Leuze

Translation of original operating instructions

LPS – Line Profile Sensor

Light section sensors

We reserve the right to make technical changes
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Figures and tables

1 General information

1.1 Explanation of symbols

The symbols used in this technical description are explained below.

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

⚠ ATTENTION LASER!
This symbol warns of possible danger caused by hazardous laser radiation. The light section sensors of the LPS 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 LPS 36 series are laser distance sensors to determine 2D profiles.

Areas of application

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

- 3D measurement of moving objects
- Manipulator control
- Measurement of free formed surfaces
- Case picking

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

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

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

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

2.2 Foreseeable misuse

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

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

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

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

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

2.3 Competent persons

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

Prerequisites for competent persons:

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

Certified electricians

Electrical work must be carried out by a certified electrician.

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

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

2.4 Exemption of liability

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

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

2.5 Laser safety notices

⚠ CAUTION LASER BEAM!

LASER RADIATION – CLASS 2M LASER PRODUCT

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

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

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

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

  There are no user-serviceable parts inside the device.

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

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

NOTE

Affix laser information and warning signs!

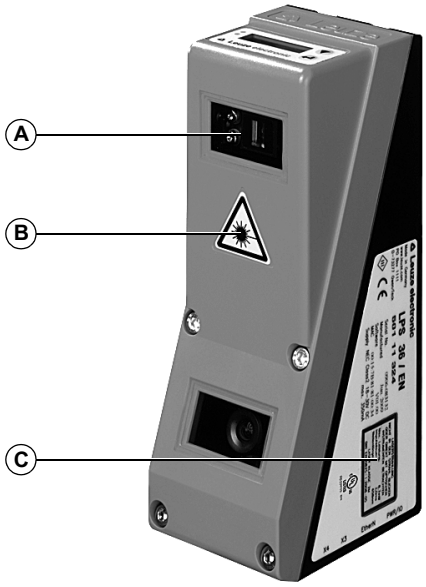
Laser warning and laser information signs are affixed to the device (see Figure 2.1):

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

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

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

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



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

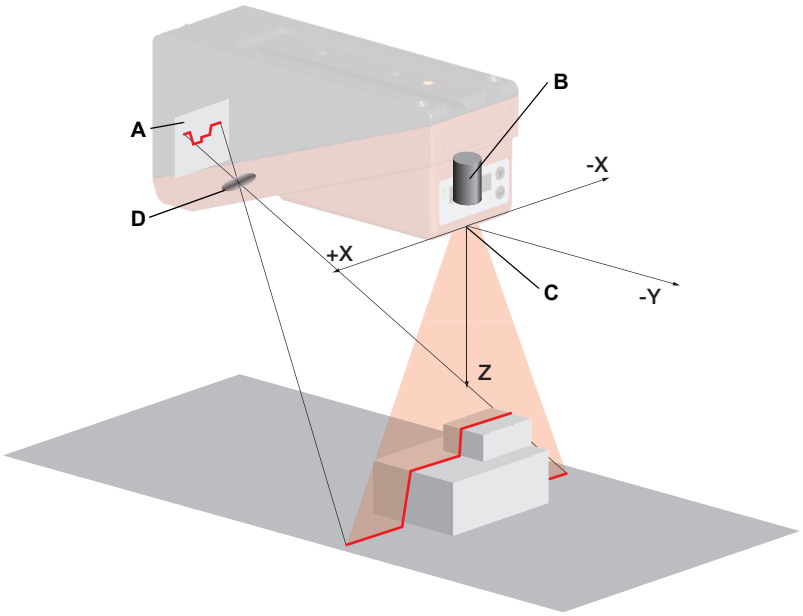
Figure 2.1: Laser apertures, laser warning signs

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

3 Operating principle

3.1 Generation of 2D profiles

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



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

Figure 3.1: Light section sensor design

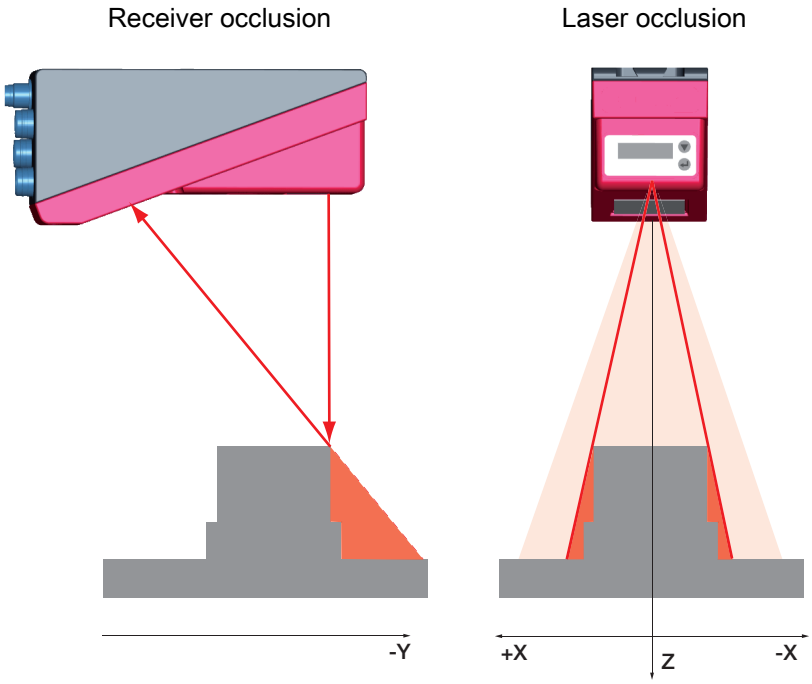
Depending on the distance of the object the laser line is projected to a different position on the CMOS planar detector as shown in Figure 3.1. By means of this position the distance of the object can be calculated.

3.2 Limits of light section sensors

3.2.1 Occlusion

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

Figure 3.2 illustrates the problem:



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

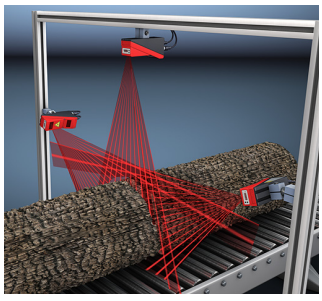
When the object is shifted to the left the object contour will still be detected by the laser but the laser line does not lie within the receiver's field of view at that point, and therefore no measurement values can be detected.

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

Figure 3.2: Occlusion

Possible measure against laser occlusion

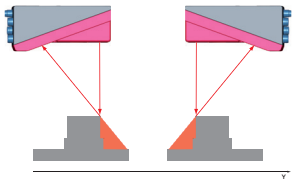
- Using multiple light section sensors with rotated viewing direction. In the application example on the right you can clearly see that the fields of vision of the three sensors complement each other and merge. The first of the sensors is operated as a master, the two others are cascaded (see "Cascading" on page 19). This reliably prevents mutual interference of the sensors.



Possible measures against receiver occlusion

- Alignment of the measurement objects so that all profile data to be measured can be seen by the receiver.
  Or:

- Installing a second sensor featuring a viewing direction rotated by 180° about the z-axis so that the objects can be viewed from 2 sides. In the example to the right, the left sensor detects the profile data on the left side of the product, and the right sensor the profile data on the right side. In this situation the second sensor is then cascaded. See "Cascading" on page 19.



3.2.2 Resolution

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

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

The following illustration shows this relation:

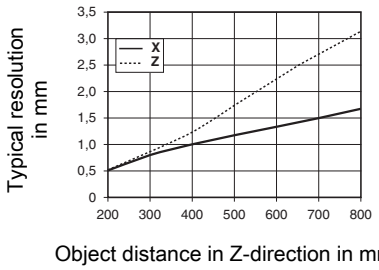


Figure 3.3: Typical resolution LPS 36…

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

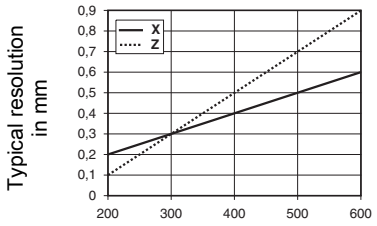
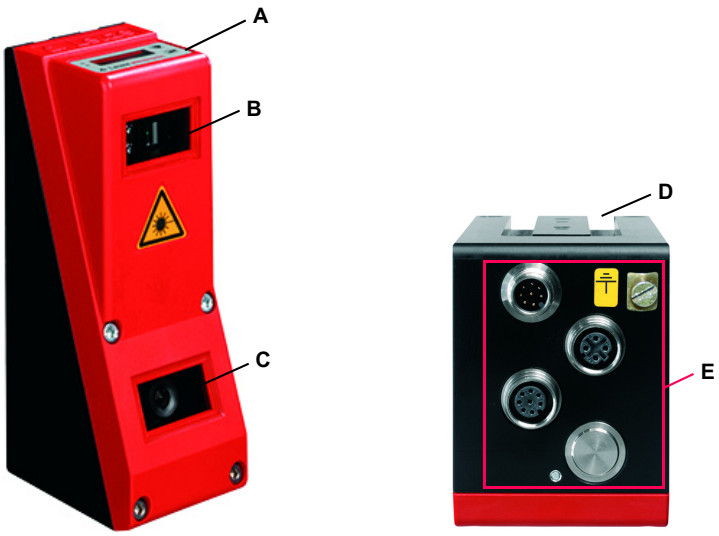


Figure 3.4: Typical resolution LPS 36HI…

4 Device description

4.1 Overview of light section sensors

4.1.1 Mechanical design



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

NOTE
The following shows a light section sensor as an example. An overview of the available types may be found in Chapter 15.1.

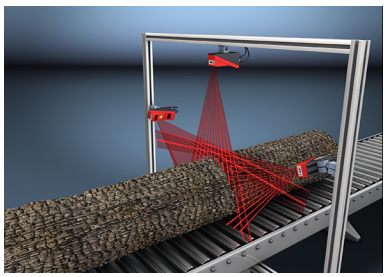
Figure 4.1: Mechanical design of Leuze light section sensors

4.1.2 General performance characteristics

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

4.1.3 Line Profile Sensor – LPS

Wherever stationary or moving objects of various sizes and positions are to be measured or detected, the LPS sensor is used. 3D data are provided reliably due to precise 2D profile measurements in connection with mobile scanning. Thus numerous application possibilities are available to determine positions, surfaces and contents.


Measurement of free formed surfaces


Manipulator control

Specific performance characteristics

- Measurement data transfer via Ethernet
- LPSsoft configuration software
- Optional: Interface for incremental encoder

Typical areas of application

- Case picking
- Manipulator control
- Measurement of free formed surfaces
- 3D Measurement of moving objects

4.2 Operating the sensor

4.2.1 Connection to PC / process control

Parameterization

For commissioning, the light section sensors are connected to a PC via the Ethernet interface (see "Connection X2 – Ethernet" on page 31) and set using the supplied LPSsoft configuration software.

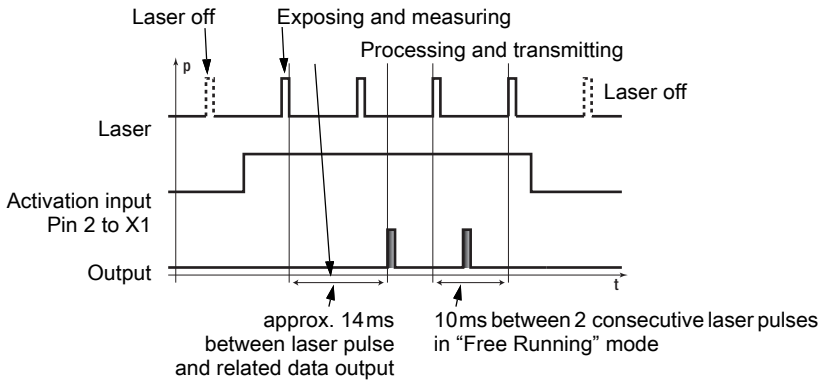
Measurement operation

In measuring mode, the light section sensors are connected to a process controller via the same X2 interface and communicate with it via Ethernet UDP, see chapter 10 "Integrating the LPS 36 in the process control (Ethernet)".

