Leuze

Translation of original operating instructions

LES – Line Edge Sensor

Light section sensors

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Figures and tables

1 General information

1.1 Explanation of symbols

The symbols used in this technical description are explained below.

⚠ ATTENTION!
This symbol precedes text messages which must strictly be observed. Failure to observe the provided instructions could lead to personal injury or damage to equipment.

⚠ CAUTION LASER BEAM!
This symbol warns of possible danger caused by hazardous laser radiation. The light section sensors of the LES 36 series use a class 2M laser: Viewing the laser output with certain optical instruments, e.g. magnifying glasses, microscopes or binoculars may result in eye damage.

NOTE
This symbol indicates text passages containing important information.

1.2 Declaration of Conformity

The laser light section sensors of the 36 and 36HI series have been developed and manufactured in accordance with the applicable European standards and directives. They comply with the safety standards UL508 and CSA C22.2 No. 14 (Industrial Control Equipment).

NOTE
The CE Declaration of Conformity for these devices can be requested from the manufacturer.

The manufacturer of the product, Leuze electronic GmbH & Co. KG in D-73277 Owen, possesses a certified quality assurance system in accordance with ISO 9001.

CE c UL us LISTED CDRH

2 Safety

This sensor was developed, manufactured and tested in line with the applicable safety standards. It corresponds to the state of the art.

2.1 Intended use

The light section sensors of the LES 36 series are laser distance sensors for presence detection of dimensions of objects using their edges.

Areas of application

The light section sensors series LES 36 are especially designed for the following areas of application:

- Edge and height measurement of web material products and paper rolls
- Width and height measurement of cartons
- Edge and height measurement of stackable materials (e.g. chipboards)
- Complex object detection with window tracking

⚠ CAUTION
Observe intended use! The protection of personnel and the device cannot be guaranteed if the device is not used in accordance with its intended use. ↳ Only operate the device in accordance with its intended use. ↳ Leuze electronic GmbH + Co. KG is not liable for damages caused by improper use. ↳ Read these operating instructions before commissioning the device. Knowledge of this document is required in order to use the equipment for its intended purpose.

NOTE
Comply with conditions and regulations! ↳ Observe the locally applicable legal regulations and the rules of the employer's liability insurance association.

⚠ OPERATION NOTICE IN ACCORDANCE WITH UL CERTIFICATION
CAUTION – Use of controls or adjustments or performance of procedures other than specified herein may result in hazardous light exposure.

⚠ CAUTION
UL applications! For UL applications, use is only permitted in Class 2 circuits in accordance with the NEC (National Electric Code).

2.2 Foreseeable misuse

Any use other than that defined under "Intended use" or which goes beyond that use is considered improper use.

In particular, use of the device is not permitted in the following cases:

- in rooms with explosive atmospheres
- as stand-alone safety component in accordance with the machinery directive [1]
- for medical purposes

1. Use as safety-related component within the safety function is possible, if the component combination is designed correspondingly by the machine manufacturer.

	NOTE
	**Do not modify or otherwise interfere with the device!** ↳ Do not carry out modifications or otherwise interfere with the device. The device must not be tampered with and must not be changed in any way. The device must not be opened. There are no user-serviceable parts inside. Repairs must only be performed by Leuze electronic GmbH + Co. KG.

2.3 Competent persons

Connection, mounting, commissioning and adjustment of the device must only be carried out by competent persons.

Prerequisites for competent persons:

- They have a suitable technical education.
- They are familiar with the rules and regulations for occupational safety and safety at work.
- They are familiar with the technical description of the device.
- They have been instructed by the responsible person on the mounting and operation of the device.

Certified electricians

Electrical work must be carried out by a certified electrician.

Due to their technical training, knowledge and experience as well as their familiarity with relevant standards and regulations, certified electricians are able to perform work on electrical systems and independently detect possible dangers.

In Germany, certified electricians must fulfill the requirements of accident-prevention regulations BGV A3 (e.g. electrician foreman). In other countries, there are respective regulations that must be observed.

2.4 Exemption of liability

Leuze electronic GmbH + Co. KG is not liable in the following cases:

- The device is not being used properly.
- Reasonably foreseeable misuse is not taken into account.
- Mounting and electrical connection are not properly performed.
- Changes (e.g., constructional) are made to the device.

2.5 Laser safety notices

⚠ CAUTION LASER BEAM!

LASER RADIATION – CLASS 2M LASER PRODUCT

Do not stare into beam or expose users of telescopic optics!

The device satisfies the requirements of IEC 60825-1:2014 / EN 60825-1:2014+A11:2021 safety regulations for a product of **laser class 2M** and complies with 21 CFR 1040.10 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.

- Never look directly into the laser beam or in the direction of reflected laser beams! If you look into the beam path over a longer time period, there is a risk of injury to the retina.
- Do not point the laser beam of the device at persons!
- Interrupt the laser beam using a non-transparent, non-reflective object if the laser beam is accidentally directed towards a person.
- When mounting and aligning the device, avoid reflections of the laser beam off reflective surfaces!
- **CAUTION!** Use of controls or adjustments or performance of procedures other than specified herein may result in hazardous light exposure.

  The use of optical instruments or devices (e.g., magnifying glasses, binoculars) in combination with the device increases the danger of eye damage.
- Observe the applicable statutory and local laser protection regulations.
- The device must not be tampered with and must not be changed in any way.

  There are no user-serviceable parts inside the device.

  CAUTION! Opening the device may result in hazardous radiation exposure!

  Repairs must only be performed by Leuze electronic GmbH + Co. KG.
- The device emits a divergent, pulsed laser beam. Laser power, pulse duration, wavelength, see technical data.

NOTE

Affix laser information and warning signs!

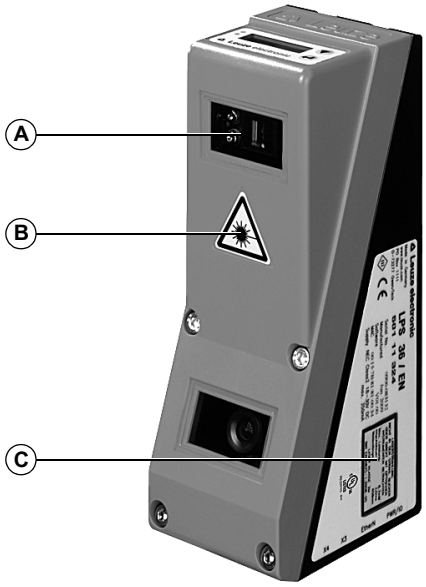
Laser warning and laser information signs are affixed to the device (see Figure 2.1):

Also included with the device are self-adhesive laser warning and laser information signs (stick-on labels) in multiple languages (see Figure 2.2).

- Affix the laser information sheet to the device in the language appropriate for the place of use.

  When using the device in the U.S.A., use the stick-on label with the "Complies with 21 CFR 1040.10" notice.
- Affix the laser information and warning signs near the device if no signs are attached to the device (e.g., because the device is too small) or if the attached laser information and warning signs are concealed due to the installation position.

  Affix the laser information and warning signs so that they are legible without exposing the reader to the laser radiation of the device or other optical radiation.



A Laser aperture
B Laser warning sign
C Laser information sign with laser parameters

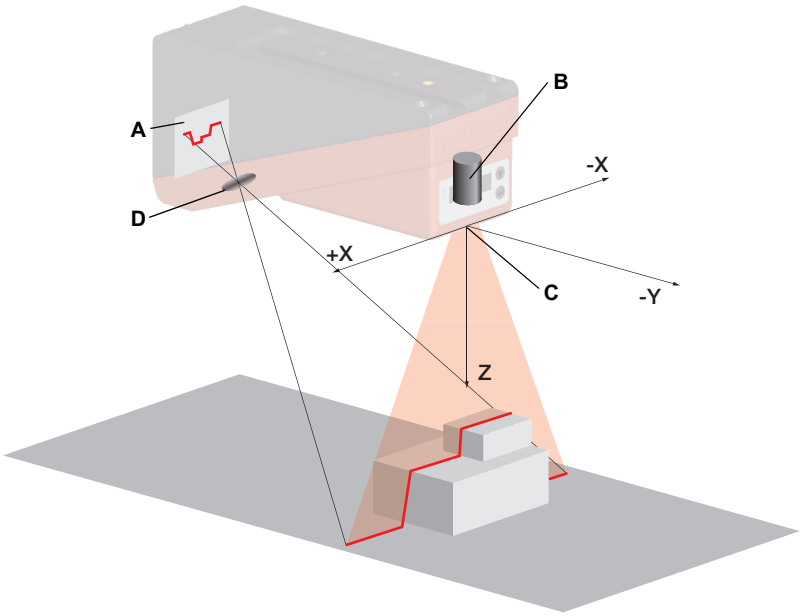
Figure 2.1: Laser apertures, laser warning signs

Figure 2.2: Laser warning and information signs – supplied stick-on labels

3 Operating principle

3.1 Generation of 2D profiles

Light section sensors work according to the triangulation principle. Using transmission optics a laser beam is expanded to a line and aimed at an object. The light remitted by the object is received by a camera, which consists of receiver optics and the CMOS area detector.



A CMOS area detector
B Laser with expansion optics
C The zero point of the coordinate system is the intersection of optical axis and front edge of the housing.
D Receiving optics

Figure 3.1: Light section sensor design

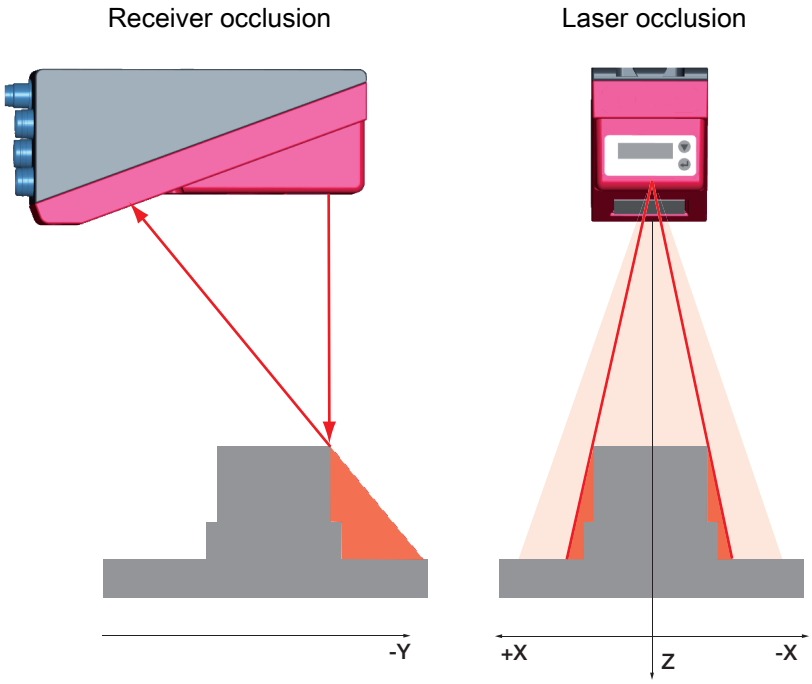
Depending on the distance of the object the laser line is projected to a different position on the CMOS planar detector as shown in Figure 3.1. By means of this position the distance of the object can be calculated.

3.2 Limits of light section sensors

3.2.1 Occlusion

The detection of high and wide objects from just one point poses the particular problem that depending on the object contour, parts of the object may be obscured by others. This effect is called occlusion.

Figure 3.2 illustrates the problem:



The receiver does not "see" any object contours in the red area because they are obscured by the upper right edge of the object.

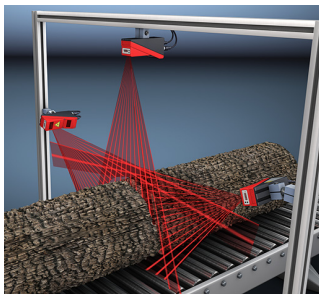
When the object is shifted to the left the object contour will still be detected by the laser but the laser line does not lie within the receiver's field of view at that point, and therefore no measurement values can be detected.

In the red areas the laser does not strike the object. Thus it is not possible to determine any data here.

Figure 3.2: Occlusion

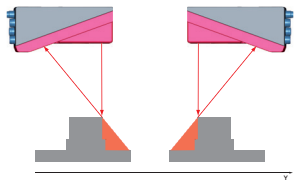
Possible measure against laser occlusion

- Using multiple light section sensors with rotated viewing direction. In the application example on the right you can clearly see that the fields of vision of the three sensors complement each other and merge. The first of the sensors is operated as a master, the two others are cascaded (see "Cascading" on page 17). This reliably prevents mutual interference of the sensors.



Possible measures against receiver occlusion

- Alignment of the measurement objects so that all profile data to be measured can be seen by the receiver.
  Or:
- Installing a second sensor featuring a viewing direction rotated by 180° about the z-axis so that the objects can be viewed from 2 sides. In the example to the right, the left sensor detects the profile data on the left side of the product, and the right sensor the profile data on the right side. In this situation the second sensor is then cascaded. See "Cascading" on page 17.



3.2.2 Resolution

In this context resolution means the smallest possible change in distance of the measurement object, which causes a unique change of the output signal. Resolution is higher in the short range than in the distant range. Small objects can be recognized better in the short range.

The length of the laser line in the X-direction is dependent on the distance Z of the measurement object from the sensor . Always the same number of measurement points is measured. From this it follows that the resolution in X-direction decreases with increasing distance in Z-direction.

The following illustration shows this relation:

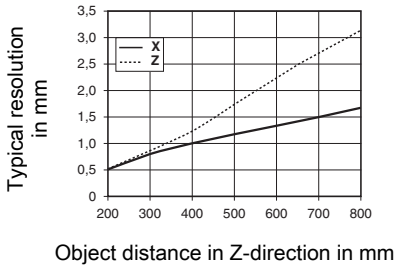


Figure 3.3: Typical resolution LES 36…

The output resolution of the measurement values on the process interface is 1/10 mm with Standard-Connect, 1/100 mm with HI-Connect (for LES 36HI/VC6 only).

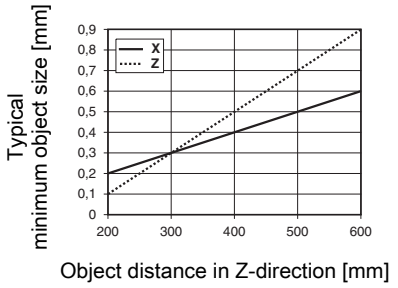
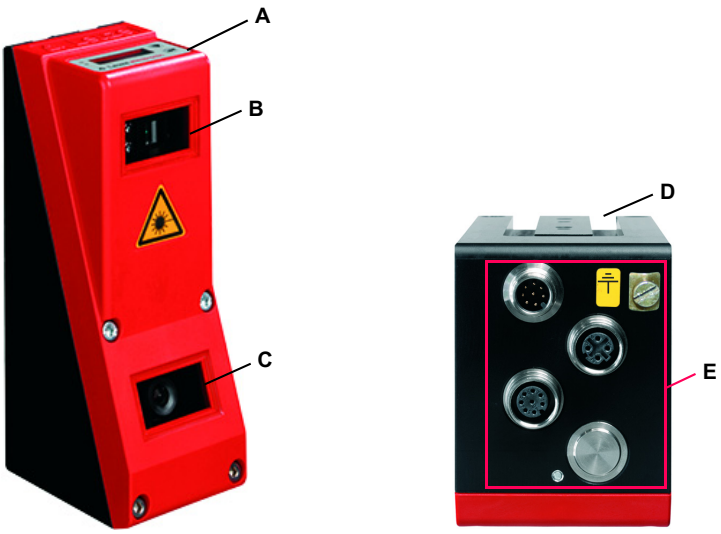


Figure 3.4: Typical minimum object size LES 36HI…

4 Device description

4.1 Overview of light section sensors

4.1.1 Mechanical design



A Display with membrane keyboard
B Laser transmitter
C Receiver (CMOS camera)
D Groove for dovetail mounting and fastening holes
E Electrical connection and grounding terminal

NOTE
The following shows a light section sensor as an example. An overview of the available types can be found in Chapter 16.1.

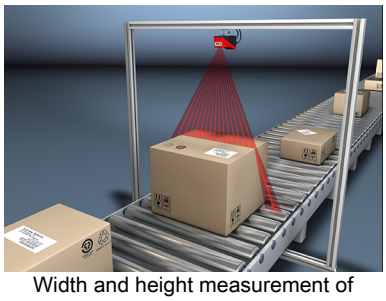
Figure 4.1: Mechanical design of Leuze light section sensors

4.1.2 General performance characteristics

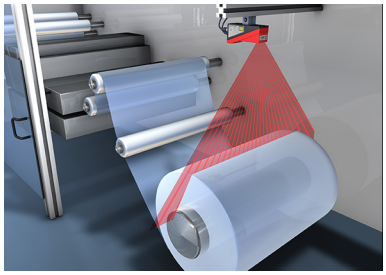
- Light section sensor for width, height and position detection
- Measurement time/response time: 10 ms
- Measuring range/detection range: 200 … 800 mm
- Measurement range/detection area: LES 36…: 200 to 800 mm, LES 36HI…: up to 600 mm
- Length of laser line: max. 600 mm
- Length of the laser line: LES 36...: max. 600 mm, LES 36HI…: max. 140 mm
- Configuration and transmission of process data via Fast Ethernet
- OLED display with membrane keyboard
- Measurement value display in mm on OLED display as an alignment aid
- Up to 16 inspection tasks
- Compact construction
- Robust design and easy operation
- Activation input, trigger input, cascading output

4.1.3 Line edge sensor – LES 36

Line edge sensors determine the positions and dimensions of objects via their edges. The sensor determines the edge positions in mm and, from those, calculates the object width and height. These data are transferred to the process control. One sensor can be used to simultaneously detect up to four value pairs of edges.



Width and height measurement of cartons



Determining width and diameter of roll goods

Specific performance characteristics

- Configuration software LESsoft
- Data calculation and processing directly inside the sensor
- Integrated PROFIBUS interface or analog output
- Up to 4 edge analysis windows with 2 edge-value pairs each
- Up to 8 analysis windows with logic operation option
- Detailed information on measurement function, analysis windows, detection functions and sensor state via Ethernet and PROFIBUS

Typical areas of application

- Edge and height measurement of web material products and paper rolls
- Width and height measurement of cartons
- Edge and height measurement of stackable materials (e.g. chipboards)

4.2 Operating the sensor

4.2.1 Connection to PC / process control

Parameterization

For commissioning, the light section sensors are connected to a PC via the Ethernet interface (see "Connection X2 – Ethernet" on page 35) and set using the supplied LESsoft configuration software.

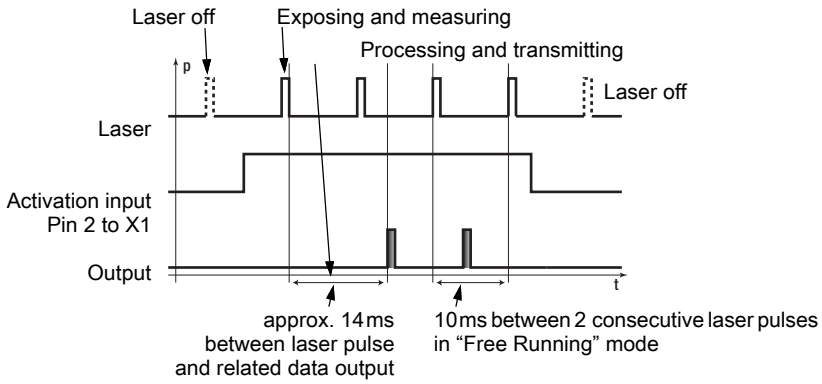
Measurement operation

In measurement operation, the LES 36…/VC6 is connected to the process control via its analog output, the LES 36…/PB is connected to the process control via PROFIBUS. Alternatively, the LES 36 can be operated via the Ethernet interface on X2, see chapter 10 "Integrating the LES in the process control (Ethernet)". Additional sensor information is then available.

4.2.2 Activation – laser on/off

The laser and the data transmission can selectively be switched on and off via the activation input **InAct** (pin 2 at X1) or via the 'Ethernet Trigger' command. Thus possible glares due to laser radiation can be prevented during time periods when no measurements are performed.

	NOTE
	The sensor is delivered ex works with the `Activation Input Disregard` setting. The possible activation sources (activation input and Ethernet activation) are ignored – the measurement function of the sensor is enabled. The activation function can be switched on via the configuration software. To do this, the `Activation Input` parameter must be set to `Regard`. The sensor then only measures if one of the activation sources is activated. If the sensor is waiting for activation, it displays `!Act` in the display.



Axles:
p level
t Time

Figure 4.2: Activation input signal sequence

Figure 4.2 shows the effect of the activation on laser and measurement value output in “Free Running” mode.

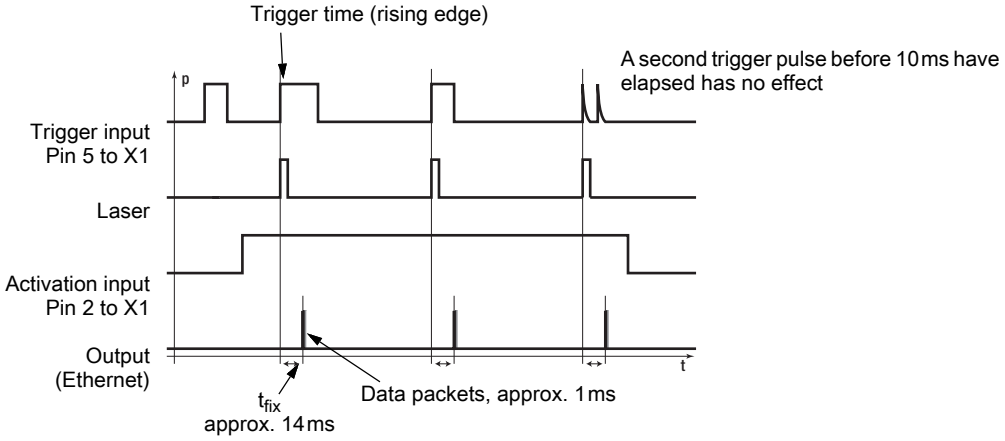
4.2.3 Triggering – Free Running

The light section sensors can measure in two modes:

- In "Free Running" operation, the light section sensor determines measurement results with a frequency of 100 Hz and outputs these continuously via the X2 interface.
- Alternatively, single measurements can also be carried out. For this purpose, the light section sensor requires a trigger signal at the trigger input (pin 5 on X1), a PROFIBUS trigger or the `Ethernet Trigger` command in measure mode (see chapter 10.3.4 "Commands in measure mode" on page 78).

  When triggering via pin 5 at X1, note:
  - Triggering occurs on the rising edge.
  - The trigger pulse must be at least 100 µs long.
  - Before the next trigger, the trigger cable must be on low-level for at least 1 ms.
  - Activation must occur at least 100 µs before the trigger edge.
  - The shortest possible time interval between two successive trigger edges is 10 ms.

NOTE
Ex works, the LES 36 is set to `Free Running` (shown on display: *fRun*). In order for it to respond to signals on the trigger input, the operating mode must be set via the LESsoft configuration software to `Input Triggered` (shown on display: *Trig*).



Axles:
p level
t Time

Figure 4.3: Trigger input signal sequence

PROFIBUS trigger

So that a measurement can be triggered on each PROFIBUS cycle, the PROFIBUS trigger of the LES responds to a change of master output byte **uTrigger**. The control only needs to increment the trigger value in order to initiate a new measurement.

The maximum trigger frequency is 100 Hz. If triggering occurs during a measurement, the trigger signal is ignored, as is the case in the **Free Running** operating mode.

4.2.4 Cascading

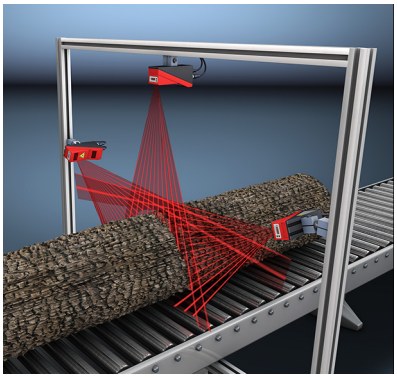
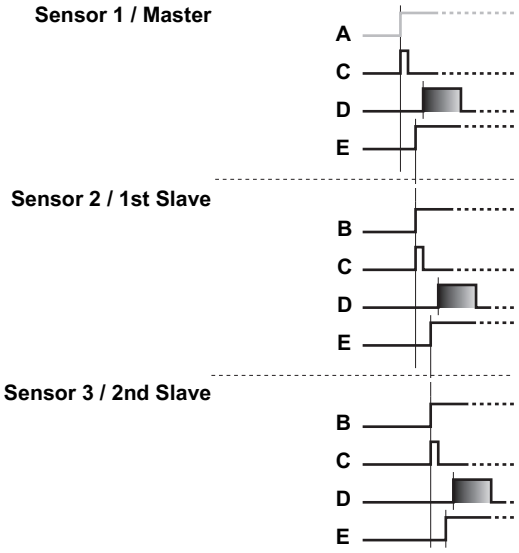


Figure 4.4: Cascading application example

If several light section sensors are operated, there is the risk of mutual interference if the reflected laser beam of one sensor can be received by the receiver of another sensor at the time of reading.

This can be clearly seen in Figure 4.4. Here three light section sensors are used to determine the log thickness reliably from all sides.



A Trigger input, pin 5 at X1 / not required
B Trigger input, pin 5 at X1
C Laser
D Measurement value output
E Cascading output, pin 6 at X1

Figure 4.5: Signal sequence for cascading

To prevent mutual interference the light section sensors can be operated cascaded: the exposure by the second sensor will be initiated following completion of the exposure by the first sensor. To achieve this, the cascading output of the first sensor must be connected to the trigger input of the second sensor. Up to 6 sensors can thus be operated cascaded.

Trigger settings

Sensor 1, or the master, can be operated in this case both triggered as well as continuously. All other sensors must be operated triggered.

Cascading settings

For all sensors except the last slave, the cascading output must be enabled via configuration software:
`Cascading Output: Enable`.

	NOTE
	In PROFIBUS mode, cascading only works as described above via the inputs/outputs **InTrig** and **OutCas** on X1. In this case, the maximum detection rate of 100 Hz is achieved. Make certain, however, that the input data of the PROFIBUS light section sensors are still transmitted in the same bus cycle; monitor the scan numbers if necessary. Alternatively, light section sensors with PROFIBUS can be selectively triggered in sequence. Master output 'uTrigger' of the sensor to be triggered is incremented on each PLC cycle; the master outputs of the other sensors do not change. The maximum detection rate of 100 Hz is not achieved with this process. If multiple sensors are triggered in a PROFIBUS cycle, mutual interference may occur between the sensors if they are in the same visual field and the time between updating byte 'uTrigger' is shorter than the maximum exposure time (Exposure Time) of 1.3 ms.

4.3 Measurement functions LES 36

With the LES 36, you can reliably detect objects and measure their edge position, height and width. Adaptation of the LES 36 to an application is performed using the LESsoft configuration software. All settings for the application are made there and stored in up to 16 inspection tasks.

Functional principle of object and edge detection with the LES

The distance profile of the application is determined along the laser line in 376 measurement points. Rectangular analysis windows, used for object and edge detection, can be defined in the measurement range.

Object detection:

The number of measurement points is counted in the analysis window (Analysis Window = AW or Edge Analysis Window = EAW) and compared with two adjustable limits. From this, the logical state **ok** or **not ok** of the analysis window is determined. For unique object detection, it may be necessary to combine multiple analysis windows. For this purpose, the LES offers the AND combination and inversion of multiple analysis windows. The logic combinations ensure the detection of problematic objects.

Edge detection:

Windows for edge detection are called Edge Analysis Windows (EAW). In an EAW, object detection can be performed as described above. Also determined in an EAW are the X and Z coordinates of the first ("left-most") and the last ("right-most") measurement point. By appropriately selecting the size and position of the EAWs, it is possible to determine coordinates of edge positions. From these, the width and height of an object are calculated. For robust edge detection, the "Sequent Hits" parameter was introduced. The minimum number of measurement points set there must occur in succession in the EAW to detect a valid edge. Outliers or missing measurement points reset the counter.

4.3.1 Inspection Task

The LES 36 supports up to 16 individual inspection tasks. Grouped together in an inspection task are all parameter settings relevant for an application:

- Operation Mode (Free Running, Input Triggered)
- Activation Input (switch laser on and off)
- Cascading Output
- Light Exposure (exposure duration of the laser)
- Field of View (sensor detection range)
- Edit Analysis Windows (size and position of four AWs and four EAWs, object detection and edge detection parameters)
- Edit Logical Combinations (logic combination of AWs and EAWs, definition of the values that are available via the Profibus)
- Analog Output (analog output definitions)

The selection of the inspection tasks is carried out:

- via the switching inputs of connection X3 (inspection tasks 0-7 only)
- Via PROFIBUS
- via LESsoft (on a PC connected via X2)
- via Ethernet (on a process control connected via X2)
- via the control panel of the sensor beginning with firmware V01.40.

4.3.2 Edge Analysis Window (EAW)

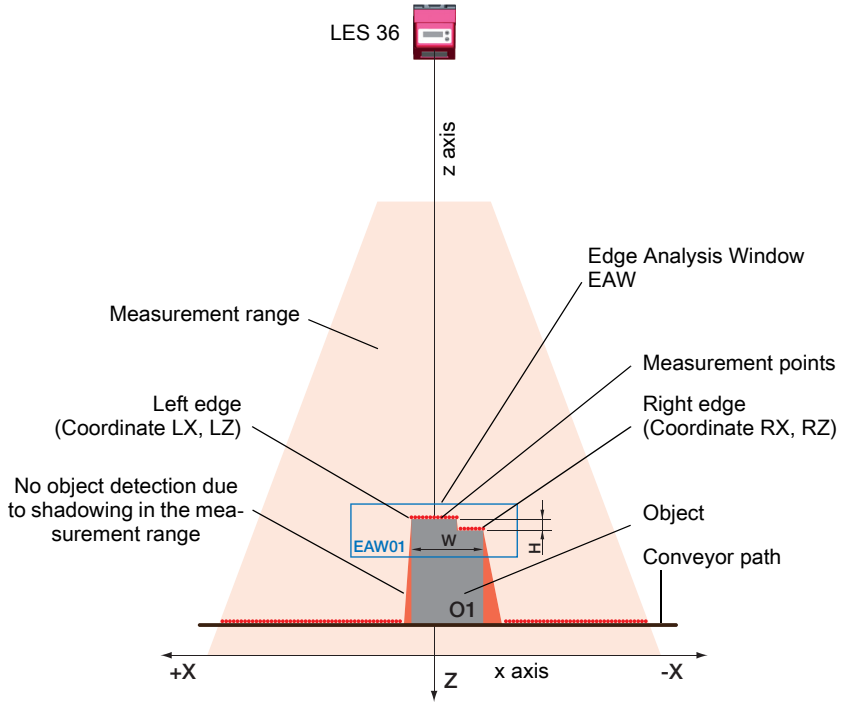
EAWs are used for edge detection; they can also be used for object detection. EAWs are configured using the LESsoft configuration software (see chapter 9.4 "Parameter settings/Parameters tab", Figure 9.3). Here, the position and size of each EAW are defined. To ensure stable measurement of edge positions, it is also possible to

- check the edge quality (Sequent Hits, see below),
- count the number of measurement points to be detected in the EAW (a quasi minimum object size).

An evaluation is carried out only within the active EAWs. Areas outside of the measurement range and field of view are ignored.

Characteristics of EAWs

- EAWs are rectangular and may overlap freely.
- The coordinates of the left-most measurement point ("leftmost" LX, LZ) and right-most measurement point ("rightmost" RX, RZ) are determined in each EAW.
- EAWs usually have an absolute position. If the object position varies, an EAW can also be positioned relative to a found edge position in the previous EAW and thus tracked.



H Height difference of 2 edges
W Object width

Figure 4.6: Edge detection with EAWs

4.3.3 Definition of EAWs and their analysis results

Edge detection

Edge detection with the LES is possible if the following prerequisites are met:

There are enough successive measurement points in the EAW at both the right and the left edge. This serves the plausibility of the edge detection.

