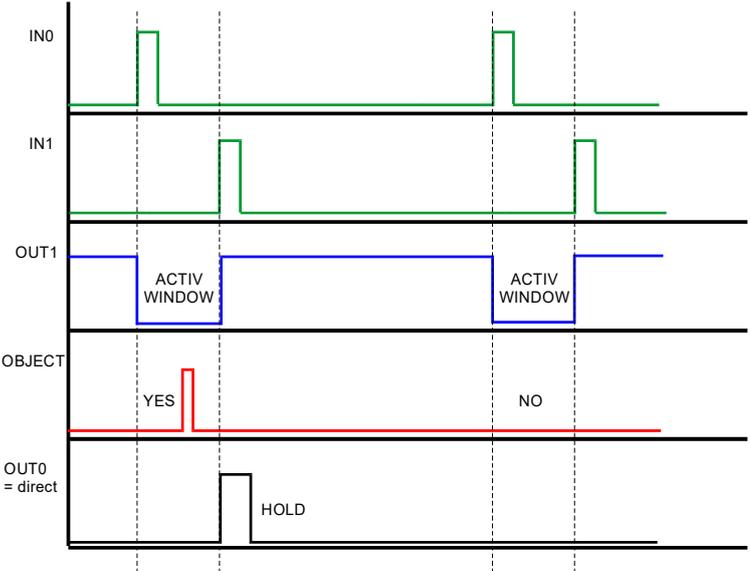
**TRIGGER:**

**TRIGGER EXT = CONT :**  
Measurement is performed continuously (permanently).

**TRIGGER = EXT :**  
An ACTIVE WINDOW is set for the sensor by the two inputs IN0 and IN1. The window is opened with a positive signal edge at IN0, and is closed again with a positive signal edge at IN1. The sensor measures during its ACTIVE TIME, and if it detects an edge, an output counting pulse is provided immediately after the ACTIVE WINDOW is closed.

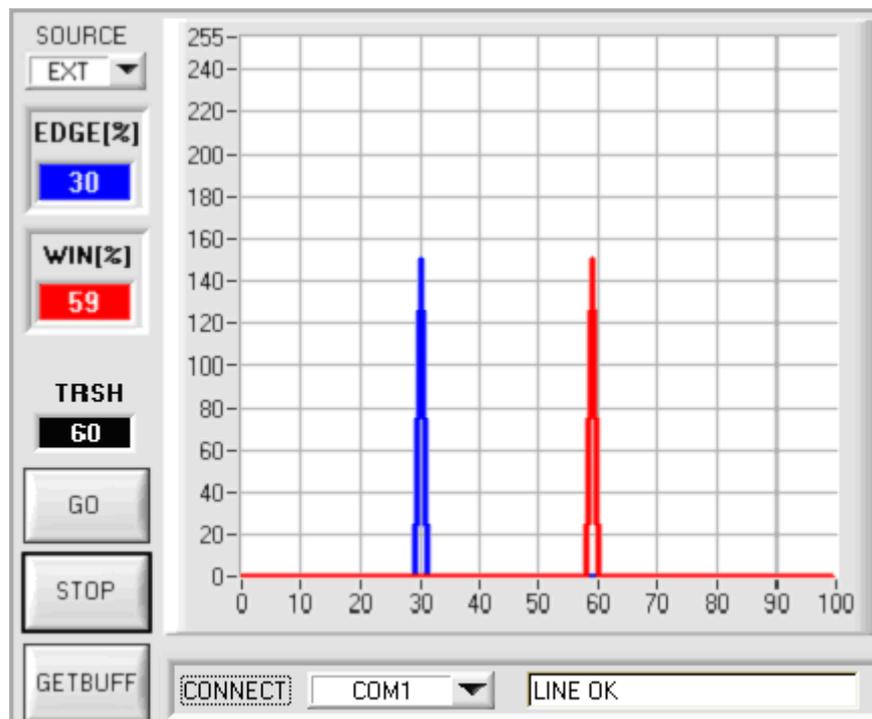
Please note:  
Only one edge can be detected during the ACTIVE TIME. Output OUT1 serves for monitoring the active time.  
For renewed edge detection, the two inputs must detect a negative signal edge.