4.2.2 Activation – laser on/off

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

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



Axles:
p level
t Time

Figure 4.2: Activation input signal sequence

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

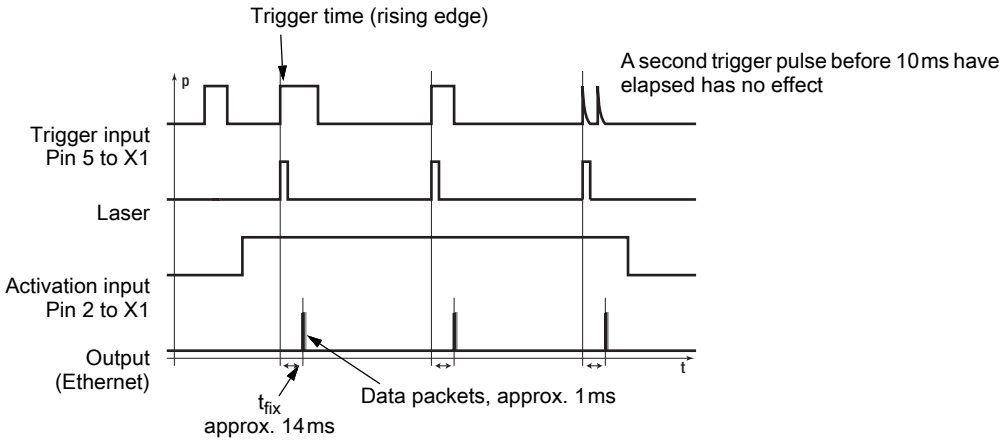
4.2.3 Triggering – Free Running

The light section sensors can measure in two modes:

- In "Free Running" operation, the light section sensor determines measurement results with a frequency of 100 Hz and outputs these continuously via the X2 interface.
- Alternatively, single measurements can also be carried out. For this purpose, the light section sensor requires either a trigger signal at the trigger input (pin 5 on X1) or the `Ethernet Trigger` command in measure mode (see chapter 10.3.4"Commands in measure mode" on page 68).

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

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



Axles:
p level
t Time

Figure 4.3: Trigger input signal sequence

4.2.4 Cascading

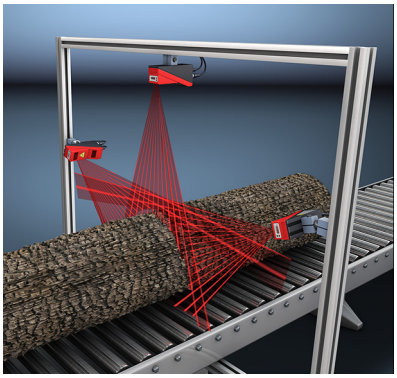
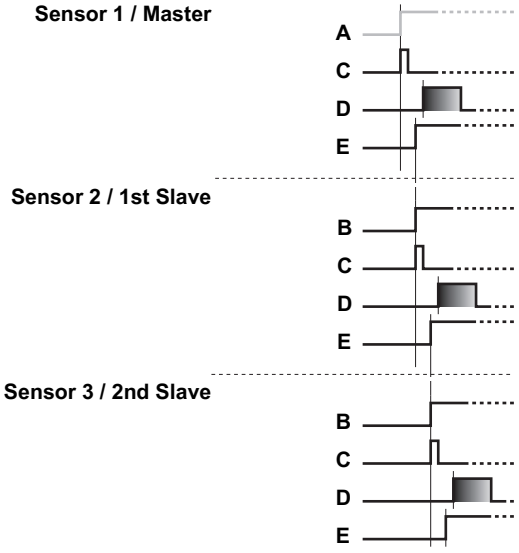


Figure 4.4: Cascading application example

If several light section sensors are operated, there is the risk of mutual interference if the reflected laser beam of one sensor can be received by the receiver of another sensor at the time of reading.
This can be clearly seen in Figure 4.4. Here three light section sensors are used to determine the log thickness reliably from all sides.



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

Figure 4.5: Signal sequence for cascading

Figure 4.6: 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`.

4.3 Inspection Task

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

- Operation Mode (Free Running, Input Triggered)
- Activation Input (switch laser on and off)
- Cascading Output
- Light Exposure (exposure duration of the laser)
- Field of View (sensor detection range)

The selection of the inspection tasks is carried out:

- via LPSsoft (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.

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 15.

NOTE
The following shows a light section sensor as an example. An overview of the available types may be found in Chapter 15.1.

Figure 5.1: Device name plate LPS 36

↳ Save the original packaging for later storage or shipping.

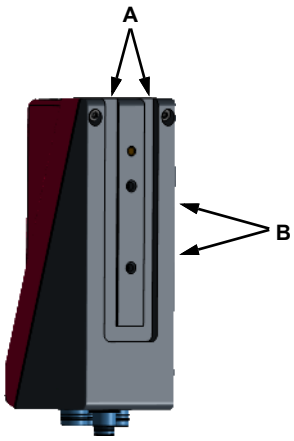
If you have any questions concerning your shipment, please contact your supplier or your local Leuze electronic sales office.

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

5.2 Mounting the LPS 36

The light section sensors can be mounted in different ways:

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



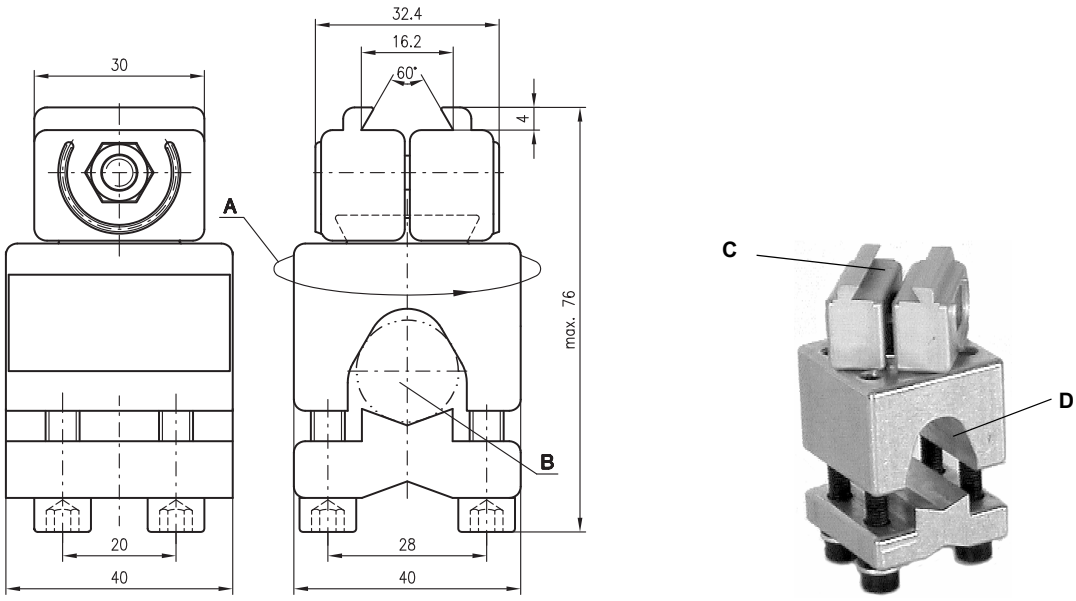
A Dovetail fastening grooves
B M4 threaded holes

Figure 5.2: Fastening options

Figure 5.3: Mounting example LPS 36

5.2.1 BT 56 mounting device

The BT 56 mounting device is available for mounting the LPS 36 using the fastening grooves. It is designed for rod mounting (Ø 16mm to 20mm). For ordering information, please refer to the chapter "Type overview and accessories" on page 81.

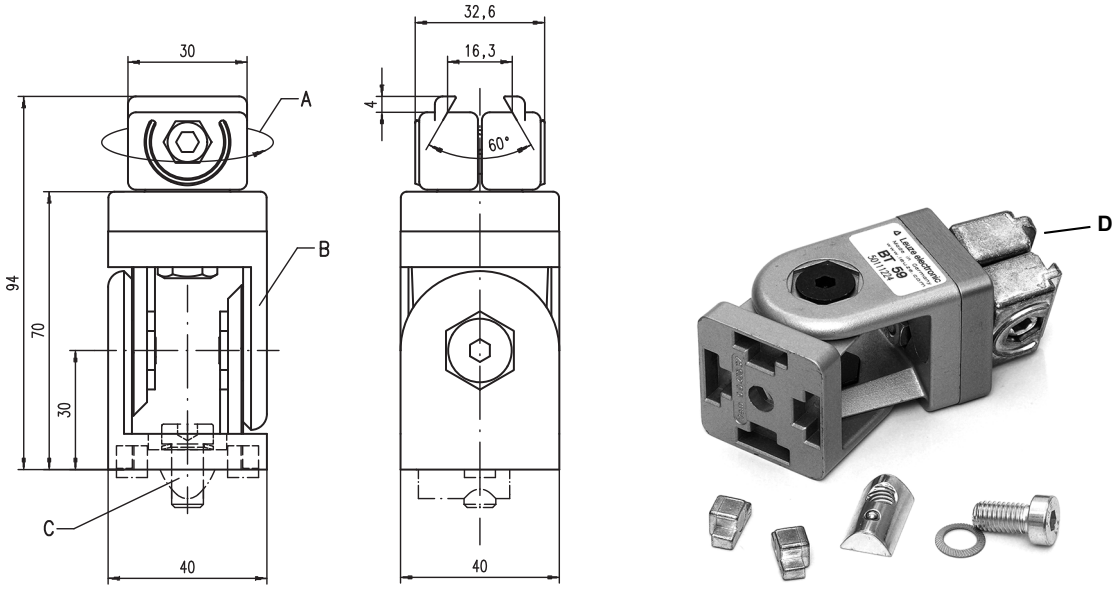


A Rod holder, turnable 360°
B Rods Ø 16 ... 20mm
C Clamping jaws for mounting on the LPS 36
D Clamp profile for mounting on round or oval pipes (Ø 16 … 20 mm)
all dimensions in mm

Figure 5.4: BT 56 mounting device

5.2.2 BT 59 mounting device

The BT 59 mounting device is available for mounting the LPS 36 on ITEM profiles using the fastening grooves. For ordering information, please refer to the chapter "Type overview and accessories" on page 81.



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

Figure 5.5: BT 59 mounting device

5.3 Device arrangement

5.3.1 Selecting a mounting location

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

- The required resolution. This is a result of the distance and the resulting line length.
- The permissible cable lengths between the LPS 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 LPS 36 by mechanical collision or jammed parts.
- Possible extraneous light (no direct sunlight or sunlight reflected by the measurement object).
- For the optimal perspective for detecting the relevant object contours, see chapter 3.2.1 "Occlusion".

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

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

5.3.2 Aligning the sensor

The zero point of the sensor coordinate system is the intersection of optical axis and front edge of the housing. The general principle is that the light section sensor should be aligned so that the back of the sensor is aligned parallel to the conveying belt or measuring plane. A rotation about the y-axis is undesirable as this then necessitates a coordinate transformation of the measurement values.

Figure 5.6 illustrates the problem:

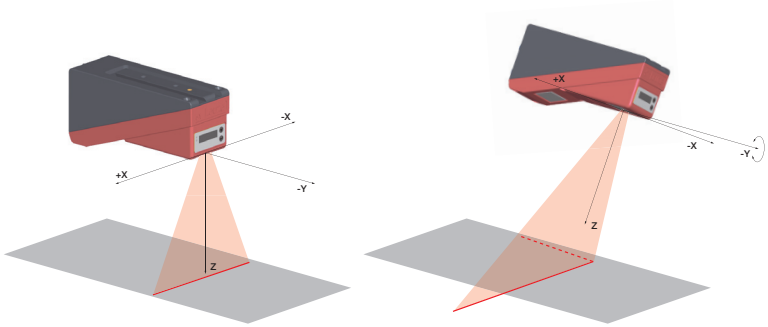


Figure 5.6: Alignment to the measuring plane

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.

A conversion into correct X/Z-coordinates is possible but to achieve this the user has to carry out a coordinate transformation in the process control. The light section sensor does not offer a conversion option internally.

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!	
	Follow the safety notices in Chapter 2. ↳ It is essential that you attach the stick-on label (laser warning signs and laser beam exit symbol) supplied with the light section sensor to the light section sensor! If the signs would be concealed as a result of the mounting situation of the LPS 36, attach the signs in the vicinity of the LPS 36 such that reading the signs cannot lead to looking into the laser beam! ↳ When installing the LPS 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 LPS 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 LPS 36.