Edges are only detected if the number of successive measurement points is greater than or equal to the defined minimum number of measurement points (Sequent Hits). If there are not enough

successive measurement points in an EAW, no edge detection and no object measurement is possible within this EAW.

Configuration of the edge detection in EAWs is performed with **LESsoft** (`Edit Analysis Windows -> Edge Detection Definitions`).

NOTE	
	If there are not enough successive measurement points on the edges of an EAW, the found edge positions are shifted away from the edges of the EAW (see Figure 4.7, different right edge position with different parameters for Sequent Hits).

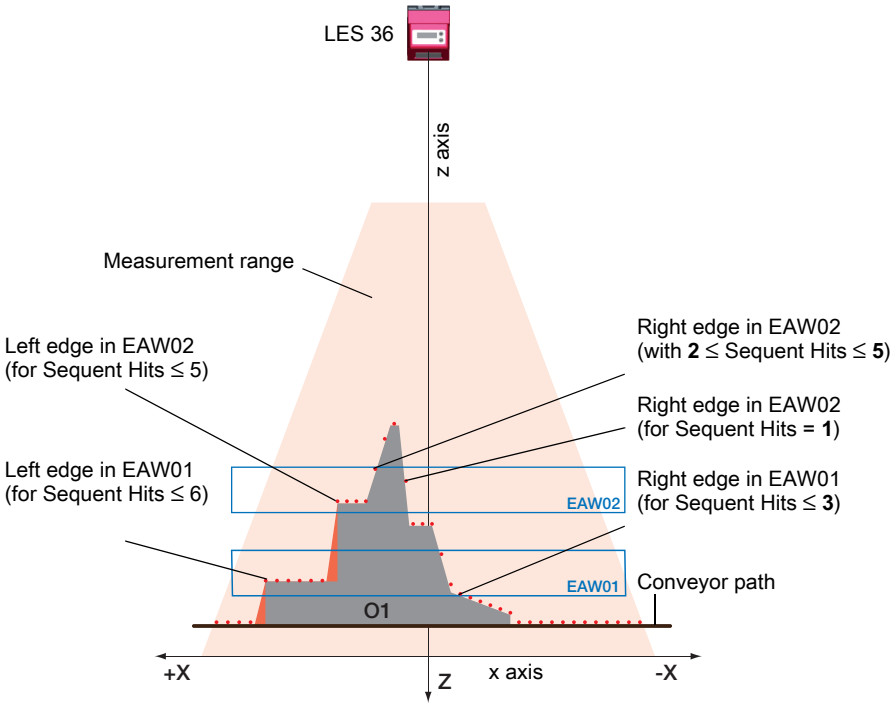
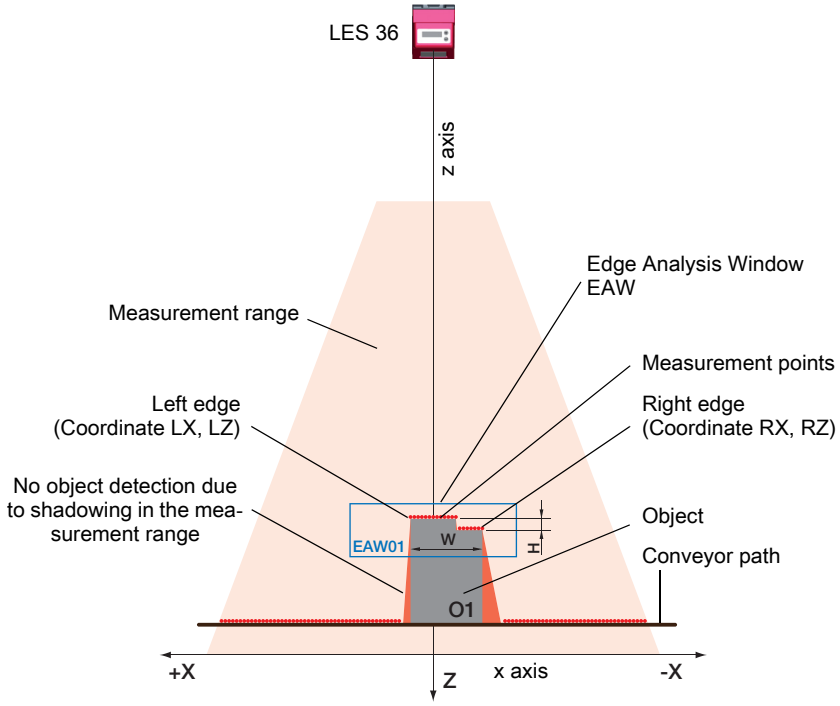


Figure 4.7: Meaning of Sequent Hits for edge detection

For each EAW, up to two measurement values can be output (configuration with **LESsoft**: `Edit Logical Combinations`):

- Edge positions: LX, LZ, RX, RZ (LX = left edge X-coordinate, LZ = left edge Z-coordinate, RX = right edge X-coordinate, RZ = right edge Z-coordinate).
- Width of objects: W (calculated from the distance of RX and LX in the X-direction).
- Height difference of left and right edge: H (calculated from the distance of RZ and LZ in the Z-direction).

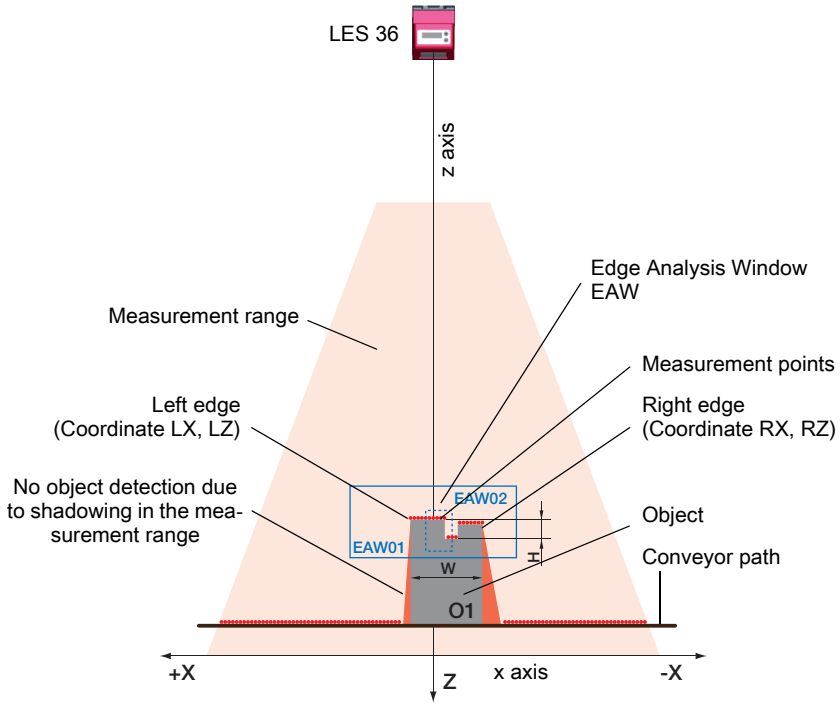


H Height difference of 2 edges
W Object width

Figure 4.8: Edge detection with EAWs

Relative window positioning

If the position tolerance of the measurement object exceeds the possible size of the analysis window, it is possible to move the EAW relative to the position of the measurement object.



H Height difference of 2 edges
W Object width

Figure 4.9: Edge detection with varying object position

For precise definition of the reference edge, the measurement object is placed within EAW01 and acquisition of measurement data is stopped (pause button) as soon as the desired reference edge has been found.

In the now static measurement profile, a further analysis window (e.g. EAW02) can be positioned relative to the right or left object edge found in EAW01. This window now tracks all position changes of the object edge to be measured, both in the X-direction and Z-direction.

NOTE
The evaluation functions are defined using LESsoft (see chapter 9.4).

Object detection

In addition to edge detection, functions for object detection are also available in the LES 36. By way of the optional configuration of the detection functions, even problematic objects can be reliably measured.

- During object detection, the number of measurement points in an EAW/AW are ascertained and compared with two adjustable limits. From this, the logical object detection state **ok** or **not ok** of the EAW is determined. Configuration of the object detection in EAWs/AWs is performed with **LESsoft** (`Edit Analysis Windows` -> `Analysis Window Definitions`).

For unique object detection, it may be necessary to combine EAWs or AWs. For this purpose, the LES offers the AND combination and inversion of multiple analysis windows. The configuration of applications with additional object detection with logic combinations is performed with LESsoft (`Edit Logical Combinations` -> `AW Logic` area).

The result of combinations can be output via PROFIBUS or Ethernet. Detailed evaluation results such as, e.g., the status of all EAWs/AWs, the number of measurement points within the EAW/AW and the state of the complete object detection are transmitted via Ethernet. You can find more information on this in Chapter 10 and Chapter 11.

NOTE
An object detection is carried out only within the active EAWs. Areas outside of the measurement range and field of view are likewise not evaluated. An object is detected if the number of measurement values in the EAW reaches or exceeds an arbitrarily defined minimum value.

NOTE
The number of hit points does not necessarily correspond with the object size, since the number of hit points is dependent on distance **z**. At near distance to the sensor (e.g., 300 mm), an object expanded in the X-direction has nearly twice as many hit points as it does at a far distance (e.g., 600 mm). If the object distance is the same, the number of hit points remains nearly constant.

4.3.4 Application examples for EAWs

Application example: web-edge measurement

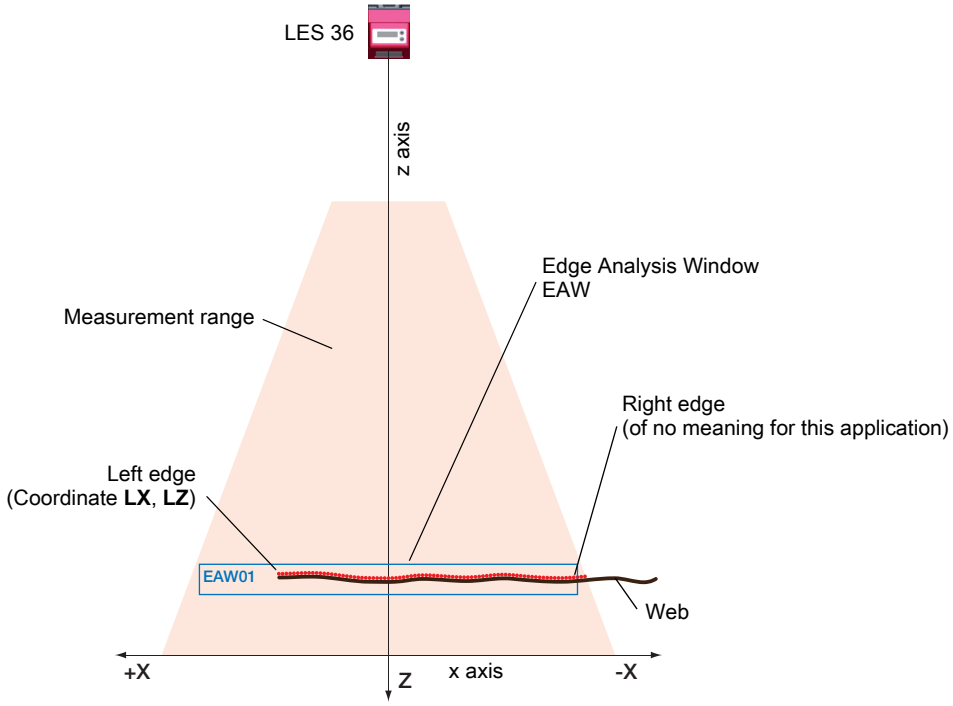
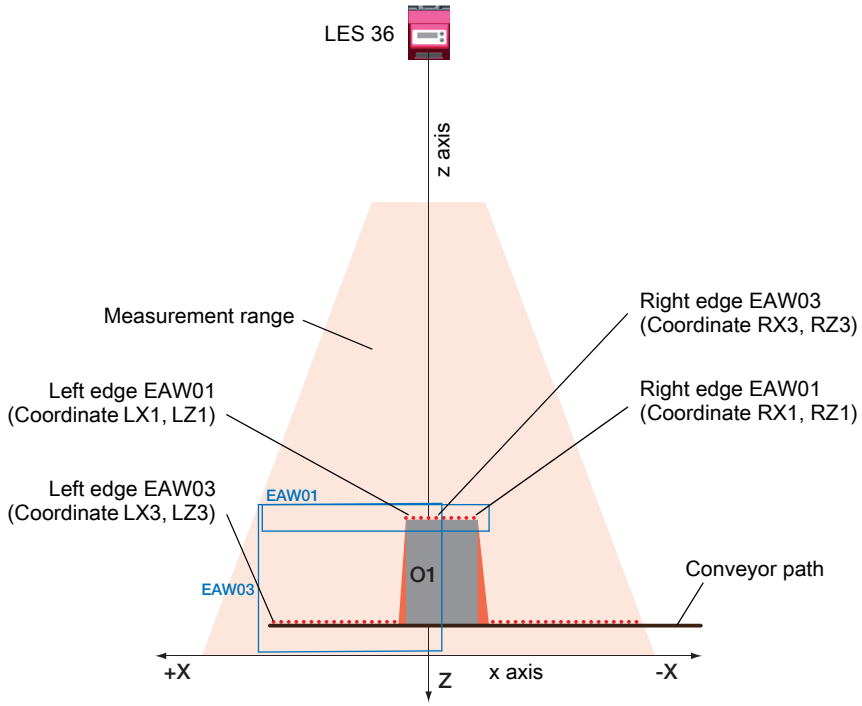


Figure 4.10: Application example: web-edge measurement

In the example shown above, the edge position of web material is to be determined. Analysis is performed in Edge Analysis Window EAW01. The edge coordinates for edge LX, LZ are determined in EAW01.

Application example: height and width measurement of a cubic object



H Height difference of 2 edges

Figure 4.11: Application example: height and width measurement of a cubic object

In the application example shown above, the height and width of a cubic object **O1** is to be determined. The object is on a conveyor line. The width is measured in edge analysis window EAW01; the height is measured in EAW03. The following measurement values are obtained:

- in the EAW01: **Object width** W = LX1 - RX1
- in the EAW03: **Object height** H = RZ3 - LZ3

4.4 Analysis Window (AW)

In addition to the EAWs, 4 AWs can be configured with the LES 36. In AWs, only object detection is possible.

During object detection, the number of measurement points in an AW is determined and compared with two adjustable limits. From this, the logical object detection state **ok** or **not ok** of the AW is determined. If there are not enough measurement points in the AW, the object detection state is **not ok**. Configuration of the object detection in EAWs/AWs is performed with **LESsoft** (`Edit Analysis Windows` -> `Analysis Window Definitions`). The position and size of the AW are configured here for each AW.

For unique object detection, it may be necessary to combine AWs or EAWs. For this purpose, the LES offers the AND combination and inversion of multiple analysis windows. The configuration of applications with additional object detection with logic combinations is performed with **LESsoft** (`Edit Logical Combinations` -> `AW Logic` panel).

The result of combinations can be output via PROFIBUS or Ethernet. Detailed evaluation results such as, e.g., the status of all EAWs/AWs, the number of measurement points within the EAW/AW and the state of the complete object detection are transmitted via Ethernet. You can find more information on this in Chapter 10 and Chapter 11.

	NOTE
	An object detection is carried out only within the active EAWs. Areas outside of the measurement range and field of view are likewise not evaluated. An object is detected if the number of measurement values in the EAW reaches or exceeds an arbitrarily defined minimum value.

	NOTE
	The number of hit points does not necessarily correspond with the object size, since the number of hit points is dependent on distance **z**. At near distance to the sensor (e.g., 300 mm), an object expanded in the X-direction has nearly twice as many hit points as it does at a far distance (e.g., 600 mm). If the object distance is the same, the number of hit points remains nearly constant.

5 Installation and mounting

5.1 Storage, transportation

⚠ ATTENTION!
When transporting or storing, package the light section sensor so that it is protected against collision and humidity. Optimum protection is achieved when using the original packaging. Ensure compliance with the approved environmental conditions listed in the specifications.

Unpacking

↳ Check the packaging content for any damage. If damage is found, notify the post office or shipping agent as well as the supplier.

↳ Check the delivery contents using your order and the delivery papers:

- Delivered quantity
- Device type and model as indicated on the name plate
- Laser warning signs
- Brief manual

The name plate provides information as to what light section sensor type your device is. For specific information, please refer to Chapter 16.

NOTE
The following shows a light section sensor as an example. An overview of the available types can be found in Chapter 16.1.

Figure 5.1: Device name plate LES 36

↳ Save the original packaging for later storage or shipping.

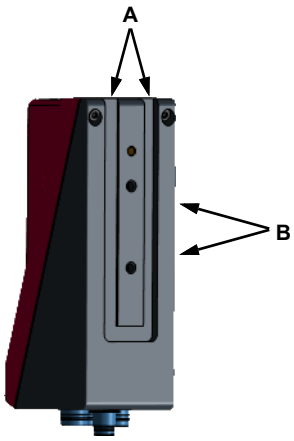
If you have any questions concerning your shipment, please contact your supplier or your local Leuze electronic sales office.

↳ Observe the applicable local regulations when disposing of the packaging materials.

5.2 Mounting the LES 36

The light section sensors can be mounted in different ways:

- By means of two M4x6 screws on the back of the device
- Using a BT 56 mounting device on the two fastening grooves.
- Using a BT 59 mounting device on the two fastening grooves.



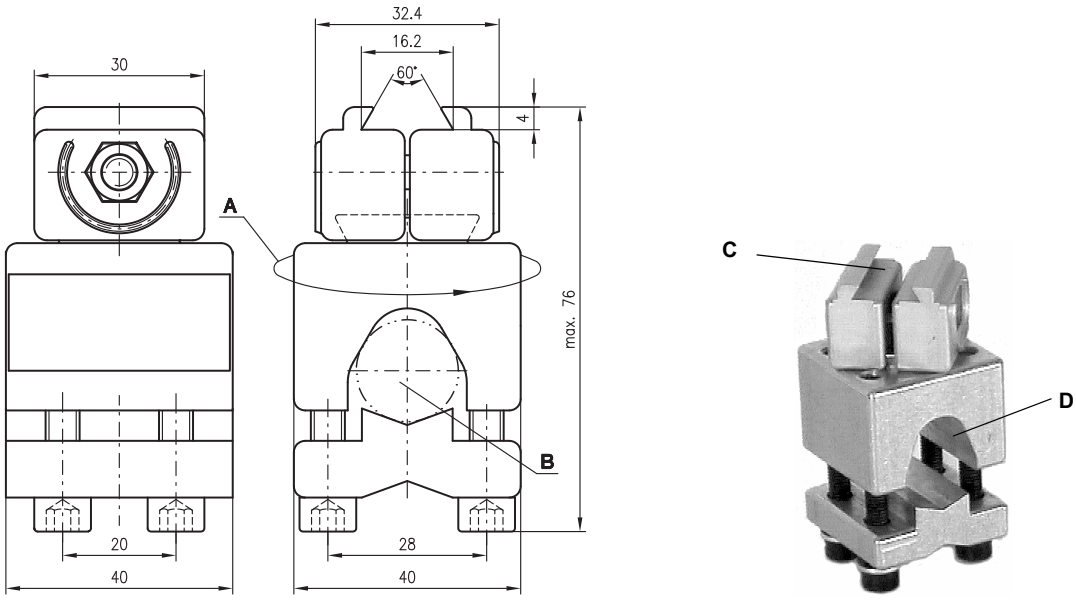
A Dovetail fastening grooves
B M4 threaded holes

Figure 5.2: Fastening options

Figure 5.3: Mounting example LES 36

5.2.1 BT 56 mounting device

The BT 56 mounting device is available for mounting the LES 36 using the fastening grooves. It is designed for rod mounting (Ø 16mm to 20mm). For ordering information, please refer to the chapter "Type overview and accessories" on page 97.

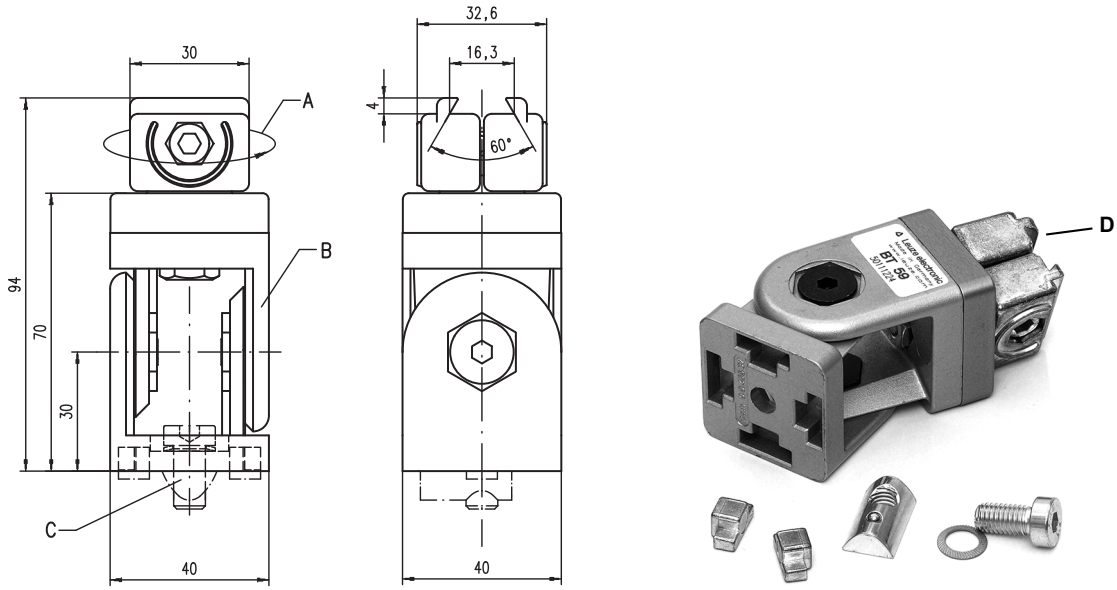


A Rod holder, turnable 360°
B Rods Ø 16 ... 20mm
C Clamping jaws for mounting on the LES
D Clamp profile for mounting on round or oval pipes (Ø 16 … 20 mm)
all dimensions in mm

Figure 5.4: BT 56 mounting device

5.2.2 BT 59 mounting device

The BT 59 mounting device is available for mounting the LES 36 on ITEM profiles using the fastening grooves. For ordering information, please refer to the chapter "Type overview and accessories" on page 97.



A Holder, turnable 360°
B ITEM joint, angle adjustable ±90°
C M8x16 screwable cylinder, M8 serrated washer, M8 sliding block, connectors for ITEM profile (2x)
D Clamping jaws for mounting on the LES 36
all dimensions in mm

Figure 5.5: BT 59 mounting device

5.3 Device arrangement

5.3.1 Selecting a mounting location

In order to select the right mounting location, several factors must be considered:

- The required resolution. This is a result of the distance and the resulting line length.
- The permissible cable lengths between the LES 36 and the host system depending on which interface is used.
- The display and control panel should be very visible and accessible.

↳ When selecting a mounting location, pay further attention to:

- Maintaining the required environmental conditions (temperature, humidity).
- Possible soiling of the optics covers on transmitter and receiver by discharged liquids, abrasion from cartons or packaging residues.
- Lowest possible chance of damage to the LES 36 by mechanical collision or jammed parts.
- Possible extraneous light (no direct sunlight or sunlight reflected by the measurement object).
- For the optimal perspective for detecting the relevant object contours, see chapter 3.2.1 "Occlusion".

	⚠ ATTENTION, LASER RADIATION!
	When mounting and aligning the LES 36, avoid reflections of the laser beam off reflective surfaces!

	NOTE
	The prevention of ambient light due to shielding of the sensor for example, ensures stable and precise measurement values. Secondary reflections of the laser line on reflective objects must be avoided as these can lead to incorrect measurements. The best measurement results are obtained when: • You adapt the operating mode (light/dark) to the application • You do not measure high-gloss objects. • There is no direct sunlight.

5.3.2 Aligning the sensor

The zero point of the sensor coordinate system is the intersection of optical axis and front edge of the housing. The general principle is that the light section sensor should be aligned so that the back of the sensor is aligned parallel to the conveying belt or measuring plane. Rotation along the Y-axis is not desirable.

Figure 5.6 illustrates the problem:

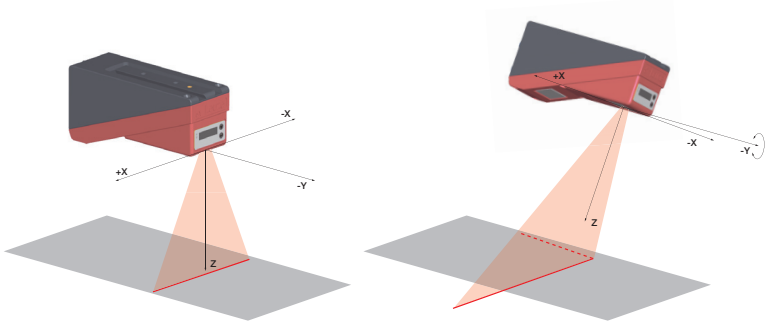


Figure 5.6: Alignment to the measuring plane

A rotation of the sensor about the y-axis distorts the entire coordinate system, which the measurement values relate to. The sensor measures along the solid line in the right picture, however the measuring plane is located on the dotted line, and a measurement towards the conveying belt shown in gray would result in a tilted plane.

When setting up an application it is therefore very important to ensure correct alignment and that the integrated alignment aid on the display is used.

5.4 Attach laser warning sign

⚠ CAUTION LASER BEAM!	
	Follow the safety notices in Chapter 2. ↳ It is essential that you attach the stick-on label (laser warning signs and laser beam exit symbol) supplied with the light section sensor to the light section sensor! If the signs would be concealed as a result of the mounting situation of the LES 36, attach the signs in the vicinity of the LES 36 such that reading the signs cannot lead to looking into the laser beam! When installing the LES 36 in North America, also attach the stick-on label saying "Complies with 21 CFR 1040.10"

5.5 Cleaning

↳ Clean the optics cover of the LES 36 with a soft cloth after mounting. Remove all packaging remains, e.g. carton fibers or styrofoam balls. In doing so, avoid leaving fingerprints on the optics cover of the LES 36.

⚠ ATTENTION!	
	Do not use aggressive cleaning agents such as thinner or acetone for cleaning the device.

6 Electrical connection

The light section sensors are connected using variously coded M12 connectors. This ensures unique connection assignments.

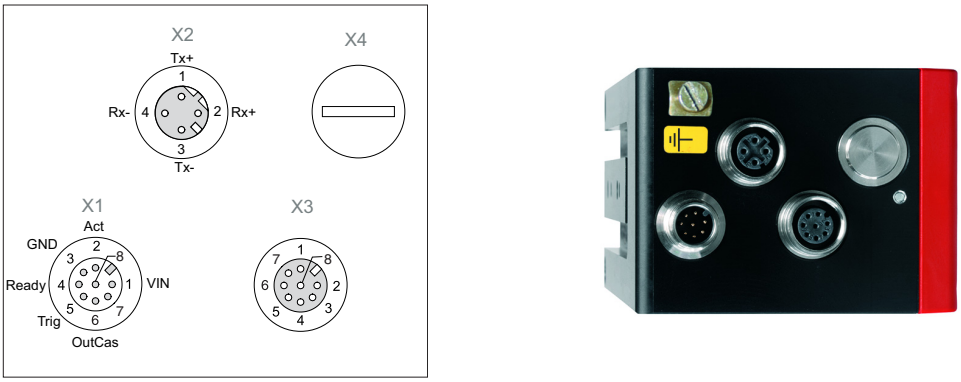
For the locations of the individual device connections, please refer to the device detail shown below.

NOTE
The corresponding mating connectors and preassembled cables are available as accessories for all connections. You can find more information on this in Chapter 16.1.

NOTE
The following shows a light section sensor as an example. An overview of the available types can be found in Chapter 16.1.

Figure 6.1: Location of the electrical connections

All the light section sensors are equipped with three M12 connectors/sockets which are A- and D-coded.



NOTE
The following shows a light section sensor as an example. An overview of the available types can be found in Chapter 16.1.

Figure 6.2: Connections of the LES 36

The pin assignment of X1 and X2 is identical for all light section sensors; X3 and X4 differ depending on device type.

↳ Using the name plate check the exact type designation. The version of X3/X4 is contained in the following table:

Type designation	X3	X4	Relevant chapter
LES 36/VC6	Switching inputs/outputs	Analog output voltage/current	see chapter 6.3.3
LES 36/PB	Not assigned	PROFIBUS	see chapter 6.3.4
LES 36HI/VC6	Switching inputs/outputs	Analog output voltage/current	see chapter 6.3.3
LES 36HI/PB	Not assigned	PROFIBUS	see chapter 6.3.4

Table 6.1: Interface version of X3 and X4

6.1 Safety notices

⚠ ATTENTION!

Do not open the light section sensor yourself under any circumstances! There is otherwise a risk of uncontrolled emission of laser radiation from the light section sensor. The housing of the LES 36 contains no parts that need to be adjusted or maintained by the user.

Before connecting the device, be sure that the supply voltage agrees with the value printed on the name plate.

Connection of the device and cleaning must only be carried out by a qualified electrician.

If faults cannot be cleared, the LES 36 should be switched off from operation and protected against accidental use.

The light section sensors LES 36 are designed in accordance with protection class III for supply by PELV (protective extra-low voltage with reliable disconnection).

NOTE

Degree of protection IP 67 is achieved only if the connectors and caps are screwed into place! The connectors used must be equipped with O-ring seals. Therefore, preferably, please use the preassembled cables by Leuze electronic.

6.2 Shielding and line lengths

The light section sensors of the 36/36HI series are equipped with modern electronics developed for industrial applications. In industrial environments, a number of sources of interference may affect the sensors. In the following, information is provided on EMC-compliant wiring of the sensors and of the other components in the switch cabinet and on the machine.

↳ Observe the following maximum line lengths:

Connection to sensor	Interface	Max. cable length	Shielding
Power supply unit	X1	50 m	Required
Activation / cascading / trigger	X1	50 m	Required
PC/Host	X2	50 m	Required
Encoder	X3	50 m	Required
Switching inputs/outputs	X3	10 m	Required
Analog output voltage/current	X4	10 m	Required
PROFIBUS DP	X4	10 m	Required

Table 6.2: Cable lengths and shielding

Shielding:

1. **Ground the LES 36 housing**:
   Connect the housing of the LES 36 via the functional earth (FE) screw provided for this purpose (see Figure 6.3, devices produced after April 2011) with the protective conductor on the machine star point. The cable should have an impedance as low as possible for high-frequency signals, i.e., be as short as possible and have a large cross-sectional area (grounding strip, …).
   If the LES 36 does not yet have an FE screw of its own, please use one of the M4 holes on the dovetail.

NOTE
Important: Place a lock washer underneath and check the penetration of the anodized coating of the LES 36 housing by measuring the electrical connection from the FE star point to the connector sleeves without connected sensor cables so that other FE interruptions can be detected on the machine base and profile rails as well.

2. **Shield all connection cables to the LES 36**:
   Apply the shield to FE on both sides. On the LES 36 end, this is ensured if the LES 36 housing is connected to FE (PE) as described under 1 (shield fitted over the connector sleeves to the housing).
   In the switch cabinet, clamp the shield flat to FE. To do this, use special **shielding clamps** (e.g., Wago, Weidmüller, …).
   Keep the length of the shieldless cable end as short as possible.
   The shield should not be connected at a terminal in a twisted fashion (no "RF braid").
3. **Disconnect power and control cables**:
   Lay the cables for the power components (motor cables, lifting magnets, frequency inverters, …) as far from the sensor cables as possible (distance > 30 cm). Avoid laying power and sensor cables parallel to one another.
   Cable crossings should be laid as perpendicular as possible.
4. **Lay cables close to grounded metal surfaces**:
   This measure reduces interference coupling in the cables.
5. **Avoid leakage currents in the cable shield**:
   Leakage currents arise from incorrectly implemented equipotential bonding. Therefore, carefully ground all parts of the machine.

