Leuze

Original operating instructions

LRS - Line Range Sensor

Light section sensors

The Sensor People

We reserve the right to make technical changes
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Abbildungs- und Tabellenverzeichnis

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.

⚠ ATTENTION LASER
This symbol warns of possible danger through hazardous laser radiation. The light section sensors of the LRS 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.

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 LRS 36 series are laser sensors for presence detection of objects in defined areas.

Areas of application

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

- Zero check of cases
- Single or multiple track presence control on transport systems
- Check whether object or lid are present

⚠ CAUTION!

Observe intended use!

The protection of personnel and the device cannot be guaranteed if the device is operated in a manner not complying 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

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.

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

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

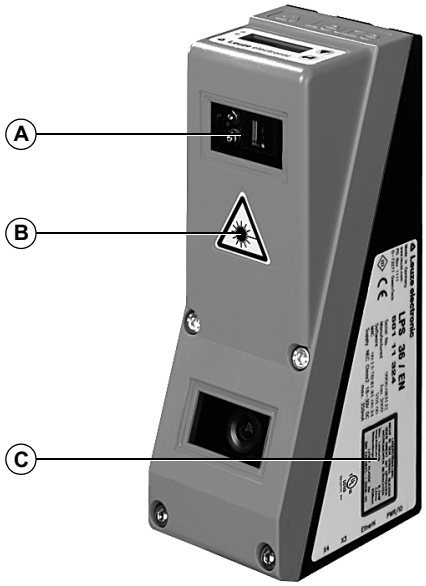
Leuze electronic GmbH + Co. KG is not liable in the following cases:

- 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

⚠ ATTENTION, LASER RADIATION – CLASS 2M LASER PRODUCT	
	**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) with the product will increase eye danger. ↳ 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 information and warning signs attached 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 US, 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

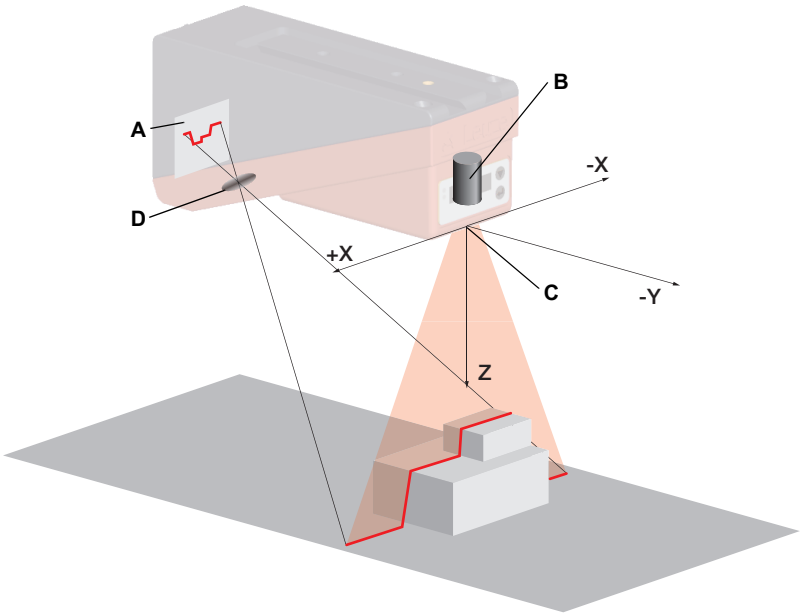
Figure 2.1: Laser apertures, laser warning signs

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

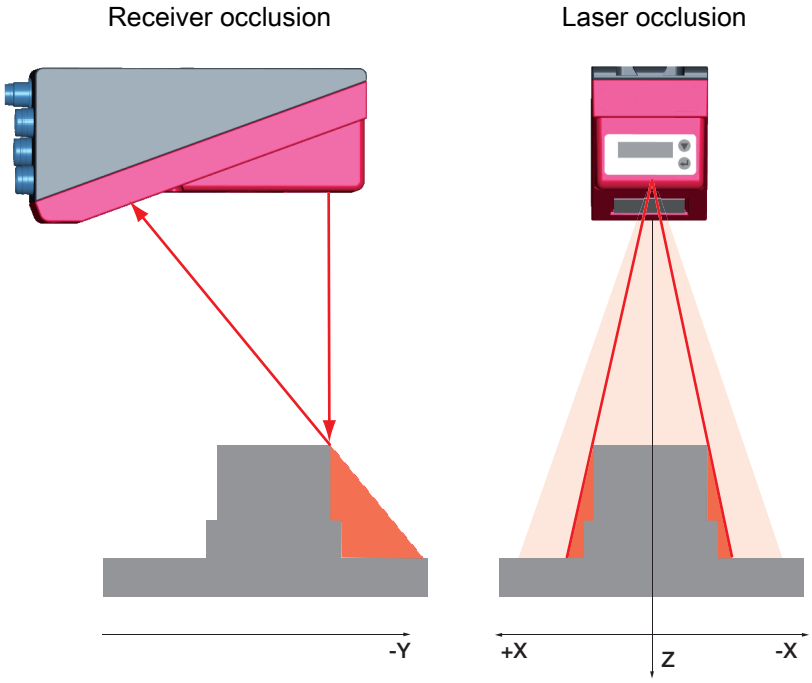
Depending on the distance of the object the laser line is projected to a different position on the CMOS planar detector as shown in Figure 3.1. By means of this position the distance of the object can be calculated.

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.

The 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.

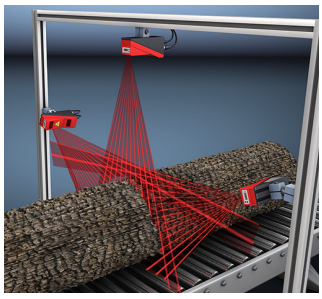
When the object is shifted to the left the object contour will still be detected by the laser but the laser line does not lie within the receiver's field of view at that point, and therefore no measurement values can be detected.

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

Figure 3.2: Occlusion

Possible measure against laser occlusion

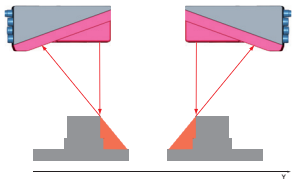
- Using multiple light section sensors with rotated viewing direction. In the application example on the right you can clearly see that the fields of vision of the three sensors complement each other and merge. The first of the sensors is operated as a master, the two others are cascaded (see "Cascading"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



Possible measures against receiver occlusion

- Alignment of the objects so that all profile data to be detected are visible to 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 Minimum object size

The length of the laser line in X direction is variable and depends on the distance in Z direction. However, always the same number of measurement points is measured. The measurement points on the object in the detection field are crucial for detecting the object.

This implies that the minimum object size (i.e., the smallest detectable object) in the X direction increases with the distance in the direction of Z.

Small objects can be recognized better in the short range.

Due to the triangulation measurement principle the reflected laser beam strikes the CMOS receiver in varying angles depending on the object distance. As a consequence, the minimum object size in Z-direction also increases with distance.

The Figure 3.3 shows this relation:

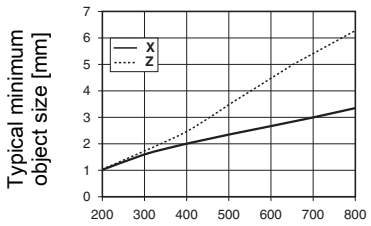
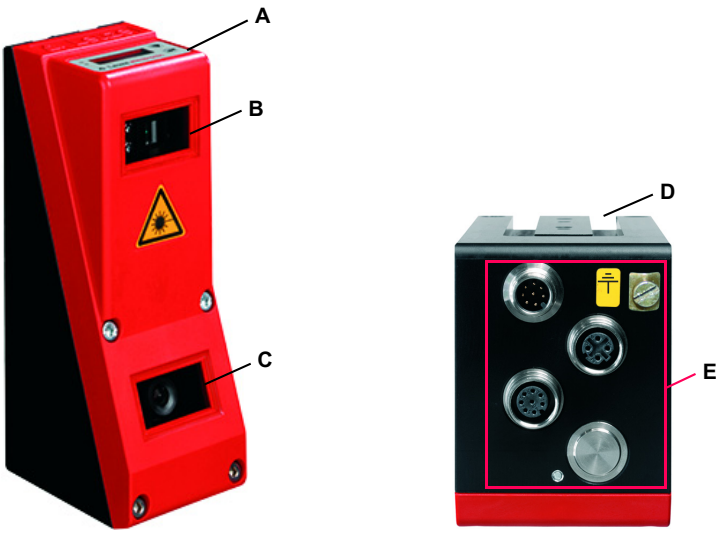


Figure 3.3: Typical minimum object size LRS 36…

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 may be found in Chapter 16.1

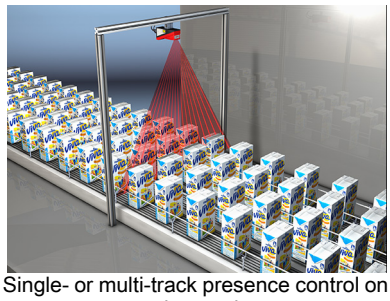
Figure 4.1: Mechanical design of Leuze light section sensors

4.1.2 General performance characteristics

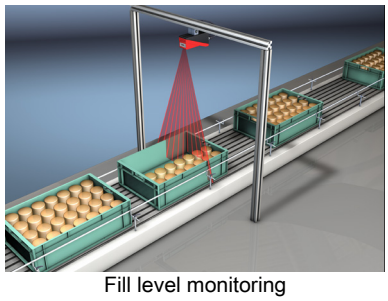
- Light section sensor for object detection
- Measurement time/response time: 10 ms
- Measurement range/detection area: 200 … 800 mm
- Length of laser line: max. 600 mm
- Configuration and transmission of process data via Fast Ethernet
- OLED display with membrane keyboard
- Measurement value display 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 Range Sensor - LRS 36

Line Range Sensors are designed to perform proximity object detection along the laser line. Similar to a light barrier or a laser scanner, the sensor detects the presence of objects through scanning. With individual configuration, one sensor can be used to detect single or multiple objects.



Single- or multi-track presence control on conveying equipment



Fill level monitoring

Specific performance characteristics

- Configuration software LRS 36soft
- Data calculation and processing directly inside the sensor
- Integrated PROFIBUS interface or 4 switching outputs
- Up to 16 detection fields with logical linking option
- Detailed information on analysis windows, switching state and sensor status via Ethernet and PROFIBUS

Typical areas of application

- Situation and position control
- Presence control of objects in defined areas
- Height and width monitoring
- Single or multiple track presence control on transport systems
- Zero check of cases

4.2 Operating the sensor

4.2.1 Connection to PC / process control

Configuration

For commissioning the light section sensors are connected to a PC via the Ethernet interface (see "Connection X2 - Ethernet" on page 36) and are then set using the configuration software supplied LRSsoft.

Detection mode

In detection mode, the LRS 36/6 is connected to the process control via its 4 switching outputs; the LRS 36/PB is connected to the process control via PROFIBUS. Alternatively, the LRS 36 can be operated via the Ethernet interface on X2, see chapter 10 "Integrating the LRS 36 in the process control (Ethernet)". Additional sensor information is then available.

4.2.2 Activation - laser on/off

Via activation input **InAct** (pin 2 on X1), via PROFIBUS (master output 'uActivation' = 1) or the 'Ethernet Trigger' command, the laser and data transmission can be specifically switched on and off. 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, PROFIBUS activation 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.

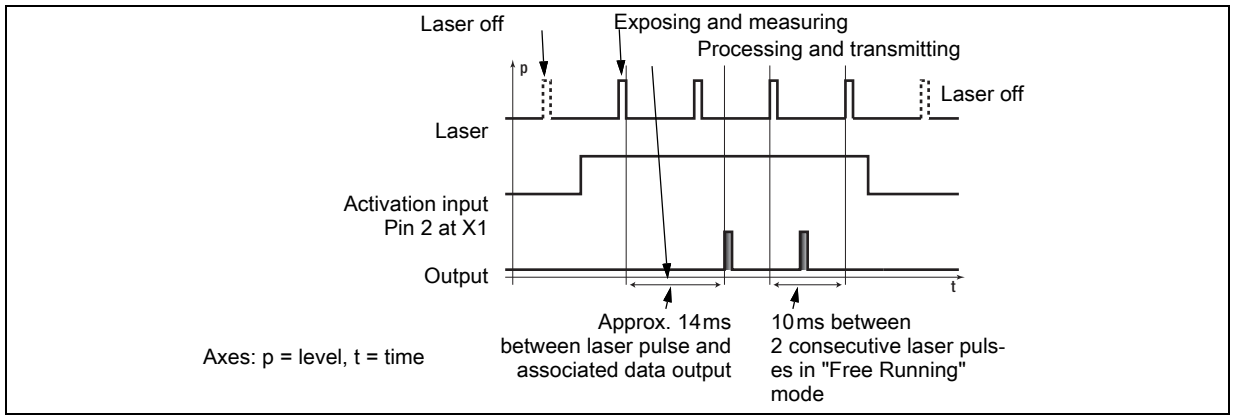


Figure 4.2: Activation input signal sequence

The 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 100Hz and outputs these continuously via the interface X2.
- 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 detection mode (see Chapter 10.3.4"Commands in detection mode" on page 75).

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

NOTE
Ex works, the LRS 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 LRSsoft configuration software to `Input Triggered` (shown on display: `Trig`).

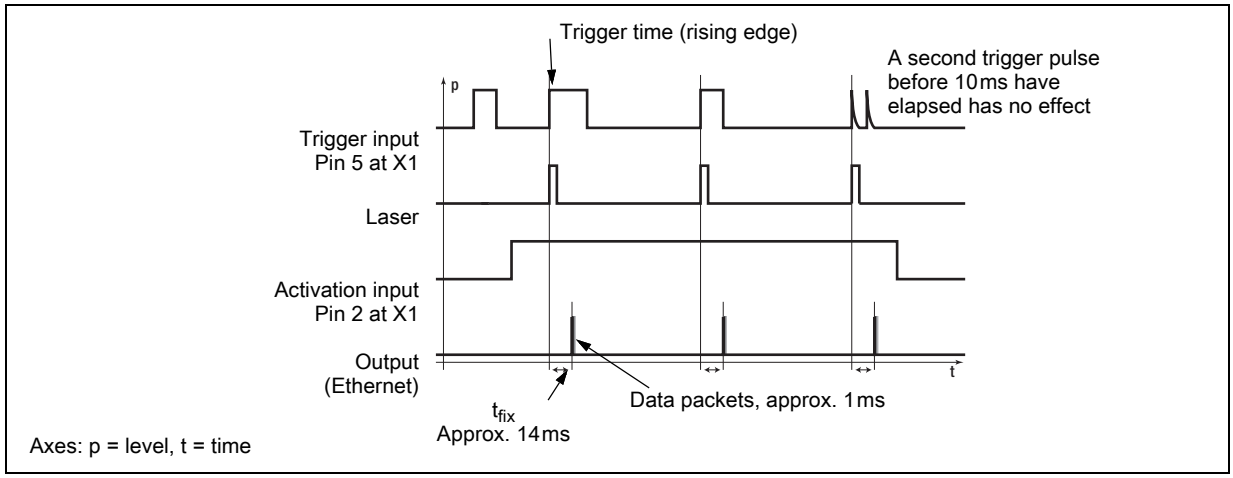


Figure 4.3: Trigger input signal sequence

PROFIBUS trigger

So that a measurement can be triggered on each PROFIBUS cycle, the PROFIBUS trigger of the LRS 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

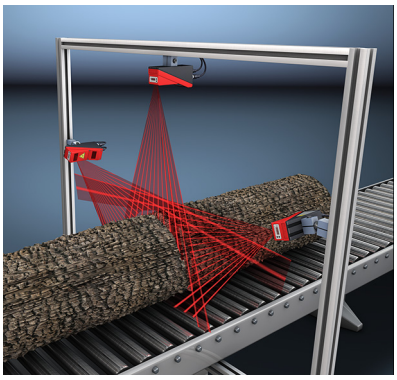
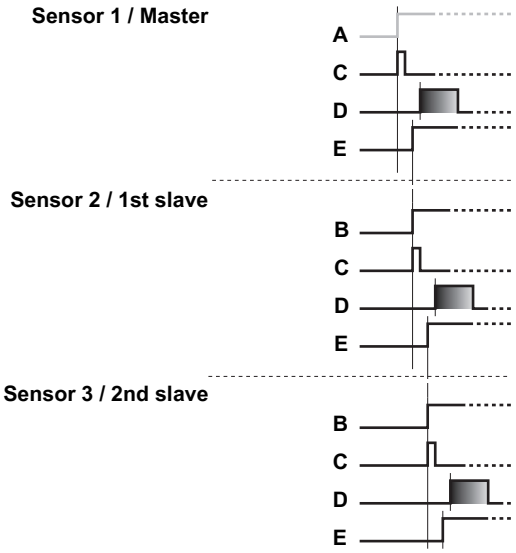


Figure 4.4: Cascading application example

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 easily be 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 operation, cascading only functions as described above via the ***InTrig*** and ***Out-Cas*** inputs/outputs at 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 Detection functions LRS 36

The LRS lets you carry out presence/absence and area monitoring with stable switching behavior and simple configuration. The sensor configuration is stored in the individual inspection tasks in the configuration software LRS 36soft to reflect the requirements of different applications.

4.3.1 Inspection Task

The LRS 36 lets you operate with up to 16 individual inspection tasks, each of which may contain up to 16 rectangular analysis windows (AWs) that can be configured independently and that may overlap arbitrarily.

1-16 AWs can be defined for each inspection task. The results of the individual AWs may be combined via logic operations (AND, OR, NOT). A different logic operation can be defined for each of the 4 switching outputs Out1 to Out4.

The selection of the inspection tasks is carried out:

- via the switching inputs of connection X3
  (inspection tasks 0-7 only)
- Via PROFIBUS
- via LRS 36soft (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 Analysis Window (AW)

The AWs are defined in the configuration software LRSsoft (see chapter 9.4 "Parameter settings/Parameters tab"). This software defines the spatial position, size and number of hit points to be detected for each AW.

An evaluation is carried out only within the active AWs. Areas outside the sensor's field of vision are also not evaluated. An object is detected if the number of hit points in the AW 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.

Analysis results

The analysis results of individual AWs can be combined logically via the LRSsoft configuration software. The result of this logic operation is output via the switching states of the four switching outputs Out1-Out4 at X3 or PROFIBUS.

Detailed evaluation results such as, e.g., the status of all AWs, the number of hit points and the state of the switching outputs are transmitted via Ethernet and can be queried via PROFIBUS. For more information please refer to Chapter 10.

4.3.3 Definition of AWs and analysis results

In Figure 4.6, 5 AWs are defined (blue rectangles). For each AW, a minimum of 5 hit points must be detected for the analysis result to be "1". If fewer hit points are detected, the analysis result is "0".

Consider the example shown:

- AW1: 8 hit points (on O1) result =1
- AW2: 4 hit points (on O2) result =0
- AW3: 1 hit points (on O2) result =0
- AW4: 3 hit points (on O2) result =0
- AW5: 11 hit points (on O4) result =1

Why is O2 not detected?