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

6 Electrical connection

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

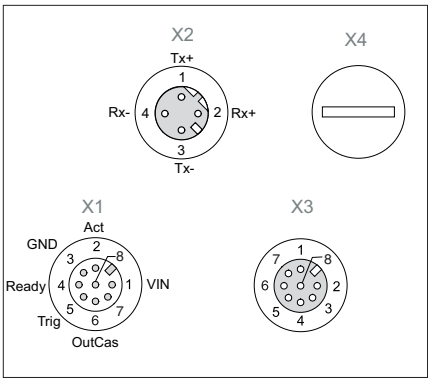
For the locations of the individual device connections, please refer to the device detail shown below.

NOTE
The corresponding mating connectors and preassembled cables are available as accessories for all connections. You can find more information on this in Chapter 15.

Figure 6.1: Location of the electrical connections

NOTE
The following shows a light section sensor as an example. An overview of the available types may be found in Chapter 15.1.

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



NOTE
The following shows a light section sensor as an example. An overview of the available types may be found in Chapter 15.1.

Figure 6.2: Connections of the LPS 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
LPS 36/EN	Encoder	Not assigned	see chapter 6.3.3
LPS 36HI/EN	Encoder	Not assigned	see chapter 6.3.3
LPS 36	Not assigned	Not assigned	-

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 LPS 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 LPS 36 should be switched off from operation and protected against accidental use.

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

NOTE

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

6.2 Shielding and line lengths

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

↳ Observe the following maximum line lengths:

Connection to sensor	Interface	Max. cable length	Shielding
Power supply unit	X1	50 m	Required
Activation / cascading / trigger	X1	50 m	Required
PC/Host	X2	50 m	Required
Encoder	X3	50 m	Required

Table 6.2: Cable lengths and shielding

Shielding:

1. **Ground the LPS 36 housing:**
   Connect the housing of the LPS 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 LPS 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 LPS 36 housing by measuring the electrical connection from the FE star point to the connector sleeves without connected sensor cables so that other FE interruptions can be detected on the machine base and profile rails as well.

2. **Shield all connection cables to the LPS 36:**
   Apply the shield to FE on both sides. On the LPS 36 end, this is ensured if the LPS 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.

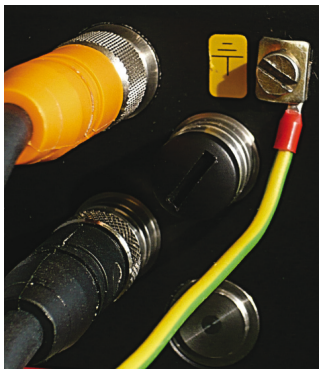
NOTE
You can measure leakage currents with a clip-on ammeter.

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.

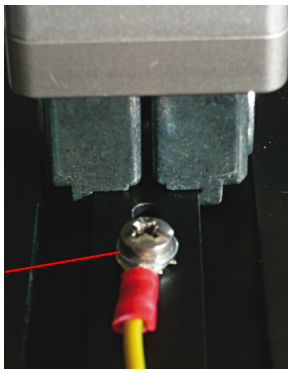
NOTE
General shielding information: Avoid spurious emissions when using power components (frequency inverters, …). The technical descriptions of the power components provide the necessary specifications according to which the respective power component satisfies its CE conformity. In practical work, 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 LPS 36 is described in practical use with images.

Connect the ground potential to the light section sensors



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

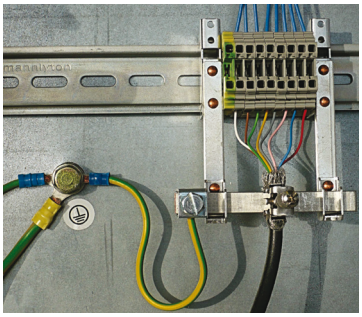


Devices produced after April 2011 are equipped with an additional grounding terminal.

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

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

Connecting the cable shielding in the switch cabinet

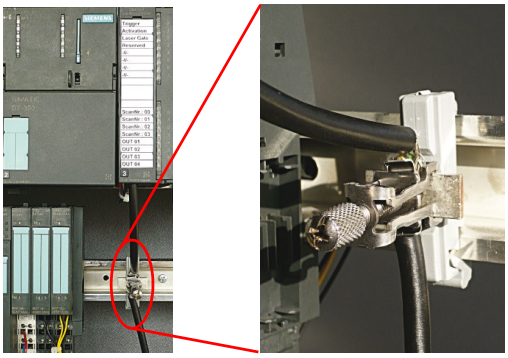


- Shield connected flat to PE
- Connect PE star point with short cables
- Galvanized mounting sheet steel

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

Figure 6.4: Connecting the cable shielding in the switch cabinet

Connecting the cable shielding to the PLC



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

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

Figure 6.5: Connecting the cable shielding to the PLC

6.3 Connection

6.3.1 Connection X1 – logic and power

⚠ ATTENTION!
All cables must be shielded!

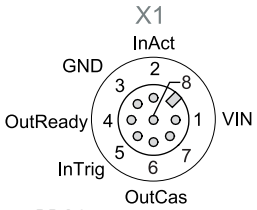
X1 (8-pin connector, A-coded)				
 **M12 connector (A-coded)**	**Pin**	**Name**	**Core color**	**Comment**
	1	VIN	wh	+24 VDC supply voltage
	2	InAct	br	Activation input
	3	GND	gn	Ground
	4	OutReady	ye	"Ready" output
	5	InTrig	gr	Trigger input
	6	OutCas	pi	Cascading output
	7		bu	not connected
	8		RD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

Table 6.3: Pin assignment X1

↳ Please use the preassembled cables “KD S-M12-8A-P1-…”, see chapter 15.2.2.

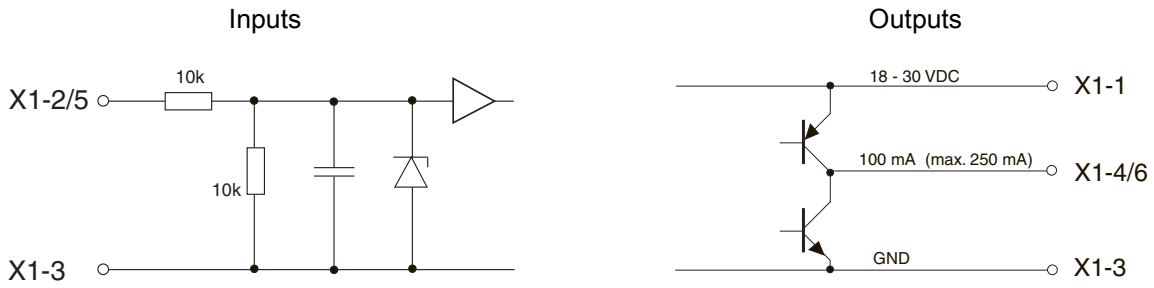


Figure 6.6: Internal wiring at X1

Power supply

For power supply specifications please refer to Chapter 14.

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 green LED’s status (see "LED status indicators" on page 35).

6.3.2 Connection X2 – Ethernet

⚠ ATTENTION!
All cables must be shielded!

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

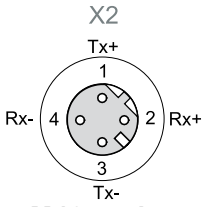
X2 (4-pin socket, D-coded)				
 **M12 socket (D-coded)**	**Pin**	**Name**	**Core color**	**°**
	1	Tx+	ye	Transmit Data +
	2	Rx+	wh	Receive Data +
	3	Tx-	OR	Transmit Data -
	4	Rx-	bu	Receive Data -
	Thread	FE	-	Functional earth (housing)

Table 6.4: Pin assignment X2

↳ Please use the preassembled cables “KS(S) ET-M12-4A-…”, see chapter 15.2.3.

Ethernet cable assignment

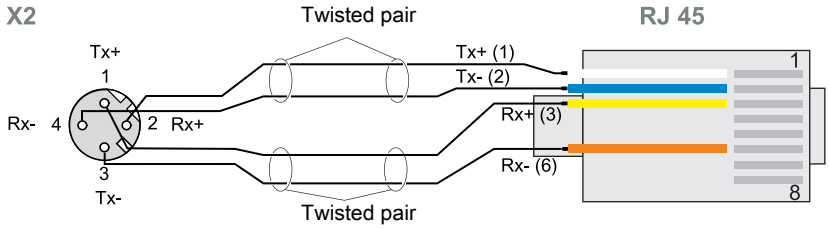


Figure 6.7: HOST / BUS IN cable assignments on RJ-45

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 – incremental encoder

The LPS 36/EN and LPS 36 36HI/EN are equipped with an interface for an incremental encoder. Differential signals (5V) or 24V signals against GND can be processed. For reasons of interference rejection, differential connection is recommended.

⚠ ATTENTION!
All cables must be shielded!

NOTE
The X3 connection is assigned only at the LxS 36/EN!

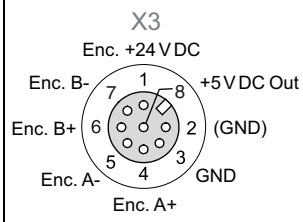
X3 (8-pin socket, A-coded)				
 **M12 socket (A-coded)**	**Pin**	**Name**	**Core color**	**Comment**
	1	Enc. +24 VDC	wh	+24 VDC supply voltage for incremental encoder
	2	(GND)	br	Ground
	3	GND	gn	Ground
	4	Enc. A+	yw	Incremental encoder connection A+
	5	Enc. A-	gr	Incremental encoder connection A-
	6	Enc. B+	pk	Incremental encoder connection B+
	7	Enc. B-	bl	Incremental encoder connection B-
	8	+5 VDC Out	RD	+5 VDC supply voltage for incremental encoder

Table 6.5: Pin assignment X3

↳ Please use the preassembled cables “KS S-M12-8A-P1-…”, see chapter 15.2.4.

The maximum permissible current consumption of connected encoders is 140 mA. The maximum pulse frequency is 300 kHz.

NOTE

New with firmware V01.20:

- Support of single-channel and two-channel encoders.
- Single Mode (no pulse duplication), i.e., “single evaluation”, or Double Mode (pulse doubling)
- Quadruple Mode (pulse quadrupling) is no longer supported
- Overflow value 0xFFFF FFF, 0xFEFF FFFF or 0x7FFF FfFF

⚠ ATTENTION!

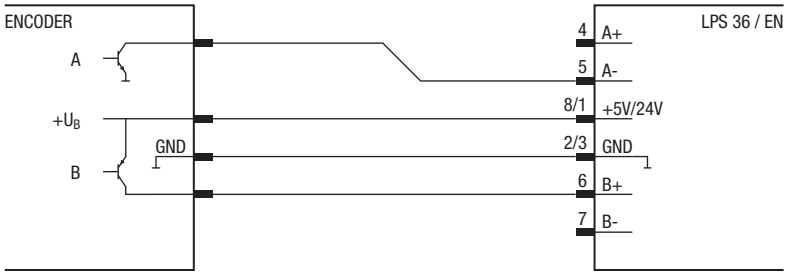
Up to firmware V01.20, encoder evaluation was permanently set to Quadruple Mode (count all 4 edges on both encoder channels). This mode is no longer supported beginning with firmware V01.20.

NOTE

New factory settings beginning with firmware V01.20 and with configuration software LPSsoft V1.3. Together with the new functions, encoder devices with the following factory settings are shipped:

- Encoder type: `2 Channel Encoder`
- Evaluation mode: `Double Mode`
  Previously: `Quadruple Mode`, this mode is no longer supported beginning with firmware V01.20. Up to firmware V01.20, encoder evaluation was permanently set to `Quadruple Mode` (count all four edges on both encoder channels).
- Counter Value Overflow: `0xFFFF FFFF`
  Previously: `0xFEFF FFFF`, the new Counter Overflow value `0xFFFF FFFF` permits distance calculation in Double Mode with 32-bit values without manual correction.

Two-channel incremental encoder with open collector outputs



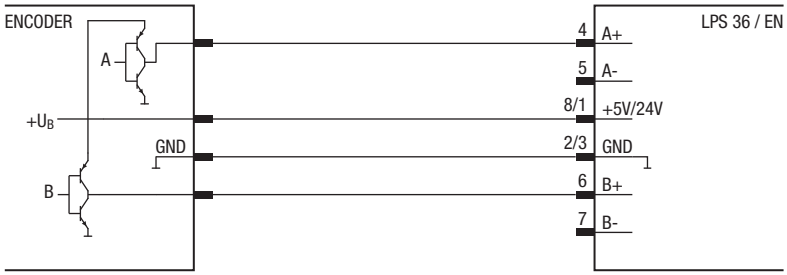
Channel A: Example of NPN output
Channel B: Example of PNP output

NOTE

Interconnection cable must be shielded!
Voltage supply for the incremental encoder is provided by the LPS 36.