NOTE
You can measure leakage currents with a clip-on ammeter.

6. **Star-shaped cable connections**:
   To avoid interference between various consumers, ensure that the devices are connected in a star shape. This will prevent cable loops.

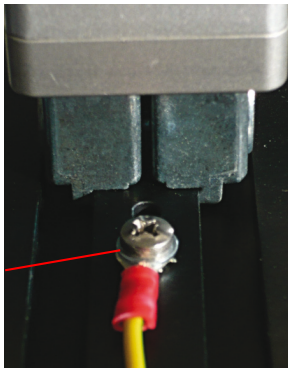
NOTE
General shielding information: Avoid spurious emissions when using power components (frequency inverters, …). The technical descriptions of the power components provide the necessary specifications according to which the respective power component satisfies its CE conformity. In practical work, the following measures have proven effective: • Screw the mains filter, frequency inverter flat on the galvanized mounting plate. • Mounting plate in the switch cabinet made of galvanized sheet steel, thickness ≥ 3 mm • Keep cable between mains filter and inverter as short as possible and twist cables. • Shield both ends of the motor cable. • Properly ground the total system. Carefully ground all parts of the machine and of the switch cabinet using copper strips, ground rails or grounding cables with large cross section.

Below, the EMC-compliant connection of the light section sensors LES 36 is described in practical use with images.

Connect the ground potential to the light section sensors

ATTENTION!

Place lock washer underneath and check the penetration of the anodized coating!

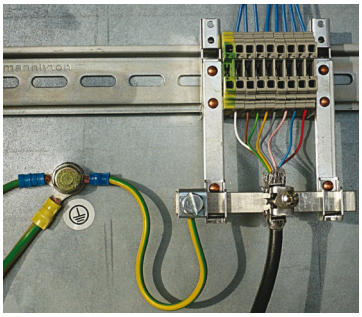


Devices produced after April 2011 are equipped with an additional grounding terminal.

All devices can also be connected to ground potential at the M4 threaded hole on the dovetail.

Figure 6.3: Connecting the ground potential to the light section sensor

Connecting the cable shielding in the switch cabinet

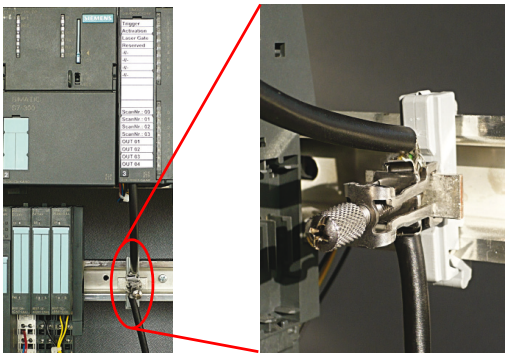


- Shield connected flat to PE
- Connect PE star point with short cables
- Galvanized mounting sheet steel

Comment:
Depicted shield components from Wago, series 790 ...:
- 790-108 Shield clamping bracket 11 mm
- 790-300 Busbar holder for TS35

Figure 6.4: Connecting the cable shielding in the switch cabinet

Connecting the cable shielding to the PLC



- Where possible, use shielded sensor cables
- Connect shield flat to PE using shield clamping system
- Mounting rails must be well grounded

Comment:
Depicted shield components from Wago, series 790 ...:
- 790-108 Shield clamping bracket 11 mm
- 790-112 Carrier with grounding foot for TS35

Figure 6.5: Connecting the cable shielding to the PLC

6.3 Connection

6.3.1 Connection X1 – logic and power

⚠ ATTENTION!	
⚠	All cables must be shielded!

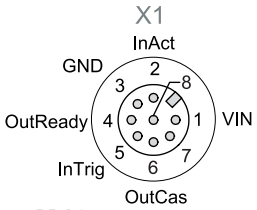
X1 (8-pin connector, A-coded)				
 **M12 connector (A-coded)**	**Pin**	**Name**	**Core color**	**Comment**
	1	VIN	wh	+24 VDC supply voltage
	2	InAct	br	Activation input
	3	GND	gn	Ground
	4	OutReady	ye	"Ready" output
	5	InTrig	gr	Trigger input
	6	OutCas	pi	Cascading output
	7		bu	not connected
	8		RD	not connected

Table 6.3: Pin assignment X1

↳ Please use the pre-assembled cables “KD S-M12-8A-P1-...”, see chapter 16.2.2.

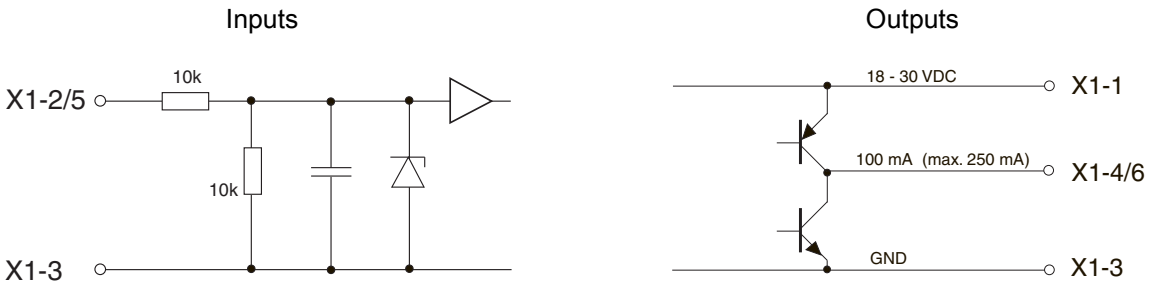


Figure 6.6: Internal wiring at X1

Power supply

For power supply specifications please refer to Chapter 15.

Activation input InAct

The activation input is used to switch the laser on and off via the process control. The sensor stops outputting data and does not respond to trigger commands or the trigger input. The equivalent circuit of the inputs at X1 is shown in Figure 6.6.

Trigger input InTrig

The trigger input is used for synchronizing the measurement with the process and for synchronizing cascaded sensors. Further information can be found in Chapter 4.2.3 and Chapter 4.2.4. The internal equivalent circuit is shown in Figure 6.6.

Cascading output OutCas

In order to operate several light section sensors cascaded this output must be connected directly to the trigger input of the following sensor. Detailed information on this topic can be found in Chapter 4.2.4. The internal equivalent circuit is shown in Figure 6.6.

Output "ready" OutReady

This output indicates operational readiness of the sensor. The output’s status corresponds to the green LED’s status (see "LED status indicators" on page 39).

6.3.2 Connection X2 – Ethernet

⚠ ATTENTION!
All cables must be shielded!

The LES 36 makes either the Ethernet interface available as host interface.

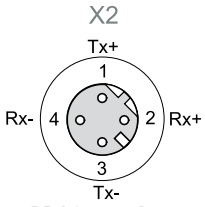
X2 (4-pin socket, D-coded)				
 **M12 socket (D-coded)**	**Pin**	**Name**	**Core color**	**°**
	1	Tx+	ye	Transmit Data +
	2	Rx+	wh	Receive Data +
	3	Tx-	OR	Transmit Data -
	4	Rx-	bu	Receive Data -
	Thread	FE	-	Functional earth (housing)

Table 6.4: Pin assignment X2

↳ Please use the preassembled cables “KS(S) ET-M12-4A-…”, see chapter 16.2.3.

Ethernet cable assignment

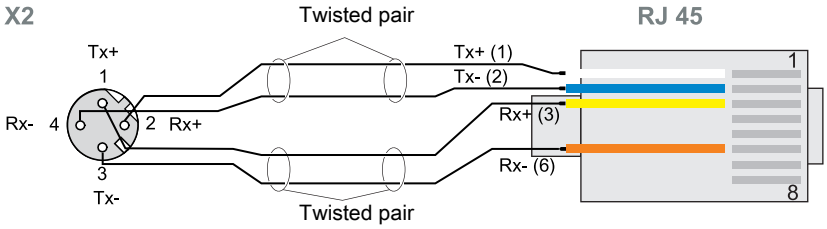


Figure 6.7: HOST / BUS IN cable assignments on RJ-45

NOTICE FOR CONNECTING THE ETHERNET INTERFACE
Ensure adequate shielding. The entire interconnection cable must be shielded and earthed. The Rx+/Rx- and Tx+/Tx- wires must be stranded in pairs. Use CAT 5 cables for the connection.

6.3.3 Connection X3 – switching inputs/outputs (LES 36…/VC6)

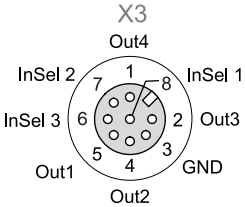
X3 (8-pin socket, A-coded)				
 **M12 socket (A-coded)**	**Pin**	**Name**	**Core color**	**Comment**
	1	Out4	wh	Output detection result 4
	2	Out3	br	Output detection result 3
	3	GND	gn	Ground
	4	Out2	ye	Output detection result 2
	5	Out1	gr	Output detection result 1
	6	InSel3	pi	Selection Inspection Task Bit 3 (MSB)
	7	InSel2	bu	Selection Inspection Task Bit 2
	8	InSel1	RD	Selection Inspection Task Bit 1 (LSB)

Table 6.5: Pin assignment X3

↳ Please use the preassembled cables “KS S-M12-8A-P1-…”, see chapter 16.2.4.

Switching outputs of connection X3

Out1 to Out4 are each a logic combination of analysis results of the individual AWs. This logic combination is defined in LRSsoft (see chapter 9.4 "Parameter settings/Parameters tab"). Up to 16 different logic combinations of the AWs and respective result mappings on Out1 to Out4 can be combined into inspection tasks.

Switching inputs of connection X3

The 3 switching inputs InSel1-3 are used to select Inspection Task 0-7. Here, “000” means Inspection Task 0, “001” Inspection Task 1, etc. The switching time between 2 inspection tasks is < 100 ms

NOTE
The Inspection Tasks 8-15 can be switched via LRSsoft, PROFIBUS or Ethernet. The setting via Ethernet overwrites the inspection task set via input InSel1-3.

6.3.4 Connection X4 – PROFIBUS DP (LES 36…/PB)

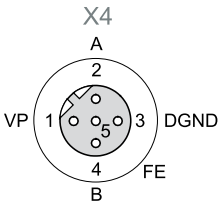
X4 (5-pin socket, B-coded)			
 **M12 socket (B-coded)**	**Pin**	**Name**	**Comment**
	1	VP	Supply voltage +5V (termination)
	2	A	Received/transmitted data RxD/TxD-N, green
	3	DGND	Data reference potential
	4	B	Received/transmitted data RxD/TxD-P, red
	5	FE	Functional earth
	Thread	FE	Functional earth (housing)

Table 6.6: Pin assignment X4 for LES 36…/PB

NOTE
Connection X4 **PROFIBUS DP** is assigned only on the LES 36/PB and LES 36HI/PB.

The connection to the PROFIBUS DP is made via the 5-pole X4 M12-socket with an external Y plug adapter. Assignments correspond to the PROFIBUS standard. The Y plug adapter enables the replacement of the LES 36…/PB without interrupting the PROFIBUS cable.

The external Y plug adapter is also needed if the LES 36…/PB is the last network device. The external bus terminating resistor (termination) is then connected to this. The 5V-supply for the termination is connected to X4.

NOTE
For connection, we recommend our pre-assembled PROFIBUS cables (see chapter 16.2.5 "Connection accessories / preassembled cables for X4 (LES 36…/PB only)") For the bus termination, we recommend our PROFIBUS terminating resistor (see chapter 16.2.5 "Connection accessories / preassembled cables for X4 (LES 36…/PB only)")

6.3.5 Connection X4 – voltage/current output (LES 36…/VC6)

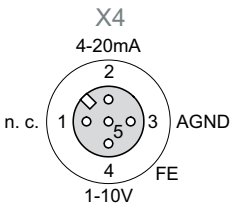
X4 (5-pin socket, A-coded)				
 **M12 socket (A-coded)**	**Pin**	**Name**	**Core color**	**Comment**
	1	n.c.	br	Not assigned
	2	4-20mA	wh	Analog current output
	3	AGND	bl	Reference potential for the analog output
	4	1-10V	bl	Analog voltage output
	5	FE	gr	Functional earth
	Thread	FE		Functional earth (housing)

Table 6.7: Pin assignment X4 for LES 36…/VC6

NOTE

Connection X4 **Analogue output** is assigned only on the LES 36/VC6, LES 36HI/VC6. Analog outputs 1-10V (voltage) and 4-20mA (current) may only be used alternately; the selection is made with **LESsoft** in the `Analog Output` tab.

Connection of the analog output is made via the 5-pin, M12-socket X4.

⚠ ATTENTION!

When connecting the analog output, note the permissible load resistance:

- Voltage output 1 … 10VDC: $R_L \geq 2k\Omega$
- Current output 4 … 20mADC: $R_L \leq 500\Omega$

Characteristic curve of analog output

Behavior of the analog output

The LES 36 is equipped with an analog output with linear response within the respective measurement range. There is a departure from linearity above and below the linear area. In spite of this, values above the maximum (> 20mA or > 10V) or below the minimum (< 4mA or < 1V) specified for the measurement range can still clearly be seen for the output values.

The analog output can be conveniently configured with **LESsoft**. To obtain the most exact resolution possible, the range of the analog output should be set as small as the application will permit (the minimum adjustment range is 10mm). The characteristic output curve can be configured as rising or falling. For this purpose, the two distance values `Position Min. Val.` and `Position Max. Val.` are set appropriately for the minimum and maximum analog output values, see Figure 6.8.

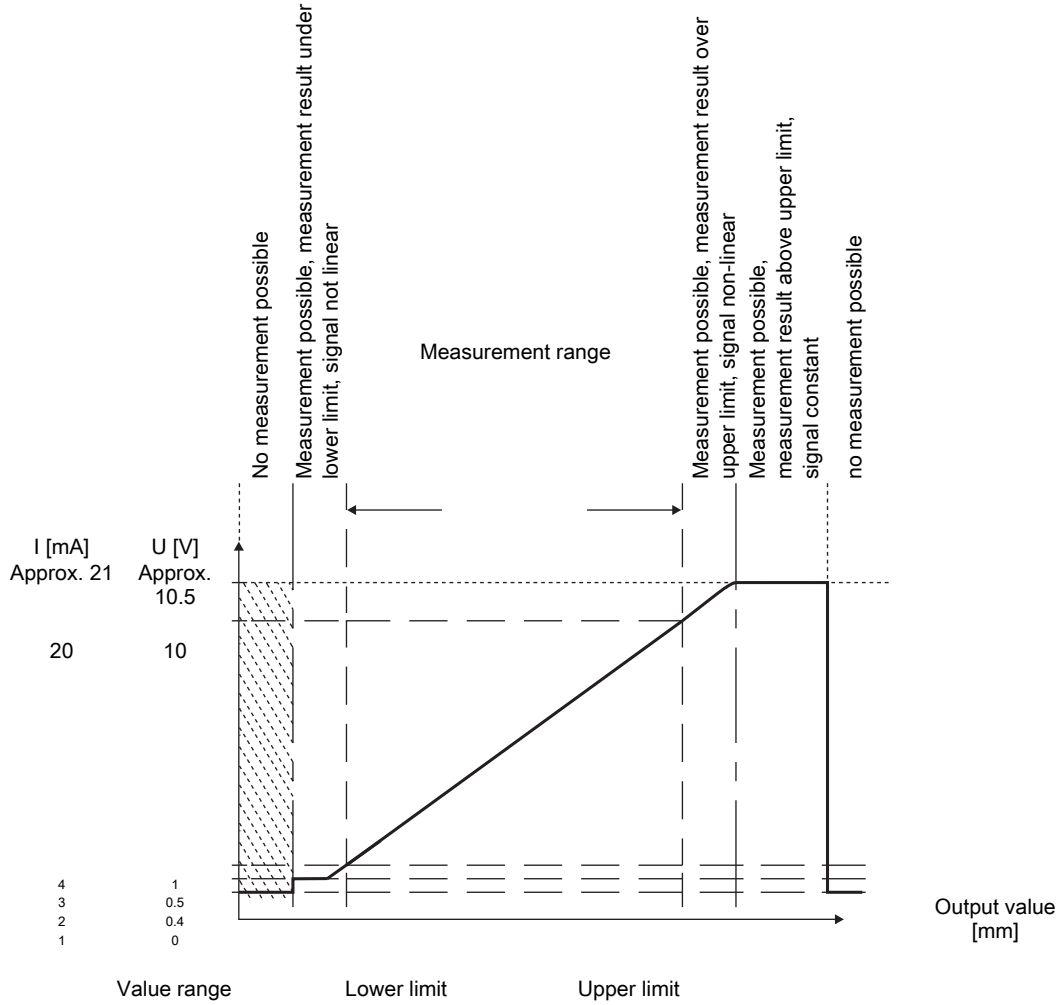


Figure 6.8: Response of analog output LES

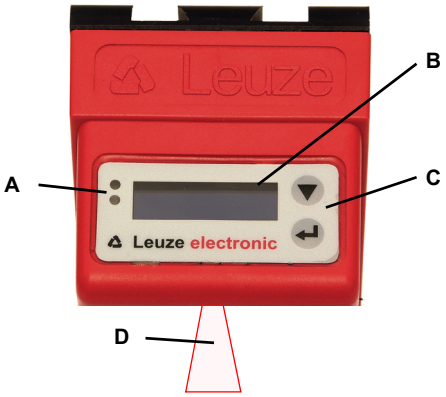
Possible value ranges depending on set analog output value:

	LES 36…	LES 36HI…
X coordinate	-300 … +300mm	-70 … +70mm
Z-coordinate	+200 … +800mm	+200 … +800mm
Height difference	0 … 600mm	0 … 400mm
Width	0 … 600mm	0 … 140mm

NOTE	
	Valid Z-values are output 10mm above and beyond the max. measurement range: 190 … 810mm.

7 Display and control panel

7.1 Indicators and operational controls



A Green and yellow device LEDs
See "LED status indicators" on page 39.
B OLED display, 128 x 32 pixels
C Membrane keyboard with 2 buttons
See "Control buttons" on page 39.
D Laser beam

Figure 7.1: Indicator and operating elements of the LES 36

After switching on the supply voltage $+U_B$ and following error-free device initialization, the green LED illuminates continuously: the LES 36 is in measure mode. The OLED display shows the alignment aid and the status display.

7.1.1 LED status indicators

LED	State	Display during measurement operation
Green	Continuous light	Sensor ready
	Off	Sensor not ready
Yellow	Continuous light	Ethernet connection established
	Flashing	Ethernet data transmission active
	Off	No Ethernet connection

Table 7.1: LED function indicator

7.1.2 Control buttons

The LES 36 is operated using the ▼ and ↵ buttons, which are located next to the OLED display.

7.1.3 Indicators in the display

The display changes depending on the current operating mode. There are the following 3 display modes:

- Alignment aid and status display
- Command mode
- Menu display
  The menu display is accessed by pressing one of the two control buttons. Operation of the LES 36 via the menu is described in Chapter 7.2.2.

With PROFIBUS devices, the bus state is first displayed after power-on (displayed for approx. 3s). If the PROFIBUS was detected, alignment aid and status are then displayed.

waiting for PB

Alignment aid

As an alignment aid, the current measurement value at the left edge (`Lxxx`), in the middle (`Mxxx`) and at the right edge (`Rxxx`) of the detection range is displayed in the OLED display in units of millimeters. If no object is detected or if the distance is too small, distance value `000` (mm) appears in the display.

L450 M450 R450

↳ Align the light section sensor by rotating it about the y-axis in such a way that the same value is indicated for L, M, R.

Status indicator

The selected inspection task (Txx), a measurement value as well as the current sensor state are displayed on the second line of the display (see chapter 4.2 "Operating the sensor").

T00 X-151 fRun

The indication of the sensor state in the display has the following meaning:

- fRun = Free Running
- Trig = Triggering
- !Act = Activation (laser on/off)

T12 means that Inspection Task 12 is currently active, for example. Value range: T00 to T15.

Meaning of the measurement value display:

- X-151 means that the X-coordinate of the right-most measurement point is at position -151 mm.
- x 040 means that the X-coordinate of the left-most measurement point is at position +40 mm.
- Z 600 means that the Z-coordinate of the right-most measurement point is at position 600 mm.
- z 500 means that the Z-coordinate of the left-most measurement point is at position +500 mm.
- W 230 means that the width of the object is 230 mm.
- H 059 means that the height of the object is 59 mm.

Definition of the displayed measurement value:

- For analog sensors, the measurement value assigned to the analog output is displayed in mm.
- For sensors with PROFIBUS, the measurement value assigned under **Edge 1 – Profibus Inputs 1** is displayed.

If, for PROFIBUS devices, no PROFIBUS is detected following power-on, no PB appears in the middle of the bottom line.

T00 no PB fRun

The following options are available for the sensor status: fRun means Free Running, Trig means triggered (see chapter 4.2.3 "Triggering – Free Running") and !ACK means that the sensor is deactivated (no laser line, see chapter 4.2.2 "Activation – laser on/off").

Command mode

If the LES 36 is connected to a control, the control can put the LES 36 into a command mode in which it receives and executes commands (see chapter 10.2.9 "Evaluation telegram"). In command mode, the OLED display has one line.

Command Mode appears on the first line of the display.

Command Mode

NOTE
If errors occur during operation, these are shown on the display. Information can be found in Chapter 13.3.

7.2 Menu description

7.2.1 Structure

Level 1	Level 2	Level 3	Level 4	Explanation / Notes	Default
Select Insp. Task Appl. Settings				Select Inspection Task menu item	
	Ext. Selection Enabled			Change task via digital inputs (external)	
		Ext. Selection Enabled		Change task via digital inputs (external) is activated.	X
		Ext. Selection Disabled		Change task via digital inputs (external) is deactivated. [1]	
	Select Insp. Task 00:Task 0			Selection of the active inspection task [2]	
		Select Insp. Task 00:Task 0		Task 0 is activated.	X

Table 7.2: Menu structure

Level 1	Level 2	Level 3	Level 4	Explanation / Notes	Default
		:		:	
		Select Insp. Task 15:Task 15		Task 15 is activated.	
	← Ext. Selection			Return to menu level 1	
Appl. Settings [3] Device Settings				Application Settings menu item	
	Exposure Time Normal Mode			Exposure time for measurements and teaching	
		Exposure Time Normal Mode		"Normal" exposure time setting	X
		Exposure Time Bright Objects		"Bright Objects" exposure time setting	
		Exposure Time Dark Objects		"Dark Objects" exposure time setting	
		Exposure Time Manual Setting		"Manual" exposure time setting (user-specific setting) [4]	
	Trigger Mode Free Running			Trigger mode for measurements	
		Trigger Mode Free Running		Trigger setting "Free Running" (continuous measurement)	X
		Trigger Mode Input Triggered		Trigger setting "Input Triggered" (trigger input signal triggers measurement)	
	← Exposure Time			Return to menu level 1	
Device Settings Error Handling				Device Settings menu item	
	Slave Address Ethernet			PROFIBUS DP Slave Address [5]	
		Slave Address 126		Setting for the PROFIBUS DP slave address	126
	Ethernet Display			Ethernet interface parameters [6]	
		IP Address 192.168.060.003		IP address of the sensor	
			IP Address 192.168.060.003	Setting the IP address (Default: 192.168.060.003)	X
		Net Mask Address 255.255.255.000		Subnet mask of the sensor	
			Net Mask Address 255.255.255.000	Setting the subnet mask (Default: 255.255.255.000)	X
		Std. Gateway 000.000.000.000		Default gateway for Ethernet communication	
			Std. Gateway 000.000.000.000	Setting for the IP address of the default gateway (default: 000.000.000.000)	X
		Port Num. Local 09008		Local port of the sensor for Ethernet communication	
			Port Num. Local 09008	Setting for the local port	9008
		Port Num. Dest. 05634		Destination port of the PC or control for Ethernet communication	
			Port Num. Dest. 05634	Setting for the destination port	5634
		← IP Address		Return to menu level 2	
	Display On			Display settings	
		Display On		Setting "On": always on with maximum brightness	
		Display Off		Setting "Off": off; is switched back on after keyboard actuation	
		Display Auto		"Auto" setting: full brightness for approximately 1 minute after button is pressed, then dimmed	X
	Password Check Inactive			Password protection for menu access	
		Password Check Inactive		Password protection deactivated	X
		Password Check Activated		Password protection activated (fixed password: "165")	
	← Slave Address			Return to menu level 1	
Error Handling Info				Error Handling menu item	

Table 7.2: Menu structure

Level 1	Level 2	Level 3	Level 4	Explanation / Notes	Default
	Reset to Factory Cancel			Reset to factory settings	
		Reset to Factory Cancel		Do not execute reset	
		Reset to Factory Execute		Execute reset with subsequent confirmation prompt	
	← Reset to Factory			Return to menu level 1	
Info ← Menu Exit				Device Information menu item	
	Part no. 50115418			Leuze part number of the sensor	
	Serial No. 01408004336			Sensor serial number	
	Ext. Info K000			Leuze-internal information	
	Software V01.50			Software version of the sensor	
	← Part no.			Return to menu level 1	
← Menu Exit Select Insp. Task				Exit menu and return to measure mode	

Table 7.2: Menu structure

1) The inspection tasks can be switched via the control panel.
2) The setting of the active inspection task applies only if “Ext. Selection” = “Disabled”
3) The application settings apply for the currently selected inspection task. Individual application settings can be made for each task.
4) With "Manual Settings", the value preset via LRSsoft is used.
5) This menu item exists only with the PROFIBUS device versions.
6) The values configured here are not applied immediately but only when the sensor is switched on the next time.

NOTE

If no button is pressed for three minutes, the LES 36 exits menu mode and switches to measure mode. The OLED display again displays the alignment aid and the sensor status display.

NOTE

After changing the PROFIBUS slave address, a power-on reset must be performed in order to permanently accept the address.

7.2.2 Operation/navigation

In menu view, the OLED display has two lines. The currently active menu item is displayed with black text on a light-blue background. The ▼ and ↲ buttons both have different functions depending on the operating situation. These functions are represented via icons on the right edge of the display – i.e. to the immediate left of the buttons.

The following displays may appear:

Menu navigation

▼ selects the next menu item (`Ethernet`)
↲ goes to the inverted submenu (`Slave Address`)

▼ selects the next menu item (`IP Address`)
↲ returns to the next higher menu (←). At the top menu level, the menu can be exited here (`Menu Exit`). The number of bars at the left edge indicates the current menu level:

Selecting values or selection parameters for editing

▼ selects the next menu item (`Net Mask Addr.`)
↲ selects edit mode for `IP Address`

Editing value parameters

▼ decrements the value of the currently selected digit (1).
↵ selects the next digit to the right (9) for editing. After having clicked through all the digits using ↵ a checkmark (☑) appears at the bottom right of the display. If an impermissible value was entered, the ↻ symbol (new entry) appears and no checkmark is offered for selection.

▼ changes the edit mode, ↻ appears.
↵ saves the new value (192.168.001.111).

▼ changes the edit mode, ☒ appears.
↵ selects the first digit (1) for renewed editing.

▼ changes the edit mode, ↻ or ☑ appears.
↵ rejects the new value(in this example, the factory setting 192.168.060.003 remains saved)

Editing selection parameters

▼ displays the next option for Display (Off).
↵ returns to the next-higher menu level and retains On.

▼ displays the next option for Display (Auto).
↵ selects the new value Off and displays the menu for confirmation:

▼ changes the edit mode, ☒ appears.
↵ saves the new value (Off).

▼ changes the edit mode, ☑ appears.
↵ rejects the new value (On remains saved).

NOTE
To ensure that values that were changed via the menu are also applied, you should disconnect the sensor from its power supply for a brief period after a change of values.

7.3 Reset to factory settings

The factory settings can be reset in three different ways:

- Hold down the ↵ button while connecting the supply voltage
- Factory Setting menu item
- By means of the LESsoft configuration software

As an example, the first of the methods mentioned above is described below:

↳ When applying the supply voltage, press the ↵ button to reset the configuration of the LES 36 to factory settings.

The display shown next to here appears.

Interrupting a reset

Pressing ▼ causes the adjacent display to appear. If you now press the ↵ button, you will exit the menu without resetting the LES 36 to factory settings.

Executing a reset

Pressing the ↵ button while the checkmark (☑) is displayed causes the adjacent safety prompt to appear.

Pressing ▼ interrupts the reset process; reset cancelled appears in the display for approx. 2s. Afterward, the LES 36 returns to measure mode.

Pressing ↵ resets all parameters to the factory settings. All settings made previously are permanently lost. reset done appears in the display for approx. 2s; the LES 36 then returns to measure mode.

You can select the resetting to factory settings also via LESsoft.

↳ In the Configuration menu select the entry Reset to Factory Settings.

8 Commissioning and configuration

8.1 Switching on

After switching on the supply voltage +U_B and following error-free device initialization, the green LED illuminates continuously: the LES 36 is in measure mode.

NOTE
After a light section sensor warmup time of 30 min., the has reached the operating temperature required for an optimum measurement.

8.2 Establish connection to PC

The LES 36 is configured via a PC using the LESsoft program before it is integrated into the process control.

In order to be able to establish an UDP communication with the PC, the IP address of your PC and the IP address of the LES 36 must lie in the same address range. The LES 36 has no built-in DHCP client, so that you need to set the address manually. This is done the easiest way via the PC.

NOTE
If you use a desktop firewall, please make certain that the PC can communicate with the LES 36 via the Ethernet interface by means of UDP on ports 9008 and 5634 (these ports are preset at the factory, but may have been changed by the user, see chapter 7.2 "Menu description"). Furthermore, the firewall must allow ICMP echo messages to pass through for the connection test (ping).

If the PC is usually connected to a network using DHCP address allocation, the easiest way to access the LES 36 is by applying an alternative configuration in the TCP/IP settings of the PC and connecting the LES 36 to the PC.

↳ To check the network address of the LES 36, switch to the Settings menu from detection mode of the LES 36 with the touch of a button.

In the `Ethernet` submenu (see chapter 7.2.1), you can read the current settings of the LES 36 one after the next by pressing ▼.

↳ Make a note of the values for `IP Address` and `Net Mask Addr.`.

The value in `Net Mask Addr.` specifies which digits of the IP address of the PC and LES 36 must match so that they can communicate with each other.

Address of the LES 36	Net mask	Address of the PC
192.168.060.003	255.255.255.0	192.168.060.xxx
192.168.060.003	255.255.0.0	192.168.xxx.xxx

Table 8.1: Address allocation in the Ethernet

Instead of **xxx** you can now allocate any numbers between 000 and 255 to your PC, but NOT THE SAME numbers as contained in the address of the LES 36.

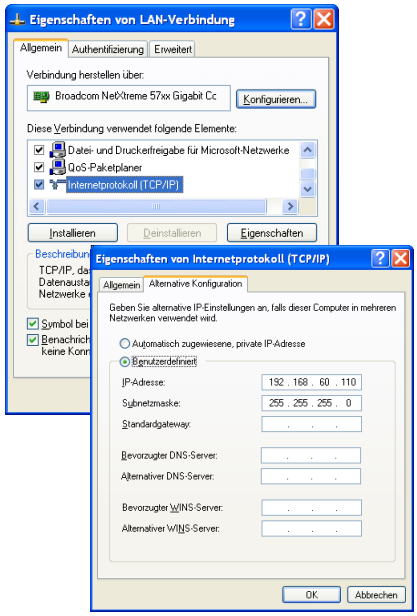
For example 192.168.060.110 (but not 192.168.060.003!). If LES 36 and PC have the same IP address, they cannot communicate with each other.

Setting the default gateway

The IP address for the default gateway can optionally be set using the `Std. Gateway` submenu item (default: 000.000.000.000).

NOTE
The IP address of the default gateway (`Std. Gateway`) and the destination port of the PC or control (`Port Num. Dest.`) are stored in the sensor configuration beginning with firmware V01.50 and LRSsoft V2.40.