O2 is not detected in AW2 because missing hit points are shadowed. For AW3, O2 is too far to the left. For AW4, the number of hit points to be detected would need to be lowered to 3.

Why is O3 not detected?

O3 is within AW3, but AW3 does not detect the object's upper edge and thus there is no detection. O3 is not detected within AW5 because, from the sensor's point of view, O4 is in front of it.

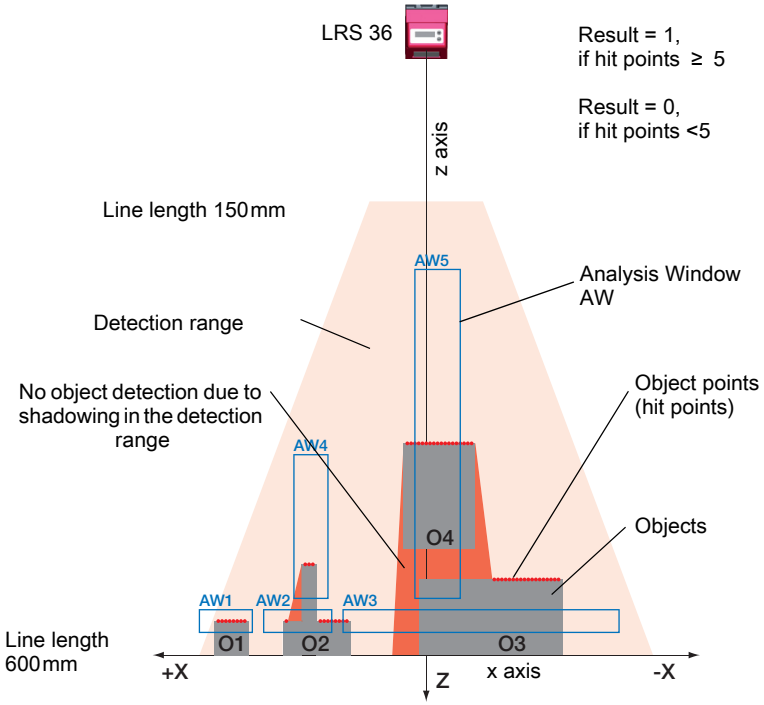


Figure 4.6: Principle of object detection - areas with laser occlusion are shown in orange

4.3.4 Application examples

Zero check of cases

In Figure 4.7 AW1 and AW2 are used to check whether a container of a certain height and width is located at a predefined position in the detection range.

AW3 is used to check whether the container is empty. It is not empty if hit points are detected in AW3.

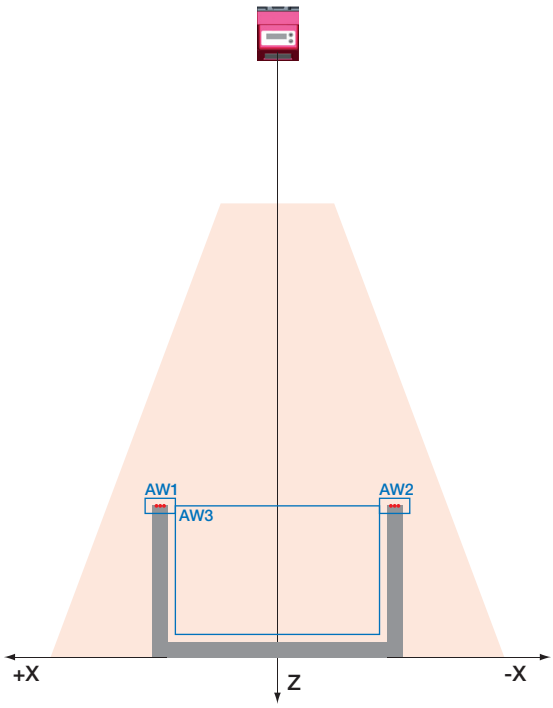


Figure 4.7: Zero check of cases

Single or multiple track presence control on transport systems

In Figure 4.8, as in Figure 4.7, AW1 and AW2 are used to check whether a container of a certain height and width is located at a predefined position in the detection range.

AW3 to AW8 are used to check whether and where objects are located in the container and what their height is.

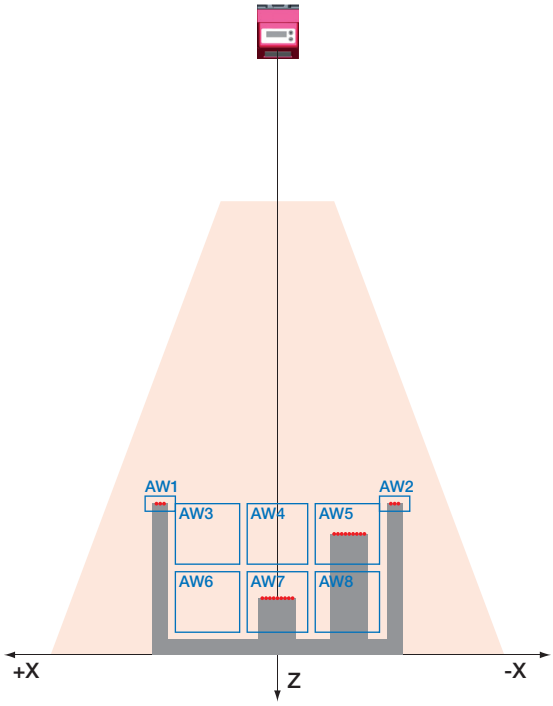


Figure 4.8: Single or multiple track presence control on transport systems

4.3.5 Creation of inspection tasks

The settings necessary for the configuration of the AWs, the assignment of the AW states to the switching outputs and the configuration of general parameters such as operating mode, activation, cascading, detection range (FoV), etc. are carried out in **LRS 36soft**, see chapter 9.4 "Parameter settings/Parameters tab" and Chapter 9.7.

4.3.6 LRS teach algorithms

Beginning with firmware V01.50, the Line Range Sensors offer various teach algorithms that considerably simplify commissioning with typical applications. Here, the analysis windows, the switch-on/switch-off conditions and the assignment to the switching outputs are created automatically.

The teach algorithms can be called up via the control panel directly on the sensor or via Ethernet using the command interface.

NOTE
A teach always causes the currently set inspection task to be changed. The Line Range Sensors can save a total of 16 different inspection tasks. **Each inspection task can be configured with an individual teach event.**

The user must set the desired exposure time (Exposure Time) prior to performing a teach or measurement. The exposure time can be changed via the control panel:

- Bright objects (exposure time predefined)
- Normal objects (exposure time predefined)
- Dark objects (exposure time predefined)
- Manual adjustment (exposure time set by the user via LRSsoft)

NOTE
With a dark conveying belt and bright objects, it is useful to set the exposure time to "dark objects" for teaching and then back to "bright objects" for measuring.

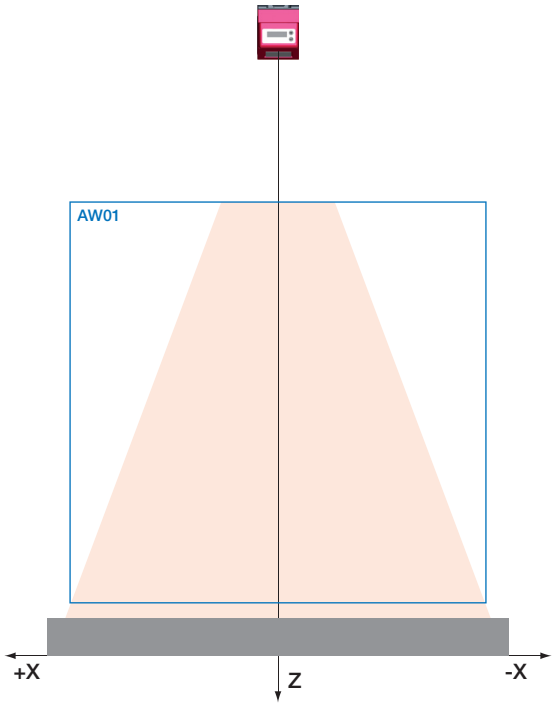
The setting is permanently stored for the currently selected inspection task. Individual application settings can be made for each inspection task.

"Area Scan" teach (Area Scan Basic)

For simple area monitoring, the LRS can be configured as an area scanner so that objects, e.g., on a conveyor line, are detected at any position within the detection range (FoV).

For this purpose, the "Area Scan" teach algorithm generates a single analysis window that covers the entire detection area up to a detected background.

The background is ascertained as the mean value from the ascertained distance values during a teach event.



Typical application:

Figure 4.9: "Area Scan" teach (Area Scan Basic)

If no "background" is found within the detection range of the LRS, no teaching is performed and the settings remain unchanged.

NOTE
The background must be a surface that is as flat as possible parallel to the X-axis of the LRS. Unevenness results in an increased distance of the AW to the background in order to prevent faulty switching. Excessive deviations or inclines lead to a teaching error, since the LRS is unable to compensate for these.

The teach is triggered via the Display menu (`Appl. Settings` -> `Teach Functions` -> `Area Scan Basic`, see Chapter 7.2) or via the Ethernet command interface. Only the Zmax value of the AW is adjusted here. The other values are permanently set to: Xmin|Xmax = -300mm|300mm / Zmin = 190mm.

If no hit points are found in the newly set AW after completing the teach, "Teach ok" is displayed for 3s. The LRS then switches to detection mode.

"Teach Error" is otherwise displayed. By acknowledging with the Enter button, you return to the menu and can again execute a teach.

When executing a teach via Ethernet command, the command word contains an error number that provides information about the result of the completed teach event (see Page 74).

If the LRS then detects an object within this AW while in detection mode, switching output OUT1 is activated (all other outputs are inactive).

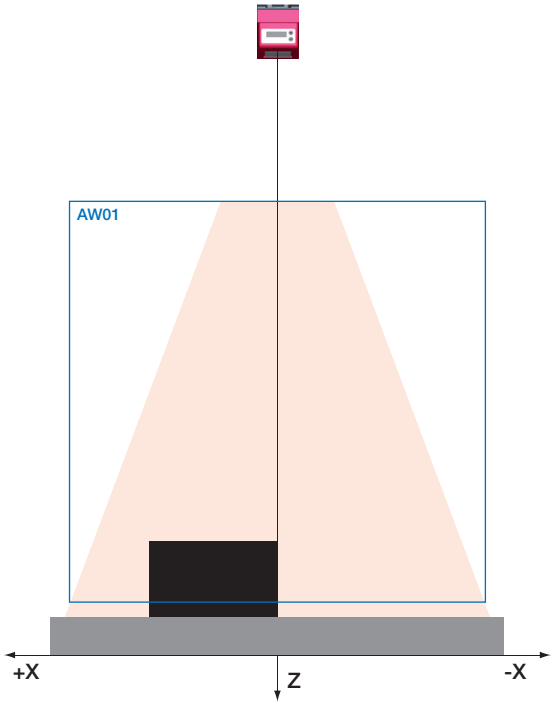


Figure 4.10: "Area Scan" teach (Area Scan Basic) - object detection in AW01

"AW01" is used as analysis window. The other AWs are set to "inactive".

The object size to be detected (Sensitivity) can be selected in 3 levels:

- "Small" (fine) Sum Hits On = 10 Sum Hits Off = 6
- "Medium" (medium) Sum Hits On = 20 Sum Hits Off = 12 (factory setting)
- "Large" (coarse) Sum Hits On = 40 Sum Hits Off = 24

Here, 1 hit corresponds to the optical resolution at the effective measurement distance (0.5 … 1.5mm).

Example: At a distance of 800mm, 20 hit points correspond to approx. 33mm; at a distance of 200mm, this corresponds to approx. 8mm.

The desired object size can be selected via the control panel on the sensor, thereby adjusting the switching behavior of the sensor (`Appl. Settings` -> `Teach Parameters` -> `Sensitivity`).

The analysis window is created with a "safety distance" (Offset) to the found background. This distance can be changed via the control panel on the sensor, thereby adjusting the switching behavior of the sensor(`Appl. Settings` -> `Teach Parameters` -> `Offset`).

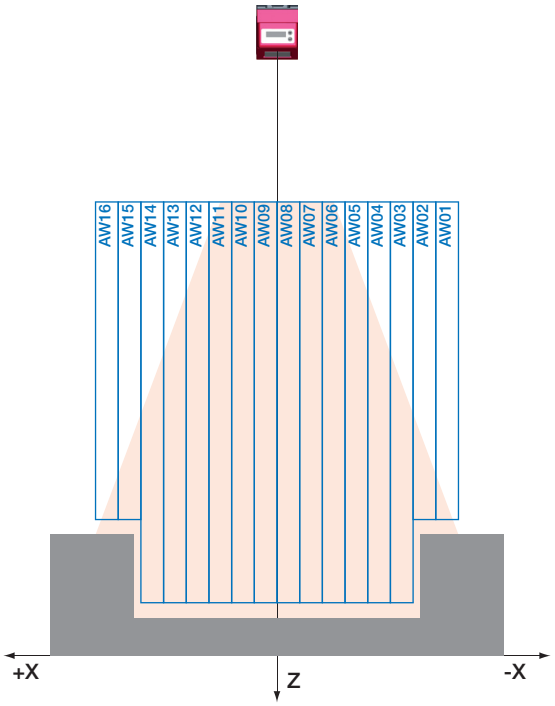
Factory setting: Offset = 20mm

"Background Suppression" teach (Area Scan Advanced)

For more complex area monitoring, the LRS can take into account existing contours, e.g., boundaries, frames or similar, during the teach event so that objects can be detected at any position within this boundary.

Here, the "Background Suppression" teach algorithm uses all 16 analysis windows, which are divided over the found background.

The widths of the 16 AWs are uniformly distributed according to the detection field width at the distance of the point farthest from the background.



Typical application:

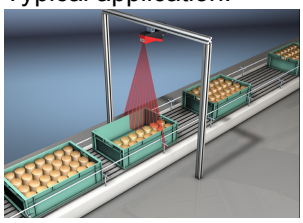


Figure 4.11: "Background Suppression" teach (Area Scan Advanced)

NOTE	
	The division into 16 analysis windows determines the tolerances and distances to the found background. This may lead to dead zones within the detection area in which no objects are detected.

The teach is triggered via the display menu (`Appl. Settings` -> `Teach Functions` -> `Area Scan adv.`, see Chapter 7.2) or via the Ethernet command interface. Only the Zmax value of the AWs is adjusted here. The width at maximum distance is divided into 16 AWs of uniform width. This automatically yields Xmin and Xmax of the individual AWs.

If no hit points are found in the newly set AWs after completing the teach, "Teach ok" is displayed for 3s. The LRS then switches to detection mode.

"Teach Error" is otherwise displayed. By acknowledging with the Enter button, you return to the menu and can again execute a teach.

When executing a teach via Ethernet command, the command word contains an error number that provides information about the result of the completed teach event (see Page 75).

If the LRS then detects an object within all 16 AWs while in detection mode, switching output OUT1 is activated (all other outputs are inactive). The found measurement points are evaluated as a sum over all AWs.

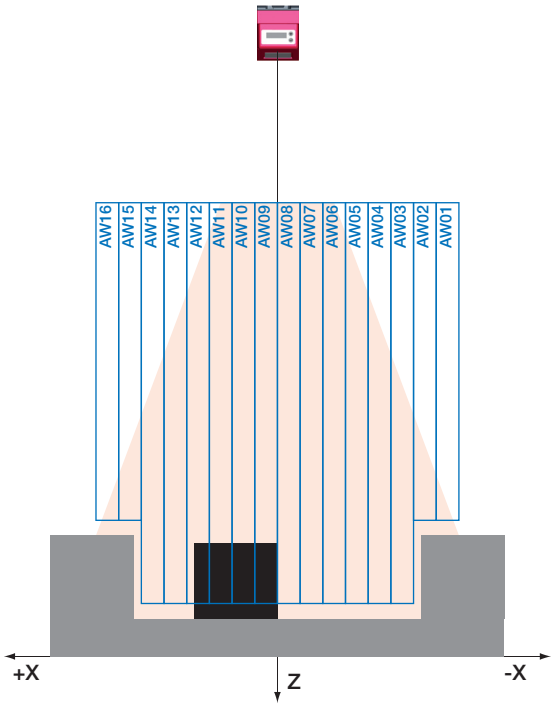


Figure 4.12: "Background Suppression" teach (Area Scan Advanced) - object detection in the AWs

The object size to be detected (Sensitivity) can be selected in 3 levels:

- "Small" (fine) Sum Hits On = 10 Sum Hits Off = 6
- "Medium" (medium) Sum Hits On = 20 Sum Hits Off = 12 (factory setting)
- "Large" (coarse) Sum Hits On = 40 Sum Hits Off = 24

Here, 1 hit corresponds to the optical resolution at the effective measurement distance (0.5 … 1.5mm).

Example: If the largest distance is 800 mm, the measurement width is 600 mm and the individual AWs are 600 / 16 = 37.5mm wide and are uniformly distributed from -300 to +300mm.

The desired object size can be selected via the control panel on the sensor, thereby adjusting the switching behavior of the sensor (`Appl. Settings` -> `Teach Parameters` -> `Sensitivity`).

Analysis windows 1 … 16 are created with a "safety distance" (Offset) to the found background. This distance can be changed via the control panel on the sensor, thereby adjusting the switching behavior of the sensor (`Appl. Settings` -> `Teach Parameters` -> `Offset`).

Factory setting: Offset = 20mm

"Multiple Track Completeness Monitoring" teach (Track Scan)

With the "Multiple Track Completeness Monitoring" teach, the LRS is to be automatically configured so that the system detects whether 1 object more or 1 object less than taught is on the conveyor line or within a transport unit (check for completeness).

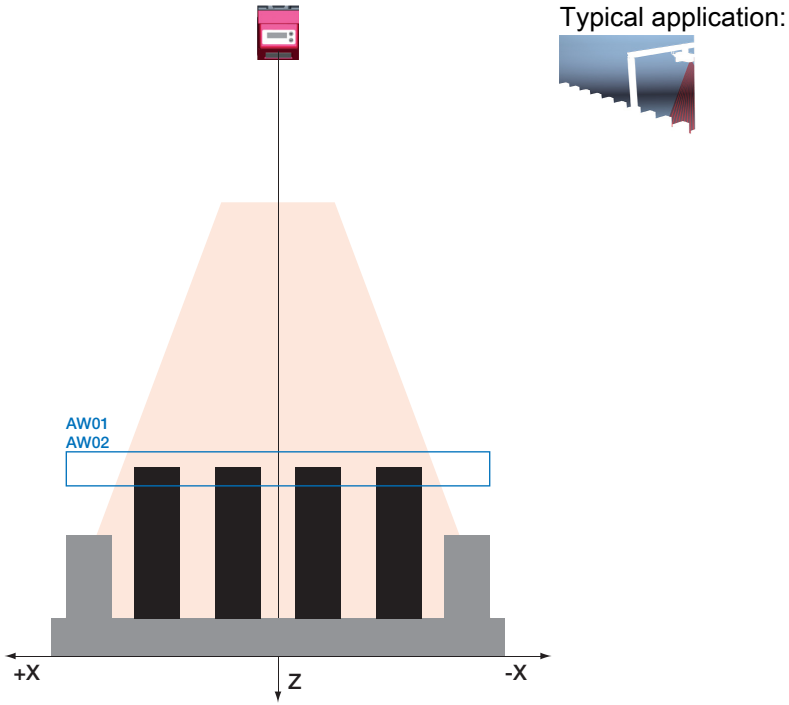


Figure 4.13: "Multiple Track Completeness Monitoring" teach (Track Scan)

AW01 and AW02 are used as analysis windows. The other analysis windows are then set to "inactive".
Output1 (OUT1) is used for the "objects complete" case.
Output2 (OUT2) is used for the "too many objects" case.
The other outputs are then set to "inactive".