Application example:  
Objects that are transported by means of mechanical or other kinds of grippers. The trigger signals (+24V) can be supplied to the sensor by means of inductive sensors or light barriers, etc.  
The advantage of this measuring method is that the sensor is completely independent of the speed.



**TRIGGER = ADJ EXT :**  
Same function as TRIGGER = EXT, with the only difference that after the end of the active window the output impulse OUT0 remains on until a new window is opened, if an object was detected during the active window.  
Please note: The output impulse remains on at least for the time set under HOLD.

**TRIGGER = EXTSTAT :**  
Same function as TRIGGER = EXT, with the only difference that the output impulse remains static at OUT0 after the detection of an edge in the active window until a new window is opened.



For operating the sensor with an active window, two initiators must inform the sensor about the active time. As described above, the active window is opened with a positive signal edge at input IN0 and is closed again with a positive signal edge at input IN1.

The TRIGGER = ADJ EXT mode was introduced to allow improved sensor adjustment. When this mode is selected, the sensor records the time from one positive signal edge at IN0 to the next positive signal edge at IN0 and values this time as 100%. This is shown in the graphic display, when the GO button is pressed and SOURCE = EXT is selected.

When the GO button is pressed, the data are automatically updated after one second. The value of 100 on the x-axis corresponds with 100% (time from IN0 to IN0).

The red graph visualised the length of the active window in percent of the time between IN0 and IN0. The blue graph visualises the appearance of an edge in percent of the time between IN0 and IN0.

It can be seen in the example shown above that the active window is equal to 59% of the time from IN0 to IN0, i.e. the sensor detected a positive signal edge at IN1 after 59% of IN0 to IN0, which closed the active window. The edge was detected at 30% of IN0 to IN0. These two values are also shown in the EDGE [%] and WIN [%] display fields.

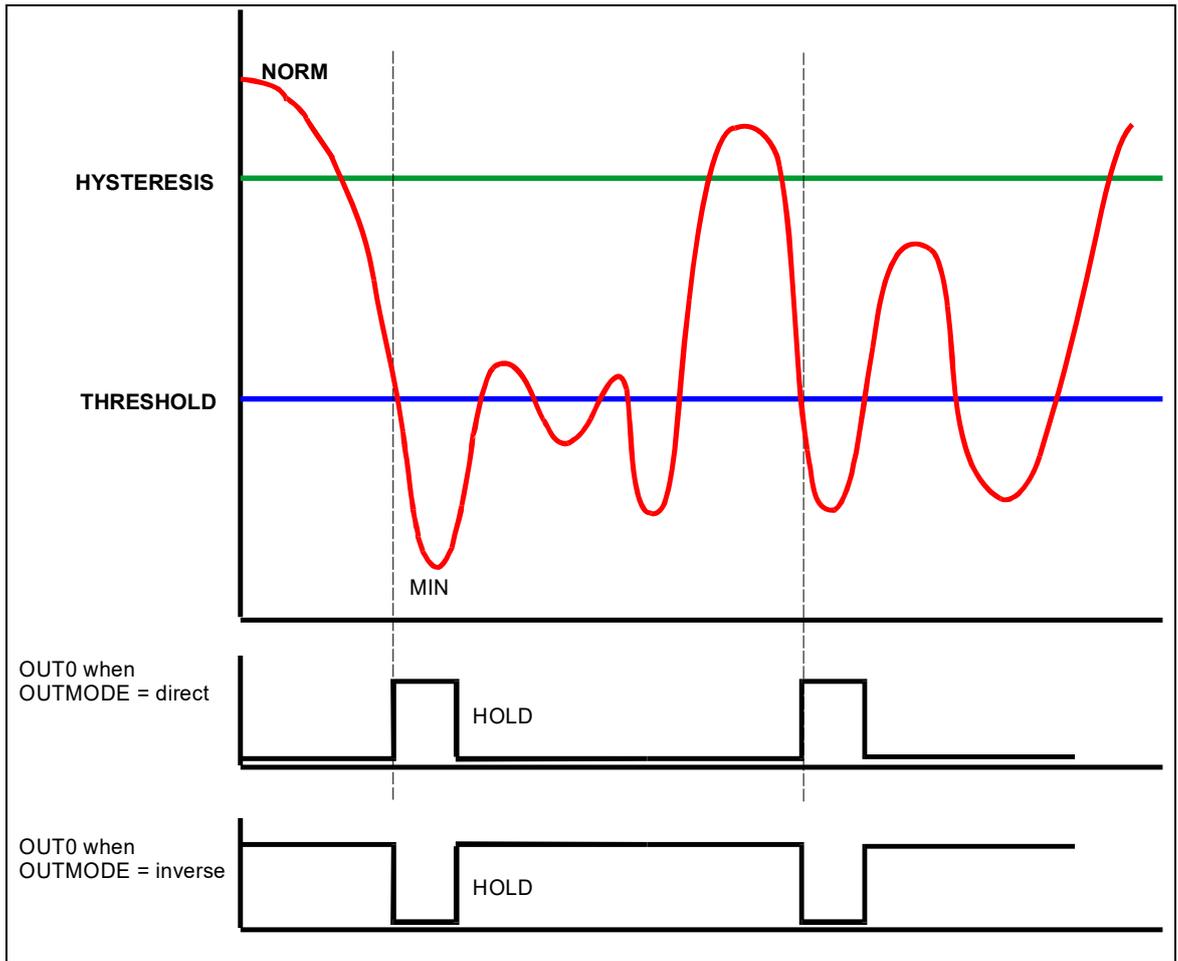
In practice, the active window should be open approx. 60% of IN0 to IN0. The edge should lie in the middle of the active window (30%).