Setting an alternative IP address on the PC



- Log in to your PC as administrator.
- Using `Start->Control Panel` go to the `Network connections` (Windows XP) menu or to the `Network center and release center` (Windows Vista) menu.
- Select the `LAN connection` there and call up the corresponding `properties` page by right-clicking it.
- Select the `Internet protocol (TCP/IP)` (by scrolling down, if necessary) and click on `Properties`.
- In the `Internet protocol (TCP/IP) Properties` window select the `Alternate configuration` tab.
- Set the `IP address` of the PC in the address range of the LES 36.
  Attention: Not the same as the LES 36!
- Set the `subnet mask` of the PC to the same value as on the LES 36.
- Close the configuration dialog by confirming all windows using `OK`
- Connect the X2 interface of the LES 36 directly to the LAN port of your PC. For the connection, use a KSS ET-M12-4A-RJ45-A-P7-… cable, see Table 16.9.

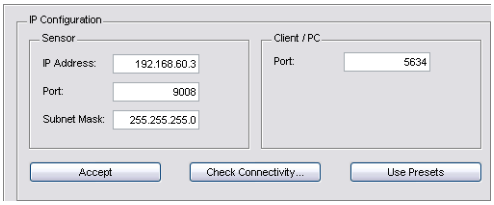
The PC first tries to establish a network connection via the automatic configuration. This takes a few seconds, after which the alternate configuration, which you just set, is activated. The PC can now communicate with the LES 36.

Information about configuring with the LESsoft can be found in Chapter 9.

8.3 Commissioning

For the commissioning and integration of the sensor in the process control the following steps are necessary:

1. Configuring LES 36 – see chapter 9.
2. Programming process control – see chapter 10 or Chapter 11
   or
3. Connect analog output accordingly – see chapter 6.3.5
4. Connect switching inputs and outputs accordingly – see chapter 6.3.3
5. When connecting in the Ethernet process controls, the IP configuration of the LES 36 is to be adjusted so that the LES 36 can communicate with the process control.
   The values corresponding to the following screenshot are preset in the LES 36 at the factory. If you would like to set different values, you must change the values via the display of the LES 36 in menu item `Ethernet` (see "Menu description" on page 40). You can test the changed values by entering them in LESsoft in the `Configuration` area and clicking on the `Check Connectivity` button.



6. Connect LES 36 to the process control. This can be performed for all LES 36 via the Ethernet interface or, depending on model, via the analog outputs or the PROFIBUS.
7. If necessary, establish connections for activation, triggering and cascading.

NOTICE ON CONNECTING MULTIPLE LIGHT SECTION SENSORS VIA ETHERNET	
	If several sensors are to be activated, all sensors as well as the control must receive **different IP addresses** on the same subnet. For all sensors **different ports** must be configured in the `Sensor` area as well as in the `Client/PC` area.

9 LESsoft configuration software

9.1 System requirements

The PC used should meet the following requirements:

- Pentium® or faster Intel® processor > 1.5 GHz (Pentium 4, Celeron, Xeon) or compatible models from AMD® (Athlon 64, Opteron, Sempron)
  The processor must support the SSE2 instruction set.
- At least 512 MB free main memory (RAM), 1024 MB recommended
- CD-ROM drive
- Hard disk with at least 1 GB available memory
- Ethernet port
- Microsoft® Windows XP ab Service Pack 2 / Windows 7

9.2 Installation

	NOTE
	If present, uninstall Matlab Runtime before beginning with the installation of the LXSsoft Suite.

The **LXSsoft_Suite_Setup.exe** installation program can be downloaded from **www.leuze.com**. You can find it for the respective product in the Downloads tab under Configuration software.

	NOTE
	Copy the downloaded file into a suitable folder on your hard drive. **Administrator privileges are necessary** for this purpose. Please note that the standard text size setting is used. For Windows XP, the necessary DPI setting is 96 DPI, for Windows 7, the display is to be set to "Smaller – 100%".

↳ To start the installation process, double-click on file LXSsoft_Suite_Setup.exe.

↳ In the first window, click on `Next`.

In the next window, you can select which configuration software you would like to install.

You will need **LPSsoft** for configuring light section sensors of the **LPS** series.

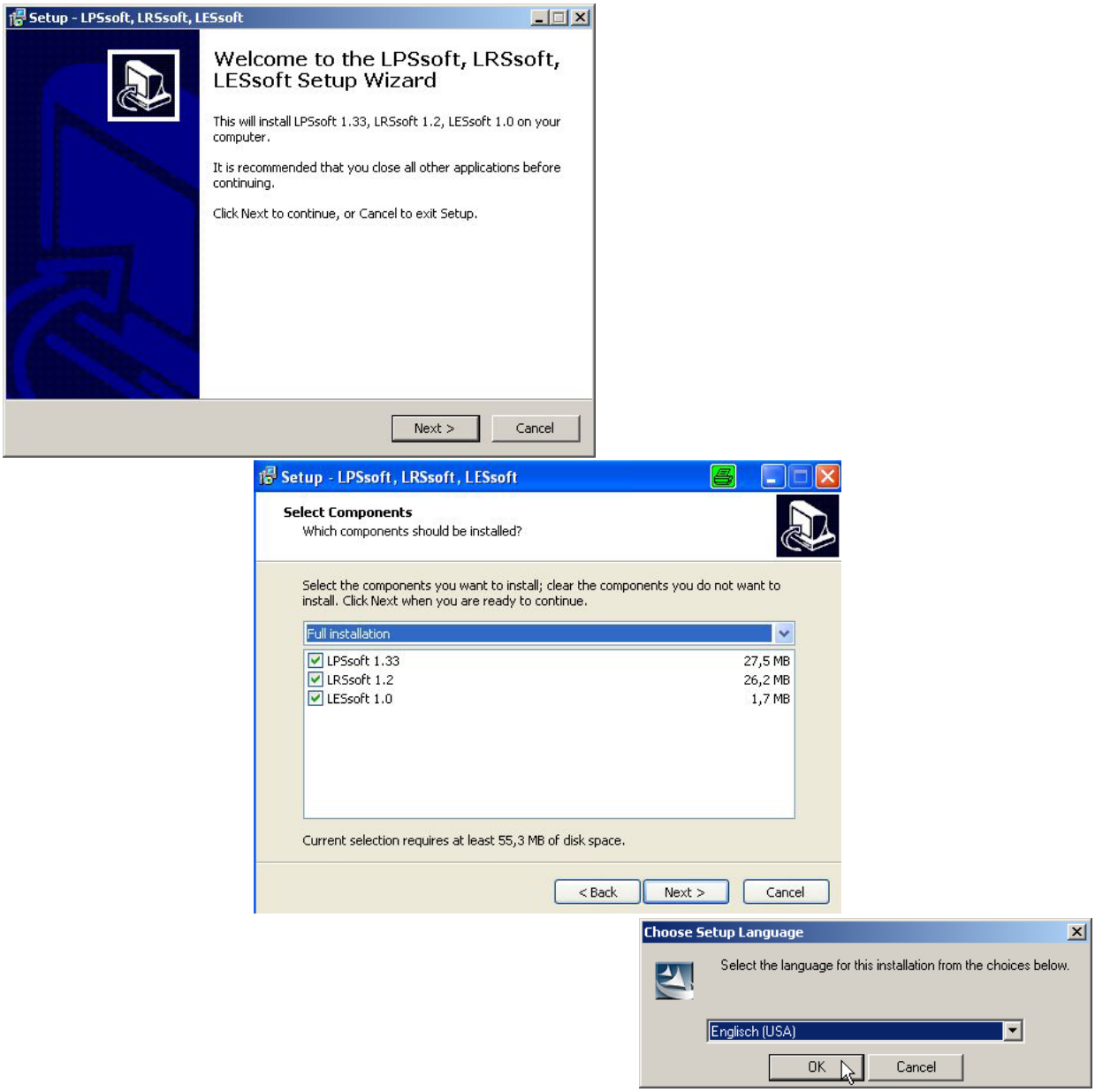
You will need **LRSsoft** for configuring light section sensors of the **LRS** series.

You will need **LESsoft** for configuring light section sensors of the **LES** series.

↳ Select the desired options and click on `Next` and, in the next window, click on `Install`.

The installation routine starts. After a few seconds, the window for selecting the installation language for the Matlab Compiler Runtime (MCR) appears. The MCR is used for the configuration in LESsoft. It is only available in English or Japanese.

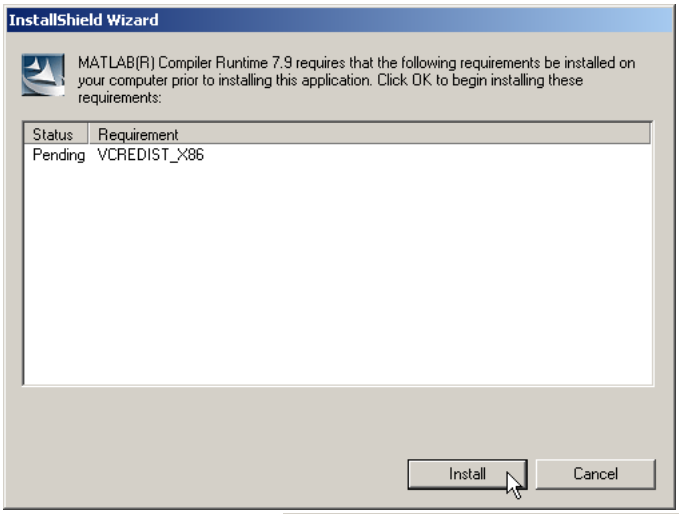
↳ Therefore, keep the`English` selection in the `Choose Setup Language` window and click `OK`.

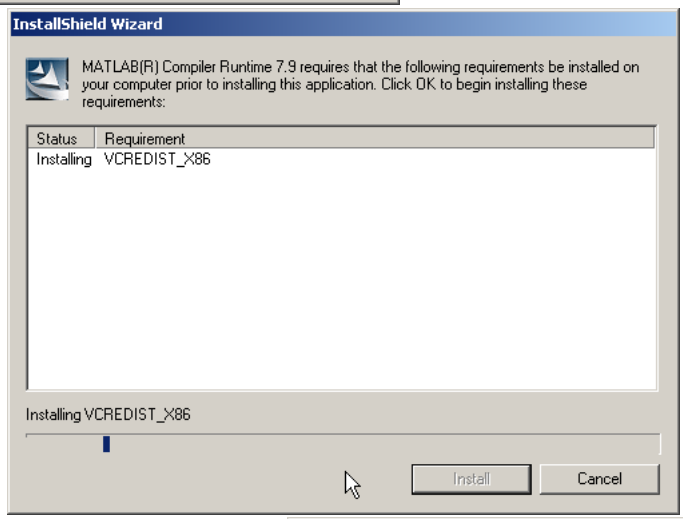


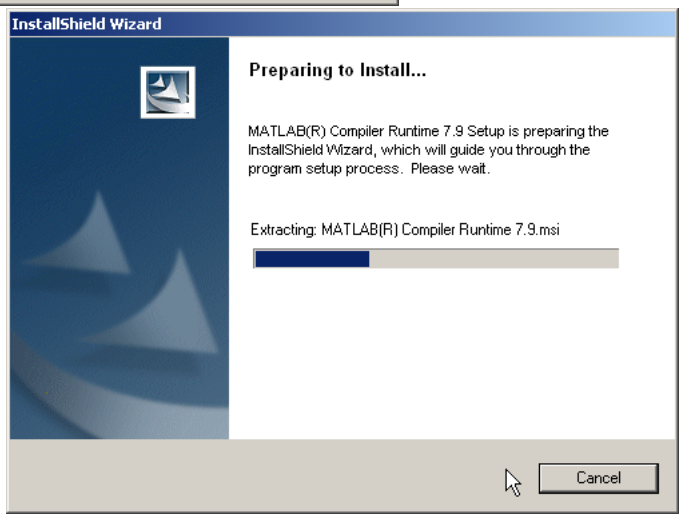
Depending on the configuration of your Windows system, the dialog shown below may then appear (missing component VCREDIST_X86).

↳ Click on `Install`.

Two additional installation windows will appear, which do not require any further entry.

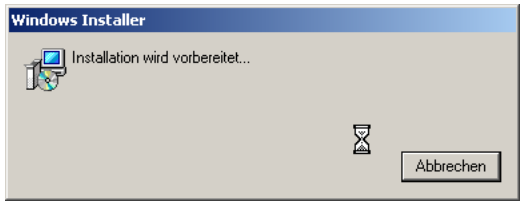


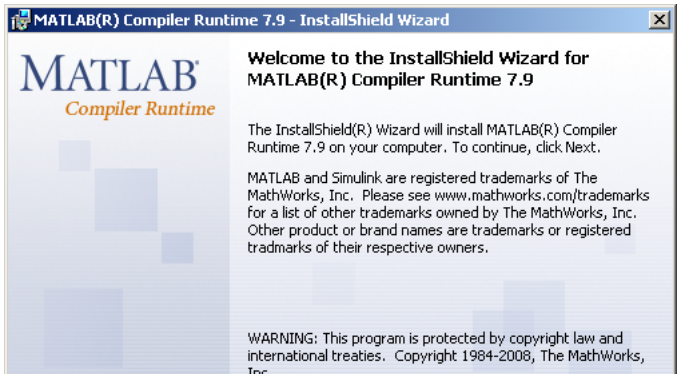




After some time (up to several minutes depending on the system configuration) the start screen of the MCR installer will appear.

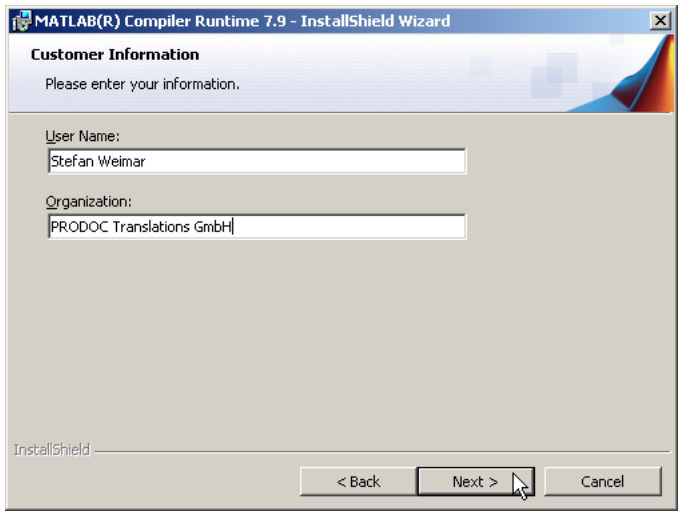
↳ Click on `Next`.





The window for entering user data appears.

↳ Enter your name and the company name and then click on `Next`.



↳ It is essential that you retain the default folder in the window for the selection of the installation path (`Destination Folder`).

The standard path is `C:\Programme\MATLAB\MATLAB Compiler Runtime\`.

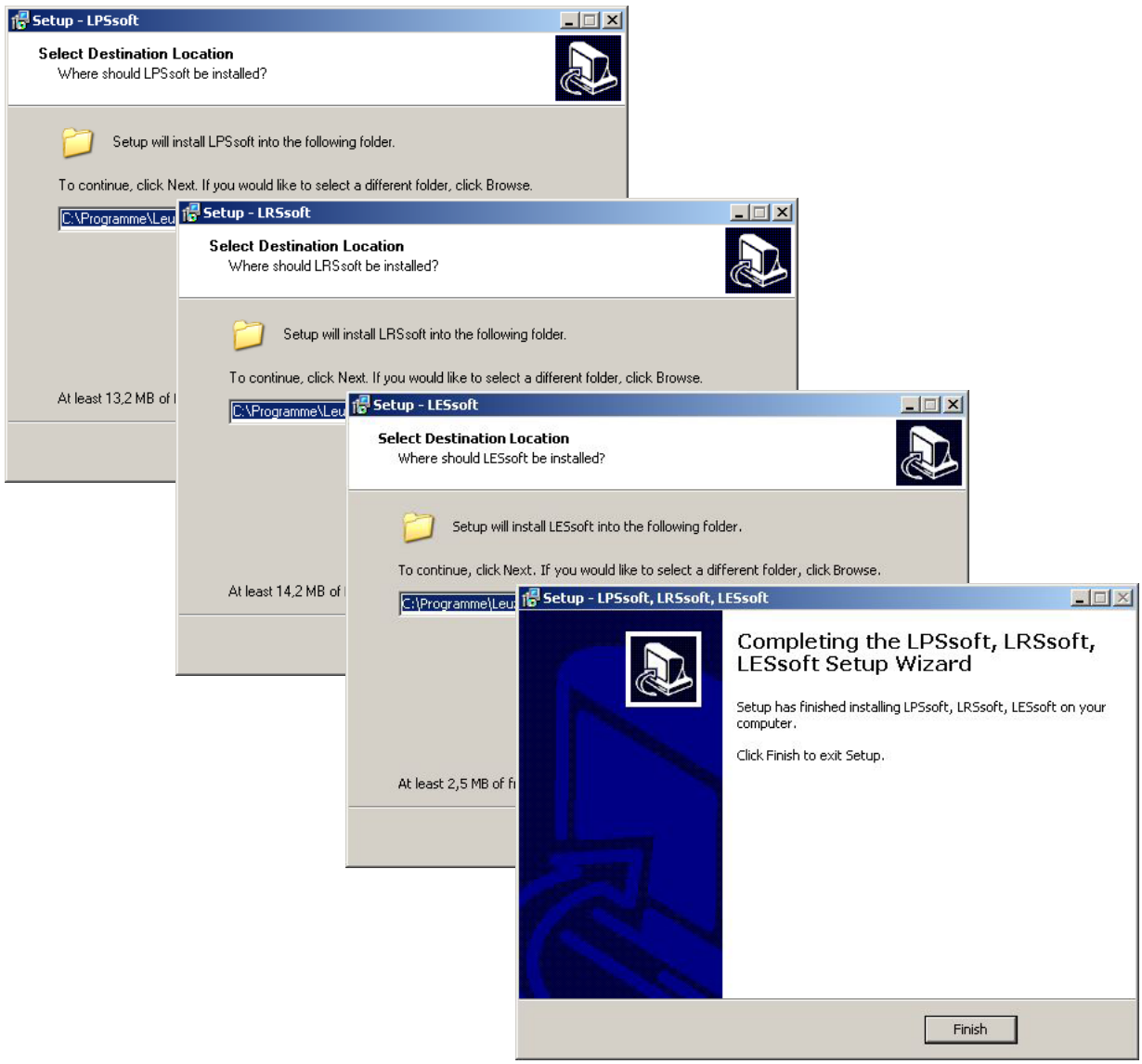
↳ Click on `Next` and in the next window click on `Install`.

The installation will start and a status window will be displayed. This can again take several minutes.

Following successful MCR installation, the `InstallShield Wizard Completed` window appears.

↳ Click on `Finish` to end the MCR installation.

The window for selecting the installation path for LESsoft/LPSsoft/LRSsoft now appears (provided you selected this option).



↳ Keep the default folder and click on `Next`.

The installation of **LPSsoft** starts. If you also selected **LRSsoft** and **LESsoft** for installation, upon completion of the **LPSsoft** installation, the same window then reappears for entering the installation path for **LRSsoft** and **LESsoft**.

↳ Keep the default folder in this case as well and click on `Next`.

Upon completion of the installation process, the window shown above appears.

The installation routine added a new **`Leuze electronic`** program group in your Start menu that contains the installed programs **`LESsoft`**/`LPSsoft`/`LRSsoft`.

↳ Click on `Finish` and then start the desired program from the Start menu.

9.2.1 Possible error message

Depending on the setting of the display, the "Width and Height must be >0" error message may be output. The cause is an incompatible setting of the display.

	NOTE
ℹ	For Windows XP, the necessary DPI setting is 96 DPI. For Windows 7, the display is to be set to "Smaller – 100% (default)".

The setting can be adjusted as follows.

- Adjust the display for Windows XP by selecting the value "96 DPI" under Properties -> Display -> Settings -> Extended -> Display -> DPI setting.
- For Windows 7, adjust the display via Control Panel -> Display by, setting the display to "Smaller – 100% (default)".

Depending on the system configuration the adjacent error message can appear at this point.

The cause of this error message is a bug in the MCR installation routine, which does not set the environment variable Path correctly in some systems.

That, however, can easily be corrected without reinstallation of the MCR.

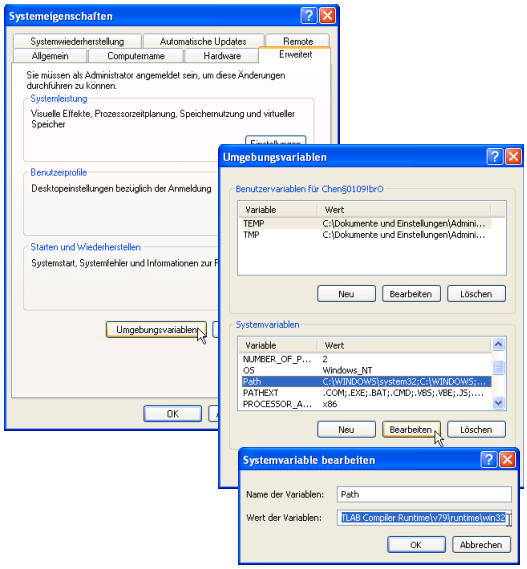
- Open the System properties window located in the Control Panel of Windows under System.
- Go to the Extended tab and click on Environment variables.

The Environment variables window opens.

- Scroll down in the System variables panel until you find the Path entry.
- Click on Path and then on Edit

The Edit system variable window opens.

There in the Variable value field you will find the ;C:\Programme\MATLAB\MATLAB Compiler Runtime\v79\runtime\win32 entry right at the end.



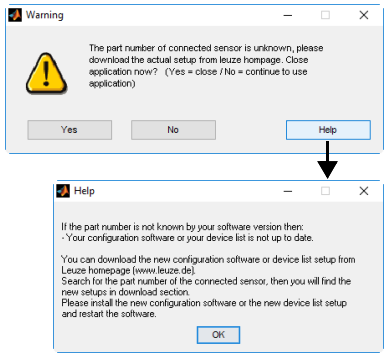
- If this entry is missing, copy the entry from this document and insert it together with the preceding semicolon.
- Then click on OK and also close any further windows using OK.
- Shut Windows down, restart Windows and then start **LESsoft** by double-clicking on it.

Now the start screen of **LESsoft** appears, as described in Chapter 9.3.

9.2.2 Device list update

At the time of purchase of a new sensor, the LPS/LES/LRS software corresponds to the state of the art. If you are already using software from earlier devices and now purchase a different model from the LxS series, it is possible that the installed software does not yet recognize the current device.

The software indicates this with the following notice:



You do, however, have the possibility to install a device list to implement new device models in the software. This can be downloaded from **www.leuze.com** in the download panel for your device under "Device list".

Install this and restart the software. The previously unknown sensor is then recognized.

	NOTE
	If the software continues to output this or a similar warning after updating the device list, it is to be assumed that the currently installed software is no longer up-to-date. A new firmware version is available on the Internet. Please download this new version, install it and restart the program.

9.3 Starting LESsoft/Communication tab

↳ Start **LESsoft** via the respective entry in the Windows Start menu.

The following screen appears:

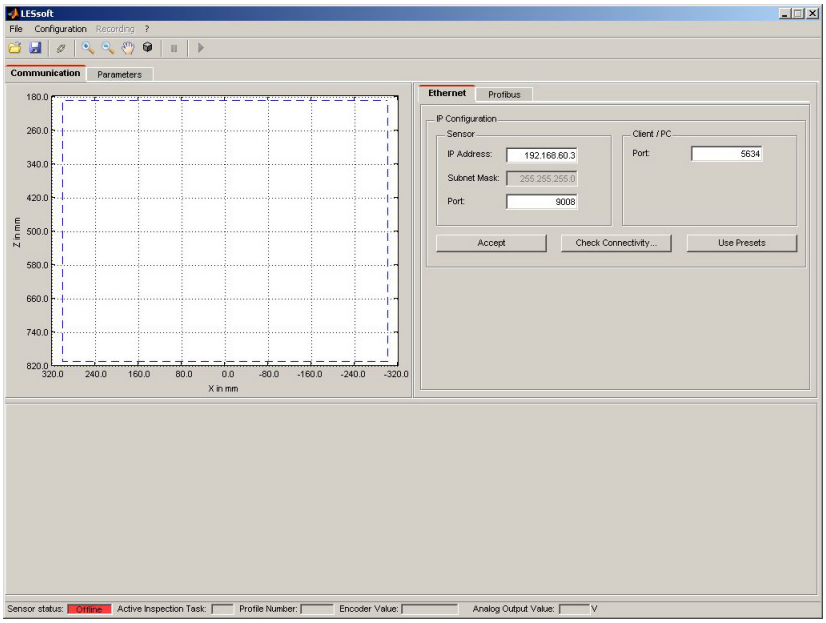


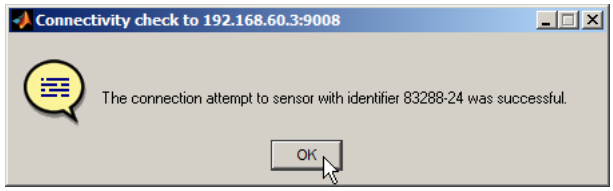
Figure 9.1: Initial screen LESsoft

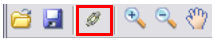
↳ In the `IP Configuration` panel, enter the settings for the LES 36 and click on `Accept`.

You have already determined this data in Chapter 8.2.

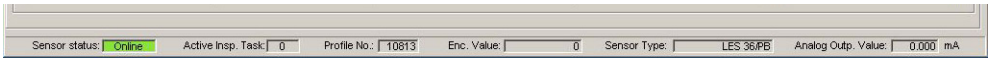
↳ Click on `Check Connectivity` to test the connection to the LES 36.

If the following message appears, the Ethernet connection to the LES 36 is correctly configured: `The connection attempt to sensor ... was successful.`



Click on the button `Connect to sensor`: 

As a result **LESsoft** establishes a connection and displays the currently measured 2D profile. In the status line at the bottom left of the display you will now find `Online` highlighted in green instead of `Offline` highlighted in red.



NOTE

The following additional information is displayed in the status line:

- Sensor connection status (Sensor status)
- Number of the Active Inspection Task
- Scan number (Profile Number)
- Encoder value dependent on the sensor type (Encoder Value)
- Connected sensor type
- Analog output status (Analog Output)

NOTE

Once the LESsoft has established a connection to the LES 36, the laser beam flashes.

PROFIBUS settings (LES 36/PB and LES 36HI/PB only)

For PROFIBUS devices, you can set the slave address and the baud rate in the PROFIBUS tab.

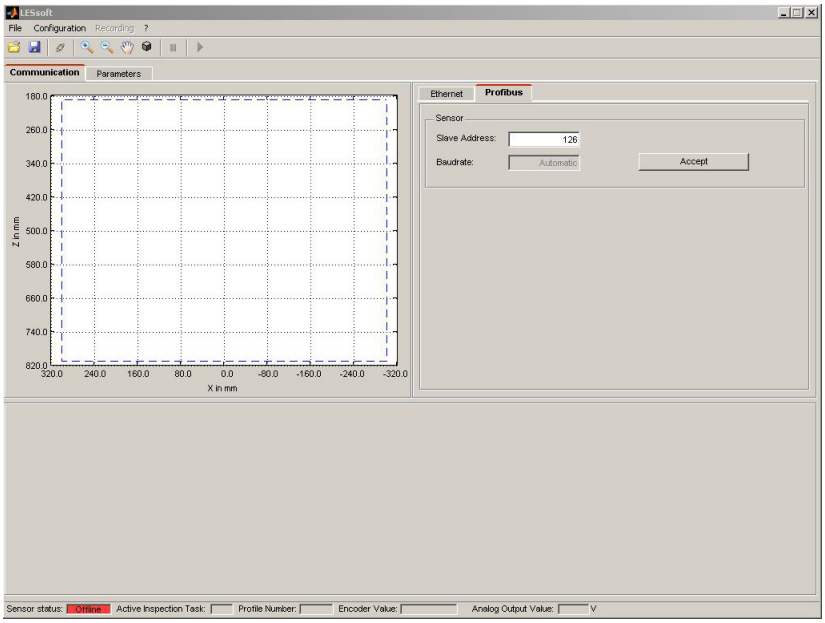


Figure 9.2: PROFIBUS settings

Automatic detection of the baud rate / automatic address assignment

The LES 36…/PB supports automatic detection of the baud rate and automatic address assignment via the PROFIBUS.

The address of the PROFIBUS participant can be set automatically by the commissioning tool of the PROFIBUS system (a class 2 PROFIBUS master). For this purpose, the slave address must be set to value **126** in the sensor (factory setting). This is performed by means of LESsoft or via the display.

The commissioning master checks whether a slave has address **126** and then assigns this slave a slave address smaller than 126. This address is permanently stored in the participant. The changed address can then be queried (and, if necessary, changed again) via the display or LESsoft.

The following baud rates can be set:

- Auto
- 19.2kBaud
- 93.75kBaud
- 500kBaud
- 3MBaud
- 9.6kBaud
- 45.45kBaud
- 187.5kBaud
- 1.5MBaud
- 6MBaud

NOTE	
	After changing the slave address via the display or LESsoft, a power-on reset must be performed in order to permanently accept the address. For the changed settings to take effect, they must be transferred to the sensor!

9.4 Parameter settings/Parameters tab

↳ Click on the Parameters tab to access the parameter settings:

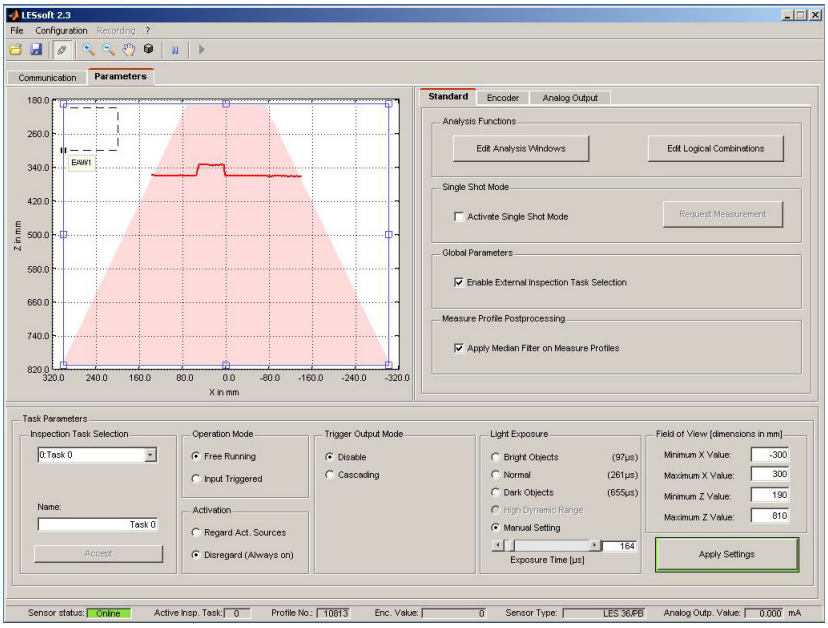


Figure 9.3: Parameter settings LESsoft

The LES is adapted to applications in the Parameters tab (Standard tab). First go to the Task Parameters panel and set the values required for operating the LES. Then go to the Analysis Functions panel and define analysis windows (EAWs, AWs) for edge and object detection.

Finally, save these settings as an Inspection Task by clicking on Apply Settings or Transmit to Sensor.

The analog output is configured in the Analog Output tab (see chapter 9.4.5).

9.4.1 Standard tab – Task Parameters panel

Inspection Task Selection

In the Inspection Task Selection panel, you can select inspection tasks.

	NOTE
	By default, changeover of the inspection tasks via the PROFIBUS master (PLC) has priority over LESsoft. In this field, the **selection** of the inspection task with LESsoft is only possible if, under Global Parameters there is **no** tick in front of Enable External Inspection Task Selection. Otherwise, the inspection task can only be selected via the process interface. By removing the tick in the Enable External Inspection Task Selection check box, the inspection task cannot be changed via the process interface while configuration is being performed. After configuring with LESsoft and before transmitting the settings to the sensor ('Transmit to Sensor'), the Enable External Inspection Taks Selection check box must again be selected. Only then can inspection tasks be selected via the process interface.