Logic of the two outputs:

- Output1 (OUT1) = 1, if the objects are complete.
- Output2 (OUT2) = 1, if there are too many objects.

The number of objects is specified by the user `Num. of Objects`).
It is required that:

- the sensor is aligned exactly parallel to the background to within 1° (on average).
- all objects are flat or only slightly arched.
- all objects have the same dimensions.

The frequency distribution of the measurement points during the teach is used to determine the distance to the top side of the objects. The minimum number of hit points is derived from the "Sensitivity" parameter.
Zmax and Zmin of the window are determined.
Zmax = object top + "offset"; Zmin = object top - "offset"
The other values are permanently set to: Xmin|Xmax = -300mm|300mm

The teach is triggered via the Display menu (`Appl. Settings` -> `Teach Functions` -> `Track Scan`, see Chapter 7.2) or via the Ethernet command interface.
When executing a teach via Ethernet command, the command word contains an error number that provides information about the result of the completed teach event (see Page 74).

	NOTE
	If possible, the containment edges and guide plates should be considerably lower than the top of the object. The "Offset" parameter must be selected by the user taking into account the containment edges and guide plates.

Using the detected hit points, the teach algorithm determines the size of the individual tracks:

Track width = hit points (during teach) / number of objects

In detection mode, the number of measurement points may deviate from the taught value by up to ±0.4 · track width:

Number of measurement points > teach value - 0.4 · track width:
-> Objects complete -> OUT1 = active
After a switching hysteresis of 20%, OUT1 is again inactive.

Number of measurement points < teach value - 0.6 · track width:
-> Objects missing -> OUT1 = inactive

Number of measurement points > teach value + 0.6 · track width
-> Too many objects -> OUT2 = active
After a switching hysteresis of 20%, OUT2 is again inactive.

In this case:
For number of measurement points < teach value + 0.4 · track width:
-> Objects again complete -> OUT2 = inactive

Setting teach parameters

- Settings via the control panel see Chapter 7.2
- Settings via Ethernet commands see Chapter 10.3.2

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.

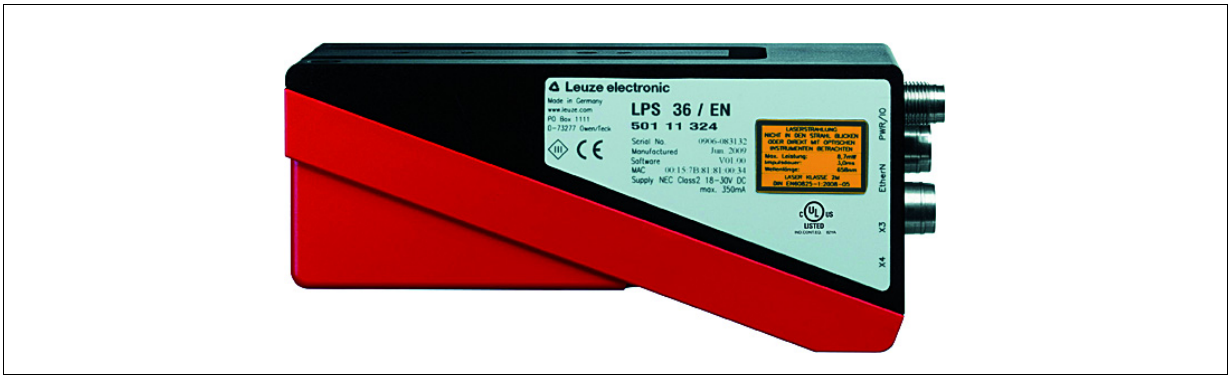


Figure 5.1: Device name plate LRS 36

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

↳ Save the original packaging for later storage or shipping.

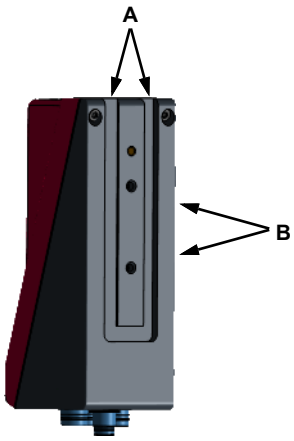
If you have any questions concerning your shipment, please contact your supplier or your local Leuze electronic sales office.

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

5.2 Mounting the LRS 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.



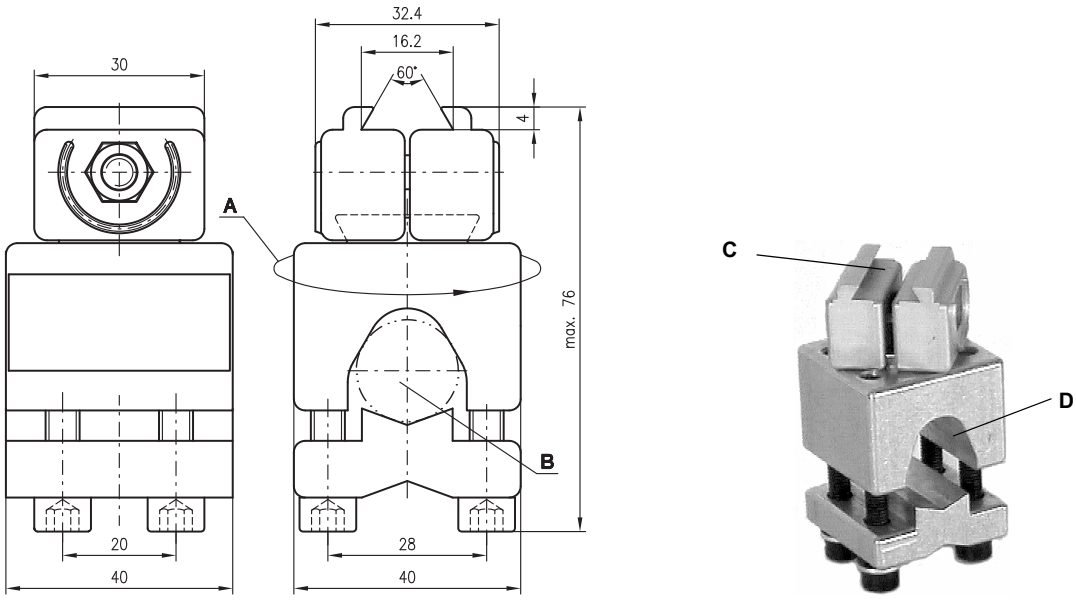
A Dovetail fastening grooves
B M 4 threaded holes

Figure 5.2: Fastening options

Figure 5.3: Mounting example LRS 36

5.2.1 BT 56 mounting device

The BT 56 mounting device is available for mounting the LRS 36 using the fastening grooves. It is designed for rod mounting (Ø 16mm to 20mm). For order guide, please refer to chapter "Type overview and accessories" on page 94.

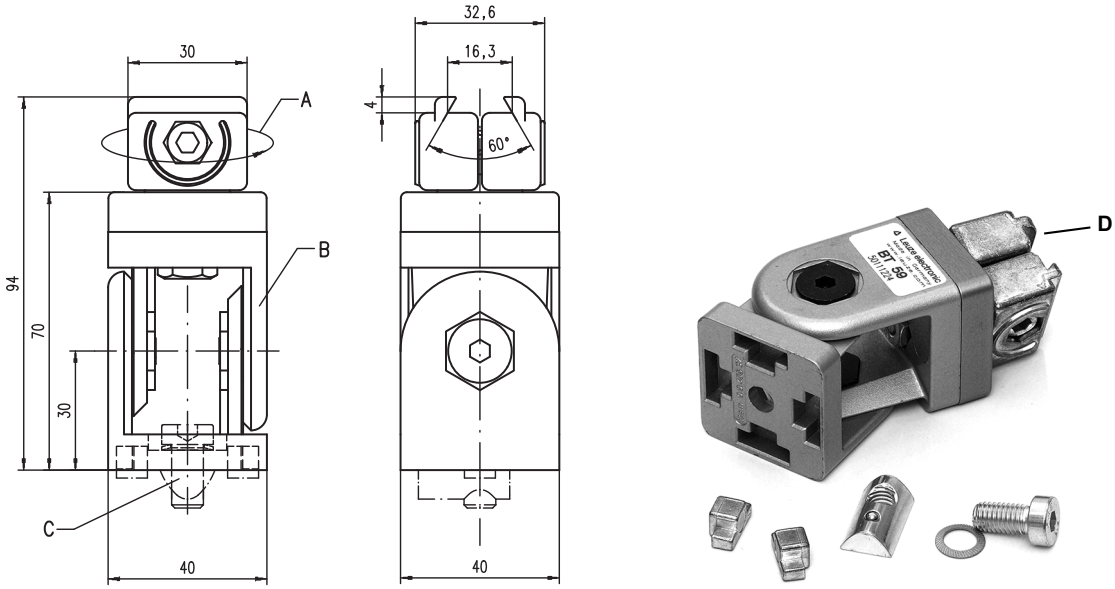


A Rod holder, turnable 360°
B Rods Ø 16 … 20 mm
C Clamping jaws for mounting on the LRS
D Clamp profile for mounting to round or oval pipes Ø 16 … 20 mm
all dimensions in mm

Figure 5.4: BT 56 mounting device

5.2.2 BT 59 mounting device

The BT 59 mounting device is available for mounting the LRS 36 on ITEM profiles using the fastening grooves. For order guide, please refer to chapter "Type overview and accessories" on page 94.



A Holder, turnable 360°
B ITEM joint, angle adjustable ±90°
C M8x16 screw cylinder, M8 serrated washer, M8 sliding block, connectors for ITEM profile (2x)
D Clamping jaws for mounting on the LRS
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 LRS 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 LRS 36 by mechanical collision or jammed parts.
- Possible extraneous light (no direct sunlight or sunlight reflected by the measurement object).
- The optimal perspective for detecting the relevant contours of objects, see chapter 3.2.1 "Occlusion".

⚠ ATTENTION, LASER RADIATION – CLASS 2 LASER PRODUCT	
	When mounting and aligning the LRS 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 result in faulty 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.

The Figure 5.6 illustrates the problem:

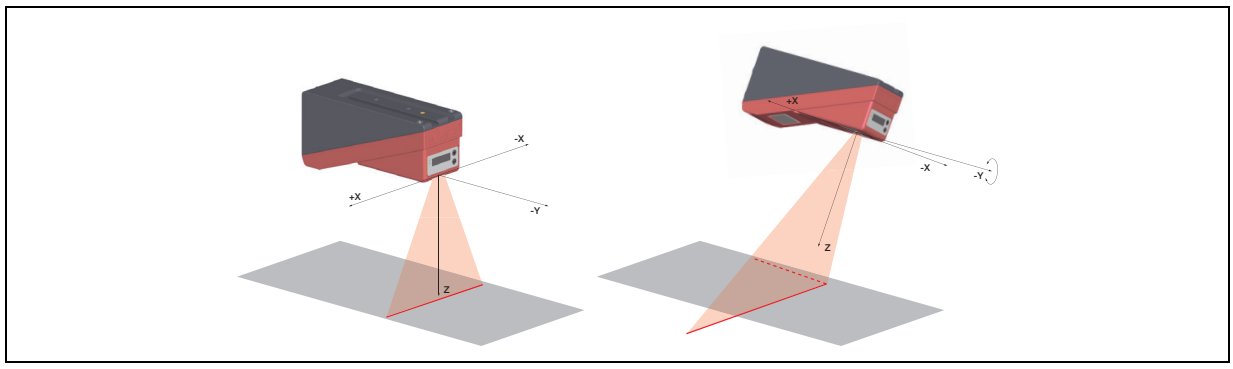


Figure 5.6: Alignment to the measuring plane

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

⚠ ATTENTION, LASER RADIATION – CLASS 2 LASER PRODUCT	
	Observe 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 LRS 36, attach the signs in the vicinity of the LRS 36 such that reading the signs cannot lead to looking into the laser beam! When installing the LRS 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 LRS 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 LRS 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.

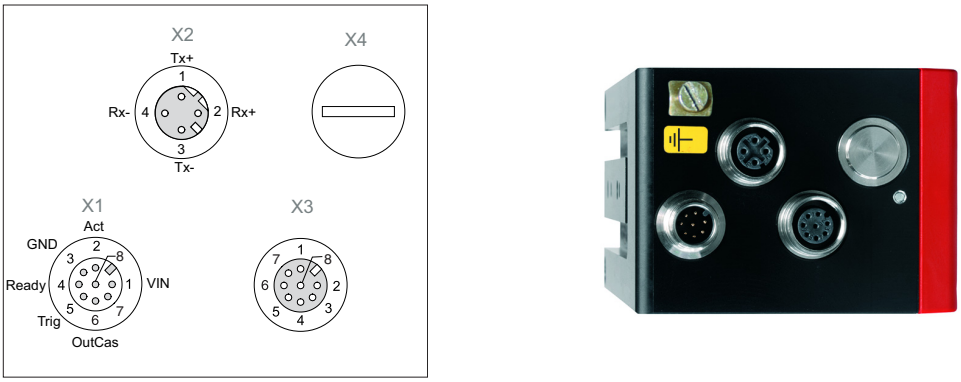
For the locations of the individual device connections, please refer to the device detail shown below.

NOTE
The corresponding mating connectors and ready-made cables are available as accessories for all connections. For additional information, refer to Chapter 16.

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

Figure 6.1: Location of the electrical connections

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



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

Figure 6.2: Connections of the LRS 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
LRS 36/6	Switching inputs / outputs	Not assigned	Chapter 6.3.3
LRS 36/PB	Not assigned	PROFIBUS DP	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 LRS 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 LRS 36 should be switched off from operation and protected against accidental use.

The LRS 36 light section sensors 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 ready-made cables by Leuze.

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
PROFIBUS DP	X4	10 m	Required

Table 6.2: Cable lengths and shielding

Shielding:

1. **Ground the LRS 36 housing:**
   Connect the housing of the LRS 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 LRS 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 LRS 36 housing by measuring the electrical connection from 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** LRS 36**:**
   Apply the shield to FE on both sides. On the LRS 36 end, this is ensured if the LRS 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 end of the cable 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.

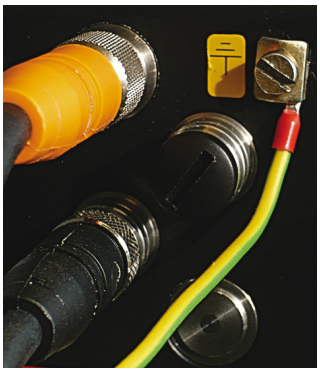
NOTE
You can measure leakage currents with a clip-on ammeter.

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.

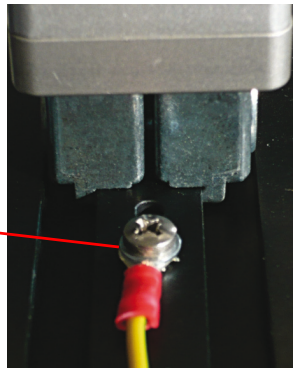
Below, the EMC-compliant connection of the light section sensors LRS 36 is described in practical use with images.

Connect the ground potential to the light section sensors



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

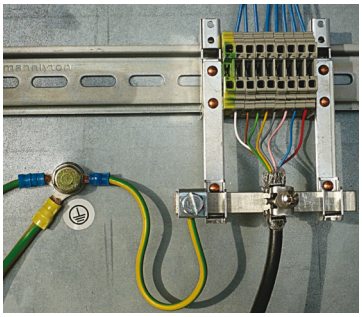
⚠ ATTENTION!
Place lock washer underneath and check the penetration of the anodized coating!



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

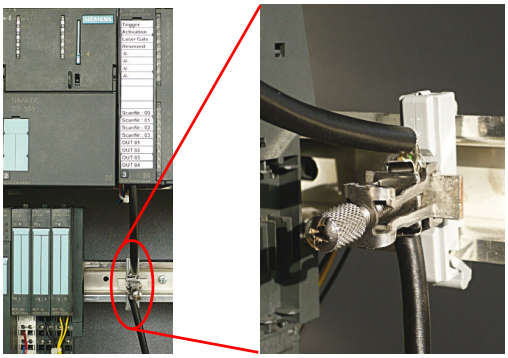


- Shield connected flat to PE
- Connect PE star point with short cables
- Galvanized mounting sheet steel

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 Connecting

6.3.1 Connection X1 - logic and power

⚠ ATTENTION!
All cables must be shielded!

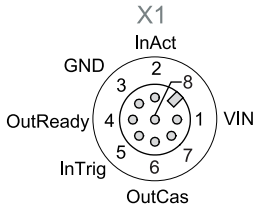
X1 (8-pin connector, A-coded)				
 M 12 connector (A-coded)	**Pin**	**Name**	**Core color**	**Comment**
	1	VIN	wh	+24 VDC supply voltage
	2	InAct	br	Activation input
	3	GND	gn	Ground
	4	OutReady	ye	"Ready" output
	5	InTrig	gr	Trigger input
	6	OutCas	pi	Cascading output
	7		bu	Not connected
	8		RD	Not connected

Table 6.3: Pin assignment X1

↳ Preferably, please use the ready-made cables "KD S-M12-8A-P1-…", see Chapter 16.2.2.

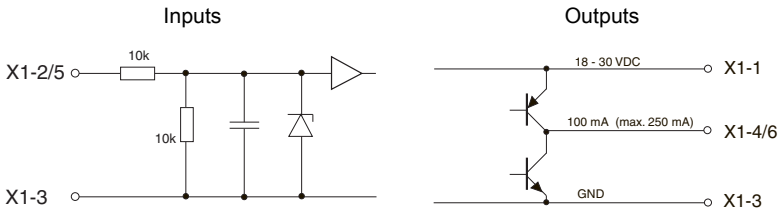


Figure 6.6: Internal wiring at X1

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 state of the output corresponds to the state of the green LED (see "LED status indicators" on page 39).

6.3.2 Connection X2 - Ethernet

⚠ ATTENTION!	
⚠	All cables must be shielded!