Figure 6.8: Two-channel incremental encoder connection: example with NPN/PNP open collector

Two-channel incremental encoder, single-ended

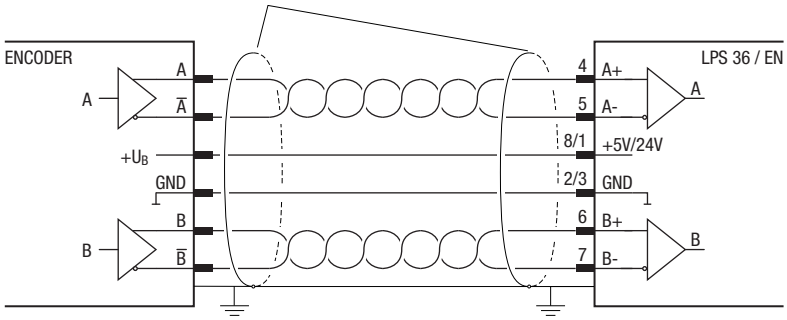


NOTE

Interconnection cable must be shielded!
Voltage supply for the incremental encoder is provided by the LPS 36.

Figure 6.9: Two-channel incremental encoder connection: single-ended example

Two-channel incremental encoder, differential



NOTE

Interconnection cable must be shielded, connect shield to housing at both sides.
Both cable pairs A and B must be produced with twisted-pair cables.
Voltage supply for the incremental encoder is provided by the LPS 36.

Figure 6.10: Two-channel incremental encoder connection: differential – RS 422 example

In general, it is recommended to use incremental encoders with RS 422 interface and 24 V supply. That way, signals can be transmitted safely even across larger distances (depending on the pulse frequency to 50 m).

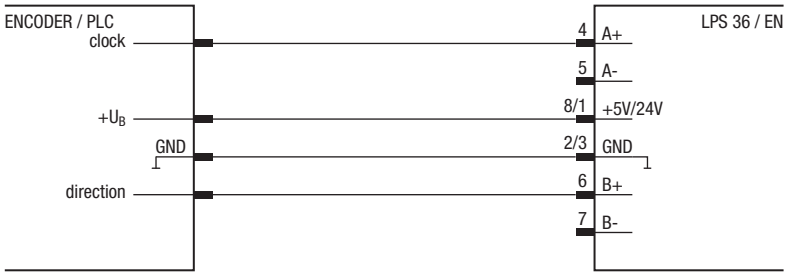
Single-channel incremental encoder (firmware V01.20 or later)

In this setting, pulses of an initiator or of a PLC output can be counted. In addition, the count direction can be toggled, e.g., via a control.

NOTE

New beginning with firmware V01.20 and with configuration software LPSsoft V1.3:

- The counting direction of the encoder pulse counter can be reversed with LPSsoft.
- When operating single-channel encoders, the pulses are counted on the A-channel. The counting direction can be changed by means of an additional direction signal on channel B:
  - Low level on pins 6/7 of X3 = upward pulse counting.
  - High level on pins 6/7 of X3 = downward pulse counting.



NOTE

Interconnection cable must be shielded!

Voltage supply for the incremental encoder is provided by the LPS 36

Figure 6.11: Single-channel incremental encoder connection: single-ended example (schematic illustration)

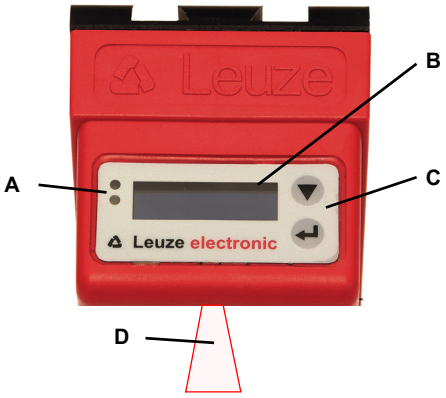
Single-channel encoders have only one output channel (here `clock` – channel A). As a result, it is generally only possible to detect the movement, not, however, the direction of movement (counting).

The count/movement direction can be preset by applying a signal (here `direction`) at channel B:

- 0 – upward counting (default, if no signal is connected to channel B)
- 1 – downward counting

7 Display and control panel

7.1 Indicators and operational controls



A Green and yellow device LEDs
See "LED status indicators" on page 35.
B OLED display, 128 x 32 pixels
C Membrane keyboard with 2 buttons
See "Control buttons" on page 35.
D Laser beam

Figure 7.1: Indicator and operating elements of the LPS 36

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

7.1.1 LED status indicators

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

Table 7.1: LED function indicator

7.1.2 Control buttons

The LPS 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 LPS 36 via the menu is described in Chapter 7.2.2.

Alignment aid

L450 M450 R450

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.

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

Status indicator

The second line of the display shows the selected inspection task (`Txx`) and the current sensor status (see chapter 4.2 "Operating the sensor").

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`.

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

When the LPS 36 is connected to a control unit, the LPS 36 can be set to command mode by the control unit, in which it receives and executes commands (see chapter 10.3 "Ethernet commands"). 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. Information can be found in Chapter 12.3.

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	
	Exposure Time Normal Mode			Exposure time for measurements and teaching	
		Exposure Time Normal Mode		"Normal" exposure time setting	X
		Exposure Time Bright Objects		"Bright Objects" exposure time setting	
		Exposure Time Dark Objects		"Dark Objects" exposure time setting	
		Exposure Time Manual Setting		"Manual" exposure time setting (user-specific setting) [4]	
	Trigger Mode Free Running			Trigger mode for measurements	
		Trigger Mode Free Running		Trigger setting "Free Running" (continuous measurement)	X
		Trigger Mode Input Triggered		Trigger setting "Input Triggered" (trigger input signal triggers measurement)	
	← Exposure Time			Return to menu level 1	

Table 7.2: Menu structure

Level 1	Level 2	Level 3	Level 4	Explanation / Notes	Default
Device Settings Error Handling				Device Settings menu item	
	Ethernet Data output			Ethernet interface parameters [5]	
		IP Address 192.168.060.003		IP address of the sensor	
			IP Address 192.168.060.003	Setting the IP address (Default: 192.168.060.003)	X
		Net Mask Address 255.255.255.000		Subnet mask of the sensor	
			Net Mask Address 255.255.255.000	Setting the subnet mask (Default: 255.255.255.000)	X
		Std. Gateway 000.000.000.000		Default gateway for Ethernet communication	
			Std. Gateway 000.000.000.000	Setting for the IP address of the default gateway (default: 000.000.000.000)	X
		Port Num. Local 09008		Local port of the sensor for Ethernet communication	
			Port Num. Local 09008	Setting for the local port	**9008**
		Port Num. Dest. 05634		Destination port of the PC or control for Ethernet communication	
			Port Num. Dest. 05634	Setting for the destination port	**5634**
		← IP Address		Return to menu level 2	
	Data output Display			Data output	
		Prescaler Value 001		Prescaler Value indicates the time interval between two scan transmissions.[6]	
			Prescaler Value 001	1 = every scan is transmitted 2 = every 2nd scan is transmitted 3 = every 3rd scan is transmitted, etc.	**1**
		← Prescaler Value		Return to menu level 2	
	Display On			Display settings	
		Display **On**		Setting "On": always on with maximum brightness	
		Display **Off**		Setting "Off": off; is switched back on after keyboard actuation	
		Display **Auto**		"Auto" setting: full brightness for approximately 1 minute after button is pressed, then dimmed	X
	Password Check Inactive			Password protection for menu access	
		Password Check **Inactive**		Password protection deactivated	X
		Password Check **Activated**		Password protection activated (fixed password: "165")	
	← Ethernet			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	
	Software V01.50			Software version of the sensor	
	← Part no.			Return to menu level 1	
← Menu Exit Select Insp. Task				Exit menu and return to measure mode	

Table 7.2: Menu structure

1) The inspection tasks can be switched via the control panel.

2) The setting of the active inspection task applies only if “Ext. Selection” = “Disabled”
3) The application settings apply for the currently selected inspection task. Individual application settings can be made for each task.
4) With "Manual Settings", the value preset via LPSsoft is used.
5) The values configured here are not applied immediately but only when the sensor is switched on the next time.
6) This parameter is used to reduce the measurement rate (data reduction), value range: 1 … 999

NOTE

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

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 (`Display`)
↲ goes to the inverted submenu (`Ethernet`)

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

Selecting values or selection parameters for editing

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

Editing value parameters

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

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

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

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

Editing selection parameters

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

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

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

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

NOTE

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

7.3 Reset to factory settings

The factory settings can be reset in three different ways:

- Hold down the ↵ button while connecting the supply voltage
- Factory Setting menu item
- By means of the LPSsoft 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 LPS 36 to factory settings.

The display shown next to here appears.

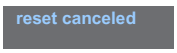
Interrupting a reset

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

Executing a reset

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

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



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

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

↳ 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 LPS 36 is in measure mode.

NOTE
After a light section sensor warmup time of 30 min., the LPS 36 has reached the operating temperature required for an optimum measurement.

8.2 Establish connection to PC

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

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

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

Address of the LPS 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 LPS 36.

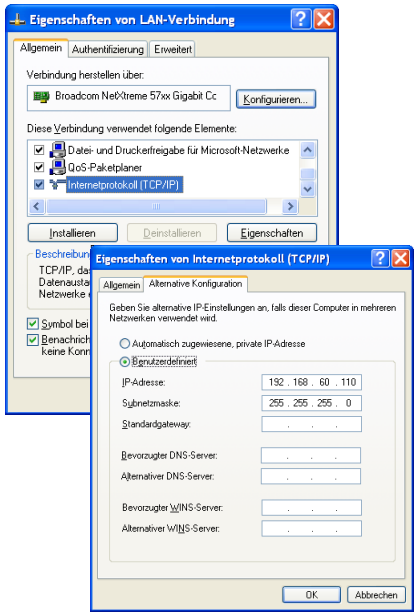
For example 192.168.060.110 (but not 192.168.060.003!). If LPS 36 and PC have the same IP address, they cannot communicate with each other.

Setting the default gateway

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

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

Setting an alternative IP address on the PC



- Log in to your PC as administrator.
- Using `Start->Control Panel` go to the `Network connections` (Windows XP) menu or to the `Network center and release center` (Windows Vista) menu.
- Select the `LAN connection` there and call up the corresponding `properties` page by right-clicking it.
- Select the `Internet protocol (TCP/IP)` (by scrolling down, if necessary) and click on `Properties`.
- In the `Internet protocol (TCP/IP) Properties` window select the `Alternate configuration` tab.
- Set the `IP address` of the PC in the address range of the LPS 36.
  Attention: Not the same as the LPS 36!
- Set the `subnet mask` of the PC to the same value as on the LPS 36.
- Close the configuration dialog by confirming all windows using `OK`
- Connect the X2 interface of the LPS 36 directly to the LAN port of your PC. Use a KB ET-…-SA-RJ45 cable for the connection; see Table 15.10

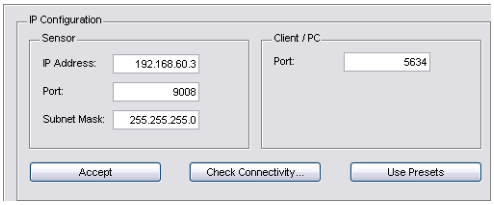
The PC first tries to establish a network connection via the automatic configuration. This takes a few seconds, after which the alternate configuration, which you just set, is activated. The PC can now communicate with the LPS 36.

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

8.3 Commissioning

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

1. Configuring LPS 36 – see chapter 9.
2. Programming process control – see chapter 10.
3. When connecting in the Ethernet process controls, the IP configuration of the LPS 36 is to be adjusted so that the LPS 36 can communicate with the process control.
   The values corresponding to the following screenshot are preset in the LPS 36 at the factory. If you would like to set different values, you must change the values via the display of the LPS 36 in menu item `Ethernet` (see "Menu description" on page 36). You can test the changed values by entering them in LPSsoft in the `Configuration` area and clicking on the `Check Connectivity` button.



4. Connect LPS to process control via the Ethernet interface.
5. If necessary, establish connections for activation, triggering and cascading.