The upper drop-down menu Inspection Task Selection lets you select one of the 16 possible inspection tasks. After the selection of the inspection task, the associated parameters are loaded and displayed. You can edit these parameters and save the edited parameters under the same name.

In the Name field, you can assign a meaningful name (max. 12 characters) to the inspection task selected above and save it by clicking on Accept.

By saving via the button Apply Settings, **the currently displayed** inspection task is temporarily stored in the sensor. When switched off, the data/settings are lost.

By saving via Configuration -> Transmit to Sensor menu command**, all inspection tasks created** are transmitted to the sensor, where they are permanently stored.

	NOTE
	If an inspection task was changed, permanent storage in the sensor should be performed with Configuration -> Transmit to Sensor.

The typical procedure for creating and saving inspection tasks is described in Chapter 9.6, "Definition of inspection tasks" on page 67.

Operation Mode

In `Operation Mode` you can set the LES 36 to continuously detect and output measurement data (factory setting) using `Free Running`. With `Input Triggered`, the LES 36 captures measurement data only if a rising edge is present at the trigger input or if either the “Ethernet Trigger” (see chapter 10.3.4) or PROFIBUS Trigger (see chapter 11.5) command is being used. Detailed information on this topic can be found in Chapter 4.2.3.

Activation

Under `Activation`, the `Regard` setting has the effect that the laser is switched on and off according to the level at the activation input or via PROFIBUS. Detailed information on this topic can be found in Chapter 4.2.2.

When the `Disregard` setting has been selected, the laser always remains switched on, independent from the level at the activation input or the PROFIBUS activation (factory setting).

Trigger Output Mode

Under `Trigger Output Mode` you can activate the cascading output using `Cascading`. Detailed information on this topic can be found in Chapter 4.2.4. When the `Disable` setting has been selected, the cascading output will not be set (factory setting).

Light Exposure

Using `Light Exposure` you can control the exposure duration of the laser during measurement value detection and adapt it to the reflective properties of the objects to be detected.

↳ Select an exposure setting that displays a continuous line around the object contour. Then try to achieve a line on a flat surface that is as continuous as possible.

Field of View

Using `Field of View` you can restrict the LES 36measurement range of the . The same happens if you click on the square handles of the measurement range framed in blue with the mouse and then pull.

Factory settings for `Field of View`:

	LES 36…	LES 36HI…
Min **X**	-300	-70
Max **X**	300	70
Min **Y**	190	190
Max **Y**	810	610

↳ By restricting to the necessary detection range, ambient light or undesired reflections can be suppressed.

Apply Settings

The `Apply Settings` button temporarily transmits the settings for the current inspection task to the sensor. When switched off, the data/settings are lost.

NOTE	
	If an inspection task was changed, permanent storage in the sensor should be performed with `Configuration -> Transmit to Sensor`.

9.4.2 Standard tab – Analysis Functions panel

The main settings of the LES 36 for implementing applications are made in the `Analysis Functions` panel.

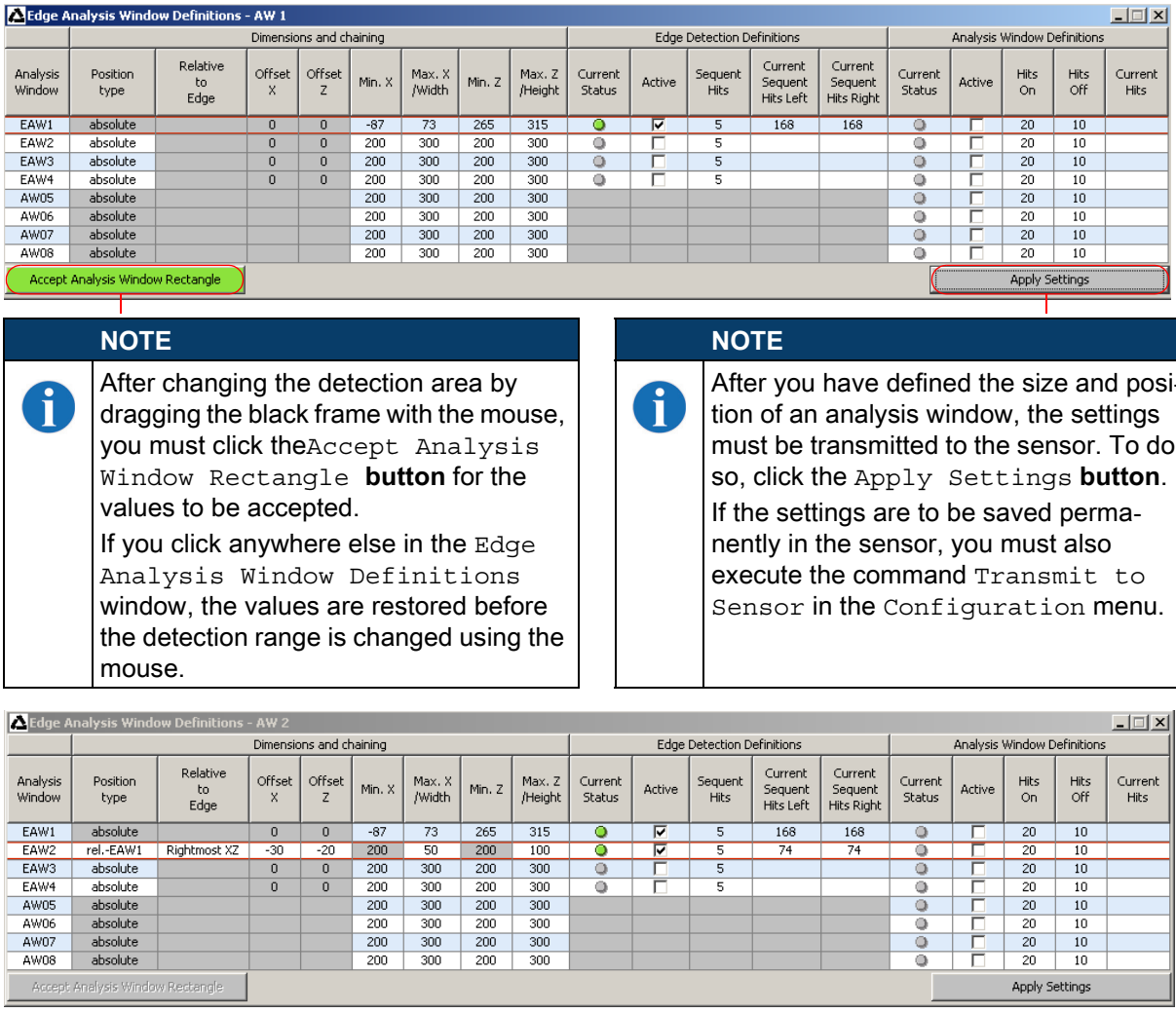
Edit Analysis Windows

In the `Analysis Functions` panel, use the `Edit Analysis Windows` button to define the rectangular analysis windows. You can define up to four edge analysis windows (EAW – Edge Analysis Window) and up to four normal analysis windows (AW – Analysis Window).

NOTE

EAWs are used for edge detection; they can also be used for object detection. In AWs, only object detection is possible. The function of the evaluation of the measurements with EAWs and AWs is described in Chapter 4.3 and Chapter 4.4.

Click the `Edit Analysis Windows` button to open the table for defining the analysis windows.



NOTE

After changing the detection area by dragging the black frame with the mouse, you must click the`Accept Analysis Window Rectangle` **button** for the values to be accepted.

If you click anywhere else in the `Edge Analysis Window Definitions` window, the values are restored before the detection range is changed using the mouse.

NOTE

After you have defined the size and position of an analysis window, the settings must be transmitted to the sensor. To do so, click the `Apply Settings` **button**.

If the settings are to be saved permanently in the sensor, you must also execute the command `Transmit to Sensor` in the `Configuration` menu.

Figure 9.4: Edit Analysis Windows

Alternatively, the spatial position and size of EAWs and AWs can be configured with the mouse or by means of keyboard entries. After selecting the `Active` check box (by clicking), a black frame with handles appears at the left in the display of the detection area. You can now use the mouse or keyboard to position the analysis window.

Using the mouse

Click and drag the handles of the analysis window using the mouse to change its size and position.

NOTE

The font of the `Accept Analysis Window Rectangle` button turns black after size and/or position of the analysis window have been changed using the mouse. You have to click the button in order to accept the values in the 2D representation.

Keyboard input

Alternatively, you can enter the desired position values directly into the Minimum/Maximum X/Z columns under Dimensions.

NOTE

The changed settings must be transferred to the sensor with `Apply Settings`.

Position type

Here you determine whether the coordinates of an analysis window are to be absolute, or whether the position of an EAW is to change relative to a found edge.

The first analysis window provides the reference and must therefore be configured with absolute coordinates. The other analysis windows can be defined relative to an edge in one of the previous EAWs.

Relative to Edge

Here you select the reference edge (e.g. within EAW1) for relative tracking of EAW2. Possible settings are:

- Tracking in X-direction: Rightmost X, Leftmost X
- Tracking in Z-direction: Rightmost Z, Leftmost Z
- Simultaneous tracking in X and Z-direction: Rightmost XZ, Leftmost XZ

Offset X / Offset Z

If you have selected relative tracking for an analysis window, you can define the offset of the X and Z-position relative to the reference edge.

You define the window width / height with Width / Height. The values Min X, Max X, Min Z, Max Z are ignored in this case.

Edge Detection Definitions

Here, you define the parameters for edge detection in up to four EAWs. Select the check box in the `Active` column to activate the respective EAW.

For the edge plausibility check, the `Sequent Hits` parameter determines the minimum number of successive measurement points (see chapter 4.3.3). For orientation as to how the Sequent Hits parameter is to be selected, the currently measured number of successive object points in the EAW is shown in the `Current Sequent Hits Left` and `Current Sequent Hits Right` columns.

An edge is detected if `Current Sequent Hits left` or `Current Sequent Hits Right` is greater than or equal to `Sequent Hits`. In this case, the status of the EAW in the `Current Status` column is green (ok). If an edge is detected, the status of the EAW in the `Current Status` column is red (not ok). If the EAW is not activated, the status is gray.

If not enough measurement points occurred in succession in an EAW, edge detection and object measurement within this EAW is not possible.

Analysis Window Definitions

Here, you define the parameters for object detection in up to four EAWs and four AWs. Select the check box in the `Active` column to activate object detection in the respective analysis window. The optionally selectable object detection enables stable measurement results even under problematic conditions.

In the `Current Hits` column, LESsoft displays the number of measurement points that are detected in the analysis window. In the `Hits On` column, you define how many measurement points must be detected in order for the evaluation result of the object detection to be **ok** in the respective analysis window. If the result is **ok**, a green dot is displayed in the `Current Status` column. The state remains green until the number of detected hit points becomes equal to or smaller than the value you set in the `Hits Off` column.

The entries in `Hits On` and `Hits Off` thus let you configure a switching hysteresis to prevent an (unwanted) change of the switching state under admissible changes in the object position or other physical quantities.

The further processing and combination of results from object detection occurs by pressing the `Edit Logical Combinations` button.

NOTE	
	The changed settings must be transferred to the sensor with `Apply Settings`.

Edit Logical Combinations

By clicking on the `Edit Logical Combinations` button, the following window appears.

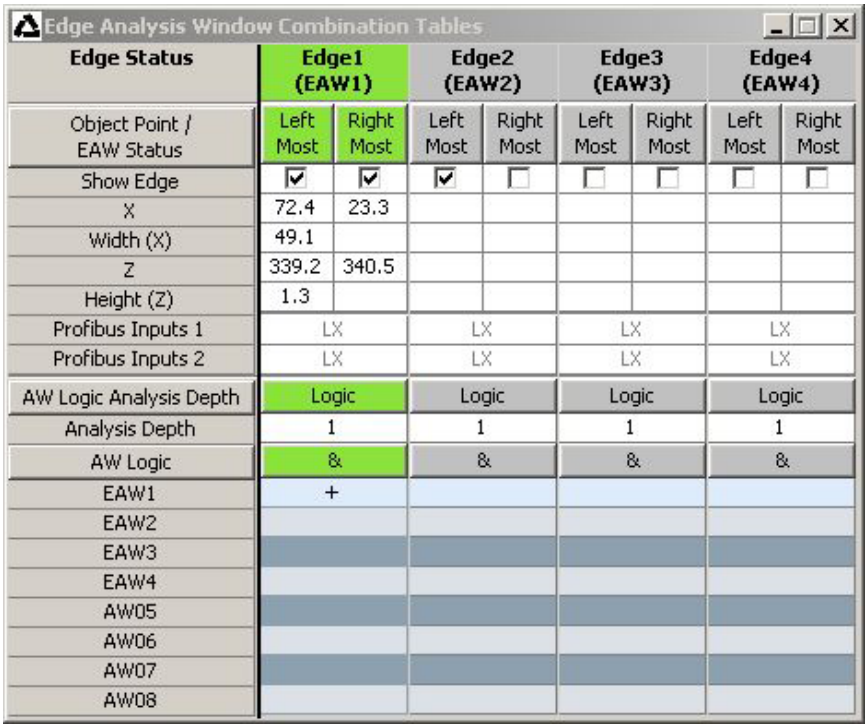


Figure 9.5: 'Edge Analysis Window Combination Tables' window

Edge State (result of edge and object detection)

The AND combination result of the `Object Point/EAW State` (edge detection state) line and the `AW Logic Analysis Depth` (state of the logic for object detection) line are displayed here for each EAW.

If no object detection was configured, the `Edge Status` corresponds to the status of edge detection.

- Green state = edge detection and object detection **ok**
- Red state = edge detection and object detection **not ok**

NOTE
For sensors with analog output, a valid measurement value transmission for edges only occurs at the analog output if the Edge State is **ok**.

Object Point/EAW State (result of edge detection)

For each EAW, the result of the edge plausibility check is displayed here for the left edge (Left Most) and right edge (Right Most).

- Green state = edge detected = **ok**
- Red state= no edge detected = **not ok**

The result is identical to the status under `Edit Analysis Windows` -> `Edge Detection Definitions`.

NOTE
A valid measurement value transmission for edges only occurs if the `Object Point/EAW Status` is **ok**.

Show Edge

If the check box is selected, the **left** edge position is displayed in the 2D view with a **green coordinate cross**, the **right** edge position with a **blue coordinate cross**.

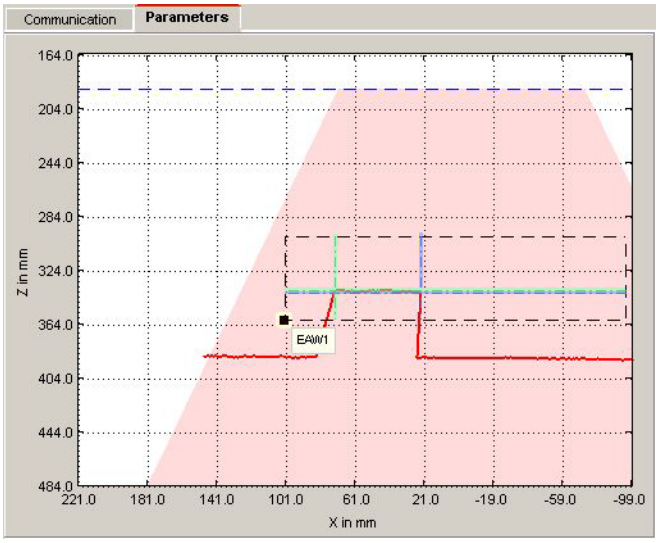


Figure 9.6: Display of the edge positions (green and blue) in the 2D display

X, Width (X), Z, Height (Z)

In the fields of these lines, the current measurement values **LX**, **RX**, **LZ**, **RZ**, **W** and **H** are displayed for each EAW in mm see chapter 4.3.3), provided the EAW was defined.

Measurement values and their meaning:

- Edge positions: LX, LZ, RX, RZ
  - LX = Left edge X coordinate
  - LZ = Left edge Z coordinate
  - RX = Right edge X coordinate
  - RZ = Right edge Z coordinate.
- Width of objects: W (calculated from the distance of RX and LX in the X-direction).
- Height difference of left and right edge: H (calculated from the distance of RZ and LZ in the Z-direction).

Profibus Inputs 1, Profibus Inputs 2

The selection of which process values are transmitted via PROFIBUS is made here. With PROFIBUS devices, 2 measurement values ((LX, RX, LZ, RZ, W or H; see chapter 4.3.3) can be output per EAW via the PROFIBUS. In the `Profibus Inputs 1` and `Profibus Inputs 2` fields, you can configure which measurement values these are for up to four edge analyses.

	NOTE
	The changed settings must be transferred to the sensor with `Apply Settings`.

Application example 1: web edge measurement

In the following example, the right edge position of web material is to be ascertained. Edge analysis window EAW1 is positioned in the measurement range so that the web material is located within the window.

The ascertained position of the right edge is -9.6mm (column `Edge1` -> `Right Most` -> line `X`). The distance from the edge to the sensor is 366.6mm (column e `Edge1` -> `Right Most` ->line `Z`).

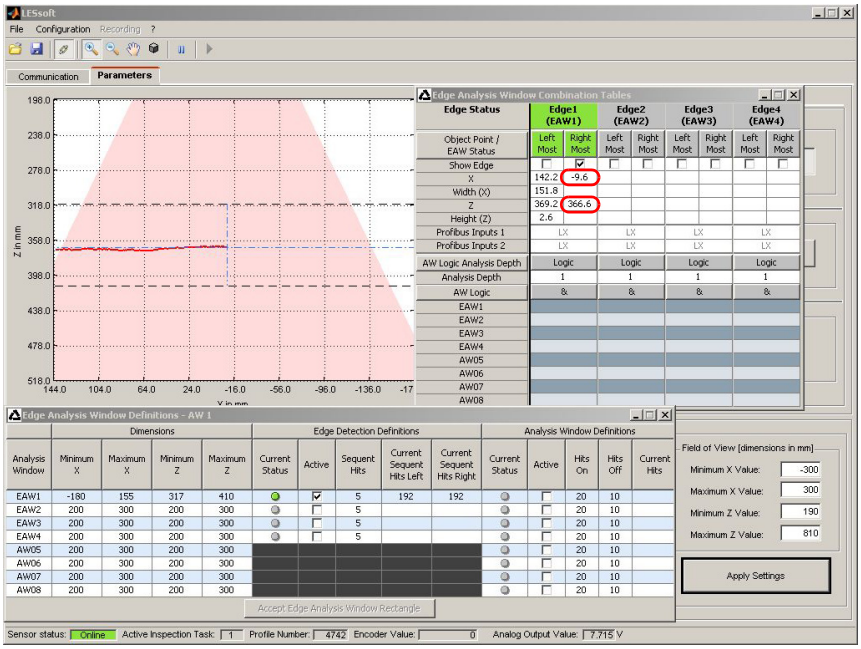


Figure 9.7: Application example 1: web edge measurement

Application example 2: height and width monitoring of cubic objects

In the following example, the height and width of a carton are measured. For the width measurement, EAW1 is positioned above the support surface. For the height measurement, EAW2 is positioned to the side of the carton. The height of EAW2 is configured so that both the support surface as well as the top side of the carton are located in EAW2.

The ascertained width of the carton is 49.7mm (column `Edge1` -> line `Width (X)`). The ascertained height is 49.6mm (column `Edge2` -> line `Height (Z)`).

All measurement results are displayed in the window to the right of the 2D view.

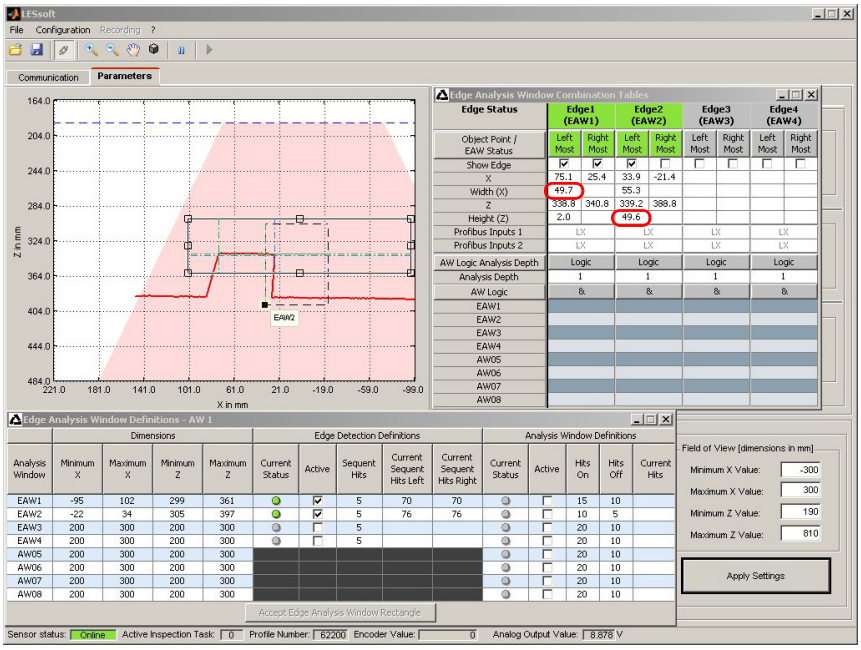


Figure 9.8: Application example 2: height and width monitoring of cubic objects

Additional object detection with LES sensors

In the lower part of the `Edge Analysis Window Combination Tables`, see Figure 9.5, an additional object detection can be configured.

NOTE
Object detection is only possible if object detection was activated in the EAW/AW. This is performed in **LESsoft** by selecting the check box in the `Active` column under `Edit Analysis Windows` -> `Analysis Window Definitions`.

EAW1 … EAW4, AW05 … AW08

Specify here which analysis windows are to be logically AND linked with one another with respect to the analysis of the `Current Hits`. With the "**+**" selection, the (E)AW state is taken into account in the AND combination. If "**-**" is selected, the inverse of the (E)AW state is taken into account.

The result of the logic combination is displayed in the `AW Logic` line.

NOTE
An entry is only possible if object detection was activated in the EAW/AW.

AW Logic

The status display of the AND combination result of EAW1 … EAW4, AW05 … AW08 is shown here:

- Green state = **ok**
- Red state = **not ok**

NOTE
A display appears only if object detection was activated in an EAW/AW.

Analysis Depth

The analysis depth is entered here. The analysis depth is the number of successive evaluations with the same result that are necessary for a change of the combination result (value range: 1 … 255).

NOTE
A display appears only if object detection was activated in an EAW/AW.

NOTE
Select a larger value for the analysis depth to give the LES a reliable switching behavior. The response time of the sensor during object detection increases accordingly (example: analysis depth = 3 -> response time 3 x 10 ms = 30 ms). Interfering signals of individual scans are suppressed. If an analysis depth = 1 (factory stetting beginning with firmware version 01.25) is selected, the response time is 10 ms.

AW Logic Analysis Depth (result of object detection)

The status display of the combination result of `AW Logic` appears here, taking into account the analysis depth.

- Green state = **ok**
- Red state = **not ok**

NOTE
A display appears only if object detection was activated in an EAW/AW.

NOTE
The changed settings must be transferred to the sensor with `Apply Settings`.

Application example 3: width monitoring of cubic objects with object detection (narrow objects are not to be detected)

The application example is similar to application example 2. The width of cartons is to be measured. For narrow objects, the measurement is to be suppressed. For width measurement, EAW1 is to be positioned above the support surface as in application example 2. In addition, object detection is configured in the `Edit Analysis Windows` -> `Analysis Window Definitions`.

NOTE
Object detection is only possible if object detection was activated in the EAW/AW. This is performed in **LESsoft** by selecting the check box in the `Active` column under `Edit Analysis Windows` -> `Analysis Window Definitions`.

The threshold for object detection in EAW1 is 60 hits. In Figure 9.9 there is a wide object with `Current Hits` = 68 in the measurement range of the LES. The object is detected, the state of object detection is green (**ok**). In the `Edge Analysis Window Combination Tables` window, the additional object detection is activated by selecting **+** under EAW1. All results are green (**ok**). The ascertained width of the carton is 49.2mm (column `Edge1` -> line `Width (X)`).

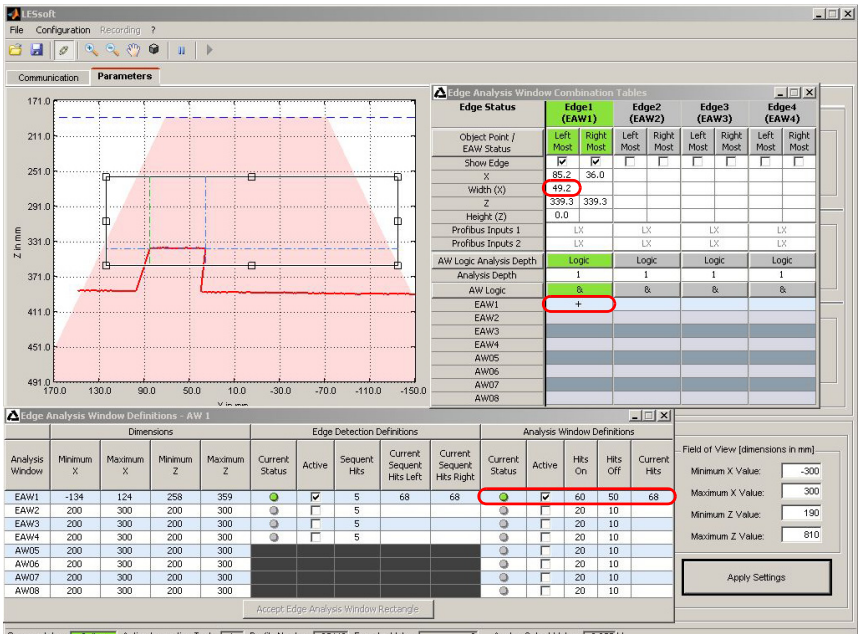


Figure 9.9: Application example 3.1: width monitoring of cubic objects with object detection

In Figure 9.10 there is a narrow object with `Current Hits` = 20 in the measurement range of the LES. The object is considered to be not detected, the state of object detection in the `Edge Analysis Window Defintions` -> `Analysis Window Definitions` is red (**not ok**).

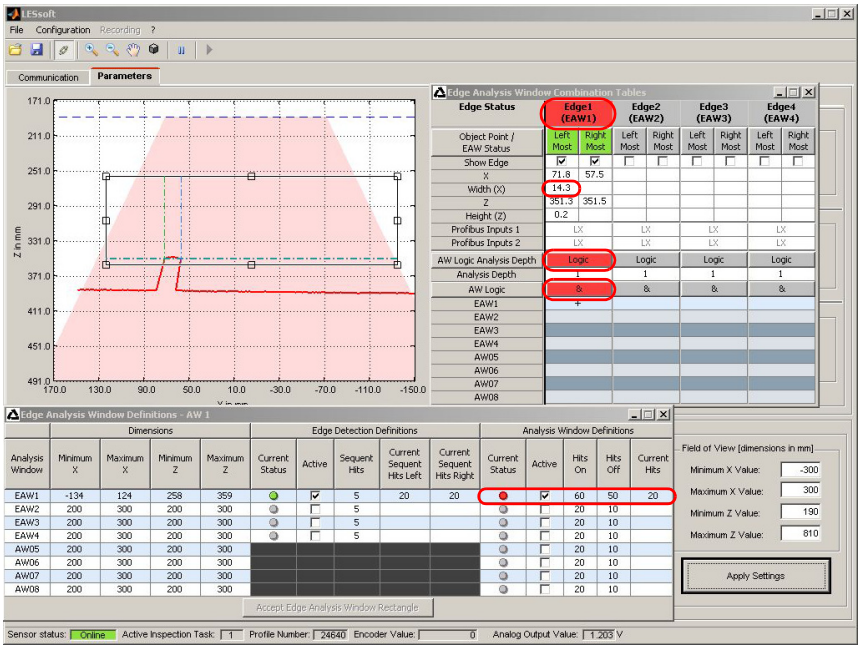


Figure 9.10: Application example 3.2: width monitoring of cubic objects with object detection

In the `Edge Analysis Window Combination Tables` window, the additional object detection is activated by selecting **+** under EAW1. The result for object detection is **not ok** (red state). The `Edge Status` (AND combination of the results of edge and object detection) is displayed red (**not ok**). The ascertained width of the object is 14.2mm (column `Edge1` -> line `Width (X)`).

	NOTE
	For sensors with **analog output**, a valid measurement value transmission for edges only occurs at the analog output if the `Edge Status` is **ok** (see page 59). For sensors with **digital switching outputs** at X3 (LES 36/VC6, LES 36 HI/VC6), the status of Edge 1 … 4 is signaled at the outputs Out1 … Out4 (HIGH active).

9.4.3 Standard tab – Single Shot Mode panel

In `Single Shot Mode`, the sensor carries out an individual analysis only when you click on the `Request Measurement` button and displays the result in **LESsoft** until `Request Measurement` is clicked again.

9.4.4 Standard tab – Global Parameters panel

Under `Global Parameters` you can use `Enable External Inspection Task Selection` to configure whether or not the inspection tasks 0 … 15 can be selected via PROFIBUS.

	NOTE
	If `Enable External Inspection Task Selection` is ticked, the inspection task can only be selected via PROFIBUS. In this case, the drop-down menu under `Inspection Task Selection` has no function.

9.4.5 Analog Output tab – configuring the analog output (LES 36…/VC only)

For analog devices, you can configure the analog voltage and current output of the LES 36…/VC6 in the `Analog Output`tab.

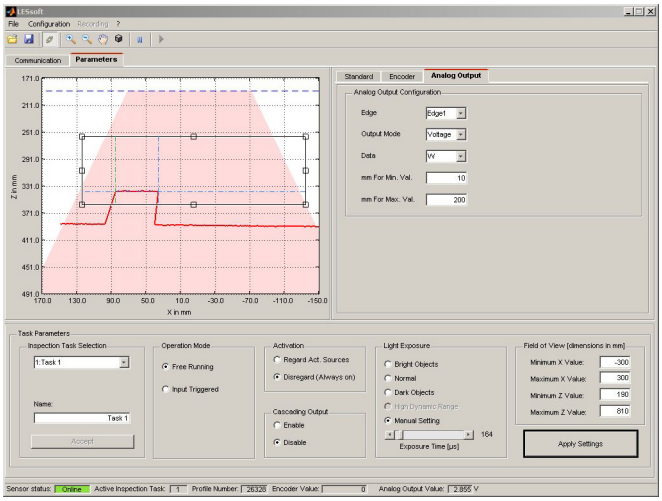


Figure 9.11: Parameter settings in LRSsoft

The following settings can be made for the analog output:

Edge
Selection of from which EAW (Edge Analysis Window) the measurement value is to be transmitted.

Output Mode
Selection of whether the current or voltage output is to be used as the process interface.

Data
Selection of which value of the selected EAW is to be output at the analog output. Select from the following measurement values:

- Edge positions: **LX**, **LZ**, **RX, RZ**
  - **LX** = Left edge X coordinate
  - **LZ** = Left edge Z coordinate
  - **RX** = Right edge X-coordinate
  - **RZ** = Right edge Z-coordinate
- Width of objects: **W**
- Height difference of left and right edge: **H**

	NOTE
	The selected value is appears in the measurement value display of the display (2nd line) in the middle.

mm For Min. Val.
Measurement value in mm for the **lower** range limit of the voltage or current (1V/4mA).

mm For Max. Val.
Measurement value in mm for the **upper** range limit of the voltage or current output (10V/20mA)

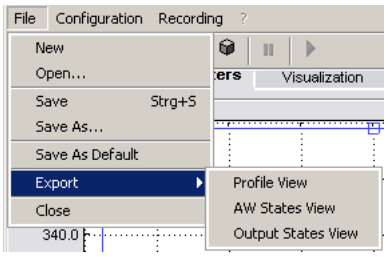
	NOTE
	The minimum adjustable range between the upper and lower range limit of the analog output is 10mm.

	NOTE
	The changed settings must be transferred to the sensor with `Apply Settings`.