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

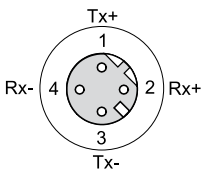
X2 (4-pin socket, D-coded)				
 M 12 socket (D-coded)	**Pin**	**Name**	**Core color**	**Comment**
	1	Tx+	ye	Transmit Data +
	2	Rx+	wh	Receive Data +
	3	Tx-	OR	Transmit Data -
	4	Rx-	bu	Receive Data -
	Thread	FE	-	Functional earth (housing)

Table 6.4: Pin assignment X2

↳ Preferably, please use the ready-made cables "KS(S) ET-M12-4A-…", see Chapter 16.2.3.

Ethernet cable assignment

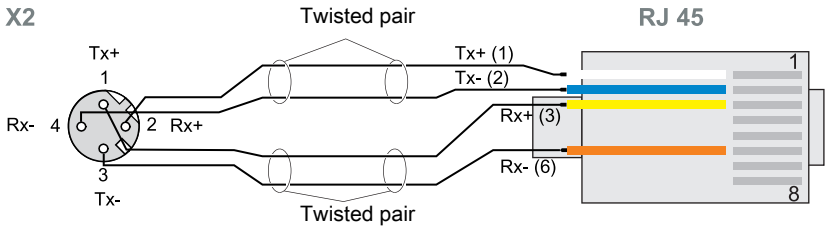


Figure 6.7: HOST / BUS IN cable assignments on RJ-45

	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 (only LRS 36/6)

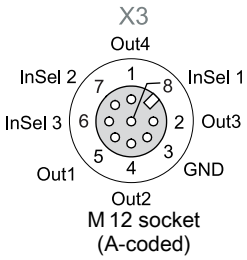
X3 (8-pin socket, A-coded)				
	Pin	Name	Core color	Comment
	1	Out4	wh	Output detection result 4
	2	Out3	br	Output detection result 3
	3	GND	gn	Ground
	4	Out2	ye	Output detection result 2
	5	Out1	gr	Output detection result 1
	6	InSel3	pi	Selection Inspection Task Bit 3 (MSB)
	7	InSel2	bu	Selection Inspection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

Table 6.5: Pin assignment X3

↳ Preferably, please use the ready-made 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 operation 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 three InSel1-3 switching inputs are used to select inspection tasks 0-7. "000" means inspection task 0, "001" inspection task 1, etc. The changeover time between two 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 (only LRS 36/PB)

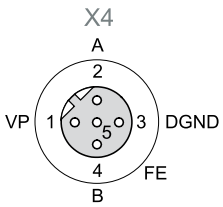
X4 (5-pin socket, B-coded)			
 M 12 socket (B-coded)	**Pin**	**Name**	**Comment**
	1	VP	Supply voltage +5V (termination)
	2	A	Receive/transmit data RxD/TxD-N, green
	3	DGND	Data reference potential
	4	B	Receive/transmit data RxD/TxD-P, red
	5	FE	Functional earth
	Thread	FE	Functional earth (housing)

Table 6.6: Pin assignment X3

NOTE
Connection X4 is assigned only at the LRS 36/PB.

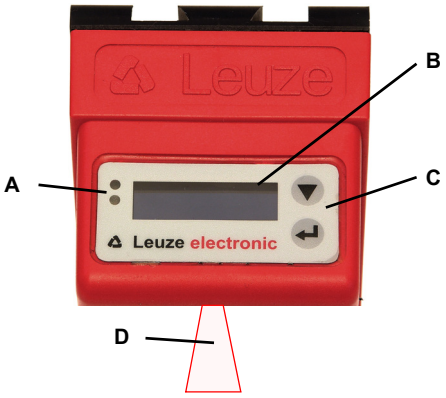
The connection to the PROFIBUS DP is made via the 5-pole X4 M12-socket with an external Y plug adapter. Assignments correspond to the PROFIBUS standard. The Y plug adapter enables the replacement of the LRS 36/PB without interrupting the PROFIBUS cable.

The external Y plug adapter is also needed if the LRS 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 the connection, we recommend our ready-made PROFIBUS cables (see chapter 16.2.5 "Connection accessories / ready-made cables for X4 (only LRS 36/PB)") For the bus termination, we recommend our PROFIBUS terminating resistor (see chapter 16.2.5 "Connection accessories / ready-made cables for X4 (only LRS 36/PB)")

7 Display and control panel

7.1 Indicators and operational controls



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

Figure 7.1: Indicator and operating elements of the LRS 36

After switching on the supply voltage +U_B and following error-free initialization of the device, the green LED illuminates continuously: the LRS 36 is in detection 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 LRS 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 LRS 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

In the second line of the display, the selected inspection task (Txx), the state of the 4 switching outputs (Qxxxx) or, for PROFIBUS devices, Out1 … Out4 of the input data byte uSensorInfo as well as the current sensor status (see chapter 4.2 "Operating the sensor") are displayed.

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.

Q0100 means Out1=0, Out2=1, Out3=0, and Out4=0, for example. Value range: Q0000 to Q1111.

If, for PROFIBUS devices, no PROFIBUS is detected following power-on, no PB appears in the middle of the bottom line instead of Q0000.

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 LRS 36 is connected to a control, the control can put the LRS 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.

	NOTE
	If errors occur during operation, these are shown on the display. Notes 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
		:		:	
		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	
	Teach Functions Teach Parameters			Teach functions	
		Area Scan Basic Cancel		"Area Scan" teach	
			Area Scan Basic **Cancel**	Do not execute teach	X
			Area Scan Basic **Execute**	Execute teach [4]	
		Area Scan adv. Cancel		"Background Suppression" teach	
			Area Scan adv. **Cancel**	Do not execute teach	X
			Area Scan adv. **Execute**	Execute teach [4]	
		Track Scan Cancel		"Multiple Track Completeness Monitoring" teach	
			Track Scan **Cancel**	Do not execute teach	X
			Track Scan **Execute**	Execute teach [4]	
		← Area Scan Basic		Return to menu level 2	
	Teach Parameters Exposure Time			Teach parameters	
		Sensitivity medium		"Sensitivity" teach parameter (object size to be detected)	
			Sensitivity **medium**	"Medium" setting (medium) (Hits On = 20; Hits Off = 12)	X
			Sensitivity **coarse**	"Coarse" setting (large) (Hits On = 40; Hits Off = 24)	
			Sensitivity **fine**	"Fine" setting (small) (Hits On = 10; Hits Off = 6)	
		Offset 020		"Offset" teach parameter (safety distance to background)	
			Offset **020**	Value setting for "Offset", value range: 1 … 599 mm	20 mm
		Num. of Objects 1		"Num. of Objects" teach parameter (number of tracks for "Track Scan")	
			Num. of Objects **1**	Value setting for "Num. of Objects", value range: 1 … 9	1
		← Sensitivity		Return to menu level 2	
	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) [5]	

Table 7.2: Menu structure

Level 1	Level 2	Level 3	Level 4	Explanation / Notes	Default
	Trigger Mode Free Running			Trigger mode for measurements	
		Trigger Mode **Free Running**		"Free Running" trigger setting (continuous measurement)	X
		Trigger Mode **Input Triggered**		"Input Triggered" trigger setting (trigger-input signal triggers measurement)	
	← Teach Functions			Return to menu level 1	
Device Settings Error Handling				Device Settings menu item	
	Slave Address Ethernet			PROFIBUS DP slave address [6]	
		Slave Address 126		Setting for the PROFIBUS DP slave address	126
	Ethernet Display			Ethernet interface parameters [7]	
		IP Address 192.168.060.003		IP address of the sensor	
			IP Address 192.168.060.003	Setting for 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 for 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**		Setting "Auto": 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 (permanent password: "165")	
	← Slave Address			Return to menu level 1	
Error Handling Info				Error Handling menu item	
	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	

Table 7.2: Menu structure

Level 1	Level 2	Level 3	Level 4	Explanation / Notes	Default
	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) In the event of a teach error, the error number (see Page 70 et seq.) is displayed, providing information about the result of the completed teach event.
5) With "Manual Settings", the value preset via LRSsoft is used.
6) This menu item exists only with the PROFIBUS device versions.
7) 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 3 minutes, the LRS 36 exits menu mode and switches to detection 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.

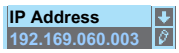
The following displays may appear:

Menu navigation

▼ selects the next menu item (`Ethernet`)
↲ switches to the submenu shown with inverted colors (`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 (`192168001111`).

▼ 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 LRSsoft 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 LRS 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 LRS 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 canceled` appears in the display for approx. 2 s. Afterward, the LRS 36 returns to detection mode.

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

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

↳ 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 initialization of the device, the green LED illuminates continuously: the LRS 36 is in detection mode.

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

8.2 Establish connection to PC

The LRS 36 is configured via a PC using the LRSsoft 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 LRS 36 must lie in the same address range. The LRS 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 LRS 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 LRS 36 is by applying an alternative configuration in the TCP/IP settings of the PC and connecting the LRS 36 to the PC.

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

In the `Ethernet` submenu (see Chapter 7.2.1), you can read the current settings of the LRS 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 LRS 36 must match so that they can communicate with each other.

Address of the LRS 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 LRS 36.

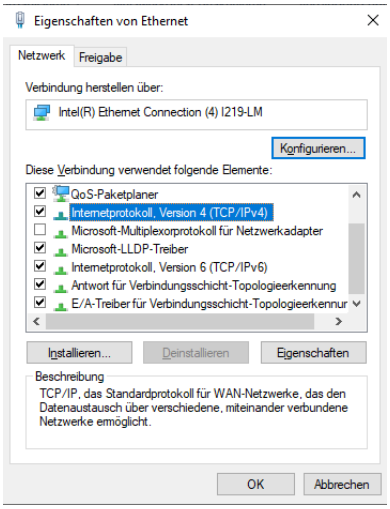
For example 192.168.060.110 (but not 192.168.060.003!). If LRS 36 and PC have the same IP address, they cannot communicate with each other.

Setting the default gateway

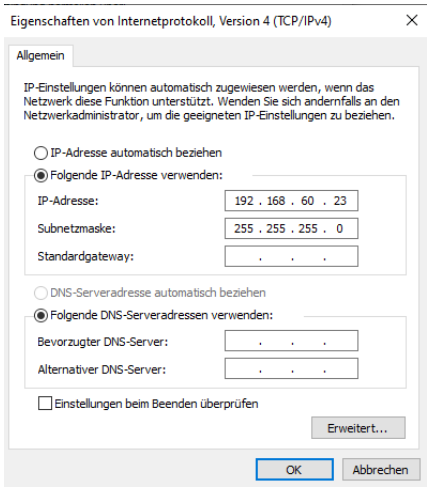
The IP address for the default gateway can optionally be set using the `Std. Gateway` submenu item (default: 000.000.000.000).

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 with Windows 10



- Log in to your PC as administrator.
- Click on Start.
- Click on Settings.
- Click on Network & Internet.
- Click on Ethernet.
- Under "Related Settings", click "Change adapter options".
- Right-click the network connection to which the LxS device is connected.
- Click on Properties.
- Click on "Internet Protocol, Version 4 (TCP/IPv4)".
- Click on the "Properties" button.



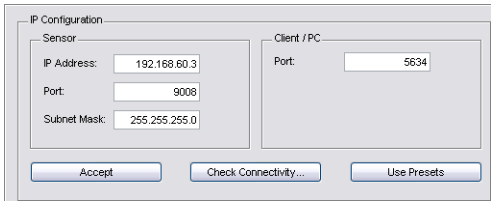
- Set the IP address of the PC to the address range of the LRS. Attention: Not the same IP address as on the LRS.
- Set the subnet mask of the PC to the same value as on the LRS .
- Close the configuration dialog by confirming all windows using OK.
- Connect the interface X2 of the LRS directly to the LAN port of your PC. Use a KB ET-…-SA-RJ45 cable for the connection; see Table 15.7.
- The PC first tries to establish a network connection via the automatic configuration. This may take a few seconds. The alternative configuration that you have just set is then activated. The PC can now communicate with the LRS.
- Information about configuring with the LRSsoft 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. LRS 36 configuration - see Chapter 9.
2. Programming process control - see Chapter 10 and Chapter 11.
   or
3. Connect switching inputs and outputs accordingly - see Chapter 6.3.
4. When connecting in the Ethernet process controls, the IP configuration of the LRS 36 is to be adjusted so that the LRS 36 can communicate with the process control.
   The values corresponding to the following screenshot are preset in the LRS 36 at the factory. If you

would like to set different values, you must change the values via the display of the LRS 36 in menu item `Ethernet` (see "Menu description" on page 41). You can test the changed values by entering them in the `Configuration` area in LRSsoft and then clicking the `Check Connectivity` button.



5. Connect LRS 36 to the process control. This can be performed for all LRS 36 via the Ethernet interface or, depending on model, via the switching outputs or the PROFIBUS.
6. Establish connections for activation, triggering and cascading, if necessary.

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 LRSsoft configuration software

9.1 System requirements

The PC used should meet the following requirements:

- Windows 7, preferably Windows 10
- Ethernet port

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. The display must be set to "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.

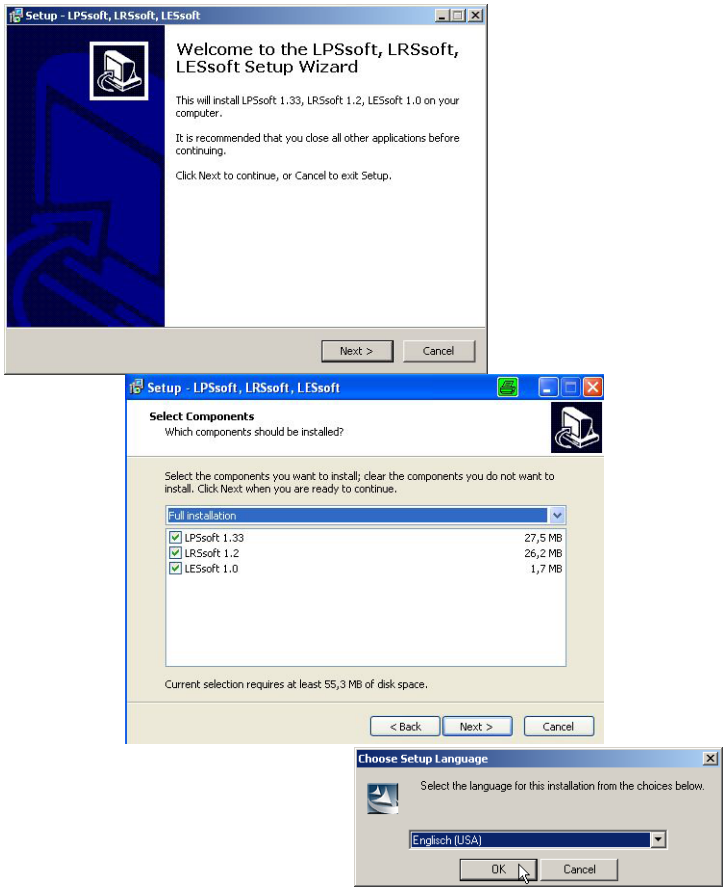
You will need **LRSsoft** for configuring light section sensors of the **LRS** series.

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 LRSsoft. It is only available in English or Japanese.

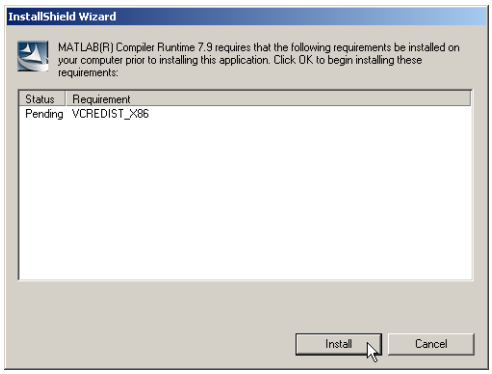
↳ Therefore keep in the `Choose Setup Language` window the selection `English` and click on `OK`.

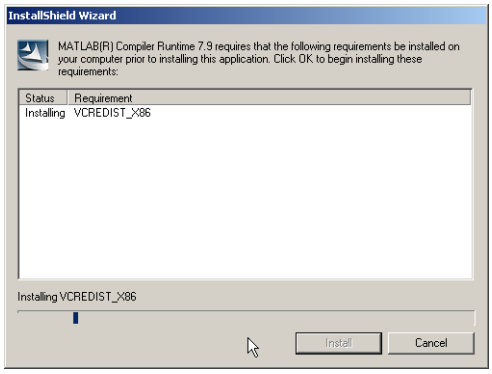


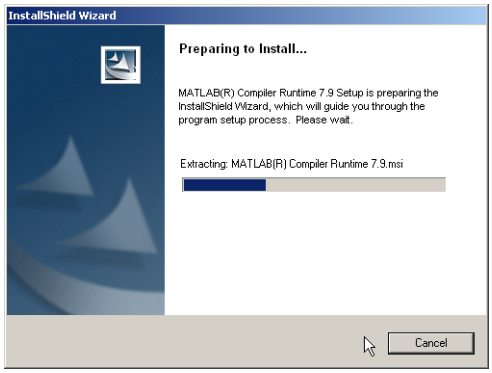
Depending on the configuration of your Windows system, the dialog shown below may then appear (missing component VCREDIST_X86).

↳ Click on `Install`.

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

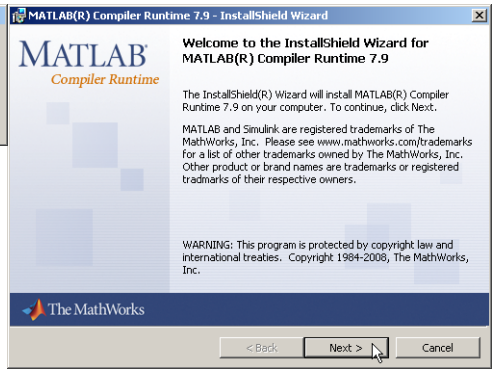






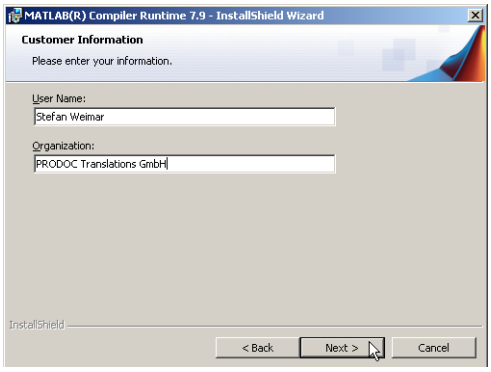
After some time (up to several minutes depending on the system configuration) the start screen of the MCR installer will appear.

↳ 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`).