ATTENTION !!! If the red graph is left of the blue graph, the initiators are too far apart.

When the two initiators have been adjusted, measurement with an active window can be started under TRIGGER = EXT.

INFO: This adjustment procedure is performed only once during sensor commissioning. The sensor does not count during this adjustment process!

<div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 5px;"> <b>TRSH MODE</b> <span style="float: right;">FIX ▼</span> </div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 5px;"> <b>TRESHOLD</b> <span style="float: right;">20</span> </div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 5px;"> <b>DELTA TRSH</b> <span style="float: right;">50</span> </div> <div style="border: 1px solid #ccc; padding: 2px;"> <b>HYSTERESIS</b> <span style="float: right;">10</span> </div>	<p><b>THRESHOLD:</b> The sensor can be operated either with a fix or with a dynamic threshold.</p> <p><b>TRSH MODE = FIX:</b> The sensor operated with a fix threshold that is set under TRESHOLD. An edge is detected when the current NORM signal falls below this threshold. The hysteresis is entered under HYSTERESIS.</p>
<div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 5px;"> <b>TRSH MODE</b> <span style="float: right;">DYN1 ▼</span> </div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 5px;"> <b>MAX TRSH</b> <span style="float: right;">20</span> </div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 5px;"> <b>DELTA TRSH</b> <span style="float: right;">50</span> </div> <div style="border: 1px solid #ccc; padding: 2px;"> <b>DELTA HYST</b> <span style="float: right;">10</span> </div>	<p><b>TRSH MODE = DYN1:</b> The sensor operates with a dynamic threshold that is calculated from the minimum NORM value of the last detected edge plus the value set under DELTA TRSH. The hysteresis is calculated from the determined threshold TRSH plus DELTA HYST.</p> <p><b>Please note!</b> After every detected edge the sensor calculates the threshold anew. If the calculated threshold is higher than MAX TRSH, the sensor sets the current threshold to the value of MAX TRSH. The sensor's sensitivity increases with higher THRESHOLD values.</p>
<div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 5px;"> <b>TRSH MODE</b> <span style="float: right;">DYN2 ▼</span> </div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 5px;"> <b>MIN TRSH</b> <span style="float: right;">20</span> </div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 5px;"> <b>DELTA TRSH</b> <span style="float: right;">50</span> </div> <div style="border: 1px solid #ccc; padding: 2px;"> <b>DELTA HYST</b> <span style="float: right;">10</span> </div>	<p><b>TRSH MODE = DYN2:</b> The sensor always automatically adjusts the threshold. Automatic adjustment is performed every second. The threshold is calculated from the current NORM minus DELTA TRSH. The hysteresis is calculated from the determined threshold TRSH plus DELTA HYST. The smallest possible threshold is MIN TRSH.</p>
<div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 5px;"> <b>TRSH</b> <span style="background-color: black; color: white; padding: 2px 10px;">20</span> </div> <div style="border: 1px solid #ccc; padding: 2px;"> <b>HYST</b> <span style="background-color: #ccc; padding: 2px 10px;">80</span> </div>	<p><b>TRSH:</b> This display shows the current threshold that the sensor operates with.</p> <p><b>HYST:</b> This display shows the current hysteresis that the sensor operates with.</p> <p>For detecting an edge, the NORM VALUE of the two RAW SIGNALS must drop below a certain THRESHOLD during measurement to initiate a counting event.</p> <p>When the sensor detects an edge (NORM VALUE drops below THRESHOLD), a search for the minimum NORM VALUE is performed until the end of the DEAD TIME (TRIGGER=CONT) or the ACTIVE TIME (TRIGGER=EXT) and during HOLD. This minimum value is stored in a 16-value JUMP BUFFER that can be read out with the GETBUFF SOFTWARE BUTTON.</p> <p>After the value has dropped below a THRESHOLD, the NORM VALUE must again lie above the value set under HYSTERESIS to allow renewed edge detection. This is an additional safety feature to suppress multiple counting around the THRESHOLD.</p> <p>(See chart next page).</p>