9.5 Menu commands

9.5.1 Saving parameter settings/File menu

The `File` menu is used to save parameter data to the PC. In this way, settings for various detection tasks can be defined within the scope of commissioning and stored on data carriers and parameter files. During operation, the LES 36 is reconfigured via **Inspection Tasks**. A parameter file stored on a data carrier can only be used with LESsoft configuration software!



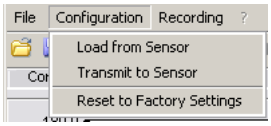
- `New` creates a new configuration file.
- `Open` opens a configuration file from the data carrier.
- `Save` saves the open configuration file with the same name.
- `Save as` saves the open configuration file under a different name.
- `Save as default` saves the open configuration as the default setting which is always loaded when LESsoft is opened.

In addition, the `File` menu offers the possibility to export the following views format to data carriers (available formats: `*.png, *.jpg, *.bmp, *.tif`):

- `Profile View:` the current view as 2D view

9.5.2 Transmitting parameter settings/Configuration menu

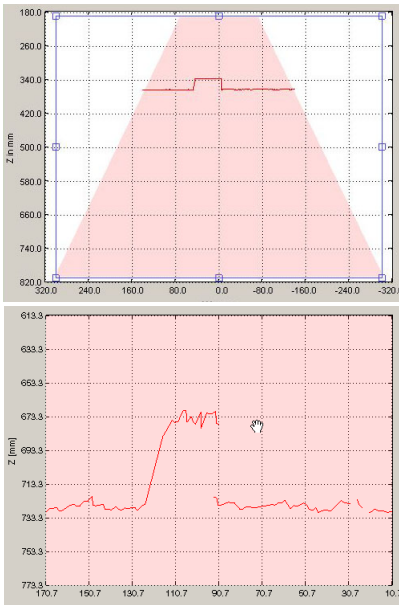
The `Configuration` menu is used to exchange parameter data with the connected LES 36.

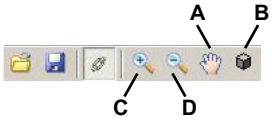


- `Load from Sensor` loads all parameter settings for all defined inspection tasks from the LES 36 and displays them in the software.
- `Transmit to Sensor` permanently stores all parameter settings of all defined inspection tasks from the configuration software in the LES 36.
- `Reset to factory settings` resets the LES 36 to factory settings.

9.5.3 Zoom and Pan/toolbar

The `Zoom in` / `Zoom out` and `Pan` buttons of the toolbar allow individual areas of the view to be enlarged for better visual evaluation:





A Pan
B `Reset plots to initial settings`
C `Zoom In`
D `Zoom Out`

Enlarge area:

1. Select Zoom in
2. Click in the view
3. Select Pan
4. Shift the area to be examined into the center of the screen

↳ Repeat until the desired view is reached

↳ Use `Reset plots to initial settings` to restore the original size.

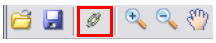
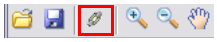
Figure 9.12: Zoom function

After activating the magnifying glass, each click on the view enlarges the displayed section. The enlarged section can then be shifted with the activated hand function to display the area of interest.

	NOTE
	The click-and-drag method for zooming known from other programs is not possible here. Before LPSsoft is operated further, the tool buttons (Zoom, Pan, …) must be activated.

9.6 Definition of inspection tasks

Typical procedure

1. **Start LESsoft** and connect it to sensor:
   Click on the button `Connect to sensor`: 
2. Fetch the configuration from the sensor via `Load from Sensor` or load it from the data carrier with `Open`.
3. Remove the tick at `Enable Selection Inputs`.
4. Use `Inspection Task Selection` to select the inspection task to be modified.
5. Display and, if necessary, enlarge 2D view of the detection range in the `Parameters` tab.
6. Standard tab – Task Parameters panel: Define required (E)AWs with mouse or keyboard in the `Analysis Windows Definitions` window (`Edit Analysis Windows` button); confirm each of the set (E)AWs with `Apply Settings`.
   Configure the `Sequent Hits` limit value for the edge plausibility check for each EAW.
7. Configure PROFIBUS process data in the `Edge Analysis Window Combination Tables` window (`Edit Logical Combinations` button) in lines `Profibus Inputs 1` and `Profibus Inputs 2`, or, alternatively, configure the analog output via the `Analog Output` tab.
8. Check the process reliability in the `Edge Analysis Window Combination Tables` window and in the 2D view.
9. Assign a name (`Name`) to the inspection task and confirm with `Accept`.
10. Temporarily transfer the inspection task with `Apply Settings`.
11. If necessary, define further inspection tasks with steps 5–9.
12. Tick `Enable Selection Inputs` again.
13. Permanently transfer the configuration including all inspection tasks to the sensor with `Transmit to Sensor`.
14. If necessary, save the configuration to data carrier with `Save As`.
15. Finally, disconnect the sensor:
    Click on the `Disconnect from sensor` button: 

10 Integrating the LES 36 in the process control (Ethernet)

10.1 General information

The LES 36 communicates with the process control via UDP/IP using the protocol described in Chapter 10.2.9. The protocol operates in two different modes:

- Measure mode
- Command Mode

In measure mode, the LES 36 transmits the evaluation telegram. This is continuously transmitted in "Free Running" operation; in triggered operation, it is transmitted only once per trigger.

In command mode the LES 36 reacts to commands from the control. The available commands are described in Chapter 10.2.9.

NOTE
If you use a firewall, please make certain that the control can communicate with the LES 36 via the Ethernet interface by means of UDP on ports 9008 and 5634 (these ports are preset at the factory, but may have been changed by the user, see chapter 7.2 "Menu description"). Furthermore, the firewall must allow ICMP echo messages to pass through for the connection test (ping).

The integration of the PROFIBUS device variant LES 36.../PB into the process control via PROFIBUS is described in Chapter 11 "Integration of the LES 36…/PB in the PROFIBUS" on page 81.

10.2 Ethernet protocol structure

NOTE
The sequence in which the individual bytes are saved varies depending on the operating system. The commands in Chapter 10.2.9 and the protocol description are represented in "big endian" format, i.e., the high-byte first followed by the low-byte (0x… hexadecimal). Windows PCs (and many controls, such as the Siemens S7), however, store data in the "little endian" format, i.e. the low byte first followed by the high byte. ↳ If, in your process environment, the LES 36 does not respond to commands from the control even though communication with LESsoft functions properly, check whether the problem lies with the byte order. **Example**: for command `0x434E` (Connect to Sensor) a Windows PC must transmit `0x4E` and `0x43` in order for it to be understood by the LES 36. The transaction number of the response from LES 36 then also contains `0x4E43` (byte sequence 0x43, 0x4E). The LES 36 sends data as “little endian”, i.e. first the low byte and then the high byte.

The possible values of individual bytes and their meaning are described below.

Protocol structure

The protocol consists of the **header** (30 bytes) followed by the **user data** (0 … 75 data words @ 2 bytes). The protocol is used both in command mode when transmitting commands and when acknowledging sensor commands as well as in measure mode.

Header

Startseq. 1	Startseq. 2	Fill character	Command no.	Fill character	Packet no.	Fill character	Transaction no.	Status	Encoder H	Encoder L	Fill character	Scan no.	Type	Quantity User data words
0xFFFF	0xFFFF	0x0000	0x0059	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0010	0x0003
Length 4 bytes, value fixed: 0xFFFF 0xFFFF		Length 2 bytes, value fixed: 0x0000	Length 2 bytes, possible values: see chapter 10.2.9	Length 2 bytes, value fixed: 0x0000	Length 2 bytes, Value range: 0x0000 … 0xFFFF	Length 2 bytes, value fixed: 0x0000	Length 2 bytes, Value range: 0x0000 … 0xFFFF	Length 2 bytes, Value range: 0x0000 … 0xFEFF	Length 4 bytes, Value range: 0x0000 0000	0xFFFF FFFF [1]	Length 2 bytes, value fixed: 0x0000	Length 2 bytes, Value range: 0x0000 … 0xFFFF	Length 2 bytes, value fixed: 0x0010	Length 2 bytes, possible values: 0x0000 / 0x0001 / 0x0002 / 0x0003 / 0x0178

Length of the header: 30 bytes

1) For sensor models with encoder input, these 4 bytes contain the encoder value.
With the LES 36, this value is always 0x0000 0000.

10.2.1 Command number

The command number specifies both the command from the control to the sensor as well as the command from the sensor to the control (see chapter 10.2.9).

In **measure mode** the sensor always sends an evaluation telegram with command number 0x5354.

10.2.2 Packet number

The packet number serves internal maintenance purposes of the manufacturer.

10.2.3 Transaction Number

In **measure mode**, 0x0000 is always displayed here.

In **command mode**, the command acknowledgment of the sensor contains the command number of the command that is answered.

10.2.4 Status

Indicates the state of the sensor. The state is coded as follows:

MSB			High byte				LSB	MSB			Low byte				LSB	Meaning of the bits
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0**	Sensor not connected via Ethernet
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**	Sensor connected via Ethernet
-	-	-	-	-	-	-	-	**0**	**0**	**0**	**1**	-	-	-	-	Measure mode
-	-	-	-	-	-	-	-	**0**	**0**	**1**	**0**	-	-	-	-	Menu mode
-	-	-	-	-	-	-	-	**0**	**1**	**0**	**0**	-	-	-	-	Command mode
-	-	-	-	-	-	-	-	**1**	**0**	**0**	**0**	-	-	-	-	Error mode
-	-	-	-	-	-	-	**0**	-	-	-	-	-	-	-	-	Sensor deactivated via activation function
-	-	-	-	-	-	-	**1**	-	-	-	-	-	-	-	-	Sensor activated via activation function
-	-	-	-	-	-	**0**		-	-	-	-	-	-	-	-	No warning
-	-	-	-	-	-	**1**		-	-	-	-	-	-	-	-	Warning, temporary sensor malfunction
-	-	**-**	-	-	**0**	-	-	-	-	-	-	-	-	-	-	Free Running measure mode
-	-	**-**	-	-	**1**	-	-	-	-	-	-	-	-	-	-	Triggered measure mode
-	-	**-**	-	**0**	-	-	-	-	-	-	-	-	-	-	-	No configuration memory connected
-	-	**-**	-	**1**	-	-	-	-	-	-	-	-	-	-	-	Configuration memory connected
-	-	**0**	-	-	-	-	-	-	-	-	-	-	-	-	-	No error
-	-	**1**	-	-	**-**	-	-	-	-	-	-	-	-	-	-	Error detected, measurement data are still sent if applicable, the sensor then switches into error mode

The LSB of the high byte is always set to 1 as long as the parameter `Activation Input` has been set to `Disregard (Always on)` in **LESsoft**.

If parameter `Activation Input` is set to `Regard`, the state of the bit corresponds to the state of the signal of an activation source (input, Ethernet activation).

NOTE
Independent of the mode that is currently active, the sensor switches to menu mode if a button if the display is touched and then neither responds to commands nor does it transmit measurement data. Menu mode automatically ends after 3 minutes if no buttons are pressed. Alternatively, the user can end menu mode with the `Exit` menu item.

10.2.5 Encoder High / Low

The encoder counter is implemented in sensor models with encoder input. All other sensors permanently display 0x00000000 an.

The **4 bytes** in **Encoder High** and **Encoder Low** specify the encoder counter value for light section sensors with encoder interface. The maximum value is 0xFFFF FFFF. Beyond that an overflow to 0x0000 0000 occurs.

10.2.6 Scan number

The **2 bytes** of the **scan number** indicate the number of single measurements in chronological order. After each measured profile, this number increases by 1. The maximum value is 0xFFFF. Beyond that an overflow to 0x0000 occurs. The Z and X data belonging to a measurement are identified by the same scan number.

10.2.7 Type

Specifies how the detection data are to be interpreted. The fixed default value is 0x0010.

10.2.8 Number of user data words

The user data have a variable length of 0, 1, 2, 3 or 75 data words (0, 2, 4, 6 or 150 bytes).

Indicates the number of user data transferred. The fixed default value in detection mode is 0x0059.

10.2.9 Evaluation telegram

In detection mode for the LES 36, the evaluation telegram is transmitted with command number 0x5354. After the header are 75 user data words with the following structure:

Byte	MSB				High byte			LSB	MSB			Low byte		LSB			Meaning of the bits
31…32	-	-	-	-	-	-	-	-	-	-	-	-	N4	N3	N2	N1	Number of the current inspection task
33…34	-	-	-	-	-	-	-	-	AW 8	AW 7	AW 6	AW 5	EA W4	EA W3	EA W2	EA W1	Results of the individual analysis windows
35…36	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of measurement points (Current Hits) in EAW1
37…38	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of measurement points (Current Hits) in EAW2
39…40	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of measurement points (Current Hits) in EAW3
41…42	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of measurement points (Current Hits) in EAW4
43…44	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of measurement points (Current Hits) in EAW5
45…46	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of measurement points (Current Hits) in EAW6
47…48	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of measurement points (Current Hits) in EAW7
49…50	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of measurement points (Current Hits) in EAW8
51…52	-	-	-	-	-	-	-	-	-	-	-	-	E4	E3	E2	E1	Results of logic line AW Logic for Edge1 … Edge4

Byte	MSB			High byte				LSB	MSB			Low byte	LSB				Meaning of the bits
53…54													E4	E3	E2	E1	Results of logic line AW Logic Analysis Depth for Edge1 … Edge4
55…56													E4	E3	E2	E1	Results of edge detection in line Object Point/EAW State
57…58													E4	E3	E2	E1	Results of Edge State line (edge and object detection)
59…60																	Current Sequent Hits Left in EAW1
61…62																	Current Sequent Hits Right in EAW1
63…64																	Left edge X-value LX in EAW1 [1]
65…66																	Left edge Z-value LZ in EAW1 [1]
67…68																	Right edge X-value RX in EAW1 [1]
69…70																	Right edge Z-value RZ in EAW1 [1]
71…72																	Width W in EAW1 [1]
73…74																	Height H in EAW1 [1]
75…76																	Current Sequent Hits Left in EAW2
77…78																	Current Sequent Hits Right in EAW2
79…80																	Left edge X-value LX in EAW2 [1]
81…82																	Left edge Z-value LZ in EAW2 [1]
83…84																	Right edge X-value RX in EAW2 [1]
85…86																	Right edge Z-value RZ in EAW2 [1]
87…88																	Width W in EAW2 [1]
89…90																	Height H in EAW2 [1]
91…92																	Current Sequent Hits Left in EAW3
93…94																	Current Sequent Hits Right in EAW3
95…96																	Left edge X-value LX in EAW3 [1]
97…98																	Left edge Z-value LZ in EAW3 [1]
99…100																	Right edge X-value RX in EAW3 [1]
101…102																	Right edge Z-value RZ in EAW3 [1]
103…104																	Width W in EAW3 [1]
105…106																	Height H in EAW3 [1]
107…108																	Current Sequent Hits Left in EAW4
109…110																	Current Sequent Hits Right in EAW4
111…112																	Left edge X-value LX in EAW4 [1]
113…114																	Left edge Z-value LZ in EAW4 [1]
115…116																	Right edge X-value RX in EAW4 [1]
117…118																	Right edge Z-value RZ in EAW4 [1]
119…120																	Width W in EAW4 [1]
121…122																	Height H in EAW4 [1]
123…180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	The remaining user data are used for internal maintenance purposes of the manufacturer.

1) Unit: 1/10 mm (0.1 mm)

10.3 Ethernet commands

ATTENTION!

The scope of the available commands has grown from firmware version to firmware version.
A **revision history / feature list** can be found in the appendix in Chapter 17.2.
The commands described below refer to the **current** firmware version of the LES 36.

NOTE

The sequence in which the individual bytes of the commands and of the protocol must be transmitted in order to be processed by the LES 36 corresponds to the "little-endian" byte sequence. The response of the LES 36 also corresponds to the "little-endian" standard. For further information, see the note in Chapter 10.2.

All other commands are acknowledged with 'Not Ack'=0x414E; the command is not processed.
Additional commands are available in command mode.

10.3.1 Elementary commands

NOTE

For command syntax (header/user data), see chapter 10.2.

Using the `Connect to sensor` and `Disconnect from Sensor` commands, a connection between control and sensor is established or terminated. The communication with the LES 36 is carried out via the ports previously configured in LESsoft.

Command from control to LES 36		Answer from LES 36 to control	
Command no.	Meaning	**Command no.**	Meaning
0x434E	**Connect to Sensor** *Connect to the sensor*	0x4141	Connection established, the sensor is permanently connected. The sensor status (bytes 17 and 18) can be used to detect whether the sensor is connected.
		0x414E	The transmitted command was not processed (possible sensor status: sensor is already connected or in menu mode, for detailed info see chapter 10.2.4 "Status").
0x4443	**Disconnect from Sensor** *Disconnect the sensor*	0x4141	Connection terminated.
		0x414E	The transmitted command was not processed (possible sensor status: sensor was already disconnected or in menu mode; for detailed info, see chapter 10.2.4 "Status").

Table 10.1: Connection commands

Command from control to LES 36		Answer from LES 36 to control	
Command no.	Meaning	**Command no.**	Meaning
0x3132	**Enter Command Mode** *Activate command mode*	0x4141	Sensor in command mode
		0x414E	The transmitted command was not processed (possible sensor status: sensor currently in menu mode and cannot execute any commands. Sensor is already in command mode) [1] .
0x3133	**Exit Command Mode** *Exit command mode*	0x4141	Sensor back to measure mode
		0x414E	The transmitted command was not processed because the sensor was not in command mode.

Table 10.2: Command mode control commands

1) For detailed information on possible sensor states, see chapter 10.2.4 "Status". You can determine whether the sensor is in menu mode with a quick glance at the display. Menu mode can be exited with the `Exit` menu item.

10.3.2 Commands in command mode

NOTE
For command syntax (header/user data), see chapter 10.2.

The following commands are available in command mode:

Command from control to LES 36			Answer from LES 36 to control		
Command no.	Meaning	Number of user data words	**Command no.**	Meaning	Number of user data words
0x0001	**Set Laser Gate** Laser activation and deactivation (toggle), *see chapter 10.3.3*	1	0x4141	Command executed	0
			0x414E	Command was not executed.	0
0x004B	**Set Actual Inspection Task** *Set the number of the current inspection task, see chapter 10.3.3*	2	0x4141 [1]	The inspection task has been set	0
			0x414E [2]	The transmitted command was not processed.	0
0x0049	**Get Actual Inspection Task** *Retrieve number of the current inspection task*	0	0x004A	The task number is transferred in the user data area. (0 = Task0, up to 15 = Task15)	1
0x0053	**Set Scan Number** *Sets uniform scan number for the transmission protocol, see chapter 10.3.3*	1	0x4141	Command executed	0
			0x414E	Command was not executed.	0
0x0059 [3]	**Set Single User Parameter** *Writes specific LES parameters to the sensor, e.g. deactivate output of X coordinates.*	3	0x4141	Parameter was set	0
0x005B [3]	**Get Single User Parameter** *Reads specific LES parameters, e.g. whether the output of X coordinates is deactivated.*	1	0x005C	Parameter is output	1
			0x414E	The transmitted command was not processed.	0
0x006D	**Set Single Inspection Task Parameter** *Changing individual parameters of the active inspection task*	3…14	0x4141	Command executed	0
			0x414E	Command was not executed.	0
0x006F	**Get Single Inspection Task Parameter** *Output of the active inspection task's individual parameters*	1	0x0070	Parameter is output	9…20
			0x414E	The transmitted command was not processed.	0

Table 10.3: Sensor control commands

1) 0x4141 = Acknowledge: Execution of the command is confirmed

2) 0x414E = Not Acknowledge or Error: Command has not been executed

3) The command acts globally on all inspection tasks.
Attention!
If the command is used to deactivate the output of X-coordinates, only Z-coordinates are transmitted. LESsoft can be used to depict 2D- and 3D-views. The sensor can only be reset to again transmit X- and Z-coordinates by means of command number 0x0059 when using parameter ID 0x07D4. The sensor can also be reset to factory settings via the keyboard and display, but all other sensor settings are lost as well.

10.3.3 Explanation of user data in command mode (command parameters)

Set Laser Gate

For sensor control command 0x0001, one word of user data is transmitted to the sensor:

Byte	MSB							High byte LSB	MSB							Low byte LSB	Meaning of the bits
31…32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	LF	**LF** = Laser Flag

LF=0 switches the laser off,

LF=1 switches the laser on.

Set Actual Inspection Task

For sensor control command 0x004B, two words of user data are transmitted to the sensor:

Byte	MSB							High byte LSB	MSB							Low byte LSB	Meaning of the bits
31…32	-	-	-	-	-	-	-	-	-	-	-	-	N4	N3	N2	N1	Number of the inspection task to be set (0 = Task0 … 15 = Task 15)
33…34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	SF	**SF** = SaveFlag

If **SF=0** then the inspection task is changed only temporarily.

If **SF=1** then the newly set inspection task is retained even after a restart of the LES 36.

Get Actual Inspection Task

The LES 36 responds to sensor control command 0x0049 with 0x004A and one word of user data:

Byte	MSB							High byte LSB	MSB							Low byte LSB	Meaning of the bits
31…32	-	-	-	-	-	-	-	-	-	-	-	-	N4	N3	N2	N1	Number of the set inspection task (0 = Task0 … 15 = Task 15)

Set Scan Number

For sensor control command 0x0053, one word of user data is transmitted to the sensor:

Byte	MSB							High byte LSB	MSB							Low byte LSB	Meaning of the bits
31…32	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	New scan number that is to be set

With the sensor control command `Set Scan Number`, it is possible to set a uniform scan number for the transmission protocol for multiple sensors operated in cascaded operation. A description of cascaded operation can be found in Chapter 4.2.4.

NOTE

1. Switch the master (sensor 1) to command mode. Continuous measurement is stopped as a result. In command mode, the cascading output is not active!
2. Set an arbitrary scan number with command 0x0053 for the master.
3. Successively switch all slaves (sensor 2, 3, …) to command mode and set the same scan number for each individual slave that you set previously under item 2 for the master.
4. Switch the slaves back to measure mode.
5. Switch the master *to measure mode.*

Set Single User Parameter

Switching transmission of X-coordinates on/off in measure mode

When used with parameter ID 0x07D4, sensor control command 0x0059 can switch the transmission of X-coordinates in measure mode on and off. The quantity of data transmitted in measure mode can thereby be reduced by one half (useful for applications that only require Z-coordinates and for controls with small Ethernet receive buffer).

When using sensor control command 0x0059 with parameter ID 0x07D4, three words of user data are transmitted to the sensor:

Byte	MSB							High byte LSB	MSB							Low byte LSB	Meaning of the bits
31…32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	SF	**SF** = SaveFlag
33…34	0	0	0	0	0	1	1	1	1	1	0	1	0	1	0	0	Parameter ID for Disable x-Output = 0x07D4
35…36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OF	**OF** = Output Flag

If **SF=0** then the output of X-coordinates is changed only temporarily.

If **SF=1** then the output of X-coordinates is retained even after a restart of the LES 36.

If **OF=0**, then X- and Z-coordinates are transmitted.

If **OF=1**, then only Z-coordinates are transmitted (X-coordinates are deactivated).

Extension of the transmission pause between the Z- and X-data packets

When used with parameter ID 0x07D8, sensor control command 0x0059 can be used to extend the transmission pause between the Z- and X-data packets from 0.1 ms (factory setting) to up to 1 ms (useful in applications with controls with slow, small Ethernet receive buffer).

When using sensor control command 0x0059 with parameter ID 0x07D8, three words of user data are transmitted to the sensor:

Byte	MSB			High byte				LSB	MSB			Low byte				LSB	Meaning of the bits
31…32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	SF	**SF** = SaveFlag
33…34	0	0	0	0	0	1	1	1	1	1	0	1	1	0	0	0	Parameter ID for transmission pause = 0x07D8
35…36	-	-	-	-	-	-	-	-	-	-	-	-	P4	P3	P2	P1	Duration of the transmission pause between the Z and X data packets in 0.1 ms steps (0 = 0.1 ms ... 9 = 1.0 ms)

If **SF=0**, the duration of the transmission pause is changed only temporarily.

If **SF=1**, the duration of the transmission pause is retained even following a restart of the LES 36.

NOTE

If the transfer of X-coordinates is switched off in measure mode, no visualization of measurement data can be performed in the 2D- and 3D-views in LESsoft.

Activating the median filter for Z-coordinates

When using parameter ID 0x07DB, sensor control command 0x0059 can be used to activate a median filter for the Z-coordinates. By activating the median filter, the Z-coordinates of the measurement values are smoothed out, while occurring edges are retained. If the median filter is activated, small interferences and structures can be suppressed.

When using sensor control command 0x0059 with parameter ID 0x07DB, three words of user data are transmitted to the sensor:

Byte	MSB			High byte				LSB	MSB			Low byte				LSB	Meaning of the bits
31…32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	SF	**SF** = SaveFlag
33…34						1	1	1	1	1	0	1	1	0	1	1	Parameter ID for median filter = 0x07DB
35…36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MF	**MF** = Median filter

If **SF=0**, the setting for the median filter is only temporary.

If **SF=1**, the setting for the median filter is retained even after a restart of the LES 36.

If **MF=0**, the median filter is deactivated.

If **MF=1**, the median filter is activated.

Get Single User Parameter

Status of the transmission of X-coordinates in measure mode

When using parameter ID 0x07D4, sensor control command 0x005B can be used to check whether X-coordinates are output.

When using sensor control command 0x005B with parameter ID 0x07D4, one word of user data is transmitted to the sensor:

Byte	MSB			High byte				LSB	MSB			Low byte				LSB	Meaning of the bits
31…32	0	0	0	0	0	1	1	1	1	1	0	1	0	1	0	0	Parameter ID for Disable x-Output = 0x07D4

The sensor responds with 0x005C and returns one word of user data.

Byte	MSB			High byte				LSB	MSB			Low byte				LSB	Meaning of the bits
31…32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OF	**OF** = Output Flag

If **OF=0** then X- and Z-coordinates are transmitted.

If **OF=1** then only Z-coordinates are transmitted (X-coordinates are deactivated).

Querying the transmission pause between the Z- and X-data packets

When using parameter 0x07D8, sensor control command 0x005B can be used to query the duration of the transmission pause between the Z- and X-data packets.

When using sensor control command 0x005B with parameter ID 0x07D8, one word of user data is transmitted to the sensor:

Byte	MSB			High byte				LSB	MSB			Low byte				LSB	Meaning of the bits
31…32	0	0	0	0	0	1	1	1	1	1	0	1	1	0	0	0	Parameter ID for transmission pause = 0x07D8

The sensor responds with 0x005C and returns one word of user data.

Byte	MSB			High byte				LSB	MSB			Low byte				LSB	Meaning of the bits
31…32	-	-	-	-	-	-	-	-	-	-	-	-	P4	P3	P2	P1	Duration of the transmission pause between the Z and X data packets in 0.1 ms steps (0 = 0.1 ms ... 9 = 1.0 ms)

Querying whether median filter is active/not active

When using parameter ID 0x07DB, sensor control command 0x005B can be used to check whether the median filter is activated.

When using sensor control command 0x005B with parameter ID 0x07DB, one word of user data is transmitted to the sensor:

Byte	MSB			High byte				LSB	MSB			Low byte				LSB	Meaning of the bits
31…32						1	1	1	1	1	0	1	1	0	1	1	Parameter ID for median filter = 0x07DB

The sensor responds with 0x005C and returns one word of user data.

Byte	MSB			High byte				LSB	MSB			Low byte				LSB	Meaning of the bits
31…32																MF	**MF=1**: Median filter active **MF=0**: Median filter inactive

Set Single Inspection Task Parameter

Individual parameters of the active inspection task can be changed with sensor control command 0x006D. The following parameters can be changed:

- Name of an inspection task,
- Operation Mode: Free Running or Input Triggered
- Enabling of activation (Activation Input: Regard or Disregard),
- Cascading Output: Enable or Disable,
- Exposure duration of the laser (Light Exposure)
- Detection range of the LPS (Field of View).

Byte	MSB			High byte				LSB	MSB			Low byte				LSB	Meaning of the bits
31…32																SF	**SF** = SaveFlag
33…34																	Parameter ID for parameter selection
35…58																	Parameter value[s] dependent on parameter ID

Parameters and settings:

If **SF=0**, then the parameter is changed only temporarily.

If **SF=1**, the parameter is retained even following a restart of the LES 36.

Parameter ID	Parameter meaning	Valid parameter values	Data type from parameters	Quantity Parameter values
0x0BB9	Name of the active inspection task	Maximum length: 12 ASCII characters, each character is saved as a 16-bit word	CHAR	12
0x0BBA	Operating mode	0=Operation Mode: Free Running; 1=Operation Mode Input Triggered	UINT8	1
0x0BBB	Enabling of activation	0=Activation Input: Disregard; 1=Activation Input: Regard	UINT8	1
0x0BBC	Enabling of the cascading output	0=Cascading Output: Disable; 1=Cascading Output: Enable	UINT8	1
0x0BBD	Exposure duration of the laser	0 = Normal (approx. 261 µs) 1 = Bright Objects (approx. 97 µs) 2 = Dark Objects (approx. 655 µs) 3 = Normal to Bright Objects (approx. 328 µs) 4 = Manual Setting (the exposure time is set using parameter ID 0x0BBE)	UINT8	1

Parameter ID	Parameter meaning	Valid parameter values	Data type from parameters	Quantity Parameter values
0x0BBE	Manual adjustment of the exposure duration	Permissible value range LES 36HI/VC6, LES 36HI/PB: 739…13109; LES 36/VC6, LES 36/PB: 973…13109 (exposure time unit in 1/10 µs). The duration of exposure is set incrementally in the sensor. The actual duration of exposure can deviate slightly from the parameter value transmitted. The exposure duration set can be accessed with the "Get Single Inspection Task Parameter" (0x006F) command in combination with parameter ID 0x0BBD.	UINT16	1
0x0BBF	X-coordinate detection range	2 signed X-values for Field of View, Value 1: Minimum X Value, Value 2: Maximum X Value, Permissible value range LES 36HI/VC6, LES 36HI/PB: -700…700; LES 36/VC6, LES 36/PB: -3000…3000 (Unit in 1/10 mm)	SINT16	2
0x0BC0	Z-coordinate detection range	2 unsigned Z-values for Field of View, value 1: Minimum Z Value, Value 2: Maximum Z Value, Permissible value range LES 36HI/VC6, LES 36HI/PB: 1950…6100; LES 36/VC6, LES 36/PB: 1900…8100 (Unit in 1/10mm)	UINT16	2

Sensor response:

Command number	Meaning	Number of user data words
0x4141	"Ack": the command has been successfully executed.	0
0x414E	"Not Ack": the command has not been executed.	0

Get Single Inspection Task Parameter

Individual parameters of the active inspection task can be output with sensor control command 0x006F. The following parameters can be accessed:

- Name of the active inspection task
- Number of the active inspection task
- Operation Mode: Free Running or Input Triggered
- Setting of activation (Activation Input: Regard or Disregard)
- Setting of cascading output (Cascading Output: Enable or Disable)
- Exposure duration of the laser (Light Exposure)
- Detection range of the LES 36 (Field of View).

Byte	MSB			High byte			LSB		MSB			Low byte			LSB		Meaning of the bits
31…32																	Parameter ID which can be accessed

Parameters and settings:

Parameter ID	Parameter meaning
0x0BB8	Number of the active inspection task
0x0BB9	Name of an inspection task
0x0BBA	Operating mode
0x0BBB	Enabling of activation
0x0BBC	Enabling of the cascading output
0x0BBD	Exposure duration of the laser
0x0BBE	Manual adjustment of the exposure duration
0x0BBF	X-coordinate detection range
0x0BC0	Z-coordinate detection range

Sensor response:

The sensor responds with 0x0070 and returns 9 … 20 user data words.

Byte	MSB			High byte			LSB	MSB			Low byte			LSB	Meaning of the bits
31…32															Parameter ID for parameter selection
33…34															Data type: 1 = UINT8; 2 = UINT16, 5 = SINT16, 7 = CHAR
35…36															Number of parameter values (byte 47 and following)
37…38															Lower limit of parameter value (HighWord)
39…40															Lower limit of parameter value (LowWord)
41…42															Upper limit of parameter value (HighWord)
43…44															Upper limit of parameter value (LowWord)
45…46															No meaning
47…70															Parameter value(s) of accessed parameter ID

10.3.4 Commands in measure mode

NOTE

For command syntax (header/user data), see chapter 10.2.