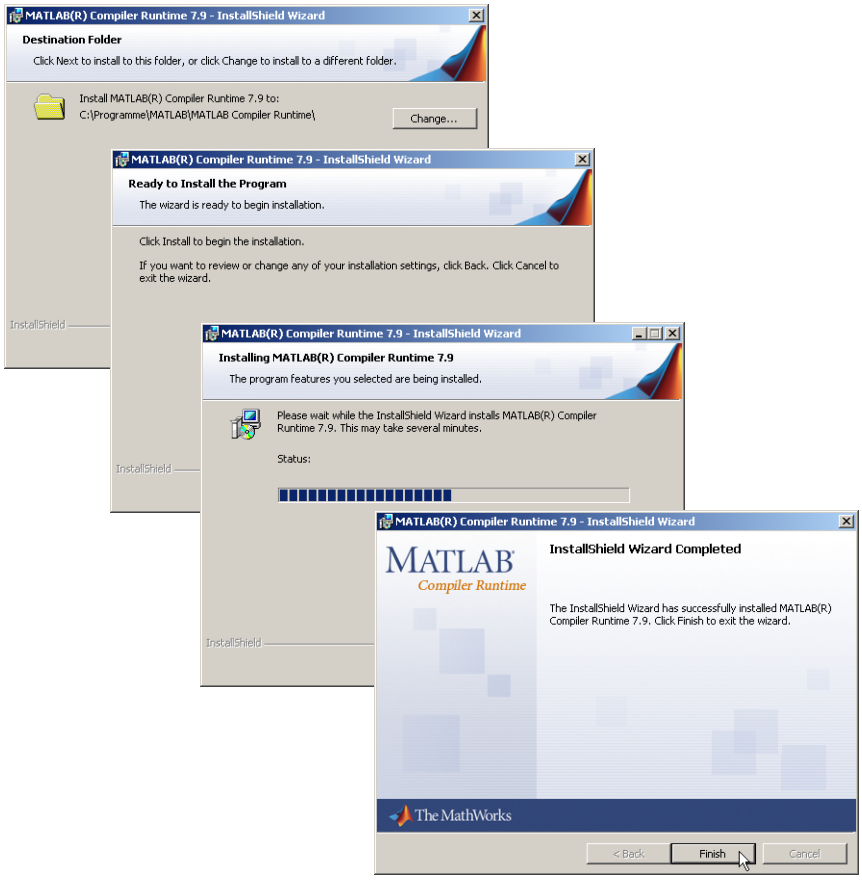
The standard path is `C:\Programs\MATLAB\MATLAB Compiler Runtime\`.

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

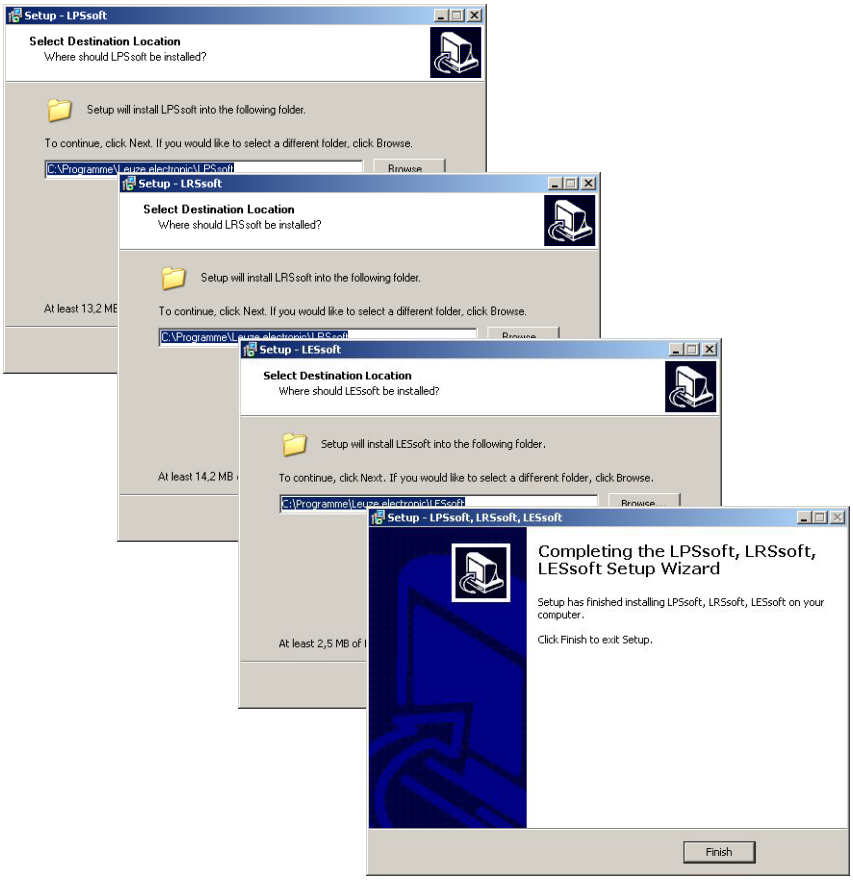
The installation will start and a status window will be displayed. This can again take several minutes.

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
	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.

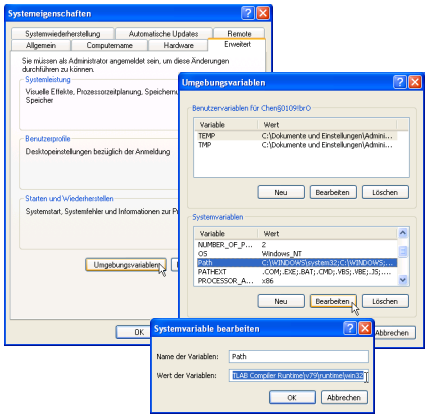
↳ Adjust the display for Windows XP by selecting the value "`96 DPI`" under `Properties -> Display -> Settings -> Extended -> Display -> DPI setting`.

↳ 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 `System control` of Windows under `System`.
- Go to the `Advanced` tab and click on `Environment variables`.

The `Environment variables` window opens.

- Scroll down in the `System variables` area 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:\Programs\MATLAB\MATLAB Compiler Runtime\v79\runtime\win32` entry right at the end.

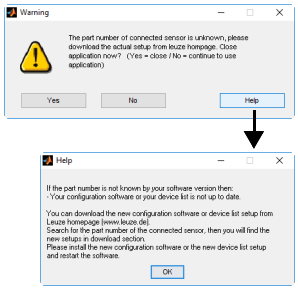
- If this entry is missing, copy the entry from this document and insert it together with the preceding semicolon.
- Then click on `OK` and close also all further windows using `OK`.
- Shut Windows down, restart Windows and then start LRSsoft by double-clicking on it.

Now the start screen of LRSsoft 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 area 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 LRSsoft/Communication tab

↳ Start LRSsoft via the respective entry in the Windows Start menu.

The following screen appears:

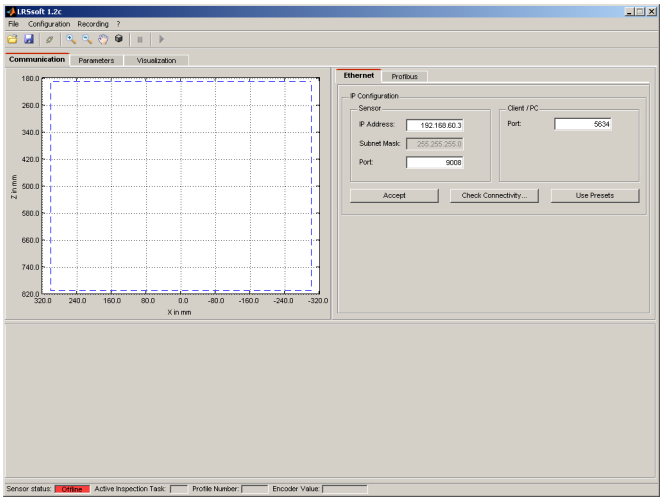


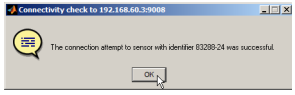
Figure 9.1: Initial screen LRSsoft

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

You had already determined this data in Chapter 8.2.

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

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



Click on the button `Connect to sensor`: 

As a result LRSsoft 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 LRSsoft has established a connection to the LRS 36, the laser beam flashes.

PROFIBUS settings (only LRS 36/PB)

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

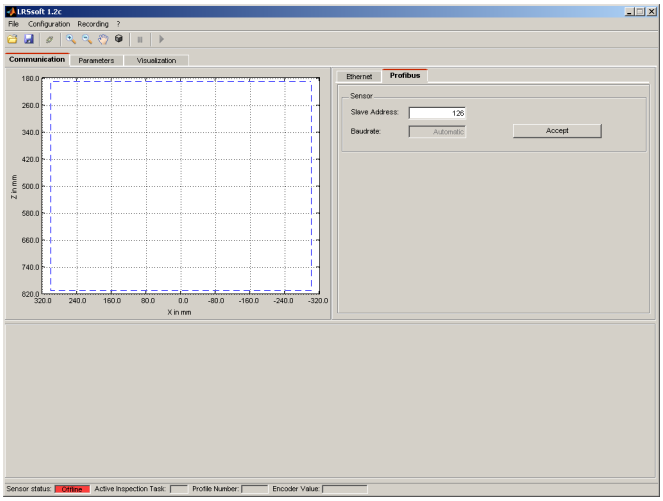


Figure 9.2: PROFIBUS settings

Automatic detection of the baud rate / automatic address assignment

The LRS 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 LRSsoft 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 LRSsoft.

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 LRSsoft, 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:

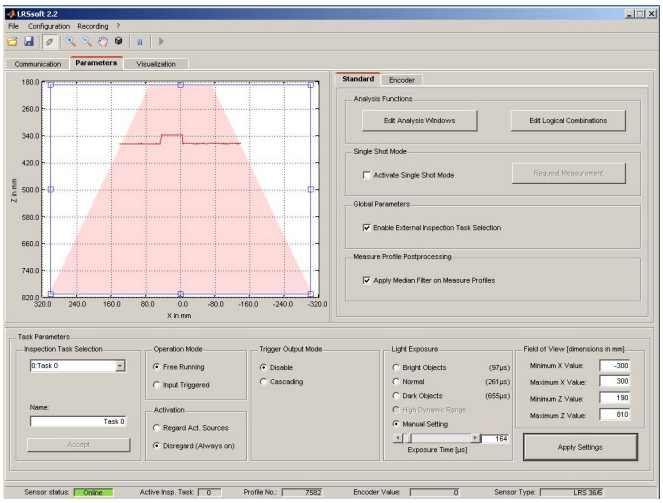


Figure 9.3: Parameter settings in LRSsoft

First go to the Task Parameters panel and set the values required for operating the LRS 36. Then go to the Analysis Functions panel and define analysis windows and their logic combination for your inspection task. Finally, save these settings as an Inspection Task by clicking on Apply Settings or Transmit to Sensor.

9.4.1 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 LRSsoft. In this field, the *selection* of the inspection task with LRSsoft 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 LRSsoft and before transmitting the settings to the sensor ('Transmit to Sensor'), the Enable External Inspection Task 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 common procedure for creating and storing inspection tasks is described in Chapter 9.7, "Definition of inspection tasks" on page 64.

Operation Mode

In Operation Mode you can configure using Free Running that the LRS 36 continuously detects and outputs measurement data (factory setting). With Input Triggered the LRS 36 captures measurement data only if a rising edge is present at the trigger input or if one of the "Ethernet Trigger" (Chapter 10.3.4) or PROFIBUS Trigger (Chapter 11.5) commands 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 detection range of the LRS 36. The same happens if you click on the square handles of the detection range framed in blue with the mouse and then pull.

Factory settings for `Field of View`:

	LRS 36...
Min **X**	-300
Max. **X**	300
Min. **Y**	190
Max. **Y**	810

↳ 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.

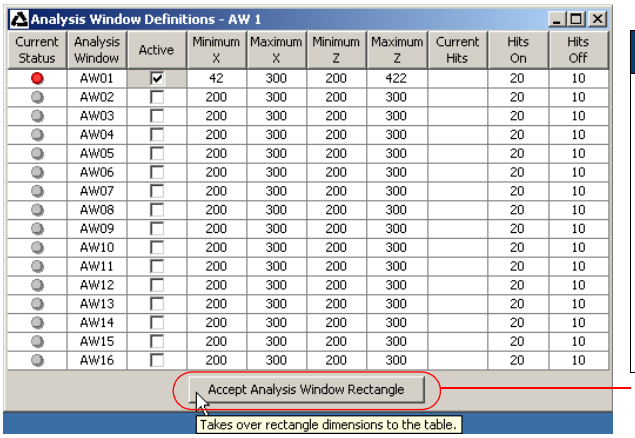
NOTE

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

9.4.2 Analysis Functions area

Edit Logical Combinations

Click on the Edit Logical Combinations button and the following window appears:



NOTE

After changing the detection range by dragging the black frame with the mouse, **click** the **button Accept Analysis Window Rectangle** so that the new values are accepted.
If you click somewhere else in the `Analysis Window Definitions` window, the values prior to changing the detection range by mouse are restored.

Figure 9.4: Window "Analysis Window Definitions"

When clicking on the check box Active in one of the 16 lines AW01 to AW16, a black frame with handles appears in the display of the detection range on the left:

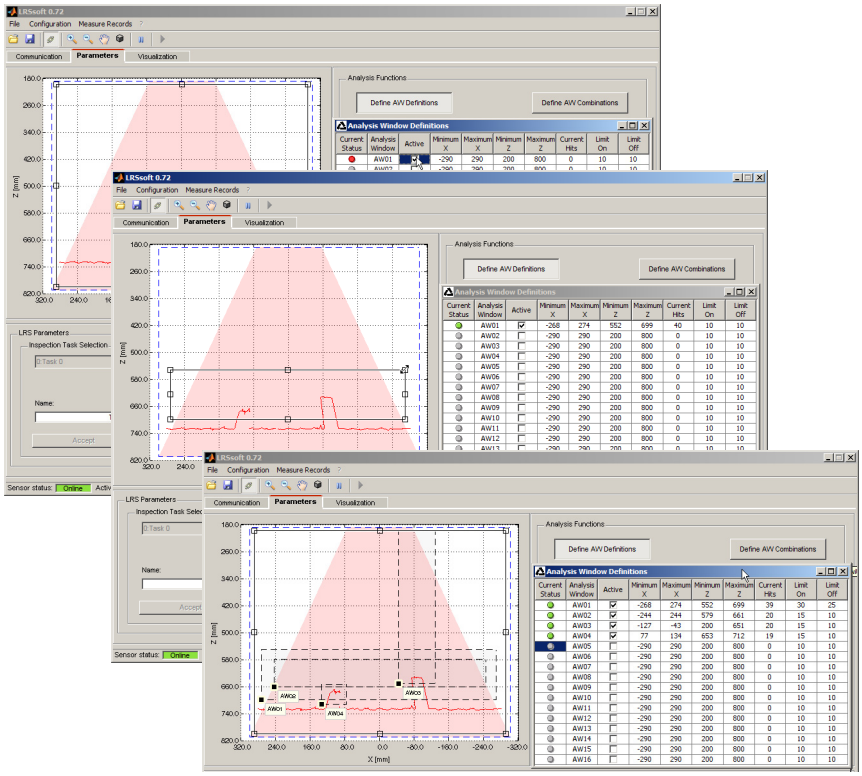


Figure 9.5: Definition of analysis windows (AW)

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 new values**.

Direct input

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

In the Current Hits column, LRSsoft displays the number of hit points that are detected in the analysis window.

NOTE
The current settings regarding detection range and analysis windows must first be transmitted to the sensor via Apply Settings. The column Current Hits then shows values.

In the Hits On column, you specify the number of hit points that must be detected for the evaluation result of the relevant AW to be "1", or for a green LED to be displayed in the column Current Status.

The LED remains green until the number of detected hit points is 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.

In Figure 9.5, a total of three analysis areas have been defined. The task is to detect objects of the same width but different heights, and the position of the objects in the detection range:

- AW01 detects that at least 2 objects of the specified width are present
- AW02 detects that at least 1 tall object is present
- AW03 detects that one tall object is present to the right
- AW04 detects that one low object is present to the left

By using a logic combination of the analysis results of these 4 AWs, you can configure the switching behavior of outputs `Out1` to `Out4` and the PROFIBUS process data in the `Analysis Window Combination Tables` panel.

Edit Logical Combinations

Click on the `Edit Logical Combinations` button and the following window appears:

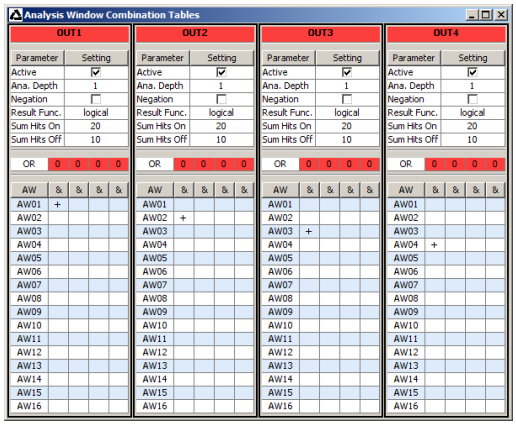


Figure 9.6: "Analysis Window Combination Tables" window

Parameter in the `Analysis Window Combination Tables` window:

Parameter	Description	Value range
Out1 - Out4	Switching output 1-4 or with PROFIBUS: state of the **uSensorInfo** sensor outputs (byte 2)	Green = active = 1 / Red = not active = 0
Active	Activation of the switching output	On/Off
Ana. Depth	Analysis depth[1], i.e. number of the successive evaluations with identical result that are required for the switching output to toggle	1 … 255
Negation	Negation of the result of the `OR` line	On/Off
Result Func.	Selection menu: "logical" = logic combination of the evaluation results (AND combination of columns 1 … 4 and subsequent OR combination of the results of the four AND combinations) "sum" = summation of the hit points of the AWs marked with "+" in the first `&` column with subsequent HitsOn/HitsOff evaluation (used with teach functions). AWs marked with "-" and the entries in columns 2 … 4 are not taken into account in the summation.	'logical' / 'sum'
HitsOn	Object size teach parameter (only with Result Func. = "sum"). If the sum of the hit points of all AWs marked with "+" is greater than or equal to the value of HitsOn, the output is activated.	1 … 376 (10/20/40 [2])
HitsOff	Object size teach parameter (only with Result Func. = "sum"). If the sum of the hit points of all AWs marked with "+" is less than or equal to the value of HitsOff, the output is deactivated.	0 … 375 (6/12/24 [2])
`OR` line	Results of the `&` columns. These results are OR-linked if "Result Func." = "logical" and then yield the state of the switching output according to the settings for `Active`, `Anal. Depth` and `Negation`	Green = 1 / Red = 0
`&` column	"Result Func." = "logical": Logical AND combination of the results of the selected AWs "Result Func." = "sum": The number of hit points of all AWs marked with "+" in the first `&` column are added up.	
AW01 - AW16	Specifies whether the result of the AW is considered in the `&` combination or summation ("+"), whether it is considered in its negated form ("-") or whether the window is not considered (" ")	'+'/'-'/' '

Table 9.1: Parameter settings for control of the switching outputs

1) Note on the analysis depth:
By selecting a large value for the analysis depth, the LRS 36 has a reliable switching behavior; the response time of the sensor increases accordingly (example: analysis depth = 3 -> 3 triggers necessary for evaluation). Interfering signals of individual scans are suppressed.
If an analysis depth of "1" (factory setting beginning with firmware version 01.25) is selected, evaluation occurs on every trigger.