<p>PARA</p> <div style="border: 1px solid gray; padding: 2px; width: 20px; display: inline-block; text-align: center;">1</div> <div style="border: 1px solid gray; padding: 2px; width: 20px; display: inline-block; text-align: center;">0</div>	<p><b>PARA:</b> This changeover switch determines whether the parameters BACKLIM, REGCNT, AVERAGE, DEAD TIME MODE (DT MODE), and DEAD TIME are displayed or hidden.</p> <p>1 = Parameter hidden 0 = Parameter displayed</p>
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<div style="border: 1px solid gray; padding: 2px; display: inline-block;">BACKLIM</div> <div style="border: 1px solid gray; padding: 2px; width: 40px; text-align: center; margin-left: 10px;">40</div>	<p><b>BACKLIM:</b> In this EDIT-BOX an intensity limit can be set. If the intensities that arrive at the receiver units DAT0 and DAT1(display window in the user interface) fall below this limit, no evaluation will be performed.</p> <p style="color: blue;">Recommended standard adjustment: BACKLIM = 40</p>
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<div style="border: 1px solid gray; padding: 2px; display: inline-block;">REGCNT</div> <div style="border: 1px solid gray; padding: 2px; width: 40px; text-align: center; margin-left: 10px;">1</div>	<p><b>REGCNT:</b> This EDIT-BOX serves for setting after how many loop runs dynamic laser diode correction should be performed.</p> <p>Example: SCAN frequency 15kHz is equal to 66.6µs REGCNT = 75 Calculation: 66.6µs * 75 = 5ms Result: Dynamic correction is performed every 5ms</p> <p>Explanation: Flatly rising magazines are detected, because automatic correction is not performed with every loop run, and the jump is automatically compensated, so to speak.</p> <p>The EDIT-BOX REGCNT is <i>enabled</i> when PMOD = DYN When PMOD = FIX the EDIT-BOX REGCNT is <i>disabled</i> as no laser transmitting power correction is done.</p> <p style="color: blue;">Recommended standard adjustment: REGCNT = 1</p>
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<div style="border: 1px solid gray; padding: 2px; display: inline-block;">AVERAGE</div> <div style="border: 1px solid gray; padding: 2px; width: 40px; text-align: center; margin-left: 10px;">1</div>	<p><b>AVERAGE:</b> This EDIT-BOX serves for setting averaging through NORM. The minimum value for averaging is 1. The maximum value for averaging is 128.</p> <p>An average of 1 is sufficient for most applications.</p> <p>Please note: If AVERAGE=1, the internal scan frequency = 15kHz. If AVERAGE=2, the internal scan frequency = 7.5kHz. If AVERAGE=4, the internal scan frequency = 3.75kHz. etc.</p> <p style="color: blue;">Recommended standard adjustment: AVERAGE = 1</p>