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

9 LPSsoft configuration software

9.1 System requirements

The PC used should meet the following requirements:

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

9.2 Installation

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

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

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

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

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

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

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

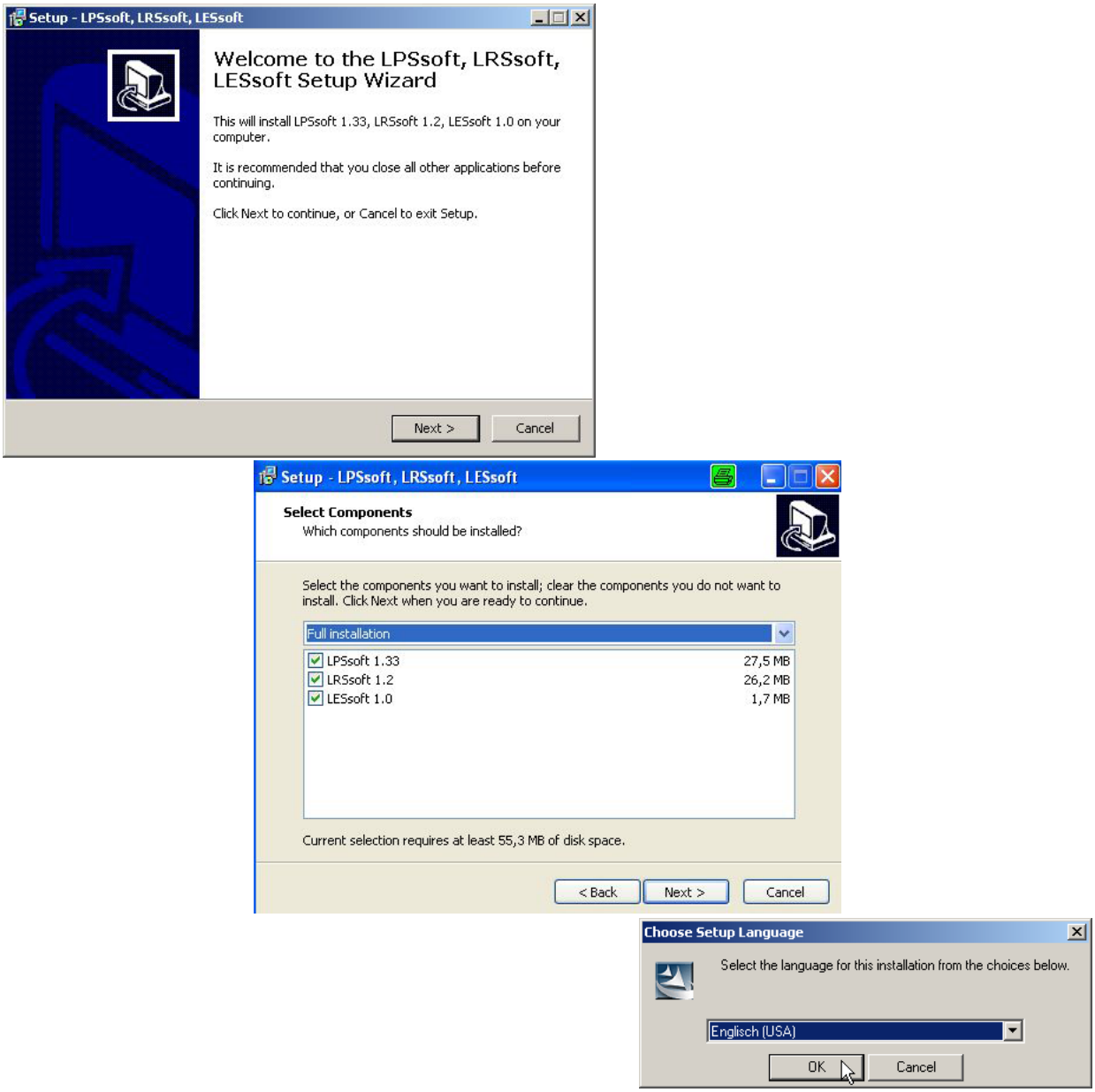
You will need **LRSsoft** for configuring light section sensors of the **LRS** series.

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

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

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

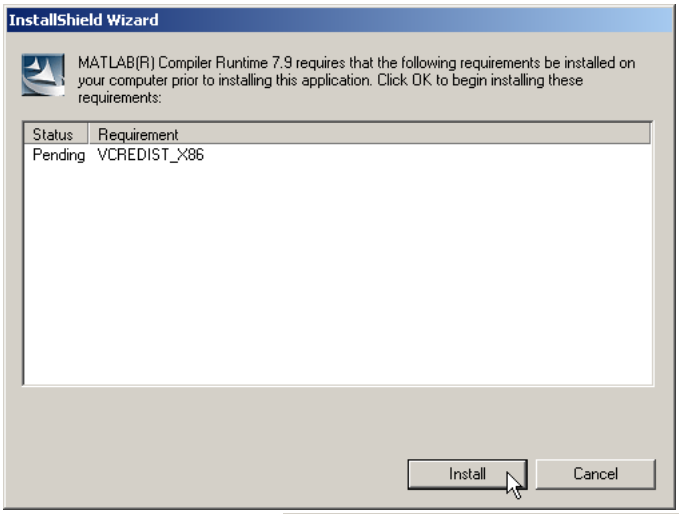
↳ Therefore, keep the`English` selection in the `Choose Setup Language` window and click `OK`.

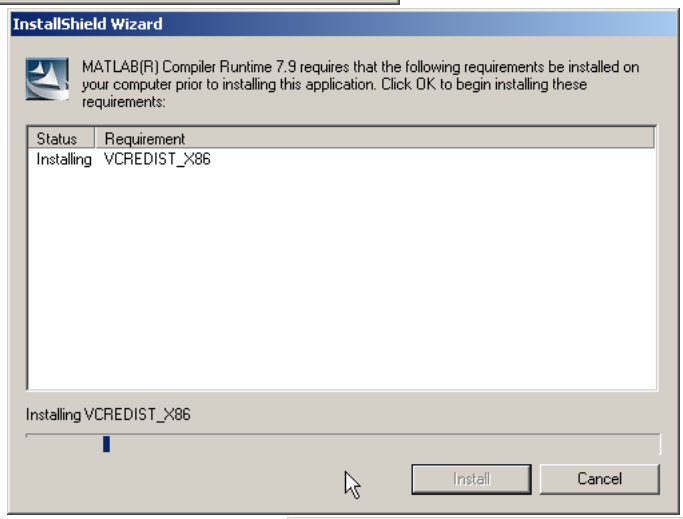


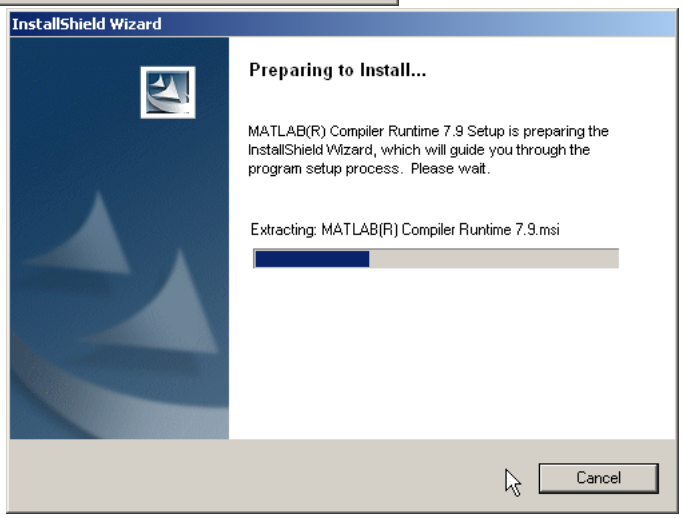
Depending on the configuration of your Windows system, the dialog shown below may then appear (missing component VCREDIST_X86).

↳ Click on `Install`.

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

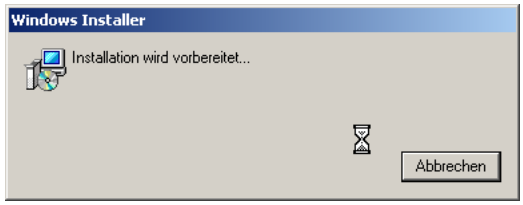


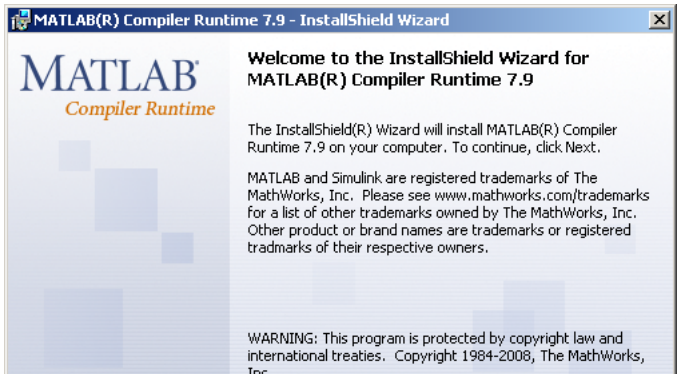




After some time (up to several minutes depending on the system configuration) the start screen of the MCR installer will appear.

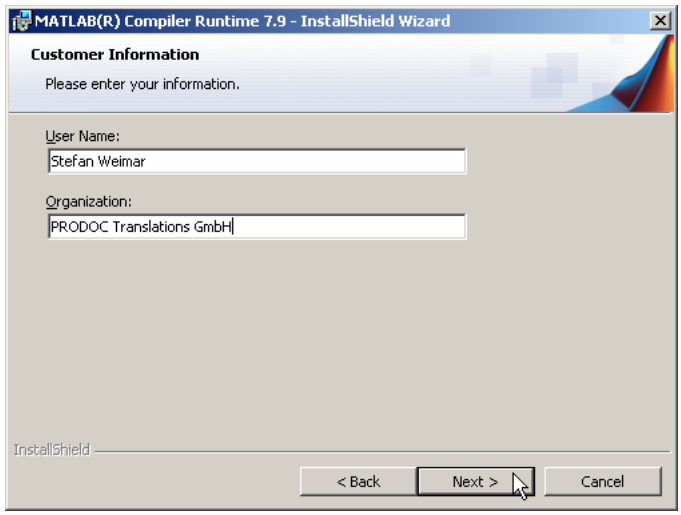
↳ Click on `Next`.





The window for entering user data appears.

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



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

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

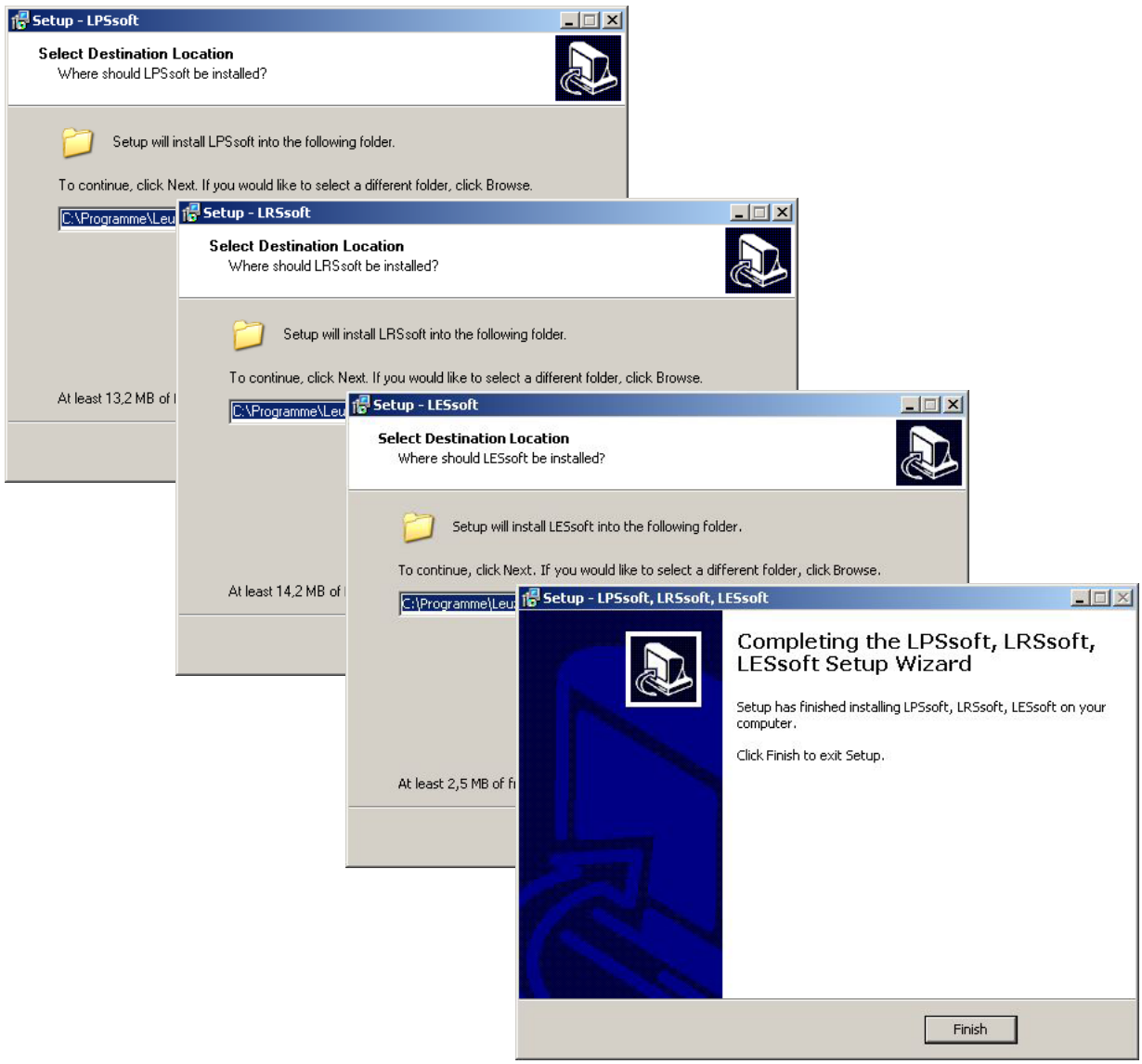
↳ Click on `Next` and in the next window click on `Install`.