2) Presetting for the "Sensitivity" teach parameter.

Evaluation for "Result Func." = "logical"

In the window of Figure 9.7, you specify logic combinations of the evaluation results of individual AWs:

↳ For each output (Out1 to Out4), you first determine in the first `&` column which AWs you want to combine via AND. The result of this combination is displayed the line `OR` above the respective column as `1` or `0`. Where applicable, define further AND combinations in the remaining `&` columns.

You may thus define up to four different AND combinations of individual outputs in the 4 columns per output.

The results of these four columns are automatically combined via OR.

The output thus toggles when one of the four AND combinations results in a 1.

Example:

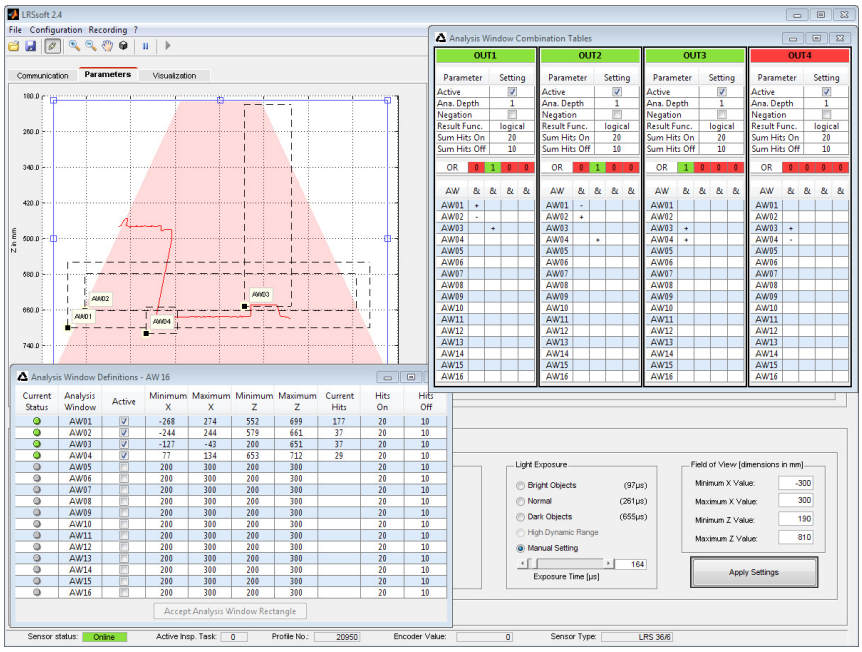


Figure 9.7: Definition of logic combinations of several AWs

In the example above, the AW definitions of Figure 9.5 apply.

This means that, with the setting for the switching outputs shown:

- **OUT1** is active (=1)
  - if an object is present in AW01 (AW01+) **AND** if no object is present in AW02 (AW02-)
    OR
  - if an object is present in AW03 (AW03+).
- **OUT2** is **not** active (=0, because the `Negation` tick is set)
  - if no object is present in AW01 (AW01-) **AND** if an object is present in AW02 (AW02+)
    OR
  - if an object is present in AW04 (AW04+).
- **OUT3** is active (=1)
  - if an object is present in AW03 (AW03+) **AND** if an object is present in AW04 (AW04+).
- **OUT4** is active (=1)
  - if an object is present in AW03 (AW03+) **AND** if no object is present in AW04 (AW04-).

As Figure 9.7 shows, logic combinations can thus be used to define various detection tasks.

The good/bad result of the logic column links is shown in color in line **OR**. In the example shown here, **column 2 is green** for **OUT1** because an object is present in AW03.

Because the columns of **OUT1** are linked with **OR**, **OUT1** is active and displayed in green.

The analysis depth **Ana. Depth** is set to **1**. This means that an evaluation is performed for the switching outputs on every trigger.

Evaluation if "Result Func." = "sum"

With the "Result Func." = "sum" setting, the logic combination of the evaluation results of individual AWs is deactivated. Instead, all hit points of the AWs that are marked with "+" **in the first & column** are added up.

NOTE
AWs marked with "-" or " " are **not** included in the summation. Likewise, & columns 2 … 4 are **not** taken into account in the summation.

Following summation, the sum of the hit points is evaluated using the `Sum Hits On` and `Sum Hits Off` parameters for controlling the switching outputs:

- Sum of hit points greater than or equal to `Sum Hits On` -> output is active (=1)
- Sum of hit points less than or equal to `Sum Hits Off` -> output is inactive (=0)

With the entries in `Sum Hits On` and `Sum Hits Off`, you can thus simultaneously set a switching hysteresis to prevent any (undesired) change of the switching state.

This type of evaluation is used with the "Background Suppression" teach function (see ""Background Suppression" teach (Area Scan Advanced)" on page 23).

9.4.3 Single Shot Mode area

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 **LRSsoft** until `Request Measurement` is clicked again.

9.4.4 Global Parameters area

Under `Global Parameters`, you can use `Enable External Task Selection` to configure whether or not the inspection tasks 0-7 can be selected via the inputs InSel1-InSel3 or PROFIBUS.

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 the inputs or PROFIBUS. In this case, the drop-down menu under `Inspection Task Selection` has no function.

9.5 Detection function/Visualization tab

↳ Click the `Visualization` tab to display the chronological trend of the states of AWs and switching outputs or of the states of the *uSensorInfo* sensor outputs (byte 2) for the PROFIBUS device:

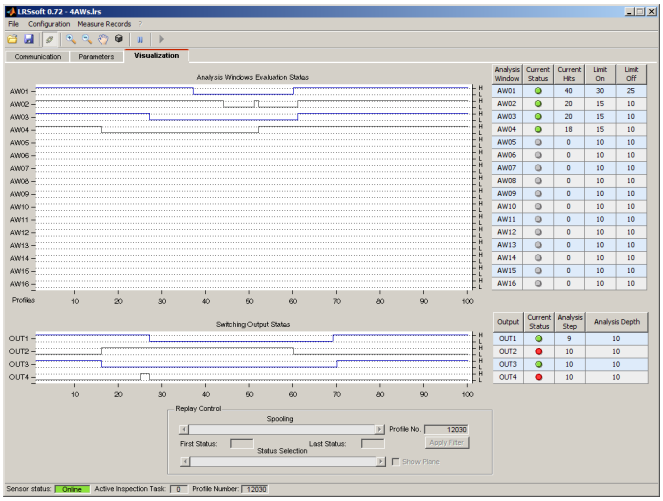


Figure 9.8: LRSsoft Visualization

9.5.1 Evaluating saved detection data

To evaluate a detection data set, you can record, store and reopen detection data as described in Chapter 9.6.3. A stored detection data set can be opened with LRSsoft via the `Recording -> Archive -> Open Record` menu.

NOTE
After opening a detection data set, the current parameter setting of the LRS should be transmitted (see Chapter 9.6.2) so that the current sensor configuration is displayed on `Hits On` and `Hits Off`.

In default mode, the detection data in the `Visualization` tab run through continuously. To stop this continuous display and to be able to examine individual data sets you must click on the arrow on the toolbar.

The sliders in the `Replay Control` area serve to evaluate them.

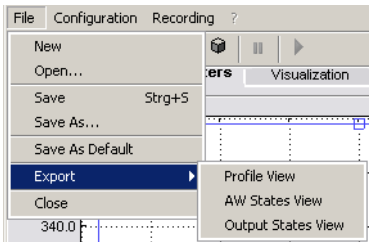
`Spooling` permits the fast shifting of the displayed section of 100 individual results across all data of the detection data set (which can easily contain several hundred individual results).

Here, the value in `First Status` shows the number of the measurement that is displayed at `0` and the value in `Last Status` the number of the measurement displayed at `100`.

Use the Status Selection slider to specify which of the individual data sets displayed in the right window area is shown in the individual results of the AWs and switching outputs or the states of the uSensorInfo sensor outputs (byte 2) for the PROFIBUS device. The associated data set number is displayed under Profile No. The Show Plane option marks this individual data set with a solid black line.

9.6 Menu commands

9.6.1 Saving parameter settings/File menu



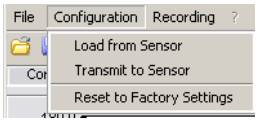
The File menu is used to save parameter data to the PC. In this way, settings for various detection tasks can be defined within the scope of commissioning and stored on data carriers and parameter files. During operation, the LRS 36 is reconfigured via **Inspection Tasks**. A parameter file stored on a data carrier can only be used with LRSsoft 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 LRSsoft 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
- AW States View: chronological trend of the state of all 16 AWs
- Output States View: chronological trend of the states of the 4 switching outputs or of the states of the uSensorInfo sensor outputs (byte 2) for the PROFIBUS device

9.6.2 Transmitting parameter settings/Configuration menu

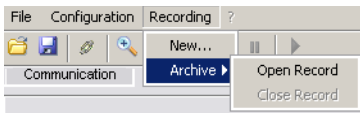


The Configuration menu is used to exchange parameter data with the connected LRS 36.

- Load from Sensor loads all parameter settings for all defined inspection tasks from the LRS 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 LRS 36.
- Reset to factory settings resets the LRS 36 to factory settings.

9.6.3 Managing detection data/Measure Records menu

Detection data are defined here as the results of individual analysis windows and the states of the switching outputs.

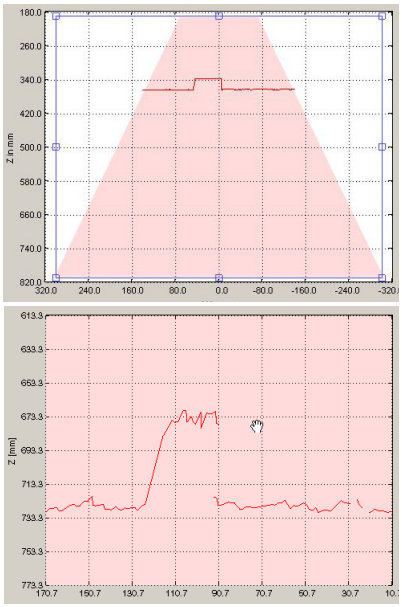


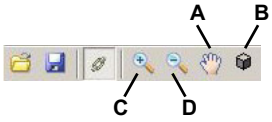
The Recording menu is used for managing detection data in *.csv format on the PC.

- New... creates a new detection data set. Following a file name query dialog, another dialog appears. It requires you to enter how many single scans (2D profiles) are to be saved in the file.
- Archive -> Open Record opens a saved detection data set.
- Archive -> Close record closes the opened detection data set.

9.6.4 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.

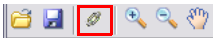
Figure 9.9: Zoom function

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.

9.7 Definition of inspection tasks

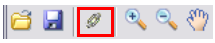
Typical procedure

1. Start **LRSsoft** and connect the sensor:
   Click on the Connect to sensor button: 
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. 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.
   - Within an AW, the pixels of the current 2D profile are determined by the LRS 36 (Current Hits).
   - For each AW, the user then configures an upper and a lower limit for the hits (Hits On/Off) and thus a switching hysteresis.
   - The result is an ok or not ok status, signaled via a green or red status display.

NOTE
The number of Current Hits does not necessarily correspond with the object size, since the number of hits 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 hits as it does at a far distance (e.g, 600mm). If the object distance is the same, the number of hits remains nearly constant.

7. Generate switching information for the outputs Out1 to Out 4 or PROFIBUS process data in the Analysis Window Combination Tables window (button Edit Logical Combinations):
   - Columnar AND combination of the results (inverted, if applicable) of individual AWs
   - OR combination in line **OR** of up to four AND results

- If applicable, inversion of the result of the OR combination
  (tick in `Negation`)
- Input for the evaluation depth

8. Assign a name (`Name`) to the inspection task and confirm with `Accept`.
9. Temporarily transfer the inspection task with `Apply Settings`.
10. Where applicable: define further inspection tasks with steps 5.-9.
11. Tick `Enable Selection Inputs` again.
12. Permanently transfer the configuration including all inspection tasks to the sensor with `Transmit to Sensor`.
13. Where applicable: save the configuration to data carrier with `Save As…`
14. Finally, disconnect the connection to the sensor:
    click on the button `Disconnect from sensor`: 

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

10.1 General information

The LRS 36 communicates with the process control via UDP/IP using the protocol described in Chapter 10.2. The protocol operates in two different modes:

- Detection mode
- Command Mode

In detection mode, the LRS 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 LRS 36 reacts to commands from the control. The commands available are described in Chapter 10.3.

NOTE
If you use a firewall, please make certain that the control can communicate with the LRS 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 PROFIBUS device model LRS 36/PB in the process control via PROFIBUS is described in Chapter 11 "Integration of the LRS 36/PB in the PROFIBUS" on page 79.

10.2 Protocol structure: Ethernet

NOTE
The sequence in which the individual bytes are saved varies depending on the operating system. The commands in Chapter 10.3 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 LRS 36 does not respond to commands from the control even though communication with LRSsoft 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 LRS 36. In the transaction number of the answer from LRS 36 there is then also `0x4E43` (byte sequence 0x43, 0x4E). The LRS 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 … 53 data words @ 2 bytes). The protocol is used both in command mode when transmitting commands and when acknowledging sensor commands as well as in detection 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	Number of user data words
0xFFFF	0xFFFF	0x0000	0x0059	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0010	0x0003
Length 4 bytes, fixed value: 0xFFFF 0xFFFF		Length 2 bytes, fixed value: 0x0000	Length 2 bytes, possible values: see Chapter 10.3	Length 2 bytes, fixed value: 0x0000	Length 2 bytes, value range: 0x0000 … 0xFFFF	Length 2 bytes, fixed value: 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, fixed value: 0x0000	Length 2 bytes, value range: 0x0000 … 0xFFFF	Length 2 bytes, fixed value: 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 LRS 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 10.3).

In **detection 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 **detection mode** 0x0000 is 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							LSB	MSB							LSB	Meaning of the bits
High byte								Low byte								
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0**	Sensor not connected via Ethernet
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**	Sensor connected via Ethernet
-	-	-	-	-	-	-	-	**0**	**0**	**0**	**1**	-	-	-	-	Detection 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 LRSsoft.

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.

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.

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 via 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 53 data words (0, 2, 4, 6 or 106 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 LRS 36, the evaluation telegram is transmitted with command number 0x5354. After the header are 53 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 16	AW 15	AW 14	AW 13	AW 12	AW 11	AW 10	AW 9	AW 8	AW 7	AW 6	AW 5	AW 4	AW 3	AW 2	AW 1	Results of the individual analysis windows
35…36	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 1
37…38	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 2
39…40	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 3
41…42	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 4
43…44	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 5
45…46	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 6
47…48	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 7
49…50	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 8
51…52	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 9
53…54	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 10
55…56	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 11
57…58	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 12

Byte	MSB							High byte LSB	MSB							Low byte LSB	Meaning of the bits
59…60	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 13
61…62	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 14
63…64	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 15
65…66	-	-	-	-	-	-	-	A9	A8	A7	A6	A5	A4	A3	A2	A1	Current number of hit points (Current Hits) in analysis window 16
67…68	O4 C4	O4 C3	O4 C2	O4 C1	O3 C4	O3 C3	O3 C2	O3 C1	O2 C4	O2 C3	O2 C2	O2 C1	O1 C4	O1 C3	O1 C2	O1 C1	Column results of the AND operation for the outputs. See "Analysis Functions area" on page 57. Example: O1/C3 = Output 1, Column 3
69…70	-	-	-	-	-	-	-	-	-	-	-	-	O4	O3	O2	O1	Switching state of the outputs Out1 - Out4. See "Analysis Functions area" on page 57.
71…72	-	-	-	-	-	-	-	-	T8	T7	T6	T5	T4	T3	T2	T1	Current counter state for the analysis depth of Output 1
73…74	-	-	-	-	-	-	-	-	T8	T7	T6	T5	T4	T3	T2	T1	Current counter state for the analysis depth of Output 2
75…76	-	-	-	-	-	-	-	-	T8	T7	T6	T5	T4	T3	T2	T1	Current counter state for the analysis depth of Output 3
77…78	-	-	-	-	-	-	-	-	T8	T7	T6	T5	T4	T3	T2	T1	Current counter state for the analysis depth of Output 4
79…80	-	-	-	-	-	-	-	-	-	-	-	-	-	I3	I2	I1	State of the three inputs for the selection of the inspection task
81…136	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	The remaining user data are used for internal maintenance purposes of the manufacturer.

10.3 Ethernet commands

ATTENTION!

The scope of the available commands has grown from firmware version to firmware version. You can find a **revision history / feature list** in the appendix in Chapter 17.2.
The commands described in the following refer to the **current** firmware version of the LRS 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 LRS 36 corresponds to the "little-endian" byte sequence. The response of the LRS 36 also corresponds to the "little-endian" standard. For further information, see the note in Chapter 10.2.

In detection mode, however, only `Connect to Sensor`, `Disconnect from Sensor`, `Enter Command Mode` and `Ethernet Trigger` can be processed (is acknowledged with 'Ack'=0x4141). 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

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 LRS 36 is carried out via the ports previously configured in LRSsoft.

Command from control to LRS 36		Answer from LRS 36 to control	
Command no.	Meaning	**Command no.**	Meaning
0x434E	**Connect to 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, detailed info see chapter 10.2.4 "Status").
0x4443	**Disconnect from Sensor**	0x4141	Connection terminated.
		0x414E	The transmitted command was not processed (possible sensor status: sensor was already disconnected or in menu mode, detailed info see chapter 10.2.4 "Status").

After switching on the sensor and establishing a connection, the sensor is initially in detection mode and continuously transmits evaluation data (Free Running) or waits for a trigger signal for transmitting evaluation data.

To switch between detection mode and command mode the `Enter Command Mode` and `Exit Command Mode` commands are available.

Command from control to LRS 36		Answer from LRS 36 to control	
Command no.	Meaning	**Command no.**	Meaning
0x3132	**Enter 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*	0x4141	Sensor back to detection mode
		0x414E	The transmitted command was not processed because the sensor was not in command mode.

1) Detailed info 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 ended with the `Exit` menu item.