The following commands are available in measure mode:

Command from control to LES 36			Answer from LES 36 to control		
Command no.	Meaning	Number of user data words	Command no.	Meaning	Number of user data words
0x4554	**Ethernet trigger** *With the Ethernet Trigger command, a single measurement is triggered in measure mode, similar to triggering via the trigger input.* *Prerequisite is that the LES 36 be configured with LESsoft under **Operation Mode** to* **Input Triggered**. *A connection to the sensor must exist before the Ethernet Trigger command can be used.*	0	0x5354	The evaluation telegram is sent as an answer (status and measurement values), see chapter 10.2.9.	1 packet @ 75
			0x414E	The transmitted command was not processed.	0
0x4541	**Ethernet Activation** The Ethernet Activation command is used to switch the measurement operation on and off corresponding to the user data word. Prerequisite is that the LES be configured with **LESsoft** under **Activation Input Mode** to **Regard**. A connection to the sensor must exist before the command can be used.	1	0x5354	In the activated state, in FreeRun mode or in the triggered mode (if triggered), the evaluation telegram is used for the response (status and measurement values), see chapter 10.2.9. In the deactivated state, there is no response to the command.	1 packet @ 75
			0x414E	The transmitted command was not processed.	0

Table 10.4: Commands in measure mode

10.3.5 Explanation of user data in measure mode (command parameters)

Ethernet Activation

For sensor control command 0x4541, one word of user data is transmitted to the sensor:

Byte	MSB					High byte		LSB	MSB				Low byte			LSB	Meaning of the bits
31…32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	IO	**EA** = Ethernet Activation Flag

EA=0 switches the measurement operation off,
EA=1 switches the measurement operation on.

10.4 Working with the protocol

NOTE

The values are displayed in hexadecimal representation (0x…). The values are only transmitted in "Little-Endian" format. For further information, see the note in Chapter 10.2.

Command without user data

`Connect to Sensor`

PC to LES 36:

Startseq. 1	Startseq. 2	Fill character	Command no.	Fill character	Packet no.	Fill character	Trans. No.	Status	Encoder H	Encoder L	Fill character	Scan no.	Type	No. of data
0xFFFF	0xFFFF	0x0000	0x434E	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000

LES 36 to PC (command executed):

Startseq. 1	Startseq. 2	Fill character	Command no.	Fill character	Packet no.	Fill character	Trans. No.	Status	Encoder H	Encoder L	Fill character	Scan no.	Type	No. of data
0xFFFF	0xFFFF	0x0000	0x4141	0x0000	0x0000	0x0000	0x434E	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000

Command with user data

`Set Actual Inspection Task` (LES 36 in command mode, activate Task 15 and do not store in volatile memory)

PC to LES 36:

Startseq. 1	Startseq. 2	Fill character	Command no.	Fill character	Packet no.	Fill character	Trans. No.	Status	Encoder H	Encoder L	Fill character	Scan no.	Type	No. of data	User data	User data
0xFFFF	0xFFFF	0x0000	0x004B	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0002	0x000F	0x0001

LES 36 to PC (command executed):

Startseq. 1	Startseq. 2	Fill character	Command no.	Fill character	Packet no.	Fill character	Trans. No.	Status	Encoder H	Encoder L	Fill character	Scan no.	Type	No. of data
0xFFFF	0xFFFF	0x0000	0x4141	0x0000	0x0000	0x0000	0x004B	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000

10.5 Operation with LxS_Lib.dll

The LxS_Lib.dll is a .NET 2.0-compatible collection of functions which considerably facilitates the integration of all Leuze light section sensors (LPS, LRS and LES) into PC environments. The LxS_Lib.dll can be used in a variety of programming languages, such as C#, Visual Basic, etc. The integration into MatLab is also possible.

The DLL can control several light section sensors via Ethernet.

The LxS_Lib.dll supports the following functions, among others:

- Establishment/deactivation of sensor connection
- Evaluation of sensor state
- Triggering, activation via Ethernet
- Activation of individual inspection tasks
- Loading and saving all created inspection tasks
- Activation of inspection tasks
- Parameter changes of the active inspection task

In addition, the LxS_Lib.dll enables the evaluation of specific user data of the LPS, LES or LRS. With the LRS and LES, all sensor information and intermediate results are available so that much more complicated evaluations can be realized in the process control.

Access

The library is contained on the supplied product CD. Alternatively, you can download the program in the Internet at **www.leuze.com**.

10.6 Operation with native C++ DLL

The native C++ DLL was created specifically for integration in C++ programs. It consists primarily of the LxS Lib functions:

- Establishment/deactivation of sensor connection
- Evaluation of sensor state
- Triggering, activation via Ethernet
- Activation of individual inspection tasks
- Activation of inspection tasks
- Parameter changes of the active inspection task

Only the loading / saving of all created inspection tasks is not possible and must be performed via the supplied LxSsoft.

10.7 Additional support when integrating sensors

Additional tools (e.g. MatLab example, function modules S7, protocol plain-text decoding, UDP terminal) are available. Please contact your Leuze distributor or service organization to acquire these.

11 Integration of the LES 36…/PB in the PROFIBUS

11.1 General information

The LES 36/PB and the LES 36HI/PB are designed as a PROFIBUS DP/DPV1 compatible slave. The input/output functionality of the sensor is defined by the corresponding GSD file. The baud rate of the data to be transmitted is max.6MBit/s. under production conditions.

For operation, the GSD file is to be appropriately modified.

The LES 36…/PB supports automatic detection of the baud rate.

Characteristics of LES 36…/PB

- Ethernet and PROFIBUS can be used in measure mode as fully-fledged interfaces.
- If the sensor is in menu mode, the PROFIBUS is active. Queries from the control are not processed and the process data are frozen (indicated by the constant scan number).
- If the sensor is in command mode, the PROFIBUS is active. Queries from the control are not processed and the process data are frozen (indicated by the constant scan number).
- If the sensor is simultaneously operated with LESsoft and PROFIBUS, the PROFIBUS is active. Queries from the control are processed with a delay; the process data is also updated with a delay (indicated by the slowly increasing scan numbers). The update occurs every 200ms.
- The input signals via Ethernet, PROFIBUS and signal lines have equal priority. The first incoming signal is executed.
- The sensor is configured via the LESsoft configuration software.

Compared to device model LES 36…/VC6 with analog output, the PROFIBUS model has the following additional functions:

- Output of up to eight measurement values (two measurement values per EAW).
- Output of the state of the object detection in up to four EAWs and four AWs.
- Output of the state of the edge detection AND object detection (logical AND combination).
- Transmission of scan number, sensor state and of the current inspection task.
- Selection of up to 16 inspection tasks.
- Activation and trigger via PROFIBUS.

11.2 PROFIBUS address assignment

The various possibilities for setting the slave address are described in the following. Automatic address assignment via the PROFIBUS (slave address **126**) is preset.

Automatic address assignment

The LES 36…/PB supports automatic detection of the baud rate and automatic address assignment via the PROFIBUS.

The address of the PROFIBUS participant can be set automatically by the commissioning tool of the PROFIBUS system (a class 2 PROFIBUS master). For this purpose, the slave address must be set to value **126** in the sensor (factory setting).

The commissioning master checks whether a slave has address **126** and then assigns this slave a node address smaller than **126**. This address is permanently stored in the participant. The changed address can then be queried (and, if necessary, changed again) via the display or LESsoft.

Address assignment with LESsoft

The PROFIBUS slave address can be set via LESsoft. This setting can be stored on the PC together with the other sensor settings.

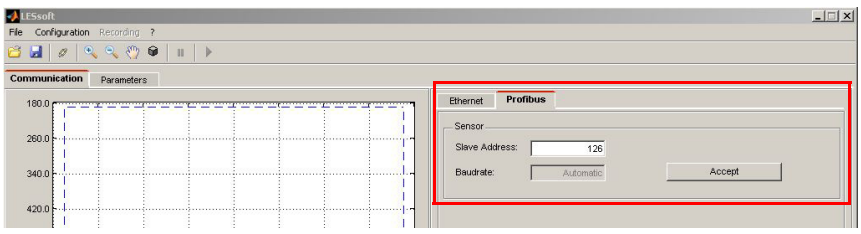


Figure 11.1: PROFIBUS address assignment with LESsoft

Address assignment with membrane keyboard and display

Setting the address with the key pad and display allows the sensor to be integrated in a PROFIBUS system while in the field with no additional tools. See "Slave Address" on page 41. The set address can also be queried by the user with no additional tools.

NOTE
After changing the PROFIBUS slave address via LESsoft or with the display/key pad, a power-on reset must be performed in order to permanently accept the address.

11.3 General information about the GSD file

If the LES 36…/PB is operated in a PROFIBUS network, configuration can be performed exclusively via the LESsoft configuration software. The functionality of the inputs/outputs of the light section sensor to the control is defined via modules. Using a user-specific configuration tool, the respective required modules are integrated and configured according to the measurement application during PLC programming.

During operation of the light section sensor on the PROFIBUS, the functionality of the inputs/outputs is assigned default values. If these values are not changed by the user, the device operates with the default setting set by Leuze electronic on delivery. Please refer to the following module descriptions for the default settings of the device.

NOTE
At least one module from the GSD file must be activated in the configuration tool of the control, usually **module M1, M2 or M3**.

NOTE
Some controls make available a so-called "universal module". This module must not be activated for the LES 36…/PB.

⚠ ATTENTION!
The device makes available a PROFIBUS interface and an Ethernet interface. Both interfaces can be operated in parallel.

NOTE
For test purposes, parameters can be changed on a LES 36…/PB operated on PROFIBUS. At this time, object detection is not possible on PROFIBUS.

NOTE
All input and output modules described in this documentation are described **from the viewpoint of the control**: **Described inputs (E) are control inputs.** **Described outputs (A) are control outputs.** **Described parameters (P) are GSD file parameters in the control.**

NOTE
The current version of the GSD file **LEUZE403.GSD** for the LES 36…/PB can be found on the Leuze website **www.leuze.com**.

11.4 Overview of the GSD modules

The LES 36…/PB has one module slot. Select the corresponding module from the GSD to set the process data of the LES 36…/PB that are to be transmitted. Several modules are available for selection. Beginning with the simplest input module **M1**, additional inputs are included with the subsequent modules. All available output data are already contained in module **M1**. The modules with higher numbers the modules with the lower numbers (example: **M2** contains **M1** and the extensions of **M2**).

NOTE
As the module number increases, so too does the number of user data bytes that are to be transmitted. The maximum measurement rate of 100 Hz can only be ensured up to module **M2**.

Therefore, only modules which contain the data actually required should be selected, i.e. the smallest possible module number should be selected.

NOTE
All input and output modules described in this documentation are described **from the viewpoint of the control**: **Described inputs (E) are inputs of the control.** **Described outputs (A) are control outputs.** **Described parameters (P) are GSD file parameters in the control.**

Output data (from viewing position of control)

Position (Bytes)	Name	Bits in byte								Value range	Meaning
		Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0		
0	uTrigger	Trig_7	Trig_6	Trig_5	Trig_4	Trig_3	Trig_2	Trig_1	Trig_0	0 … 255	Triggering via PROFIBUS (in the case of changes)
1	uActivation	-	-	-	-	-	-	-	Act_On	0 … 1	Activation (=1) or deactivation (=0) of the sensor
2	uInspTask		-	-	-	IT_b3	IT_b2	IT_b1	IT_b0	0 … 15	Inspection task of PROFIBUS master and save flag (B7)

Table 11.1: PROFIBUS – Overview of output data (from viewing position of control)

Input data (from viewing position of control)

GSD Module	Position (Bytes)	Name	Bits in byte								Value range	Meaning
			Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0		
M1 – 8 Byte	0	wScanNum (HighByte)	SN_b15	SN_b14	SN_b13	SN_b12	SN_b11	SN_b10	SN_b9	SN_b8	0 … 255	Scan number (Highbyte)
	1	wScanNum (LowByte)	SN_b7	SN_b6	SN_b5	SN_b4	SN_b3	SN_b2	SN_b1	SN_b0	0 … 255	Scan number (Lowbyte)
	2	uSensorInfo	Edge4	Edge3	Edge2	Edge1	IT_b3	IT_b2	IT_b1	IT_b0	0 … 255	SensorInfo (edge detection status, No. inspection task)
	3	uSensorState	ErrM	Cmd	Menu	Meas	ErrF	WarnF	active	con-nect	0 … 255	Sensor state
	4	uResultEdge/ Logic	LEAW4	LEAW3	LEAW2	LEAW1	DAW4	DAW3	DAW2	DAW1	0 … 255	Obj. Point/EAW Status 1...4, AW Logic Ana. Depth 1...4
	5	uResultAWs	AW08	AW07	AW06	AW05	EAW4	EAW3	EAW2	EAW1	0 … 255	State of AW05…AW08 and EAW1…EAW4
	6	wEdgeAW1Da-ta1 (HighByte)	sign	OP_b14	OP_b13	OP_b12	OP_b11	OP_b10	OP_b9	OP_b8	-32768… +32767	Signed measure-ment value 1 in the edge analy-sis window EAW1
	7	wEdgeAW1Da-ta1 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0		

Table 11.2: PROFIBUS – Overview of input data (from viewing position of control)

GSD Module	Position (Bytes)	Name	Bits in byte								Value range	Meaning
			Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0		
M2 – 16 Bytes	8	wEdgeAW1Data2 (HighByte)	sign	OP_b14	OP_b13	OP_b12	OP_b11	OP_b10	OP_b9	OP_b8	-32768… +32767	Signed measurement value 2 in the edge analysis window EAW1
	9	wEdgeAW1Data2 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0		
	10	wEdgeAW2Data1 (HighByte)	sign	OP_b14	OP_b13	OP_b12	OP_b11	OP_b10	OP_b9	OP_b8	-32768… +32767	Signed measurement value 1 in the edge analysis window EAW2
	11	wEdgeAW2Data1 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0		
	12	wEdgeAW2Data2 (HighByte)	sign	OP_b14	OP_b13	OP_b12	OP_b11	OP_b10	OP_b9	OP_b8	-32768… +32767	Signed measurement value 2 in the edge analysis window EAW2
	13	wEdgeAW2Data2 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0		
	14	wEdgeAW3Data1 (HighByte)	sign	OP_b14	OP_b13	OP_b12	OP_b11	OP_b10	OP_b9	OP_b8	-32768… +32767	Signed measurement value 1 in the edge analysis window EAW3
	15	wEdgeAW3Data1 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0		
M3 – 22 Bytes	16	wEdgeAW3Data2 (HighByte)	sign	OP_b14	OP_b13	OP_b12	OP_b11	OP_b10	OP_b9	OP_b8	-32768… +32767	Signed measurement value 2 in the edge analysis window EAW3
	17	wEdgeAW3Data2 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0		
	18	wEdgeAW4Data1 (HighByte)	sign	OP_b14	OP_b13	OP_b12	OP_b11	OP_b10	OP_b9	OP_b8	-32768… +32767	Signed measurement value 1 in the edge analysis window EAW4
	19	wEdgeAW4Data1 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0		
	20	wEdgeAW4Data2 (HighByte)	sign	OP_b14	OP_b13	OP_b12	OP_b11	OP_b10	OP_b9	OP_b8	-32768… +32767	Signed measurement value 2 in the edge analysis window EAW4
	21	wEdgeAW4Data2 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0		

Table 11.2: PROFIBUS – Overview of input data (from viewing position of control)

11.5 Description of the output data

PROFIBUS trigger

So that a measurement can be triggered on each PROFIBUS cycle, the PROFIBUS trigger of the LES responds to a change of master output byte **uTrigger**. The control only needs to increment the trigger value in order to initiate a new measurement.

The maximum trigger frequency is 100 Hz. If triggering occurs during a measurement, the trigger signal is ignored, as is the case in the **Free Running** operating mode (shown on display: `fRun`).

Activation – Sensor activation

Alternatively, activation can be switched on in detection mode via activation input **InAct** (pin 2 on X1) or master output **uActivation** = 1.

NOTE
With the **Disregard** parameter setting in LESsoft, the sensor is always activated; input **InAct** and activation via PROFIBUS are ignored.

Inspection Tasks – Selection of inspection tasks

With master output **uInspTask** (bits IT_b3 … IT_b0 in output data byte 2), inspection tasks 0 … 15 can be selected. The changeover occurs in cyclical IO operation and lasts approx. 70 ms. During the changeover, the PROFIBUS IO data are frozen and the internal reconfiguration occurs. This is indicated by the scan number, which does not increase.

After changing the inspection task, the PROFIBUS IO data of the sensor are again updated. Value **uSensorInfo** in the input data then indicates the inspection task set in the sensor and the scan number again increases with each new measurement.

⚠ ATTENTION!
While configuring the LES with LESsoft via Ethernet, global parameter **Enable External Inspection Task Selection** should be switched off so that the inspection task is not automatically changed by the control during configuration. After configuring, the check box for this parameter must be selected again before the configuration is transmitted to the sensor by means of **Transmit Configuration To Sensor**. Otherwise, inspection tasks can no longer be selected via PROFIBUS!

11.6 Description of the input data

Several modules are available for selection. Beginning with the simplest input module **M1**, additional inputs are included with the subsequent modules. All available output data are already contained in module **M1**. The modules with higher numbers the modules with the lower numbers (example: **M2** contains **M1** and the extensions of **M2**).

11.6.1 Module M1

Module **M1** provides the minimum required PROFIBUS data.

The maximum measurement rate of 100 Hz is ensured if this module is set.

Scan number

The scan number is made available as PROFIBUS master input. This is a 16-bit value (bytes **wScanNum**, HighByte and LowByte).

The scan number is increased by 1 on each measurement. In **FreeRunning** mode, the scan number also increases even if no sensor is explicitly activated. In triggered mode, the scan number is increased on each (successful) trigger.

If the inspection task is changed, the PROFIBUS IO data of the sensor are frozen and the scan number does not change.

NOTE
It is recommended that the scan number be monitored in the application in order to determine whether the data are actually new.

Sensor info

Byte **uSensorInfo** contains in the high nibble (bits 7 … 4) the **Edge Status** (state of edge detection) of the sensor of all four EAWs **Edge1** … **Edge4** and in the low nibble (bits 3 … 0) the inspection task **IT_b3** … **IT_b0** set in the sensor.

Bit	Designation	Meaning
7	**Edge4**	State of the edge detection (Edge State) in EAW4:0 = **not ok** (red), 1 = **ok** (green)
6	**Edge3**	State of the edge detection (Edge State) in EAW3: 0 = **not ok** (red), 1 = **ok** (green)
5	**Edge2**	State of the edge detection (Edge State) in EAW2: 0 = **not ok** (red), 1 = **ok** (green)
4	**Edge1**	State of the edge detection (Edge State) in EAW1: 0 = **not ok** (red), 1 = **ok** (green)
3	**IT_b3**	Number of the currently set inspection task. Value range 0 … 15
2	**IT_b2**	
1	**IT_b1**	
0	**IT_b0**	

Table 11.3: Input data byte **uSensorInfo**

Sensor state

Sensor status byte **uSensorState** contains the following information:

Bit	Designation	Meaning
7	**ErrM**	Error mode, permanent sensor malfunction
6	**Cmd**	Command mode: the sensor is in command mode. The queries from the control are not processed and the measurement data are frozen (indicated by the constant scan number).
5	**Menu**	Menu mode: the sensor is operated by the user via the display/key pad. The queries from the control are not processed and the measurement data are frozen (indicated by the constant scan number).
4	**Meas**	Measure mode: the sensor is in measure mode. This is the normal operating state in which the maximum measurement rate is attained.
3	**ErrF**	Error, permanent sensor malfunction.

Table 11.4: Input data byte **uSensorState**

Bit	Designation	Meaning
2	**WarnF**	Warning, temporary sensor malfunction.
1	**Active**	Sensor activated.
0	**connect**	Sensor connected via Ethernet.

Table 11.4: Input data byte **uSensorState**

Logic

The **uResultEdge/Logic** sensor status byte contains the following information:
The high nibble (bits 7 ... 4) contains the **Object Point/EAW status** for all 4 EAWs and the low nibble (bits 3 ... 0) contains the **AW Logic Analysis Depth** status for all 4 EAWs.

Bit	Designation	Meaning
7	**LEAW4**	'Object Point/EAW Status' for EAW4: 0 = **not ok** (red), 1 = **ok** (green)
6	**LEAW3**	'Object Point/EAW Status' for EAW3: 0 = **not ok** (red), 1 = **ok** (green)
5	**LEAW2**	'Object Point/EAW Status' for EAW2: 0 = **not ok** (red), 1 = **ok** (green)
4	**LEAW1**	'Object Point/EAW Status' for EAW1: 0 = **not ok** (red), 1 = **ok** (green)
3	**DAW4**	Status 'AW Logic Analysis Depth' for EAW4: 0 = **not ok** (red), 1 = **ok** (green)
2	**DAW3**	Status 'AW Logic Analysis Depth' for EAW4: 0 = **not ok** (red), 1 = **ok** (green)
1	**DAW2**	Status 'AW Logic Analysis Depth' for EAW4: 0 = **not ok** (red), 1 = **ok** (green)
0	**DAW1**	Status 'AW Logic Analysis Depth' for EAW4: 0 = **not ok** (red), 1 = **ok** (green)

Table 11.5: Input data byte **uResultEdge/Logic**

Object detection

Sensor status byte **uResultAWs** contains the following information:
The high nibble (bits 7 ... 4) contains the object detection status of the 4 AWs and the low nibble (bits 3 ... 0) contains the object detection status of the 4 EAWs (see "Current Status" at "Analysis Window Definitions" on page 58).

Bit	Designation	Meaning
7	**AW08**	State of the object detection for AW08: 0 = not detected or not activated, 1 = detected
6	**AW07**	State of the object detection for AW07: 0 = not detected or not activated, 1 = detected
5	**AW06**	State of the object detection for AW06: 0 = not detected or not activated, 1 = detected
4	**AW05**	State of the object detection for AW05: 0 = not detected or not activated, 1 = detected
3	**EAW4**	State of the object detection for EAW4: 0 = not detected or not activated, 1 = detected
2	**EAW3**	State of the object detection for EAW3: 0 = not detected or not activated, 1 = detected
1	**EAW2**	State of the object detection for EAW2: 0 = not detected or not activated, 1 = detected
0	**EAW1**	State of the object detection for EAW1: 0 = not detected or not activated, 1 = detected

Table 11.6: Input data byte **uResultAWs**

Measurement value 1 in Edge Analysis Window EAW1

This is a signed 16-bit value (bytes **wEdgeAW1Data1** HighByte and **wEdgeAW1Data1** LowByte). Measurement value 1 of the edge analysis window EAW1 (= Profibus Inputs 1) is output in the value (for configuration, see "Profibus Inputs 1, Profibus Inputs 2" on page 60).

The **value range is -32768 ... +32767**. The measurement value has the **unit 0.1mm**i.e. a measurement value of +1263 corresponds to 126.3mm.

Byte	Bit	Designation	Meaning
wEdgeAW1Data1 (High byte)	7	**sign**	Sign
	6	**OP_b14**	Measurement value
	5	**OP_b13**	Measurement value
	4	**OP_b12**	Measurement value
	3	**OP_b11**	Measurement value
	2	**OP_b10**	Measurement value
	1	**OP_b9**	Measurement value
	0	**OP_b8**	Measurement value
wEdgeAW1Data1 (Low byte)	7	**OP_b7**	Measurement value
	6	**OP_b6**	Measurement value
	5	**OP_b5**	Measurement value
	4	**OP_b4**	Measurement value
	3	**OP_b3**	Measurement value
	2	**OP_b2**	Measurement value
	1	**OP_b1**	Measurement value
	0	**OP_b0**	Measurement value

Table 11.7: Input data bytes **wEdgeAW1Data1** (high and low byte)

11.6.2 Module M2

The maximum measurement rate of 100 Hz is ensured if this module is set.

NOTE
Module **M2** contains the input data from module **M1**. This section only describes the additional input data.

Measurement value 2 in edge analysis window EAW1 (wEdgeAW1Data2)

Measurement value 1 in edge analysis window EAW2 (wEdgeAW2Data1)

Measurement value 2 in edge analysis window EAW2 (wEdgeAW2Data2)

Measurement value 1 in edge analysis window EAW3 (wEdgeAW3Data1)

These are signed 16-bit measurement values
(For configuration, see "Profibus Inputs 1, Profibus Inputs 2" on page 60).

NOTE
For a description, see "Measurement value 1 in Edge Analysis Window EAW1" on page 86.

11.6.3 Module M3

If this module is set, the maximum measurement rate is reduced to less than 100 Hz, depending on bus load.

NOTE
Module **M3** contains the input data from module **M2**. This section only describes the additional input data.

Measurement value 2 in edge analysis window EAW3 (wEdgeAW3Data2)

Measurement value 1 in edge analysis window EAW4 (wEdgeAW4Data1)

Measurement value 2 in edge analysis window EAW4 (wEdgeAW4Data2)

These are signed 16-bit measurement values
(For configuration, see "Profibus Inputs 1, Profibus Inputs 2" on page 60).

NOTE
For a description, see "Measurement value 1 in Edge Analysis Window EAW1" on page 86.

12 Care, maintenance and disposal

12.1 General maintenance information

Usually, the light section sensor does not require any maintenance by the operator.

Cleaning

In the event of dust buildup, clean the LES 36 with a soft cloth; use a cleaning agent (commercially available glass cleaner) if necessary.

	NOTE
	Do not use aggressive cleaning agents such as thinner or acetone for cleaning the light section sensors. Use of improper cleaning agents can damage the housing window.

12.2 Repairs, servicing

Repairs to the device must only be carried out by the manufacturer.

↳ Contact your Leuze distributor or service organization should repairs be required.
The addresses can be found on the inside of the cover and on the back.

	NOTE
	When sending light section sensors to Leuze electronic for repair, please provide an accurate description of the error.

12.3 Disassembling, packing, disposing

Repacking

For later reuse, the device is to be packed so that it is protected.

	NOTE
	Electrical scrap is a special waste product! Observe the locally applicable regulations regarding disposal of the product.

13 Diagnostics and troubleshooting

13.1 General causes of errors

Error	Possible error cause	Measures
Control receives no measurement data	Ethernet connection interrupted	Check connection with LESsoft. See "Commissioning" on page 45.
	Control not connected to sensor	Use "To sensor" command.
Object contours not detected	Occlusion	See "Occlusion" on page 12.
	Contamination of the optics covers	Clean optics covers, see "Cleaning" on page 88.
	Ambient light	Avoid ambient light, shield the sensor, see "Selecting a mounting location" on page 28. Restrict the detection range with LPSsoft, see "Field of View" on page 56.
	Reflections	Avoid reflections. Restrict the detection range with LPSsoft, see "Field of View" on page 56.
	Unsuitable exposure setting	Adapt exposure duration to the reflective properties of the objects to be detected. See "Light Exposure" on page 56.
	Object not in measurement range	Visual assessment with LESsoft, reduce the working distance/position of the sensor to the object. See "Standard tab – Task Parameters panel" on page 55.
	Detection range selected too small	Configure detection range with LESsoft. See "Field of View" on page 56.
	Wrong inspection task selected	Change inspection task with LESsoft or use Ethernet command “Set Actual Inspection Task”. See "Set Actual Inspection Task" on page 74.
Sensor does not respond to commands	Sensor in measure/menu mode	Exit menu view on OLED display. Connect sensor to control. Switch sensor to command mode if necessary.
	Sensor not connected	Check settings of the Ethernet interface. Connect sensor to control
	Sensor not activated	Activate sensor via PIN 2 on X1. Switch off activation input. See "Activation" on page 56.
No laser line	Sensor not activated	Activate sensor via PIN 2 on X1.
	Laser was deactivated in command mode with the "Set Laser Gate" command	Switch on laser. See "Set Laser Gate" on page 74.
	Sensor in trigger mode	Activate single measurement by means of Ethernet trigger or via PIN 5 on X1.

Table 13.1: General causes of errors

Error	Possible error cause	Measures
Sensor does not respond to trigger	Sensor in command mode	Exit command mode with the "Exit Command Mode" command.
	Triggering too fast.	Reduce trigger rate. The shortest possible interval between two successive trigger signals is 10 ms. See "Triggering – Free Running" on page 16.
Sensor cannot be deactivated via the activation input	Activation Input set to "Disregard"	Use LESsoft to configure the activation input to “Regard”. See "Activation" on page 56.

Table 13.1: General causes of errors

13.2 Interface error

Error	Possible error cause	Measures
No connection Yellow LED does not illuminate	Wiring error	Check Ethernet cable.
No connection Yellow LED illuminates	DHCP activated in network, no fixed or alternate network address assigned.	Assign an alternative IP address, see "Establish connection to PC" on page 44.
	Incorrect IP address/subnet mask set on LES 36.	Check IP address/subnet mask, **IP addresses** of LES 36 and control must be **different**, but **subnet mask must be the same**, see Table 8.1 "Address allocation in the Ethernet" on page 44.
	Incorrect port assigned to LES 36 / control	Using ping command check whether the sensor responds. If so, check port assignment to LES 36 and control. The set ports must match.
	Firewall blocks ports	Switch off firewall temporarily and repeat connection test.

Table 13.2: Interface error

13.3 Error messages in display (starting from firmware V01.40)

Only 1 error can be shown in the display. In the event of an error, the first line of the display shows an error message and the second line displays a plain-text message.

Error	Possible error cause	Measures
Error: 001xx, 005xx, 006xx	EMC interference	Check wiring, shield sensor.
Error: 00302, 00309, 00402, 00403	Ambient temperature too high	Select installation space with a lower temperature.
Error: 01000	Supply voltage when switching on too high	Check supply voltage.
Error: 01001	Supply voltage when switching on too low	Check supply voltage.
Output Overload	Short-circuit on output, EMC interference	Check wiring, shield sensor.

Table 13.3: Error messages in display

NOTE

If deviating error messages occur, contact your Leuze distributor or service organization.

↳ Please disconnect the sensor from the supply voltage and eliminate the cause of the error.

If a short-circuit occurs on the output, the following is displayed:

↳ Please eliminate the cause of the error.

NOTE

Acknowledging the error with the "Enter" button on the membrane keyboard causes a software reset of the sensor. During this time, the sensor is not ready – this can be seen at: X1 pin 4: Out Ready and Ethernet protocol: “Status”.

The sensor starts automatically and is then ready again. An Ethernet connection must be re-established.

NOTE

↳ Please act in accordance with Chapter 14 if servicing is required.

↳ In the "Measures" column, please cross the items that you have already checked. This information is required by our service team when you contact them; see Chapter 14.