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<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <span style="float: left;">OUTMODE</span> <span style="float: right;">DIRECT ▼</span> </div>	<p><b>OUTMODE:</b>                  This EDIT-BOX determines how the output pulse should be output at OUT0:</p> <p><b>Direct:</b>                  When a counting event occurs, output OUT0 changes from LOW (0V) to HIGH (+24V), until HOLD is over.</p> <p><b>Inverse:</b>                  When a counting event occurs, output OUT0 changes from HIGH (+24V) to LOW (0V), until HOLD is over.</p>
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<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <span style="float: left;">DT MODE</span> <span style="float: right;">FIX ▼</span> </div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <span style="float: left;">DEAD TIME[ms]</span> <span style="float: right;">8 ▼</span> </div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <span style="float: left;">DT MODE</span> <span style="float: right;">DYN ▼</span> </div> <div style="border: 1px solid #ccc; padding: 5px;"> <span style="float: left;">DEAD TIME[%]</span> <span style="float: right;">24 ▼</span> </div>	<p><b>DEAD TIME MODE (DT MODE):</b>                  This function field shows the DEAD TIME MODE that is used.</p> <p><b>DT MODE = FIX:</b>                  A fixed dead time is used. The dead time is set in milliseconds under DEAD TIME[ms].</p> <p><b>DT MODE = DYN:</b>                  A dynamic dead time is used. The dead time is set in percent under DEAD TIME[%].</p> <p>The time between two edges is valuated as 100%.                  The dead time is calculated in accordance with the set percentage value at DEAD TIME[%].</p> <p>The dead time can be measured through monitor output OUT1 (low-active).</p> <p>If TRIGGER = EXT is selected, the sensor operates with an ACTIVE TIME. In this case, the EDIT BOXES DT MODE und DEAD TIME [%] are <i>disabled</i>. The active time can be measured through monitor output OUT1 (low-active).</p> <p style="color: blue;"><b>Recommended standard adjustment:</b>                  DT MODE = DYN                  DEAD TIME [%] = 18 or 24</p>
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<p>SOURCE RAW</p> <p>DAT0 <b>109</b></p> <p>DAT1 <b>131</b></p> <p>NORM <b>116</b></p>	<p><b>SOURCE:</b> This function field serves for selecting the data that are to be displayed in the graphic window (RAW, NORM).</p> <p><b>RAW:</b> The raw data DAT0 and DAT1 are visualised in the graphic window. In addition these values are displayed in the two numerical value output fields DAT0 and DAT1.</p> <p><b>NORM:</b> The NORM calculated from DAT0 and DAT1 is displayed in the graphic window. In addition this value is displayed in the numerical value output field NORM.</p> <p><b>EXT:</b> Please cf. <b>TRIGGER</b></p>
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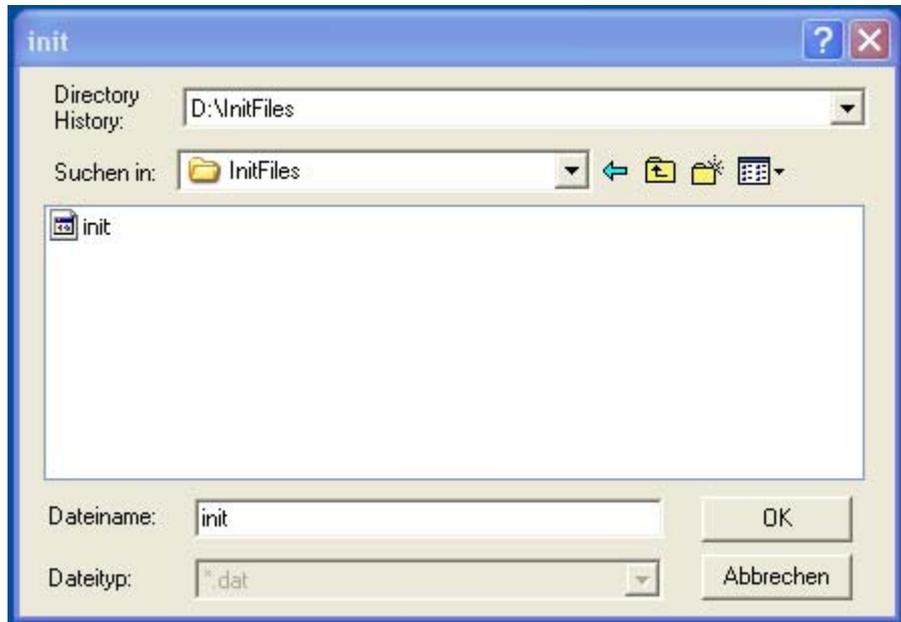
<p>GO [F11]</p>	<p><b>GO:</b> A click on the GO button (or pressing shortcut keybutton F11) starts the display of the data set under TYPE in the graphic display window.</p>
<p>STOP [F12]</p>	<p><b>STOP:</b> A click on the STOP button (or pressing shortcut keybutton F12) stops the graphic display.</p>