10.3.2 Commands in command mode

NOTE

Command syntax (header/user data), see Chapter 10.2

The following commands are available in command mode:

Command from control to LRS 36			Answer from LRS 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 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** *Get number of the current inspection task*	0	0x004A	In the user data area the task number is transferred. (0 = Task0, up to 15 = Task15)	1

Command from control to LRS 36			Answer from LRS 36 to control		
Command no.	Meaning	Number of user data words	**Command no.**	Meaning	Number of user data words
0x0053	**Set Scan Number** *Set scan number,* *see* Chapter 10.3.3. Ensure identical scan numbers with multiple sensors; for description, see "Set Scan Number" on page 72	1	0x4141	Scan number set	0
			0x414E	The transmitted command was not processed.	0
0x006D	**Set Single Inspection Task parameter** *Writes individual inspection task parameters temporarily or permanently in the sensor.*	3…14	0x4141	Parameter was set	0
			0x414E	The transmitted command was not processed.	0
0x006F	**Get Single Inspection Task parameter** *Reads individual inspection task parameters.*	1	0x0070	Parameter is output	9…20
			0x414E	The transmitted command was not processed.	0
0x0071	**Execute Area Scan Basic Teach** Execute "Area Scan" teach (Area Scan Basic), *see Chapter 4.3.6.* The teach parameters are transferred in the user data.	2	0x0072	In the user data area, the error number is output and the calculated mean value of the found level is output in 1/10mm.	2
0x0073	**Execute Track Scan Teach** Execute "Multiple Track Completeness Monitoring" teach (Track Scan), *see Chapter 4.3.6.* The teach parameters are transferred in the user data.	3	0x0074	In the user data area, the error number is output and the calculated distance value of the top side of the objects is output in 1/10mm.	2
0x0075	**Execute Area Scan Advanced Teach** Execute "Background Suppression" teach (Area Scan Advanced), *see Chapter 4.3.6.* The teach parameters are transferred in the user data.	2	0x0076	In the user data area, the error number is output and the largest ascertained distance value of the background is output in 1/10mm.	2

1) 0x4141 = Acknowledge: Execution of the command is confirmed
2) 0x414E = Not Acknowledge or Error: Command has not been executed

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 configured (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 LRS 36.

Get Actual Inspection Task

The LRS 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 configured 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 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 LRS 36.

Parameter ID	Parameter meaning	Valid parameter values	Parameter data type	Number of 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	Parameter data type	Number of parameter values
0x0BBE	Manual adjustment of the exposure duration	Permissible value range LRS 36/6, LRS 36/6.10, LRS 36/PB: 973…13109 (exposure time unit in 1/10µs). 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 LRS 36/6, LRS 36/6.10, LRS 36/PB: -3000…3000 (unit in 1/10mm)	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 (unit in mm), permissible value range LRS 36/6, LRS 36/6.10, LRS 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 LRS 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

Execute Area Scan Basic Teach

The "Area Scan" teach (Area Scan Basic) is executed with sensor control command 0x0071, see Chapter 4.3.6.

With sensor control command 0x0071, 2 user data words are passed to the sensor:

Byte	MSB				High byte			LSB	MSB				Low byte			LSB	Meaning of the bits
31…32																	**Safety distance** parameter (Offset) in mm, Value range: 1 … 599
33…34																	**Object size** parameter (Sensitivity): 1 = fine 2 = medium 3 = coarse

Sensor response:

The sensor responds with 0x0072 and returns 2 user data words.

Byte	MSB				High byte			LSB	MSB				Low byte			LSB	Meaning of the bits
31…32																	Error no.
33…34																	Calculated mean value of the found level in 1/10mm

Error no.:

Error no.	Meaning
0x0000	No error
0x0001	It could not be triggered
0x0002	Limits of the calculated AWs are not in the detection area
0x0003	Hit points are contained in the calculated AW
0x0004	Error when saving the newly calculated parameter values
0x0005	The processor did not respond to commands
0x0006	No valid Z profile data
0x0007	No maximum found with at least 5 points (uneven objects or objects not in detection area)

Execute Track Scan Teach

The "Multiple Track Completeness Monitoring" teach (Track Scan) is executed with sensor control command 0x0073, see Chapter 4.3.6.

With sensor control command 0x0073, 3 user data words are passed to the sensor:

Byte	MSB				High byte			LSB	MSB				Low byte			LSB	Meaning of the bits
31…32																	**Safety distance** parameter (Offset) in mm, Value range: 1 … 599
33…34																	**Object size** parameter (Sensitivity) 1 = fine 2 = medium 3 = coarse
35…36																	**Number of objects** parameter (Num. of Objects) Value range: 1 … 9

Sensor response:

The sensor responds with 0x0074 and returns 2 user data words.

Byte	MSB			High byte			LSB		MSB			Low byte			LSB		Meaning of the bits
31…32																	Error no.
33…34																	Calculated distance value of the top side of the objects in 1/10mm

Error no.:

Error no.	Meaning
0x0000	No error
0x0001	It could not be triggered
0x0002	Limits of the calculated AWs are not in the detection area
0x0003	Hit points are contained in the calculated AW
0x0004	Error when saving the newly calculated parameter values
0x0005	The processor did not respond to commands
0x0006	No valid Z profile data
0x0007	No maximum found with at least 5 points (uneven objects or objects not in detection area)

Execute Area Scan Advanced Teach

The "Background Suppression" teach (Area Scan Advanced) is executed with sensor control command 0x0075, see Chapter 4.3.6.

With sensor control command 0x0075, 2 user data words are passed to the sensor:

Byte	MSB			High byte			LSB		MSB			Low byte			LSB		Meaning of the bits
31…32																	**Safety distance** parameter (Offset) in mm, Value range: 1 … 599
33…34																	**Object size** parameter (Sensitivity) 1 = fine 2 = medium 3 = coarse

Sensor response:

The sensor responds with 0x0076 and returns 2 user data words.

Byte	MSB			High byte			LSB		MSB			Low byte			LSB		Meaning of the bits
31…32																	Error no.
33…34																	Largest ascertained distance value of the background in 1/10mm

Error no.:

Error no.	Meaning
0x0000	No error
0x0001	It could not be triggered
0x0002	Limits of the calculated AWs are not in the detection area
0x0003	Hit points are contained in the calculated AW
0x0004	Error when saving the newly calculated parameter values
0x0005	The processor did not respond to commands
0x0006	No valid Z profile data
0x0007	No maximum found with at least 5 points (uneven objects or objects not in detection area)

10.3.4 Commands in detection mode

NOTE
Command syntax (header/user data), see Chapter 10.2

The following commands are available in detection mode:

Command from control to LRS 36			**Answer from** LRS 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 detection mode, similar to triggering via the trigger input.* *Prerequisite is that the LRS 36 be configured with LRSsoft 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 switching information), see Chapter 10.2.9	1 packet @ 53
			0x414E	The transmitted command was not processed.	0
0x4541	**Ethernet Activation** The Ethernet Activation command is used to switch the *detection mode* on and off corresponding to the user data word. Prerequisite is that the LRS be configured with **LRSsoft** 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 switching information), see Chapter 10.2.9. In the deactivated state, there is no response to the command.	1 packet @ 53
			0x414E	The transmitted command was not processed.	0

10.3.5 Explanation of user data in detection 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 off detection mode,
EA=1 switches on detection mode.

10.4 Working with the protocol (Ethernet)

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 LRS 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

LRS 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` (LRS 36 in command mode, activate Task 15 and do not store in volatile memory)

PC to LRS 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

LRS 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

You can download the library from our website www.leuze.com.

In the search field of the website, enter your device type and go to the download area for the device. Here you will find the zip file "Example project DLL C#". This file contains the library "LxS_Lib.dll".

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.

Access

You can download the library from our website www.leuze.com.

In the search field of the website, enter your device type and go to the download area for the device. Here you will find the zip file "Example project Native DLL C++".

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 LRS 36/PB in the PROFIBUS

11.1 General information

The LRS 36/PB is 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 LRS 36/PB supports automatic detection of the baud rate

Characteristics of LRS 36/PB

- Ethernet and PROFIBUS can be used simultaneously in detection 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 LRSsoft and PROFIBUS, the PROFIBUS is active. Queries from the control are processed with a delay; the process data are 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 LRSsoft configuration software.

Compared to device model LRS 36/6 with switching outputs, the PROFIBUS model has the following additional functions:

- Output of the status of 16 analysis windows
- Output of hits (current hits) in up to 16 analysis windows
- Result of logic combinations
- Transmission of scan number and sensor status
- Selection of up to 16 inspection tasks
- Activation and trigger via PROFIBUS

The restriction on the selection of maximum 8 inspection tasks via the switching inputs for the LRS 36/6 does not exist for the LRS 36/PB. Up to 16 different inspection tasks can be activated by the control

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 LRS 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 LRSsoft.

Address assignment with LRSsoft

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

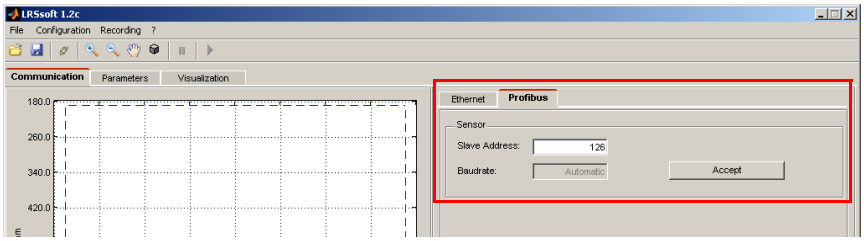


Figure 11.1: PROFIBUS address assignment with LRSsoft

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 42. The set address can also be queried by the user with no additional tools.

	NOTE
	After changing the PROFIBUS slave address via LRSsoft 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 LRS 36 is operated in a PROFIBUS network, configuration can be performed exclusively via the LRSsoft 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 settings set by Leuze 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 or M2**.

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

	⚠ WARNING!
	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 LRS 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**: **Inputs (I) described are inputs of the control.** **Outputs (O) described are outputs of the control.** **Parameters (P) described are parameters of the GSD file in the control.**

	NOTE
	The current version of the GSD file **LEUZE401.GSD** for the LRS 36/PB can be found on the Leuze website **www.leuze.com**.

11.4 Overview of the GSD modules

The LRS 36/PB has one module slot. Select the corresponding module from the GSD to set the process data of the LRS 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 detection rate of 100 Hz can only be ensured up to module **M3**.

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**:
Inputs (I) described are inputs of the control.
Outputs (O) described are outputs of the control.
Parameters (P) described are parameters of the GSD file 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 4 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	Out4	Out3	Out2	Out1	IT_b3	IT_b2	IT_b1	IT_b0	0 … 255	Sensor info (Insp. Task No., outputs)
	3	uSensorState	ErrM	Cmd	Menu	Meas	ErrF	WarnF	active	connect	0 … 255	Sensor state
M2 6 byte	4	wResultAWs (HighByte)	AW16	AW15	AW14	AW13	AW12	AW11	AW10	AW9	0 … 255	State of AWs (Highbyte)
	5	wResultAWs (LowByte)	AW8	AW7	AW6	AW5	AW4	AW3	AW2	AW1	0 … 255	State of AWs (Lowbyte)

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		
M3 16 byte	6	wActObjPtsAW1 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 1
	7	wActObjPtsAW1 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
	8	wActObjPtsAW2 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 2
	9	wActObjPtsAW2 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
	10	wActObjPtsAW3 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 3
	11	wActObjPtsAW3 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
	12	wActObjPtsAW4 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 4
	13	wActObjPtsAW4 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
	14	wActObjPtsAW5 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 5
	15	wActObjPtsAW5 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
M4 24 bytes	16	wActObjPtsAW6 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 6
	17	wActObjPtsAW6 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
	18	wActObjPtsAW7 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 7
	19	wActObjPtsAW7 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
	20	wActObjPtsAW8 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 8
	21	wActObjPtsAW8 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
	22	wActObjPtsAW9 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 9
	23	wActObjPtsAW9 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	

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		
M5 38 bytes	24	wActObjPtsAW10 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 10
	25	wActObjPtsAW10 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
	26	wActObjPtsAW11 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 11
	27	wActObjPtsAW11 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
	28	wActObjPtsAW12 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 12
	29	wActObjPtsAW12 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
	30	wActObjPtsAW13 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 13
	31	wActObjPtsAW13 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
	32	wActObjPtsAW14 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 14
	33	wActObjPtsAW14 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
	34	wActObjPtsAW15 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 15
	35	wActObjPtsAW15 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	
	36	wActObjPtsAW16 (HighByte)	-	-	-	-	-	-	-	OP_b8	0 … 1	Current number of hit points (Current Hits) in analysis window 16
	37	wActObjPtsAW16 (LowByte)	OP_b7	OP_b6	OP_b5	OP_b4	OP_b3	OP_b2	OP_b1	OP_b0	0 … 255	

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 LRS 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 LRSsoft, 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.

⚠ WARNING!
While configuring the LRS 36 with LRSsoft 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 detection 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 states of the internal (virtual) switching outputs of the sensor **Out4** … **Out1** in the high-nibble (bit 7 … 4) and the inspection task set in the sensor **IT_b3** … **IT_b0** in the low-nibble (bit 3 … 0).

Bit	Designation	Meaning
7	**Out4**	State of the (virtual) switching output **4**: 0 = not active, 1 = active
6	**Out3**	State of the (virtual) switching output **3**: 0 = not active, 1 = active
5	**Out2**	State of the (virtual) switching output **2**: 0 = not active, 1 = active
4	**Out1**	State of the (virtual) switching output **1**: 0 = not active, 1 = active
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**	Detection mode: the sensor is in detection mode. This is the normal operating state in which the maximum detection rate is attained.
3	**ErrF**	Error, permanent sensor malfunction.
2	**WarnF**	Warning, temporary sensor malfunction.
1	**Active**	Sensor activated.
0	**connect**	Sensor connected via Ethernet.

Table 11.4: Input data byte **uSensorState**

11.6.2 Module M2

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

NOTE

Module ***M2*** contains the input data from module ***M1***. Only the additional input data are described in this section.

Evaluation results of the analysis window

The binary evaluation results of the 16 analysis windows (**A**nalysis **W**indows) **AW1** … **AW16** (see chapter 9.4.2 "Analysis Functions area") are provided as PROFIBUS master input. This is a 16-bit value (bytes **wResultAWs** HighByte and **wResultAWs** LowByte).

Byte	Bit	Designation	Meaning
wResultAWs (high byte)	7	**AW16**	Evaluation result on analysis window 16: 1 = On; 0 = Off
	6	**AW15**	Evaluation result on analysis window 15: 1 = On; 0 = Off
	5	**AW14**	Evaluation result on analysis window 14: 1 = On; 0 = Off
	4	**AW13**	Evaluation result on analysis window 13: 1 = On; 0 = Off
	3	**AW12**	Evaluation result on analysis window 12: 1 = On; 0 = Off
	2	**AW11**	Evaluation result on analysis window 11: 1 = On; 0 = Off
	1	**AW10**	Evaluation result on analysis window 10: 1 = On; 0 = Off
	0	**AW9**	Evaluation result on analysis window 9: 1 = On; 0 = Off
wResultAWs (low byte)	7	**AW8**	Evaluation result on analysis window 8: 1 = On; 0 = Off
	6	**AW7**	Evaluation result on analysis window 7: 1 = On; 0 = Off
	5	**AW6**	Evaluation result on analysis window 6: 1 = On; 0 = Off
	4	**AW5**	Evaluation result on analysis window 5: 1 = On; 0 = Off
	3	**AW4**	Evaluation result on analysis window 4: 1 = On; 0 = Off
	2	**AW3**	Evaluation result on analysis window 3: 1 = On; 0 = Off
	1	**AW2**	Evaluation result on analysis window 2: 1 = On; 0 = Off
	0	**AW1**	Evaluation result on analysis window 1: 1 = On; 0 = Off

Table 11.5: input data byte **wResultAWs** (high and low byte)

The PLC thereby obtains direct access to the evaluation results of all AWs and can include these in logic combinations of its own.

NOTE

The restriction for the logic combinations in the LRS 36/6 to 4 switching outputs can thereby be circumvented and the control can define further switching outputs itself via logic combinations of its own.

11.6.3 Module M3

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

NOTE

Module ***M3*** contains the input data from module ***M2***. Only the additional input data are described in this section.

Number of hit points (Current Hits) in analysis window 1

This 16-bit value (bytes **wActObjPtsAW1**, HighByte and LowByte) specifies the number of detected object points (Current Hits) in analysis window 1 (AW1). The PLC can thereby make its own evaluation within the analysis window without taking into account the input and output thresholds (HitsOn/HitsOff) configured in the sensor (see chapter 9.4.2 "Analysis Functions area").

Number of hit points (Current Hits) in analysis window 2

: : : : : :

Number of hit points (Current Hits) in analysis window 5

See description under "Number of hit points (Current Hits) in analysis window 1".

	NOTE
	By evaluating the number of hit points (Current Hits) in an analysis window, a qualitative determination of the object size/expansion in the X direction at a constant distance can be realized.

11.6.4 Module M4

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

	NOTE
	Module ***M4*** contains the input data from module ***M3***. Only the additional input data are described in this section.

Number of hit points (Current Hits) in analysis window 6

: : : : : :

Number of hit points (Current Hits) in analysis window 9

See description under **Number of hit points (Current Hits) in analysis window 1** in Chapter 11.6.3.

	NOTE
	By evaluating the number of hit points (Current Hits) in an analysis window, a qualitative determination of the object size/expansion in the X direction at a constant distance can be realized.

11.6.5 Module M5

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

	NOTE
	Module ***M5*** contains the input data from module ***M4***. Only the additional input data are described in this section.

Number of hit points (Current Hits) in analysis window 10

: : : : : :

Number of hit points (Current Hits) in analysis window 16

See description under **Number of hit points (Current Hits) in analysis window 1** in Chapter 11.6.3.

	NOTE
	By evaluating the number of hit points (Current Hits) in an analysis window, a qualitative determination of the object size/expansion in the X direction at a constant distance can be realized.

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 LRS 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 optical 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 LRSsoft. See "Commissioning" on page 46.
	Control not connected to sensor	Use "To sensor" command.
Object contours not detected	Occlusion	See "Occlusion" on page 12.
	Soiling of the optics covers	Clean lens covers, see "Cleaning" on page 87.
	Ambient light	Prevent ambient light, shield sensor, see "Selecting a mounting location" on page 30. Limit detection range with LPSsoft, see "Field of View" on page 57.
	Reflections	Avoid reflections. Limit detection range with LPSsoft, see "Field of View" on page 57.
	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 LRSsoft, reduce working distance/position of the sensor to the object. See "Task Parameters panel" on page 56.
	Detection range selected too small	Configure detection range with LRSsoft. See "Field of View" on page 57.
	Wrong inspection task selected	Change inspection task with LRSsoft or use Ethernet command "Set Actual Inspection Task". See "Set Actual Inspection Task" on page 71.
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 or via PROFIBUS. Switch off activation input. See "Activation" on page 56.
No laser line	Sensor not activated	Activate sensor via PIN 2 on X1 or via PROFIBUS.
	Laser was deactivated in command mode with the "Set Laser Gate" command	Switch on laser. See "Set Laser Gate" on page 71.
	Sensor in trigger mode	Activate single measurement by means of Ethernet trigger or via PIN 5 on X1 or via PROFIBUS.
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 LRSsoft to configure the activation input to "Regard". See "Activation" on page 56.

Table 13.1: General causes of errors

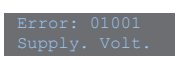
13.2 Interface error

Error	Possible error cause	Measures
No connection Yellow LED not illuminated	Wiring error	Check Ethernet cable.
No connection Yellow LED not illuminated	DHCP activated in network, no fixed or alternate network address assigned.	Assign alternate IP address, see "Establish connection to PC" on page 45.
	Incorrect IP address/subnet mask set on LRS 36.	Check IP address/subnet mask, IP addresses of LRS 36 and control must be different, subnet mask however must be the same, see Table 8.1 "Address allocation in the Ethernet" on page 45.
	Incorrect port assigned to LRS 36 / control	Using ping command check whether the sensor responds. If so, check port assignment to LRS 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. The error number is displayed in the event of a teaching error.