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

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

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

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



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

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

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

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

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

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

9.2.1 Possible error message

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

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

The setting can be adjusted as follows.

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

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

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

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

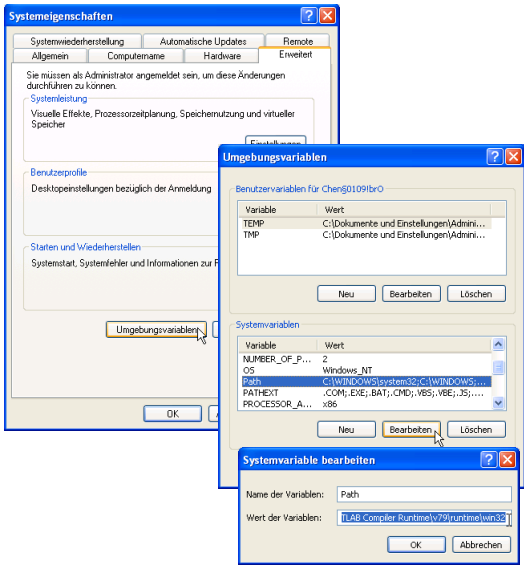
- Open the System properties window located in the Control Panel of Windows under System.
- Go to the Extended tab and click on Environment variables.

The Environment variables window opens.

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

The Edit system variable window opens.

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



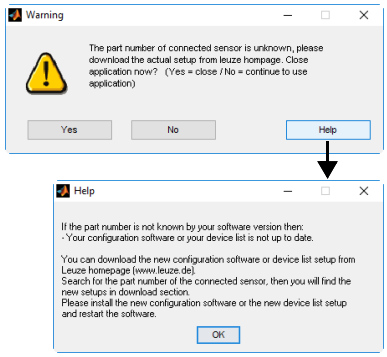
- If this entry is missing, copy the entry from this document and insert it together with the preceding semicolon.
- Then click on OK and also close any further windows using OK.
- Shut Windows down, restart Windows and then start LPSsoft by double-clicking on it.

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

9.2.2 Device list update

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

The software indicates this with the following notice:



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

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

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

9.3 Starting LPSsoft/Communication tab

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

The following screen appears:

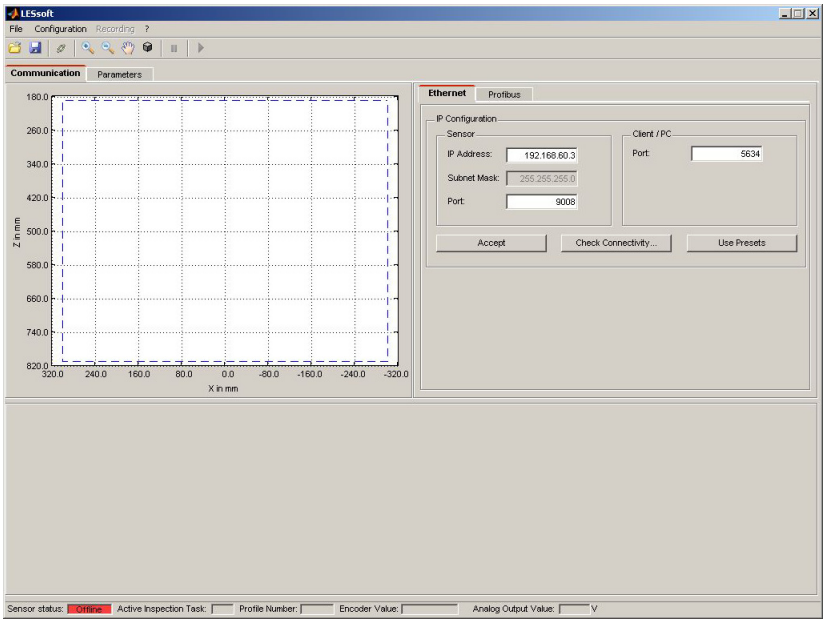


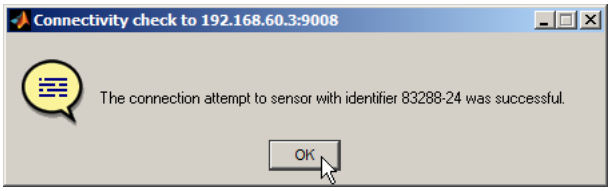
Figure 9.1: Initial screen LPSsoft

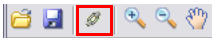
↳ In the `IP Configuration` panel, enter the settings for the LPS 36 and click on `Accept`.

You have already determined this data in Chapter 8.2.

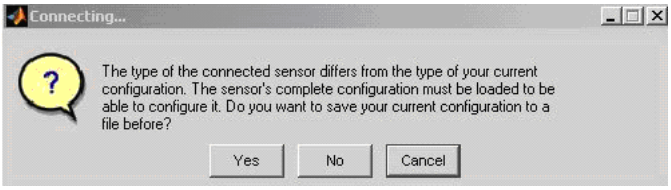
↳ Click on `Check Connectivity` to test the connection to the LPS 36.

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

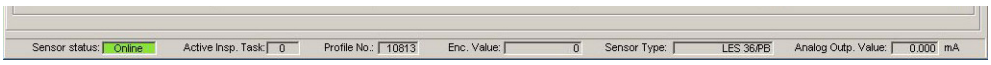


Click on the button `Connect to sensor`: 

If the connected sensor type does not correspond with the standard type stored in **LPSsoft**, a query appears asking whether the current parameter set should be saved in **LPSsoft**.



As a result **LPSsoft** 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)

9.4 Parameter settings/Parameters tab

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

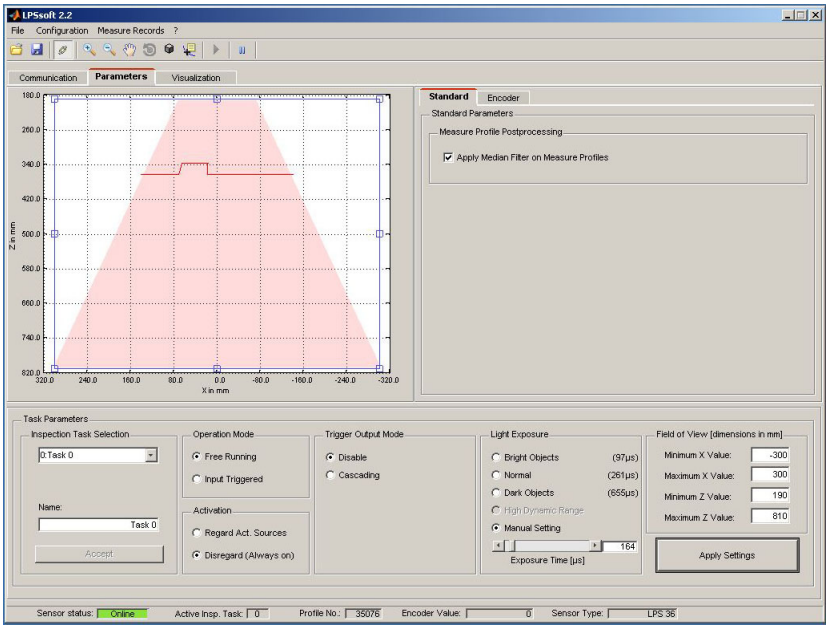


Figure 9.2: Parameter settings in LPSsoft when LPS 36Hi is connected

In the Standard tab, a median 3 filter can be activated in the Standard Parameters area. By activating the median filter in the checkbox, the Z-coordinates of the measurement values are smoothed out, while occurring edges are retained.

9.4.1 Standard tab – Task Parameters panel

Inspection Task Selection

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

The inspection task is selected either in this field or via Ethernet commands.

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

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

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

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

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

The typical procedure for creating and saving inspection tasks is described in Chapter 9.7, "Definition of inspection tasks" on page 56.

Operation Mode

In Operation Mode you can set the LPS 36 to continuously detect and output measurement data (factory setting) using Free Running. With Input Triggered, the LPS 36 captures measurement data only if a rising edge is present at the trigger input or the “Ethernet Trigger” command (see chapter 10.3.4) is 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. 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 (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 measurement range of the LPS 36. The same happens if you click on the square handles of the measurement range framed in blue with the mouse and then pull.

Factory settings for `Field of View`:

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

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

Apply Settings

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

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

9.4.2 Encoder tab – Encoder Parameters panel

With the LPS 36/EN and LPS 36HI/EN, you can configure the model and the characteristics of the connected encoder in the `Encoder` tab.

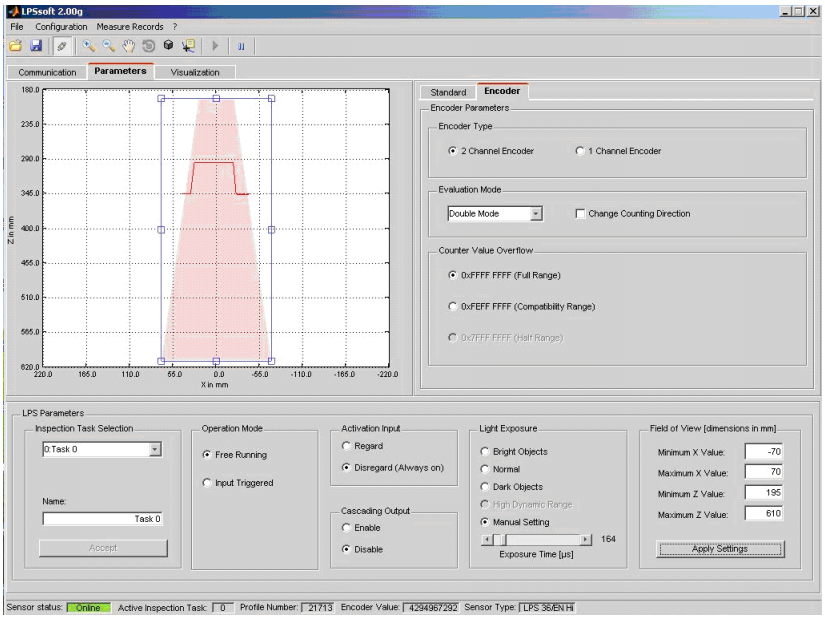


Figure 9.3: Encoder settings

Encoder Type

Specify whether the encoder is a single-channel encoder (`1 Channel Encoder`) or two-channel encoder (`2 Channel Encoder`) here.

Two-channel encoders have an A and a B channel whose signals are shifted 90° with respect to one another. This allows the direction of movement to be detected (forward/backward).