<p>GETBUFF [F8]</p>	<p><b>GETBUFF:</b> When the GETBUFF button is clicked (or after pressing shortcut keybutton F8), the last minimum values of the NORM SIGNAL after edge detection are displayed.</p> <p>In addition, the TRSH which the values of the NORM SIGNAL must remain under is visualized in the graphical display window.</p> <p>Upon detection of an edge the sensor starts to search the minimum value of the NORM SIGNAL during the DEAD TIME and HOLD. This value is then stored in a 16-value ring buffer.</p> <p>Based on these VALUES, the optimum TRSH for the current product flow can then be set.</p>
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Sample	Signal Value
0	25
1	25
2	25
3	55
4	35
5	35
6	30
7	25
8	25
9	60
10	55
11	40
12	30
13	25
14	25
15	25

<div style="border: 1px solid gray; padding: 5px;"> <input checked="" type="checkbox"/> RAM    <input type="button" value="SEND"/>  <input type="checkbox"/> EE        <input type="button" value="GET"/>  <input type="checkbox"/> FILE         </div>	<p>This group of function keys serves for parameter exchange between the PC and the control unit through the serial RS232 interface.</p>
<p><b>SEND:</b> When the SEND button is clicked (or pressing shortcut keybutton F9), all the currently set parameters are transferred between the PC and the control unit or to an output file. The target of the respective parameter transfer is determined by the selected button (RAM, EE, or FILE).</p>	
<p><b>GET:</b> The current setting values can be called up from the control unit by clicking on the GET button (or pressing shortcut keybutton F10). The source of data exchange is determined by the selected button (RAM, EE, or FILE).</p>	
<p><b>RAM:</b> The current parameters are written to the RAM memory of the control unit, or they are read from the RAM, i.e. these parameters are lost again when the voltage is switched off at the control unit.</p>	
<p><b>EE:</b> The current parameters are written to the non-volatile EEPROM memory of the control unit, or they are read from the EEPROM, i.e. the parameters in the internal EEPROM are stored when the voltage is switched off.</p>	
<p><b>FILE:</b> A click on this selection button opens an info field with the file name of the current parameter file.</p>	
<p>PLEASE NOTE: The current parameters are only stored in the current parameter file or read from the current parameter file, when the SEND or GET button is activated with a mouse click.</p>	

If another parameter file should be accessed, the file button must first be activated with a mouse click. Another dialog window then opens, in which an existing parameter file can be selected, or in which a file name for the new parameter file can be entered:



**CONNECT setting:**

This function field is used for selecting the serial RS232 interface at the PC.

The SI-LCC-Scope software starts with the standard configuration COM1 and the respective communication status.

If the interface assignment at the PC is not known, a selection can be made from COM1, COM2, ..., and COM9 by clicking on the  symbol in the CONNECT group.

A status field provides information about the status of the RS232 connection between the PC and the control unit.