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.
Teach Error: 001 … 007	Error number 1 … 7, see Page 74 et seq.	Depending on the teach type (see "LRS teach algorithms" on page 21), establish correct conditions and repeat teach.

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
- File `LRSsoft.log` (located in the installation directory of **LRSsoft**)
- Parameter file `*.lrs`
- 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

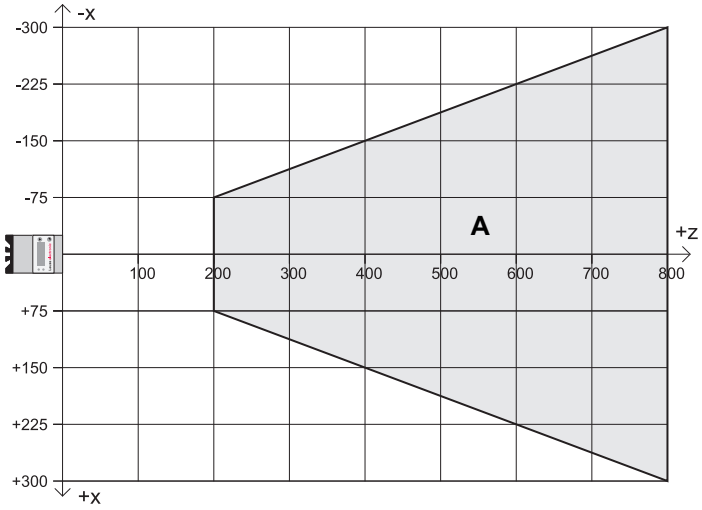
15 Technical data

15.1 General technical data

Optical data		
Detection range[1)]		200 … 800mm (z-direction)
Light source		Laser
Laser class		2M acc. to 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
Object detection		
Minimum object size in x direction [3)]		2 … 3mm
Minimum object size in z direction 2)		2 … 6mm
Time behavior		
Response time		³ 10ms (adjustable)
Readiness delay		Approx. 1.5s
Electrical data		
Operating voltage UB [4)]		18 … 30VDC (incl. residual ripple)
Residual ripple		£ 15% of UB
Open-circuit current		£ 200mA
Ethernet interface		UDP
Switching outputs		1 (ready) / 100mA / push-pull on X1 [5)]
		1 (cascading) / 100mA / push-pull on X1 4)
		4 / 100mA / push-pull on X3 4) [6)] (only LRS 36/6 and LRS 36/6.10)
Inputs		1 (trigger) on X1
		1 (activation) on X1
		3 (inspection task selection) on X3 [7)] (only LRS 36/6 and LRS 36/6.10)
Signal voltage high/low		³ (UB-2V)/£ 2V
PROFIBUS (only LRS 36/PB)		
Interface type		1x RS 485 on X4 (only LRS 36/PB)
Protocols		PROFIBUS DP/DPV1 slave
Baud rate		9.6kBaud … 6stMBaud
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		620g
Connection type		M12 connector
Environmental data		
Ambient temp. (operation/storage)		-30°C … +50°C/-30°C … +70°C
Protective circuit [8)]		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) Luminosity coefficient 6 % ... 90 %, entire detection range, at 20 °C after 30 minutes warmup time, medium range U_B
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 value, depends on measurement distance and object, requires testing under application conditions
4) For UL applications: use is permitted exclusively in Class 2 circuits according to NEC
5) The push-pull switching outputs must not be connected in parallel
6) Number of detection fields: up to 16 with logic operation option
7) Number of inspection tasks: up to 16 (8 of these can be activated via inputs)
8) 1=transient protection, 2=polarity reversal protection, 3=short circuit protection for all outputs, requires external protective circuit for inductive loads

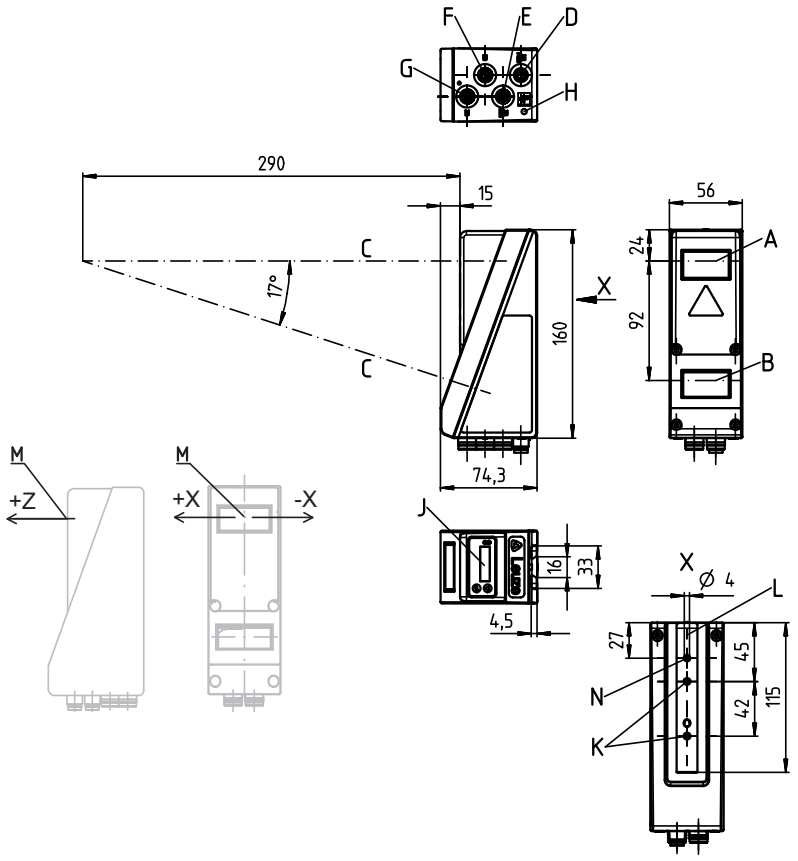
15.2 Typical detection range



A Detection range
X line length

Figure 15.1: Typical detection range LRS 36

15.3 Dimensioned drawing



A	Transmitter
B	Receiver
C	Optical axis
D	X1: M12x1 connector, 8-pin, A-coded
E	X2: M12x1 socket, 4-pin, D-coded
F	X3: M12x1 socket, 8-pin, A coded
G	X4: M12x1 socket, 5-pin, B coded
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 detection data
N	4mm bore hole in transmitter axis

Figure 15.2: LRS 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, measurement range 200 … 800mm, line length 600mm with Ethernet interface, incremental encoder connection	50111324
LPS 36	Line profile sensor for profile generation, measurement range 200 … 800mm, line length 600mm with Ethernet interface	50111325
LPS 36.10	Line profile sensor for profile generation, measurement range 200 … 800mm, line length 600mm with Ethernet interface, plastic screen	50138405
LPS 36 HI/EN	Line profile sensor for profile generation, measurement range 200 … 600mm, line length 140mm with Ethernet interface, incremental encoder connection	50111334
LPS 36 HI/EN.10	Line profile sensor for profile generation, measurement range 200 … 600mm, line length 140mm with Ethernet interface, incremental encoder connection, plastic screen	50137351

Table 16.1: LPS 36 type overview

16.1.2 LRS

Type designation	Description	Part no.
LRS 36/6	Line profile sensor for product detection (also multi-track), detection range 200 … 800mm, line length 600mm, Ethernet interface, 4 switching outputs for detection information, 3 switching inputs for selection of the inspection task	50111330
LRS 36/6.10	Line profile sensor for product detection (also multi-track), detection range 200 … 800mm, line length 600mm, Ethernet interface, 4 switching outputs for detection information, 3 switching inputs for selection of the inspection task, model with plastic screen	50115418
LRS 36/PB	Line profile sensor for product detection (also multi-track), detection range 200 … 800mm, line length 600mm, Ethernet interface, PROFIBUS DP	50111332
LRS 36/PB.10	Line profile sensor for product detection (also multi-track), detection range 200 … 800 mm, line length 600 mm, Ethernet interface, PROFIBUS DP, version with plastic screen	50143924

Table 16.2: LRS 36 type overview

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 … 800mm, line length 600mm, Ethernet interface, PROFIBUS DP	50111327
LES 36HI/PB	Line profile sensor for edge detection and object measurement (also multi-track), detection range 200 … 600mm, line length 140mm, Ethernet interface, PROFIBUS DP	50111331
LES 36/VC6	Line profile sensor for edge detection and object measurement (also multi-track), detection range 200 … 800mm, line length 600mm, Ethernet interface, analog current or voltage output, 4 switching outputs for detection information, 3 switching inputs for selection of the inspection task	50111333
LES 36HI/VC6	Line profile sensor for edge detection and object measurement (also multi-track), detection range 200 … 600mm, line length 140mm, Ethernet interface, analog current or voltage output, 4 switching outputs for detection information, 3 switching inputs for selection of the inspection task	50111329
LES 36HI/VC6.10	Line profile sensor for edge detection and object measurement (also multi-track), detection range 200 … 600mm, line length 140mm, Ethernet interface, analog current or voltage output, 4 switching outputs for detection information, 3 switching inputs for selection of the inspection task, plastic screen	50136678

Table 16.3: LES 36 type overview

16.2 Accessories

16.2.1 Mounting

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 LRS 36

16.2.2 Accessories – Ready-made cables for voltage supply X1

Contact assignment for X1 connection cable

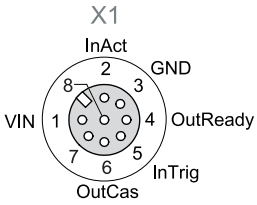
Connection cable X1 (8-pin socket, A-coded)			
 **M 12 socket (A-coded)**	**Pin**	**Name**	**Core color**
	1	VIN	wh
	2	InAct	br
	3	GND	gn
	4	OutReady	ye
	5	InTrig	gr
	6	OutCas	pi
	7	**Do not connect!**	bu
	8	**Do not connect!**	RD

Tabelle 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 LRS 36

16.2.3 Accessories for Ethernet interface X2

Ready-made cables with M12 connector/open cable end

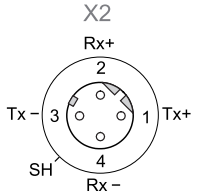
M12 Ethernet connection cables (4-pin plug, D-coded, open cable end)				
 **M 12 connector (D-coded)**	**Name**	**Pin (M12)**	**Core color**	
	Tx+	1	ye	
	Rx+	2	wh	
	Tx-	3	OR	
	Rx-	4	bu	
	SH	Shield (thread)	-	

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 plug/open cable end

Ready-made cables with M12 connector/RJ-45 connector

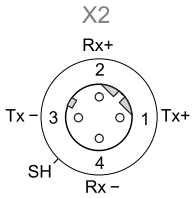
M12 Ethernet connection cables (4-pin plug, D-coded, M12 to RJ-45)				
 **M 12 connector (D-coded)**	**Name**	**Pin (M12)**	**Core color**	**Pin (RJ-45)**
	Tx+	1	ye	1
	Rx+	2	wh	3
	Tx-	3	OR	2
	Rx-	4	bu	6
	SH	Shield (thread)	-	

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

Type designation	Description	Part no.
M12 connector for X2 to RJ-45 plug		
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

Ready-made cables with M12 connector/M12 connector

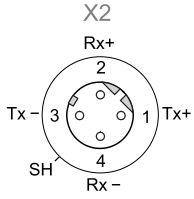
M12 Ethernet connection cables (4-pin plug, D-coded, on both sides)				
 **M 12 connector (D-coded)**	**Name**	**Pin (M12)**	**Core color**	**Pin (M12)**
	Tx+	1	ye	1
	Rx+	2	wh	2
	Tx-	3	OR	3
	Rx-	4	bu	4
	SH	Shield (thread)	-	Shield (thread)

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 featuring M12 plug/M12 plug

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

Table 16.12: Ethernet connection cables featuring M12 plug/M12 plug

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 LRS 36

16.2.4 Accessories ready-made cables for X3 (only LRS 36/6)

Contact assignment for X3 connection cables

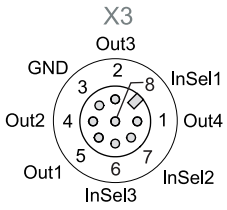
X3 (8-pin connector, A-coded)			
 **M 12 connector (A-coded)**	**Pin**	**Name**	**Core color**
	1	Out4	wh
	2	Out3	br
	3	GND	gn
	4	Out2	ye
	5	Out1	gr
	6	InSel3	pi
	7	InSel2	bu
	8	InSel1	RD

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 2 m	50135138
KS S-M12-8A-P1-050	Cable length 5 m	50135139
KS S-M12-8A-P1-100	Cable length 10 m	50135140
KS S-M12-8A-P1-150	Cable length 15 m	50135141
KS S-M12-8A-P1-300	Cable length 30 m	50135142

Table 16.15: X3 cables for the LRS 36/6

16.2.5 Connection accessories / ready-made cables for X4 (only LRS 36/PB)

Contact assignment for X4 connection cables

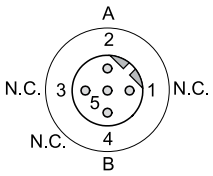
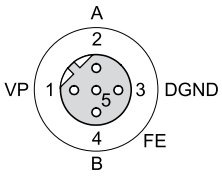
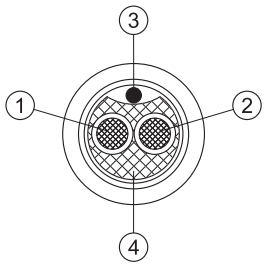
X4 (5-pin connector, B-coded)			
X4  **M 12 connector (B-coded)**	**Pin**	**Name**	**Comment**
	1	N.C.	–
	2	A	Receive/transmit data RxD/TxD-N, green
	3	N.C.	–
	4	B	Receive/transmit data RxD/TxD-P, red
	5	N.C.	–
X4  **M 12 socket (B-coded)**	Thread	FE	Functional earth (housing)

Table 16.16: Pin assignment X4



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

Figure 16.1: Cable structure for PROFIBUS connection cables

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 LRS 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 connector + M12 socket for PROFIBUS, axial connectors, cable length 2m	50135253
KDS PB-M12-4A-M12-4A-P3-050	M12 connector + M12 socket for PROFIBUS, axial connectors, cable length 5m	50135254
KDS PB-M12-4A-M12-4A-P3-100	M12 connector + M12 socket for PROFIBUS, axial connectors, cable length 10m	50135255
KDS PB-M12-4A-M12-4A-P3-150	M12 connector + M12 socket for PROFIBUS, axial connectors, cable length 15m	50135256
KDS PB-M12-4A-M12-4A-P3-300	M12 connector + M12 socket for PROFIBUS, axial connectors, cable length 30m	50135257

Table 16.18: PROFIBUS cables for LRS 36/PB

16.2.6 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.

16.2.7 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 16.19: 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

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 (AW)
Rectangular area of the LRS 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).

Analysis Window (Analysis Window = AW)
Rectangular area for which the number of object points in the AW is evaluated.
The result of the AWs is true (=1) when the number of hit points (Current Hits) is ≥ to the `Hits On`.
The result of the AWs is false (=0) when the number of hit points (Current Hits) is ≤ to the `Hits Off`.
If the number of hit points (Current Hits) is between `Hits On/OFF`, the result of the AWs remains unchanged.

Filter Depth (Analysis Depth)
The analysis depth determines the number of identical results after which the switching output information changes.
The analysis depth increases both the achievable response time and the switching reliability, e.g. the standard response time of 10 ms increases to 100 ms at an analysis depth of 10.
The analysis depth can be set for each output individually (differently)

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.

Display
Display/Control panel directly at the sensor.

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.

Inspection Task
Summary of all settings, which are required to solve an application. The LRS 36 permits working with up to 16 individual inspection tasks. Each task can contain up to 16 AWs that are independently configurable and may overlap arbitrarily. Each inspection task thus contains a complete sensor configuration: up to 16 AWs and their respective parameters, the assignment of the AW states to the switching outputs, and parameters such as operating mode, activation input, cascading, detection range (FoV) etc. (see chapter 9.4 "Parameter settings/Parameters tab").

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

Cascading	Triggered series connection of several sensors. A master sensor takes over the control (synchronization) of up to 9 slaves.
Combination table (AW combination table)	Combination table for the analysis windows Editing window in the LRSsoft configuration software, where the output is activated and inverted, the analysis depth is entered and, above all, the AW states are assigned to the binary switching outputs OUT 1 to Out 4. For each switching output, it is possible to combine several AW states to an intermediate result via an AND logic operation, and to combine 4 intermediate results via an additional OR operation.
Measurement time	Time between two individual measurements.
Object	Medium to be detected by sensor.
Object points (Hit Points)	Number of pixels of an object that are located in the analysis window (AW).
Offline	LRSsoft is operated without sensor
Online	LRSsoft 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.
2D view	Graphical presentation of the X/Z-coordinate values of an object within the detection range.
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)

Table 17.1: Revision History - Firmware

Firmware	Function range	Meaning	Required configuration software
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	PROFIBUS support	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)
Beginning 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 Ethernet command	
	New "Get/Set Single Inspection Task Parameter" commands	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	
Beginning with V01.41	Additional operator control possibility at the sensor	Inspection task selection via the control panel of the sensor	LxSsoft V2.30 (LPSsoft V2.20, LESsoft V2.30, LRSsoft V2.20)
	Supports LES 36/VC6, LES 36HI/VC6	Additional device types LES 36/VC6, LES36HI/VC6	
	Relative window positioning of LES		

Table 17.1: Revision History - Firmware

Firmware	Function range	Meaning	Required configuration software
Beginning with V01.50	Implementation of teach functions on the LRS 36	Three teach functions: "Area Scan" "Background Suppression" "Multiple Track Completeness Monitoring" Configuration and execution via menu and Ethernet.	LRSsoft V2.40
	Ethernet default gateway, destination port number	IP address for default gateway and destination port number can be set	
	New menu structure	More clearly arranged structure of the operating menu	
Beginning 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 in LRSsoft
LPSsoft V1.30, LRSsoft V1.10	Trigger operation is also supported while configuration software 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 direction 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 settings and LRS 36/PB
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 model	Configuration of LPS 36Hi/EN
LXSsoft V2.30 (LPSsoft V2.20, LESsoft V2.30, LRSsoft V2.20)	Import Inspection Task	Settings of individual inspection tasks can be imported from a saved LRS 36 project

Table 17.2: Revision History - Configuration software

Version	Function range	Meaning
LXSsoft V2.31 (LPSsoft V2.31, LESsoft V2.31, LRSsoft V2.31)	Documentation updated	
LRSsoft V2.40	Evaluation function for the summation of all hit points of selected AWs	The new teach functions required extensions for the logical evaluation of analysis windows.
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 V2.52 (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 by means of an update without needing to install a new software version (see Chapter 9.2.2)

Table 17.2: Revision History - Configuration software

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