14 Service and support

24-hour on-call service at:
+49 7021 573-0

Service hotline:
+49 7021 573-123

E-mail:
techsupport.de@leuze.com

Website:
www.leuze.com

14.1 What to do should servicing be required?

Please have the following information to hand when you contact our service department:

- Device type
- Serial number
- Firmware version
- Configuration software version
- Display on the device display
- `LESsoft.log` file (located in the installation directory of **LESsoft**)
- Parameter file `*.les`
- stored measurement data `*.csv`
- Screenshots and images where necessary

We also require the following contact information:

- Company
- Contact person/department
- E-mail address
- Phone number
- Address

15 Technical data

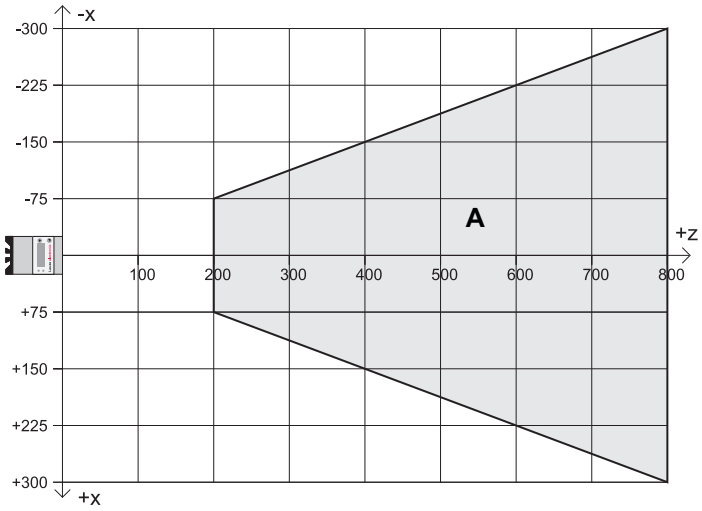
15.1 General technical data

		LES 36…	LES 36HI…
Optical data			
Measurement range [1]	in **Z**-direction	200 … 800mm	200 … 600 mm
Light source		Laser	
Laser class		2M in acc. with IEC 60825-1:2014 / EN 60825-1:2014+A11:2021	
Wavelength		658nm (visible red light)	
Max. output power (peak)		8.7mW [2]	
Pulse duration		< 3ms	
Laser line		600 x 3mm at 800mm	approx. 170 x 1.5 mm at 600 mm
Error limits (relative to measurement distance)			
Resolution [3] [4]	in **X**-direction in **Z**-direction	1 … 1.7mm 1 … 3mm	0.2 … 0.6mm 0.1 … 0.9mm
Linearity in **Z** direction[3]		≤ ±1%	
Repeatability in **Z** direction[3]		≤ 0.5%	
B/w detection thresholds		≤ 1% (6 ... 90% diffuse reflection	
Object detection			
Minimum object size in **X**-direction [5]		2 … 3mm	0.6 … 2mm
Minimum object size in **Z** direction[2]		2 … 6mm	0.4 … 3mm
Time behavior			
Measurement time		10ms	
Readiness delay		approx. 1.5s	
Electrical data			
Supply voltage U_B [6]		18 … 30VDC (incl. residual ripple)	
Residual ripple		≤ 15% of VCC	
Open-circuit current		≤ 200mA	
Ethernet interface		UDP	
Switching outputs		1 (ready) / 100mA / push-pull on X1 [7]	
		1 (cascading) / 100mA / push-pull on X1 [6]	
		4 / 100mA / push-pull on X3 [6] [8] (LES 36/VC6 and LES 36HI/VC6 only)	
Inputs		1 (trigger) on X1	
		1 (activation) on X1	
		3 (inspection task selection) on X3 [9] (LES 36/VC6 and LES 36HI/VC6 only)	
Signal voltage high/low		≥ (U_B-2V)/≤ 2V	

		LES 36…	LES 36HI…
Analog output (LES 36/VC6, LES 36HI/VC6)			
Analog output		Voltage 1 … 10 V, $R_L \geq 2\,k\Omega$	
		Current 4 … 20 mA, $R_L \leq 500\,\Omega$	
PROFIBUS (only LES 36/PB and LES 36HI/PB)			
Interface type		1 x RS 485 on X4	
Protocols		PROFIBUS DP/DPV1 slave	
Baud rate		9.6 kBaud … 6 MBaud	
Indicators			
Green LED	Continuous light	Ready	
	Off	No voltage	
Yellow LED	Continuous light	Ethernet connection available	
	Flashing	Ethernet data transmission active	
	Off	No Ethernet connection available	
Mechanical data			
Housing		Aluminum frame with plastic cover	
Optics cover		Glass or plastic (see chapter 16.1)	
Weight		620 g	
Connection type		M 12 connector	
Environmental data			
Ambient temp. (operation/storage)		-30°C … +50°C/-30°C … +70°C	
Protective circuit [10)]		1, 2, 3	
VDE protection class		III, protective extra-low voltage	
Degree of protection		IP 67	
Standards applied		IEC/EN 60947-5-2, UL 508	

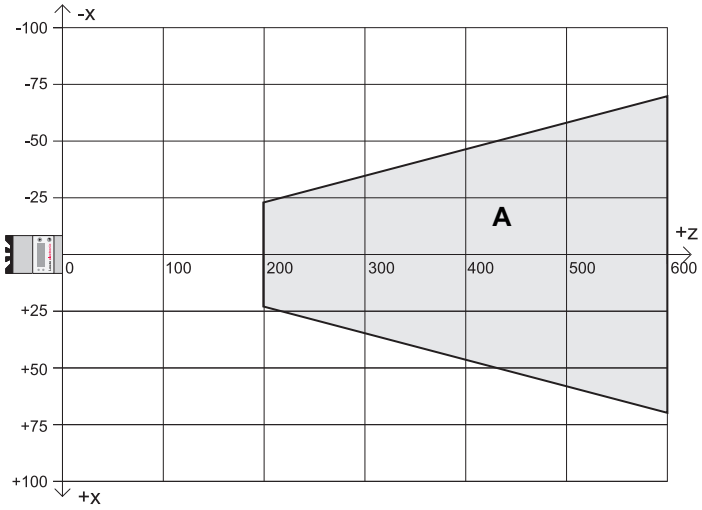
1) Degree of remission: 6% ... 90%, entire measuring range, at 20°C after 30 min warm-up time, medium range $_{UB}$
2) Max. accessible emission according to measurement condition 3 laser standard IEC 60825-1 (measuring aperture with 7 mm diameter at 100 mm distance from the virtual source)
3) Minimum and maximum value dependent on the measurement distance, at 20°C after 30 min. warmup time, average range U_B, **z** resolution at factory setting median “3”
4) Degree of remission 90%, identical object, identical environment conditions, measurement object ≥ 20 x 20 mm²
5) Minimum value, depends on distance and object, requires testing under application conditions
6) For UL applications: use is permitted exclusively in Class 2 circuits according to NEC
7) The push-pull switching outputs must not be connected in parallel
8) Number of detection fields: up to 16 with logic operation option
9) Number of inspection tasks: up to 16 (8 of these can be activated via inputs)
10) 1=transient protection, 2=polarity reversal protection, 3=short circuit protection for all outputs, requires external protective circuit for inductive loads

15.2 Typical measurement range



A Measurement range
X line length

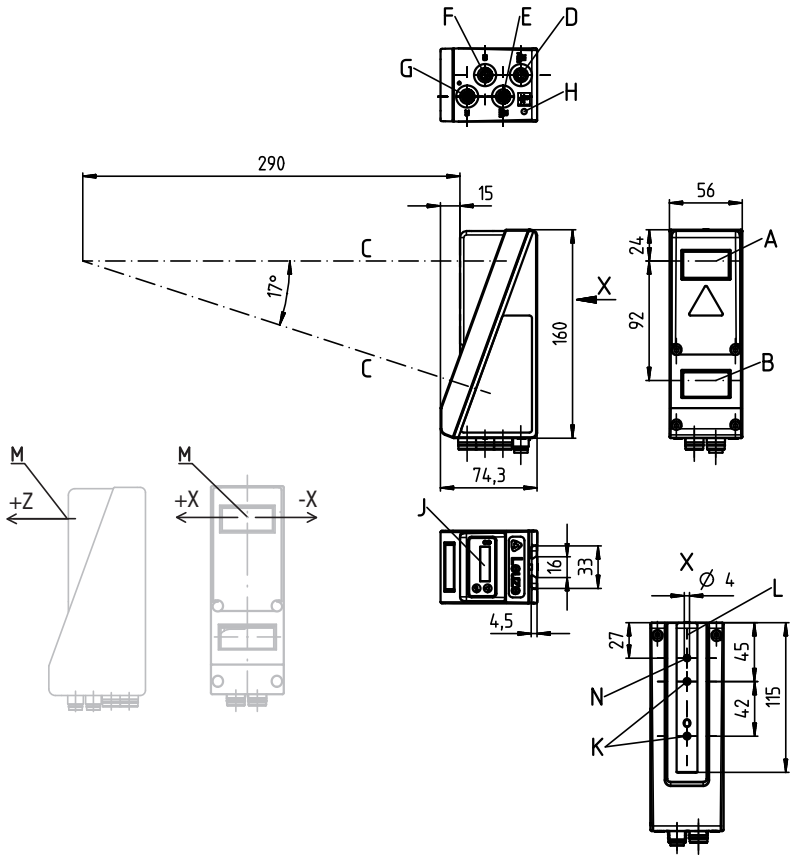
Figure 15.1: Typical measurement range LES 36



A Measurement range z-axis
X X-axis measurement range

Figure 15.2: Typical measurement range LES 36HI

15.3 Dimensioned drawing



A	Transmitters
B	Receivers
C	Optical axis
D	X1: M12x1 connector, 8-pin, A coded
E	X2: M12x1 socket, 4-pin, D-coded
F	X3: cap
G	X4: M12x1 socket, 5-pin, B-coded (LES 36…/PB), A-coded (LES 36…/VC6)
H	FE screw
J	OLED display and membrane keyboard
K	M4 thread, 4.5 deep
L	Holder for mounting system BT 56 / BT 59
M	Zero point and orientation of the coordinate system for measurement data
N	4mm bore hole in transmitter axis

Figure 15.3: LES 36 dimensioned drawing

16 Type overview and accessories

16.1 Type overview

16.1.1 LPS

Type designation	Description	Part no.
LPS 36/EN	Line profile sensor for profile generation, measuring range 200 ... 800 mm, line length 600 mm with Ethernet interface, incremental encoder connection	50111324
LPS 36	Line profile sensor for profile generation, measuring range 200 ... 800 mm, line length 600 mm with Ethernet interface	50111325
LPS 36.10	Line profile sensor for profile generation, measuring range 200 ... 800 mm, line length 600 mm with Ethernet interface, plastic screen	50138405
LPS 36 HI/EN	Line profile sensor for profile generation, measuring range 200 … 600 mm, line length 140 mm with Ethernet interface, incremental encoder connection	50111334
LPS 36 HI/EN.10	Line profile sensor for profile generation, measuring range 200 … 600 mm, line length 140 mm with Ethernet interface, incremental encoder connection, plastic screen	50137351

Table 16.1: Overview of LPS types

16.1.2 LRS

Type designation	Description	Part no.
LRS 36/6	Line profile sensor for product detection (also multi-track), detection range 200 … 800 mm, line length 600 mm, Ethernet interface, 4 switching outputs for detection information, 3 switching inputs for selecting the inspection task	50111330
LRS 36/6.10	Line profile sensor for product detection (also multi-track), detection range 200 … 800 mm, line length 600 mm, Ethernet interface, 4 switching outputs for detection information, 3 switching inputs for selecting the inspection task, version with plastic screen	50115418
LRS 36/PB	Line profile sensor for product detection (also multi-track), detection range 200 … 800 mm, line length 600 mm, Ethernet interface, PROFIBUS DP	50111332

Table 16.2: Overview of LRS types

16.1.3 LES

Type designation	Description	Part no.
LES 36/PB	Line profile sensor for edge detection and object measurement (also multi-track), detection range 200 … 800 mm, line length 600 mm, Ethernet interface, PROFIBUS DP	50111327
LES 36HI/PB	Line profile sensor for edge detection and object measurement (also multi-track), detection range 200 … 600 mm, line length 140 mm, Ethernet interface, PROFIBUS DP	50111331
LES 36/VC6	Line profile sensor for edge detection and object measurement (also multi-track), detection range 200 ... 800 mm, line length 600 mm, Ethernet interface, analog current or voltage output, 4 switching outputs for detection information, 3 switching inputs for selecting the inspection task	50111333
LES 36HI/VC6	Line profile sensor for edge detection and object measurement (also multi-track), detection range 200 ... 600 mm, line length 140 mm, Ethernet interface, analog current or voltage output 4 switching outputs for detection information, 3 switching inputs for selecting the inspection task	50111329
LES 36HI/ VC6.10	Line profile sensor for edge detection and object measurement (also multi-track), detection range 200 ... 600 mm, line length 140 mm, Ethernet interface, analog current or voltage output 4 switching outputs for detection information, 3 switching inputs for selecting the inspection task, plastic screen	50136678

Table 16.3: Overview of LES types

16.2 Accessories

16.2.1 Fastening

Mounting devices

Type designation	Description	Part no.
BT 56	Mounting device featuring dovetail for rod	500 27375
BT 59	Mounting device featuring dovetail for ITEM profile	50111224

Table 16.4: Mounting devices for the LES 36

16.2.2 Accessories – Preassembled cables for voltage supply X1

Contact assignment for X1 connection cable

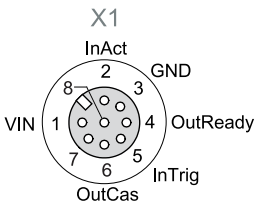
X1 connection cable (8-pin socket, A-coded)			
 **M12 socket (A-coded)**	**Pin**	**Name**	**Core color**
	1	VIN	wh
	2	InAct	br
	3	GND	gn
	4	OutReady	ye
	5	InTrig	gr
	6	OutCas	pi
	7	**Do not connect!**	bu
	8	**Do not connect!**	RD

Table 16.5: Cable assignment KD S-M12-8A-P1-…

Order codes of the cables for voltage supply

Type designation	Description	Part no.
M12 socket for X1, axial connector, open cable end		
KD S-M12-8A-P1-020	Cable length 2m	50135127
KD S-M12-8A-P1-050	Cable length 5m	50135128
KD S-M12-8A-P1-100	Cable length 10m	50135129
KD S-M12-8A-P1-150	Cable length 15m	50135130
KD S-M12-8A-P1-250	Cable length 25m	50135131
KD S-M12-8A-P1-500	Cable length 50m	50135132

Table 16.6: X1 cables for the LES 36

16.2.3 Accessories for Ethernet interface X2

Preassembled cables with M12 connector/open cable end

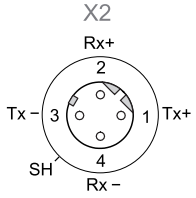
M12 Ethernet connection cables (4-pin connector, D-coded, open cable end)				
 **M12 connector (D-coded)**	**Name**	**Pin (M12)**	**Core color**	
	Tx+	1	ye	
	Rx+	2	wh	
	Tx-	3	OR	
	Rx-	4	bu	
	SH	Shield (thread)	-	

Table 16.7: Cable assignment KS ET-M12-4A-P7-…

Type designation	Description	Part no.
M12 connector for X2, axial connector, open cable end		
KS ET-M12-4A-P7-020	Cable length 2m	50135073
KS ET-M12-4A-P7-050	Cable length 5m	50135074
KS ET-M12-4A-P7-100	Cable length 10m	50135075
KS ET-M12-4A-P7-150	Cable length 15m	50135076
KS ET-M12-4A-P7-300	Cable length 30m	50135077

Table 16.8: Ethernet connection cables featuring M12 socket/open cable end

Preassembled cables with M12 connector/RJ-45 connector

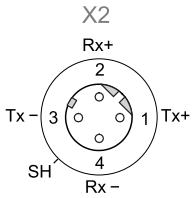
M12 Ethernet connection cables (4-pin connector, D-coded, M12 to RJ-45)				
 **M12 connector (D-coded)**	**Name**	**Pin (M12)**	**Core color**	**Pin (RJ-45)**
	Tx+	1	ye	1
	Rx+	2	wh	3
	Tx-	3	OR	2
	Rx-	4	bu	6
	SH	Shield (thread)	-	

Table 16.9: Cable assignment KSS ET-M12-4A-RJ45-A-P7-…

Type designation	Description	Part no.
M12 connector for X2 to RJ-45 connector		
KSS ET-M12-4A-RJ45-A-P7-020	Cable length 2m	50135080
KSS ET-M12-4A-RJ45-A-P7-050	Cable length 5m	50135081
KSS ET-M12-4A-RJ45-A-P7-100	Cable length 10m	50135082
KSS ET-M12-4A-RJ45-A-P7-150	Cable length 15m	50135083
KSS ET-M12-4A-RJ45-A-P7-300	Cable length 30m	50135084

Table 16.10: Ethernet connection cables M12 connector/RJ-45

Pre-assembled cables with M12 connector/M12 connector

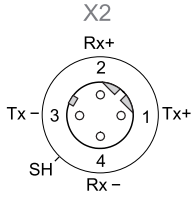
M12 Ethernet connection cables (4-pin connector, D-coded, on both sides)				
 **M12 connector (D-coded)**	**Name**	**Pin (M12)**	**Core color**	**Pin (M12)**
	Tx+	1	ye	1
	Rx+	2	wh	2
	Tx-	3	OR	3
	Rx-	4	bu	4
	SH	Shield (thread)	-	Shield (thread)

Table 16.11: Cable assignment KSS ET-M12-4A-M12-4A-P7-…

Type designation	Description	Part no.
M12 connector + M12 connector for X2		
KSS ET-M12-4A-M12-4A-P7-020	Cable length 2m	50137077
KSS ET-M12-4A-M12-4A-P7-050	Cable length 5m	50137078

Table 16.12: Ethernet connection cables M12 connector/M12 connector

Type designation	Description	Part no.
KSS ET-M12-4A-M12-4A-P7-100	Cable length 10m	50137079
KSS ET-M12-4A-M12-4A-P7-150	Cable length 15m	50137080
KSS ET-M12-4A-M12-4A-P7-300	Cable length 30m	50137081

Table 16.12: Ethernet connection cables M12 connector/M12 connector

Connectors

Type designation	Description	Part no.
D-ET1	RJ45 connector for user-configuration	50108991
KDS ET M12 / RJ 45 W – 4P	Converter from M12, D-coded, to RJ 45 socket	50109832

Table 16.13: Connectors for the LES 36

16.2.4 Accessories – Preassembled cables for X3 (LES 36…/VC6 only)

Contact assignment for X3 connection cables

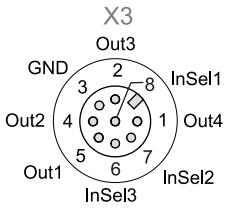
X3 (8-pin connector, A-coded)			
 **M12 connector (A-coded)**	**Pin**	Name	**Core color**
	1	Out4	wh
	2	Out3	br
	3	GND	gn
	4	Out2	ye
	5	Out1	gr
	6	InSel3	pi
	7	InSel2	bu
	8	InSel1	RD

Table 16.14: Cable assignment KS S-M12-8A-P1-…

Order code of X3 connection cables

Type designation	Description	Part no.
M12 connector for X3, axial connector, open cable end, shielded		
KS S-M12-8A-P1-020	Cable length 2m	50135138
KS S-M12-8A-P1-050	Cable length 5m	50135139
KS S-M12-8A-P1-100	Cable length 10m	50135140
KS S-M12-8A-P1-150	Cable length 15m	50135141
KS S-M12-8A-P1-300	Cable length 30m	50135142

Table 16.15: X3 cables for the LES 36…/VC6

16.2.5 Connection accessories / preassembled cables for X4 (LES 36…/PB only)

Contact assignment for X4 connection cables

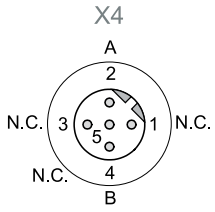
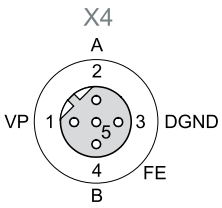
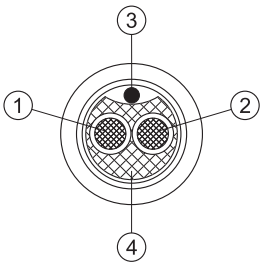
X4 (5-pin connector, B-coded)			
	Pin	**Name**	**Comment**
 **M 12 connector (B-coded)**	1	N.C.	–
	2	A	Received/transmitted data RxD/TxD-N, green
	3	N.C.	–
	4	B	Received/transmitted data RxD/TxD-P, red
	5	N.C.	–
 **M12 socket (B-coded)**	Thread	FE	Functional earth (housing)

Table 16.16: Pin assignment X4 (PROFIBUS)



1 Conductor with insulation **red**
2 Conductor with insulation **green**
3 Drain wire
4 Fibrous fleece

Figure 16.1: Cable structure for PROFIBUS connection cable

Order codes for X4 connection accessories

Type designation	Description	Part no.
Terminator plug for PROFIBUS bus termination		
TS 02-4-SA	M12 terminating resistor for PROFIBUS	50038539
PROFIBUS T-connector		
KDS BUS OUT M12-T-5P	M12 T-connector for BUS OUT	50109834

Table 16.17: PROFIBUS connection accessories for the LES 36 36…/PB

Order code of PROFIBUS connection cables for X4

Type designation	Description	Part no.
KD PB-M12-4A-P3-020	M12 socket for BUS IN, axial connector, open cable end, cable length 2m	50135242
KD PB-M12-4A-P3-050	M12 socket for BUS IN, axial connector, open cable end, cable length 5m	50135243
KD PB-M12-4A-P3-100	M12 socket for BUS IN, axial connector, open cable end, cable length 10m	50135244
KD PB-M12-4A-P3-150	M12 socket for BUS IN, axial connector, open cable end, cable length 15m	50135245
KD PB-M12-4A-P3-300	M12 socket for BUS IN, axial connector, open cable end, cable length 30m	50135246
KS PB-M12-4A-P3-020	M12 connector for BUS OUT, axial connector, open cable end, cable length 2m	50135247
KS PB-M12-4A-P3-050	M12 connector for BUS OUT, axial connector, open cable end, cable length 5m	50135248
KS PB-M12-4A-P3-100	M12 connector for BUS OUT, axial connector, open cable end, cable length 10m	50135249
KS PB-M12-4A-P3-150	M12 connector for BUS OUT, axial connector, open cable end, cable length 15m	50135250
KS PB-M12-4A-P3-300	M12 connector for BUS OUT, axial connector, open cable end, cable length 30m	50135251
KDS PB-M12-4A-M12-4A-P3-020	M12 plug + M12 socket for PROFIBUS, axial connectors, Cable length 2m	50135253
KDS PB-M12-4A-M12-4A-P3-050	M12 plug + M12 socket for PROFIBUS, axial connectors, cable length 5m	50135254
KDS PB-M12-4A-M12-4A-P3-100	M12 plug + M12 socket for PROFIBUS, axial connectors, cable length 10m	50135255
KDS PB-M12-4A-M12-4A-P3-150	M12 plug + M12 socket for PROFIBUS, axial connectors, cable length 15m	50135256
KDS PB-M12-4A-M12-4A-P3-300	M12 plug + M12 socket for PROFIBUS, axial connectors, cable length 30m	50135257

Table 16.18: PROFIBUS cables for LES 36 36…/PB

16.2.6 Connection accessories / preassembled cables for X4 (LES 36…/VC6 only)

Contact assignment for X4 connection cables

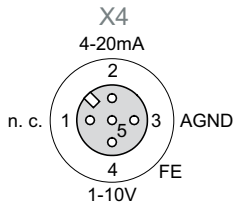
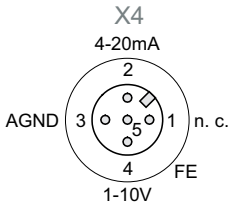
X4 (5-pin socket, A-coded)			
 **M12 socket (A-coded)**	**Pin**	**Name**	**Comment**
	1	N.C.	–
	2	4-20mA	Analog current output
	3	AGND	–
	4	1-10V	Analog voltage output
	5	FE	Functional earth
 **M12 connector (A-coded)**	Thread	FE	Functional earth (housing)

Table 16.19: Pin assignment X4

X4 connection cable order codes (LES 36…/VC6 only)

Type designation	Description	Part no.
KB 008-3000 A-S	M12 connector for X4, axial connector, open cable end, shielded, UL, cable length 3m	50101941
KB 008-10000 A-S	M12 connector for X4, axial connector, open cable end, shielded, UL, cable length 10m	50102971

Table 16.20: Connection cables for LES 36/VC6, LES 36HI/VC6

16.2.7 Configuration software

NOTE	
	The current version of the configuration software can be found on the Leuze website **www.leuze.com**. To do this, enter your part number in the Search field. You can find the software in the **Downloads** tab for your device.

16.2.8 Configuration memory

Type designation	Description	Part no.
K-DS M12A-8P-0.75m-LxS36-CP	Configuration memory for LxS 36 light section sensors	50125541

Table 16.21: Configuration memory for LxS 36

The configuration memory for the LxS 36 light section sensors is connected to connection X1 and extends the existing connection cable to the voltage supply (see chapter 16.2.2). The configuration memory saves the configured inspection tasks as well as the setting of general parameters such as operating mode, activation, cascading, detection range (FoV), etc., from the connected sensor and transfers these to a new device following an exchange.

17 Appendix

17.1 Glossary

2D view	Graphical presentation of the X/Z-coordinate values of an object within the detection range.
Activation input	Input for switching the laser beam on/off. There is no exact time allocation between the application/removal of the signal and the switch-on/off time.
Alignment aid	Visualization of the Z-coordinates on the display: the measurement values at the left edge, in the center and at the right edge of the laser line extending along the X-axis are displayed. It is designed to align the light emission area of the laser parallel to the conveying belt.
Analysis Window (Analysis Window – AW)	Rectangular area of the LES 36 in which objects are detected. An object is only detected if the number of object measurement points (current hits) is greater than or equal to the defined minimum number of measurement points (Hits On).
Cascading	Triggered series connection of several sensors. A master sensor takes over the control (synchronization) of up to 9 slaves.
Detection range (Field of view – FoV)	The detection range is defined via configuration software. Without changing the predefined range it extends trapezoidally according to the maximum detection range specifications. If the maximum detection range is not required to solve the application task, it is recommended to reduce the detection range to a minimum.
Display	Display/Control panel directly at the sensor.
Edge analysis window (EAW)	Rectangular area of the LES in which the edges are detected and analyzed. An edge is only detected if the number of successive measurement points (Current Sequent Hits Left /Right) is greater than or equal to the defined minimum number of measurement points (Sequent Hits). Edge analysis windows can also be used for object detection.
Exposure	Time span of light striking the CMOS receiver, while being reflected off the object to be detected.
File	Task set, which can be stored or accessed via the user interface of the PC or the control.
Inspection task	All settings for the application are made in the configuration software and are stored in up to 16 inspection tasks. It is possible to easily adapt to different tasks by changing over the inspection task.
IP address	Address in network
Measurement time	Time between two individual measurements.
Object	Medium to be detected by sensor.
Offline	**LESsoft** is operated without sensor
Online	**LESsoft** is operated with sensor

Profile **Profile data**	Distance and position progression of one or more measurements, coordinates of the respective X/Z-values when passing through the laser beam along the x-axis.
Trigger	Triggering one or more measurement processes with precise time allocation.
UDP	Standardized connectionless Ethernet protocol, Layer 4.

17.2 Revision History / Feature list

17.2.1 Firmware

Firmware	Function range	Meaning	required Configuration software
Beginning with V01.10	Multiple inspection tasks for the LPS 36	Up to 16 different configurations can be stored in the sensor; switch between configurations by means of a command	LxSsoft V1.20 (LPSsoft V1.20, LRSsoft V1.04)
Beginning with V01.20	Optimized encoder interface	LPS 36/EN: single-channel encoders are also supported, encoder options, new factory settings	LxSsoft V1.20 (LPSsoft V1.20, LRSsoft V1.10)
	Deactivation of data output – X-coordinates	LPS 36: Reduction of data quantity (useful for PLC evaluation)	
	Extension of the transmission pause between the Z- and X-data packets	LPS 36: Improved reading of data packets (useful for PLC evaluation)	
	Ethernet trigger	Reduction of data quantity (useful for PLC evaluation), reduction in cabling	
Beginning with V01.25	Supports PROFIBUS	Other LRS 36/PB device types with PROFIBUS	LxSsoft V1.30 (LPSsoft V1.30, LRSsoft V1.20)
	Ethernet sensor activation	Activation now possible via Ethernet. Reduction in cabling	
	Factory setting – analysis depth 1 for LRS 36	LRS 36: the maximum detection rate can be achieved with this setting.	
Beginning with V01.30	Supports LES 36	Additional device types LES 36/PB with PROFIBUS and LES 36/VC with analog output	LxSsoft V1.40 (LPSsoft V1.33, LESsoft V1.10, LRSsoft V1.20)

Table 17.1: Revision History – Firmware

Firm-ware	Function range	Meaning	required Configuration software
Begin-ning with V01.40	Support of LPS 36HI/EN	Additional device types LPS 36HI/EN	LxSsoft V2.00 (LPSsoft V2.00, LESsoft V1.10, LRSsoft V1.20)
	New "Ethernet Activation" command	Switching on laser via Ether-net command	
	New "Get/Set Single Inspec-tion Task Parameter" com-mands	Parameter adjustment via Ethernet commands without LPSsoft	
	Display of error numbers on display	Fast detection of the cause of the error	
	Extension of the maximum cable lengths	Maximum cable length 50 m	
Begin-ning with V01.41	Additional operator control possibility at the sensor	Inspection task selection via the control panel of the sen-sor	LxSsoft V2.30 (LPSsoft V2.20, LESsoft V2.30, LRSsoft V2.20)
	Supports LES 36/VC6, LES 36HI/VC6	Additional device variants LES 36/VC6, LES36HI/VC6	
	Relative window positioning of LES		
Begin-ning with V01.50	Ethernet default gateway, destination port number	IP address for default gate-way and destination port number can be set	LESsoft V2.40
	New menu structure	More clearly arranged struc-ture of the operating menu	
Begin-ning with V01.60	New white display	Change of display color from blue to white	

Table 17.1: Revision History – Firmware

17.2.2 Configuration software

Version	Function range	Meaning
LxSsoft V1.20 (LPSsoft V1.20, LRSsoft V1.04)	Installer for LPSsoft and LRSsoft	simple installation, “Accept” button with LRSsoft
LPSsoft V1.30, LRSsoft V1.10	Trigger operation is also sup-ported while configuration soft-ware is running	LRS 36, LPS 36: optimized diagnosis in trigger operation
	Display of encoder counter value	LRS 36/EN: visualization encoder
	New: Encoder parameters	LRS 36/EN: encoder interface configuration: single-/multi-channel encoder, overflow values, reversal of direc-tion of rotation
LxSsoft V1.30 (LPSsoft V1.30, LRSsoft V1.20)	Support of the other LRS 36/PB device types with PROFIBUS	Configuration of PROFIBUS set-tings and LRS 36/PB

Table 17.2: Revision History – Configuration software

Version	Function range	Meaning
LxSsoft V1.40 (LPSsoft V1.33, LESsoft V1.10, LRSsoft V1.20)	Support of the additional device types LES 36/PB with PROFIBUS and LES 36/VC with analog output	Configuration of LES 36 device variants
LxSsoft V1.41 (LPSsoft V1.33, LESsoft V1.10, LRSsoft V1.20)	Installer for Windows 7	Software runs with the 32 and 64 bit version of Windows 7
LxSsoft V2.00 (LPSsoft V2.00, LESsoft V1.10, LRSsoft V1.20)	Support of additional LPS 36Hi/EN device types	Configuration of LPS 36Hi/EN
LxSsoft V2.30 (LPSsoft V2.20, LESsoft V2.30, LRSsoft V2.20)	Import Inspection Task Edit Analysis Windows – Position Type	Settings of individual inspection tasks can be imported from a saved LES 36 project Edge Analysis Windows can be positioned relatively and can thus track object movement.
LxSsoft V2.31 (LPSsoft V2.31, LESsoft V2.31, LRSsoft V2.31)	Also supports LES 36/VC6 device type Documentation updated	
LxSsoft V2.40 (LPSsoft V2.40, LESsoft V2.40, LRSsoft V2.40)	Configuration and saving of the IP address of the default gateway and the destination port number	The IP address of the default gateway and the destination port number can now be configured and saved in the parameter set.
LxSsoft V2.41 (LPSsoft V2.40, LESsoft V2.41, LRSsoft V2.40)	Also supports LES 36HI/PB device type	
LxSsoft V2.52 (LPSsoft V2.52, LESsoft V2.52, LRSsoft V2.52)	Support of new device models	
LxSsoft V2.60 (LPSsoft V2.60, LESsoft V2.60, LRSsoft V2.60)	Updatable device list, support of new device models	The device list can be updated without having to install a new software version (see chapter 9.2.2)

Table 17.2: Revision History – Configuration software

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