The status field provides the following status messages

<b>Init COM-PORT:</b>	The PC tries to establish a connection with the control unit through the respective selected interface.
<b>LINE OK:</b>	The connection between the PC and the control unit could be established successfully. The version number is also displayed:
	

<b>TIMEOUT:</b>	<p>A connection between the control unit and the PC could not be established, or the connection is faulty.          In this case it should first be checked whether the control unit is supplied with voltage, and whether the RS232 interface cable is correctly connected.</p> <p>The TIMEOUT error must always be remedied before new parameters and measured values are transferred!!</p>
<b>Invalid port number:</b>	The selected interface is not available at the PC.

### 8.3 RS232 communication protocol

<b>RS232 communication protocol PC ↔ SI-LCC Scope V5.0</b>
<ul style="list-style-type: none"> <li>- Standard RS232 serial interface without hardware-handshake</li> <li>- 3-wire: GND, TX0, RX0</li> <li>- Speed: 4800 baud, 8 data-bits, no parity-bit, 1 stop-bit in binary mode</li> </ul> <p>The control device (PC or PLC) has to send a data frame of 17 bytes to the LCC hardware. All bytes must be transmitted in binary format. The meaning of the parameters is described in the software manual for LCC.</p> <p><u>Method:</u> The LCC hardware is permanently reading (polling) the incoming byte at the RS232 connection. If the incoming byte = 0x55 (<b>synch-byte</b>), then the 2.byte (<b>order-byte</b>) is read in, after this, 15 bytes (parameters) will be read. After reading in the completely data frame, the LCC hardware executes the order which is coded at the 2. byte (<b>order-byte</b>).</p>

<b>Format of the data frame:</b>		
<b>Byte No.</b>	<b>Meaning:</b>	<b>Comment:</b>
1	sync-byte = 0x55	hex-code 0x55, binary: 01010101, synchronisation byte
2	<b>ORDER NUMBER</b>	order byte
3	parameter THRESHOLD	Threshold value (0 ... 255)
4	parameter HYSTERESIS	Hysteresis value (0...255)
5	parameter POWER	LED intensity (0 ... 100%)!
6	parameter PMOD	LED mode STAT, DYN (0, 1)
7	parameter HOLD[ms]	Hold time 1,2,5,10,20,50,75 or 100ms coded to (0,1,2,3,4,5,6,7)
8	parameter TRIGGER	Trigger mode CONT, EXT, ADJEXT, EXTSTAT (0,1,2,3)
9	parameter BACKLIM	Lower intensity limit (0 ... 255)
10	parameter REGCNT	Value for power controls (0...255)
11	parameter AVERAGE	Signal averaging 1,2,4,8,16,32,64,128 coded to (0,1,2,3,4,5,6,7)
12	parameter DEAD TIME MODE	Dead time DYN or FIX (0,1)
13	parameter DEAD TIME	Value for dead time in % or ms Dead time mode = DYN → Dead time in % (0,6,12,18,24,30,36,42,48,54,60,66,72,78,84,90) coded to (0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15) Dead time mode = FIX → Dead time in ms (0, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 2000, 2500, 3000, 4000, 5000) coded to (0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15)
14	parameter OUTMODE	Function of the digital output (0=direct, 1=inverse)
15	parameter TRSH MODE	Threshold Mode (0=STAT, 1=DYN)
16	parameter DELTA TRSH	Delta Threshold value (0...255)
17	free	

<b>Value</b>	<b>ORDER NUMBER</b>	<b>(parameter byte no. 2)</b>
0	nop	no operation
1	save parameter from PC into RAM	volatile: 17 bytes PC→LCC (sync-byte, ORDER, 15 parameters)
2	save parameter from PC into RAM + EEPROM	nonvolatile: 17 bytes PC→LCC (sync-byte, ORDER, 15 parameters)
3	Send parameter from RAM to PC	15 bytes binary LCC→PC
4	Send parameter from EEPROM to RAM and to PC	15 bytes binary LCC→PC
5	Send data from RAM to PC (DAT0, DAT1, NORM, ADJEDGE, ADJEDGEH, ADJIN0L, ADJIN0H, ADJIN01L, ADJIN1H, TRSH, HYST)	11 bytes binary LCC→PC
6	Send BUFF to PC (last 16 edges)	16 bytes binary LCC→PC
7	Send line ok = 0xAA to PC and version; Version coded to 1,0	3 bytes binary LCC→PC