NOTE
Up to firmware V01.10, only two-channel encoders were supported.

Single-channel encoders have only an A-channel. If necessary, the counting direction can be changed using an additional direction signal on channel B (see chapter 6.3.3 "Connection X3 – incremental encoder"):

- Low level on pins 6/7 of X3 = upward pulse counting.
- High level on pins 6/7 of X3 = downward pulse counting.

If channel B is not connected, counting is upward (factory setting).

Evaluation Mode

The selection box can be used to select two count modes for the encoder pulse counter (see structure of the protocol header in Chapter 10.2 on page 57, Encoder_H/Encoder_L data words):

- `Single Mode` (for one- and two-channel encoders)
  The encoder counter is increased by +1 for each encoder pulse on channel A.
  Only 1 edge of the pulse is counted.
- `Double Mode` (for one- and two-channel encoders)
  For each encoder pulse on channel A, the encoder counter is increased by +2.
  Both edges of the pulse are counted.

The `Change Counting Direction` check box can be used to reverse the upward/downward counting direction of the encoder pulse counter.

NOTE
For two-channel encoders, the counting direction can also be reversed by exchanging the connections of channels A and B.

Counter Value Overflow

Use the check boxes in the `Counter Value Overflow` panel to select the maximum value of the encoder pulse counter above which an overflow occurs (the counter restarts with 0x0000 0000):

- `0xFFFF FFFF (Full Range):` only with Double Mode
- `0xFEFF FFFF (Compatibility Range):` only with Double Mode (compatible up to firmware V01.10)
- `0x7FFF FFFF (Half Range):` fixed for Single Mode

Factory settings:

- **Encoder type:** `2 channel encoder`
- **Evaluation mode**: `Double Mode`
  Previously: `Quadruple Mode`, this mode is not supported with firmware V01.20 and later. Up to firmware V01.20, encoder evaluation was permanently set to `Quadruple Mode` (count all four edges on both encoder channels).
- **Counter Value Overflow**: `0xFFFF FFFF`
  Previously: `0xFEFF FFFF`, the new Counter Overflow value `0xFFFF FFFF` permits distance calculation in Double Mode with 32-bit values without manual correction.

9.5 Measurement function/Visualization tab

↳ Click on the `Visualization` tab to view a 3D visualization of your measurement data:

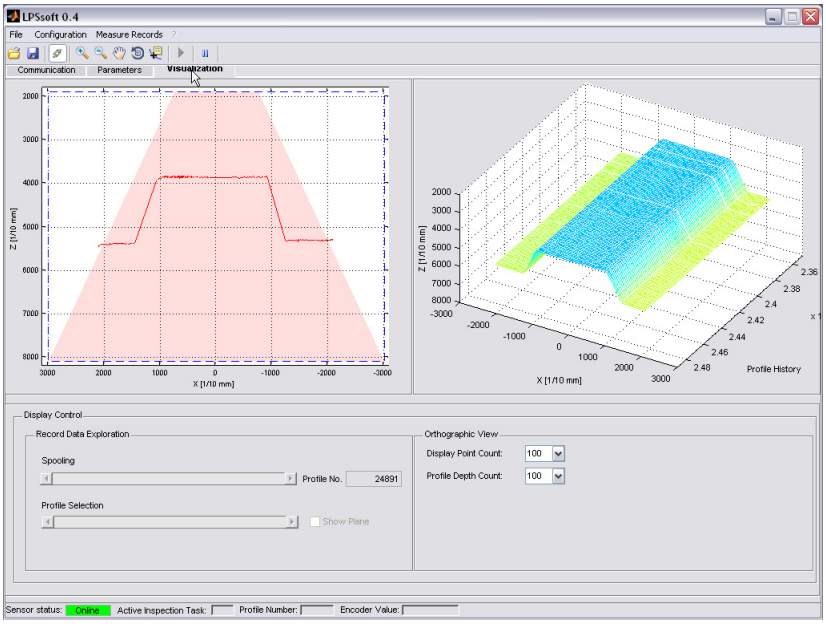
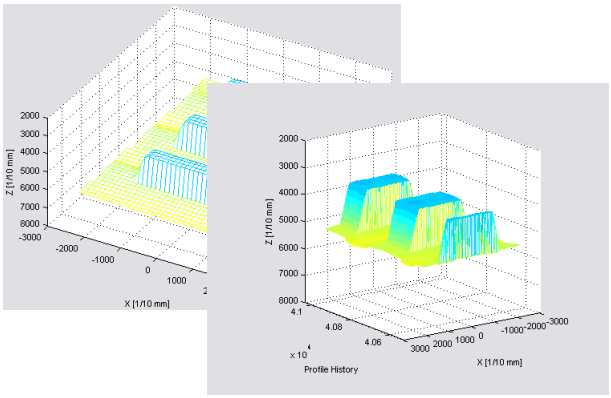


Figure 9.4: 3D Visualization with LPSsoft

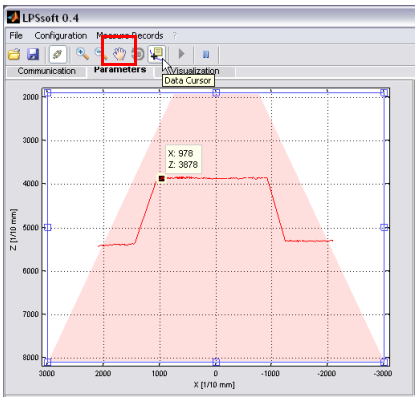
The left image shows the familiar 2D-view; displayed at the right are the measurement values in chronological order.

You can adapt the 3D view:

- `Display Point Count` specifies how many of the 376 single measurement values in total will be displayed along the laser line.
- `Profile Depth Count` specifies how many consecutive single measurements will be displayed in the 3D diagram in chronological order.
- The `Rotate 3D` tool on the toolbar enables free and arbitrary rotation of the 3D view.



In the 2D view you can view precise measurement values at individual points of the laser line using the `Data Cursor` tool.



9.5.1 Evaluating saved measurement data

To evaluate a measurement data set, you can record/store measurement data and reopen as described in Chapter 9.6.3. After opening the file, the data are initially continuously fed into the 3D-view. To stop this continuous display and to be able to examine individual profiles and again restart the display, click on the arrow in the toolbar.

The sliders in the Display Control panel are used for evaluation; the function of these sliders is described in the following.

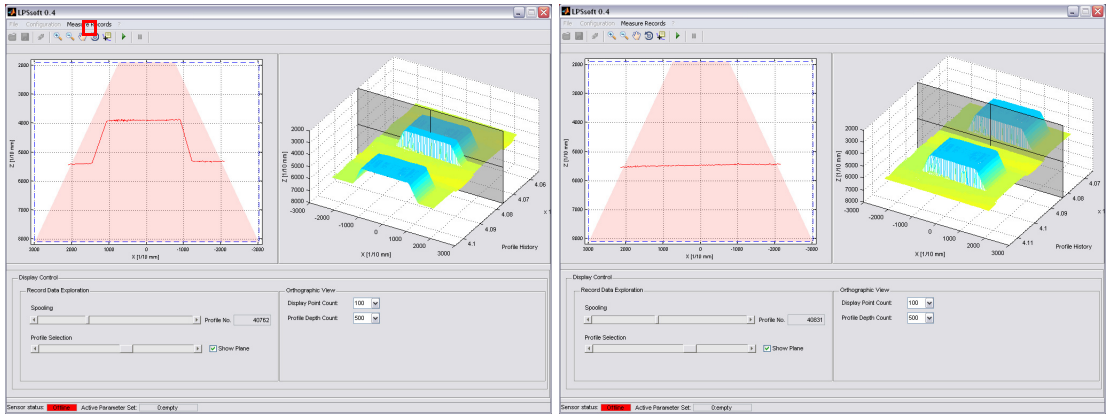


Figure 9.5: Evaluating saved 3D data

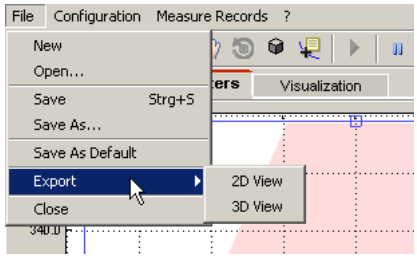
Spooling enables scrolling through all single data sets from the first to the last one within the measurement data set.

You can configure how many data sets are displayed in the 3D view by using Profile Depth Count. Using the Profile Selection slider you can configure which of the displayed single data sets (profiles) from the 3D view will be shown in 2D view. The associated data set number is displayed under Profile No.. The Show Plane option displays this single data set also in 3D view.

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 LPS 36 is reconfigured via **Inspection Tasks**. A parameter file stored on a data carrier can only be used with LPSsoft configuration software!



- New creates a new configuration file.

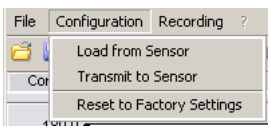
- New creates a new configuration file.
- Open opens a configuration file from the data carrier.
- Save saves the open configuration file with the same name.
- Save as saves the open configuration file under a different name.
- Save as default saves the open configuration as the default setting which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

- 2D View: the current 2D view
- 3D View: the current 3D view

9.6.2 Transmitting parameter settings/Configuration menu

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



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

9.6.3 Saving measurement data/Measure Records menu

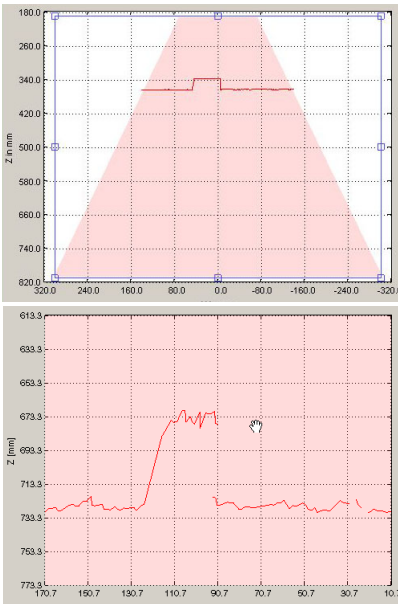
The `Measure Records` menu is used for saving measurement data (including the encoder values) on the PC in `*.csv` format.

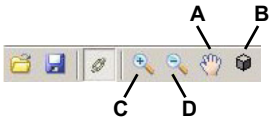
- `New...` creates a new measurement data set. Following a file name query dialog, another dialog appears. It requires you to enter how many single measurements (profiles) are to be saved in the file.
- `Archive -> Open record` opens a saved measurement data set.
- `Archive -> Close record` closes the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

NOTE
With measurement data open, **LPSsoft** cannot establish a connection to the sensor. A connection with the sensor is only possible after closing the measurement 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 9.6: 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.

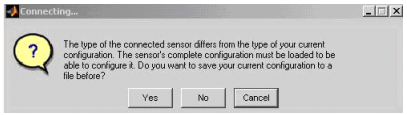
NOTE
The click-and-drag method for zooming known from other programs is not possible here. Before LPSsoft is operated further, the tool buttons (Zoom, Pan, …) must be activated.

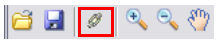
9.7 Definition of inspection tasks

Typical procedure

1. **Start LPSsoft** and connect it to sensor:
   Click on the button `Connect to sensor`: 

   If the connected sensor type does not correspond with the standard type stored in **LPSsoft**, a query appears asking whether the current parameter set should be saved in **LPSsoft**.



2. Fetch the configuration from the sensor via `Load from Sensor` or load it from the data carrier with `Open`.
3. Use `Inspection Task Selection` to select the inspection task to be modified.
4. Display and, if necessary, enlarge 2D view of the detection range in the `Parameters` tab.
5. Set LPS parameters (see "Standard tab – Task Parameters panel" on page 50)
6. Assign a name (`Name`) to the inspection task and confirm with `Accept`.
7. Temporarily transfer the inspection task with `Apply Settings`.
8. If necessary, define further inspection tasks with steps 4–6.
9. Tick `Enable Selection Inputs` again.
10. Permanently transfer the configuration including all inspection tasks to the sensor with `Transmit to Sensor`.
11. If necessary, save the configuration to data carrier with `Save As`.
12. Finally, disconnect the sensor:
    Click on the `Disconnect from sensor` button: 

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

10.1 General information

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

- Measure Mode
- Command Mode

In measure mode the LPS 36 transmits measurement data. In the “Free Running” measurement operating mode, measurements are performed continuously with a maximum measurement frequency of 100 Hz and the measurement data are sent without an additional request being made. In triggered mode, measurement is performed after a rising edge on the trigger input or as a response to the “**Ethernet Trigger**” command (see chapter 10.3.4 "Commands in measure mode").

In command mode the LPS 36 reacts to commands from the control. The available commands are in Chapter 10.3 described.

	NOTE
	If you use a firewall, please make certain that the control can communicate with the LPS 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).

10.2 Protocol structure

	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 LPS 36 does not respond to commands from the control even though communication with LPSsoft 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 LPS 36. The transaction number of the response from LPS 36 then also contains `0x4E43` (byte sequence 0x43, 0x4E). The LPS 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**. The protocol is used both in command mode when transmitting commands and when acknowledging sensor commands as well as in measure mode.

Header

Startseq. 1	Startseq. 2	Fill character	Command no.	Fill character	Packet no.	Fill character	Transaction no.	Status	Encoder H	Encoder L	Fill character	Scan no.	Type	Quantity User data words
0xFFFF	0xFFFF	0x0000	0x0059	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0010	0x0003
Length 4 bytes, value fixed: 0xFFFF 0xFFFF		Length 2 bytes, value fixed: 0x0000	Length 2 bytes, possible values: see chapter 10.3	Length 2 bytes, value fixed: 0x0000	Length 2 bytes, Value range: 0x0000 ... 0xFFFF	Length 2 bytes, value fixed: 0x0000	Length 2 bytes, Value range: 0x0000 ... 0xFFFF	Length 2 bytes, Value range: 0x0000 ... 0xFEFF	Length 4 bytes, Value range: 0x0000 0000 ... 0xFFFF FFFF 1)		Length 2 bytes, value fixed: 0x0000	Length 2 bytes, Value range: 0x0000 ... 0xFFFF	Length 2 bytes, value fixed: 0x0010	Length 2 bytes, possible values: 0x0000 / 0x0001 / 0x0002 / 0x0003 / 0x0178

Length of the header: 30 bytes

1) The maximum value here is determined by the setting of the encoder type, see "Counter Value Overflow" on page 52.

User data

User data														User data
0x000	...													0x03C0

Length of the user data: see number of user data words in the header

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 measure mode, a differentiation is made between 2 varieties of measurement data transfer:

- Standard-Connect:
  Command number 0x5858 signals that the data packet of the sensor contains X-coordinates. Command number 0x5A5A signalizes that the data packet contains Z-coordinates.
- HI-Connect (only with LPS 36HI/EN):
  Command number 0x5A58 signalizes that the data packet contains X- and Z-coordinates.

10.2.2 Packet number

The packet number serves internal maintenance purposes of the manufacturer.

10.2.3 Transaction Number

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

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

10.2.4 Status

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

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

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

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. After that, there is an overflow to 0x0000 0000 (see chapter 9.4.2 "Encoder tab – Encoder Parameters panel"). Beyond that an overflow to 0x0000 0000 occurs.

10.2.6 Scan number

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

10.2.7 Type

Specifies how the data are to be interpreted. The fixed default value is 0x0010. That equates to 16 bit data.

10.2.8 Number of user data words

Number of user data words specifies how many data words of the data type defined in the previous field are contained in the packet.

The user data have a variable length of 0, 1, 2, 3 or 376 or 480 data words (0, 2, 4, 6 or 752 or 960 bytes).

10.2.9 User data

In command mode, the commands can contain user data. These are then described in more detail in the corresponding command description.

In measure mode, the measurement values of the sensor are transmitted to the user data. These are differentiated according to the type of establishment of connection to the sensor (Standard-Connect or HI-Connect).

All variants of the LPS 36 and the LPS 36HI/EN support **Standard Connect**:

For each measurement, a packet of Z-data (command number 0x5A5A) and then a packet of X-data (command number 0x5858), each with 376 values of 2 bytes, are transmitted. With the LPS 36HI/EN, values 241 … 376 are set to 0 (compatibility). The resolution is 1/10mm. The Z- and X-data packets have the same scan number; this should be checked in the control.
The Z-data has a value range of 0 … 8100.
The X-data is transferred as signed values in two's complement. 0 … 32767 are positive X-values, 32768 … 65535 are negative X-values (where 65535 corresponds to the value -1). For negative values (>32768), the process control must therefore subtract 65536 from the transferred X-values to obtain the actual X-values.

The LPS 36HI/EN also supports **HI-Connect**:

The Z- and X-data is transmitted in one packet (command number 0x5A58) with 480 values of 2 bytes. The resolution is 1/100mm.
The payload words 1 … 240 contain the Z-data, value range 0 … 61000. This is followed by the X data as signed values in the range of -7000 … +7000.
Invalid measurement values have a Z- and X-value of 0.
If an LPS 36HI/EN is used in a system instead of an LPS 36 without the establishment of connection being changed (Standard-Connect), it behaves compatibly to the standard LPS 36. Whether the application profits from the higher resolution of the LPS 36HI/EN can also be easily tested this way.

NOTE
If the detection range has previously been limited using LPSsoft, the measuring points, which were not detected, will be transferred with 0 value. Invalid measurement values (e.g. due to occlusion, object reflectivity too low, …) are also transmitted with a Z- and X-value of 0.

10.3 Ethernet commands

⚠ ATTENTION!
The scope of the available commands has grown from firmware version to firmware version. One **Revision History / Feature list** can be found in the appendix in Chapter 16.2. The commands described below refer to the **current** firmware version of the LPS 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 LPS 36 corresponds to the "little-endian" byte sequence. The response of the LPS 36 also corresponds to the "little-endian" standard. For further information, see the note in Chapter 10.2.

NOTE
If the LPS 36 is operated in command mode, the LPS 36 transmits no data (useful for operation with PLC controls).

In measure mode, commands `Connect to Sensor`, `Disconnect from Sensor`, `Enter Command mode`, `Ethernet Trigger` and `Ethernet Activation` 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
For command syntax (header/user data), see chapter 10.2.

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

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

Table 10.1: Connection commands

When first connecting after switching on, the sensor is always in measure mode and continuously transmits measurement data (“Free Running”) or waits for a trigger signal for transmitting measurement data.

If the LPS 36HI is connected with the `Connect to Sensor` command and a user data value of 0x0001, then the sensor is connected via HI-Connect.

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

Table 10.2: Connection commands

Byte	**MSB**			**High byte**			**LSB**	**MSB**			**Low byte**			**LSB**		**Meaning of the bits**
31…32															SF	**SF = 0**: Standard-Connect 2 separate data packets for Z- and X-coordinates with 782 bytes each **SF = 1**: HI-Connect, LPS 36HI/EN only 1 common data package for Z- and X-coordinates with 990 bytes

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

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

Table 10.3: Command mode control commands

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

10.3.2 Commands in command mode

NOTE

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

The following commands are available in command mode:

Command from control to LPS 36			Answer from LPS 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
0x0003 [1]	**Trigger Single Measurement** *Single measurement (software trigger)*	0	0x4141	Single measurement carried out	0
			0x414E	Single measurement not carried out	0
0x0011 [2]	**Get X Coordinates** *Query X-coordinates of the previously triggered single measurement. Repeated queries yield always the same values without retriggering.*	0	0x0012	In the user data area 376 values are always transferred. The X-coordinates are transferred as "signed" values. If the LPS 36HI was connected to HI-Connect (see chapter 10.3.1), the measured values in the unit 1/100mm.	376
0x0013 [2]	**Get Z Coordinates** *Query Z-coordinates of the previously triggered single measurement. Repeated queries yield always the same values without retriggering.*	0	0x0014	In the user data area 376 values are always transferred. If the LPS 36HI was connected to HI-Connect (see chapter 10.3.1), the measured values in the unit 1/100mm.	376
0x005F	**Get ZX Coordinates** *Only for LPS 36HI, which is connected with HI-Connect. X- and Z-coordinates are transferred in one packet. Repeated queries yield always the same values without retriggering.*	0	0x0060	In the user data area 480 values are always transferred. The user data structure corresponds to that of HI-Connect.	376
0x0029 [5]	**Set Encoder Value** *Setting the encoder counter (see chapter 10.3.3).*	2	0x4141	Encoder counter value set	0
			0x414E	The transmitted command was not processed.	0
0x004B	**Set Actual Inspection Task** *Set the number of the current inspection task, see chapter 10.3.3*	2	0x4141 [3]	The inspection task has been set	0
			0x414E [4]	The transmitted command was not processed.	0
0x0049	**Get Actual Inspection Task** *Retrieve number of the current inspection task*	0	0x004A	The task number is transferred in the user data area. (0 = Task0, up to 15 = Task15)	1
0x0053	**Set Scan Number** *Set the scan number, see chapter 10.3.3.* Ensure identical scan numbers with multiple sensors; for description, see "Set Scan Number" on page 63	1	0x4141	Scan number set	0
			0x414E	The transmitted command was not processed.	0
0x0059 [5]	**Set Single User Parameter** *Writes specific LPS parameters to the sensor, e.g. disable output of X-coordinates.*	3	0x4141	Parameter was set	0
			0x414E	The transmitted command was not processed.	0
0x005B [5]	**Get Single User Parameter** *Reads specific LPS 36 parameters, e.g., whether the output of X-coordinates is deactivated.*	1	0x005C	Parameter is output	1
			0x414E	The transmitted command was not processed.	0
0x006D	**Set Single Inspection Task Parameter** *Writes individual inspection task parameters to the sensor temporarily or permanently.*	3…14	0x4141	Parameter was set	0
			0x414E	The transmitted command was not processed.	0
0x006F	**Get Single Inspection Task Parameter** *Reads out individual inspection task parameters.*	1	0x0070	Parameter is output	9…20
			0x414E	The transmitted command was not processed.	0

Table 10.4: Sensor control commands

1) Command cannot be processed until firmware V01.26 if the LPS 36 is set to Operation Mode “Input Triggered” (see chapter 9.4.1 "Standard tab – Task Parameters panel", Operation Mode on see page 50).

2) Commands 0x0011 and 0x0013 can be transmitted no sooner than 30ms after command 0x0003 to obtain valid measurement data.

3) 0x4141 = Acknowledge: Execution of the command is confirmed
4) 0x414E = Not Acknowledge or Error: Command has not been executed
5) The command acts globally on all inspection tasks.
Attention!
If the command is used to deactivate the output of X-coordinates, only Z-coordinates are transmitted. LPSsoft can be used to depict 2D- and 3D-views. The sensor can only be reset to again transmit X- and Z-coordinates by means of command number 0x0059 when using parameter ID 0x07D4. The sensor can also be reset to factory settings via the keyboard and display, but all other sensor settings are lost as well.

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

Set Laser Gate

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

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

LF=0 switches the laser off,
LF=1 switches the laser on.

Set Encoder Value

For sensor control command 0x0029, 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	L16	L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1	Encoder value LowWord (Value range: 0x0000 … 0xFFFF)
33…34	H16	H15	H14	H13	H12	H11	H10	H9	H8	H7	H6	H5	H4	H3	H2	H1	Encoder value HighWord (Value range: 0x0000 … 0xFFFF)

NOTE

Please note that the transmitted encoder values must not exceed the maximum value of the encoder pulse counter (see parameter `Counter Value Overflow` in LPSsoft, see chapter 9.4.2)

Set Actual Inspection Task

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

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

If **SF=0** then the inspection task is changed only temporarily.
If **SF=1** then the newly set inspection task is retained even after a restart of the LPS 36.

Get Actual Inspection Task

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

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

Set Scan Number

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

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

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

NOTE

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

Set Single User Parameter

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NOTE

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

Activating the median filter for Z-coordinates

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

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

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

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

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

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

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

Get Single User Parameter

Status of the transmission of X-coordinates in measure mode

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

Command syntax:

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	0x005B	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0010	0x0001

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

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

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

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

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

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

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

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

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

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

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

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

Querying whether median filter is active/not active

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

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

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

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

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

Set Single Inspection Task Parameter

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

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

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

Parameters and settings:

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

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

Parameter ID	Parameter meaning	Valid parameter values	Data type from parameters	Quantity Parameter values
0x0BB9	Name of the active inspection task	Maximum length: 12 ASCII characters, each character is saved as a 16-bit word	CHAR	12
0x0BBA	Operating mode	0=Operation Mode: Free Running; 1=Operation Mode Input Triggered	UINT8	1
0x0BBB	Enabling of activation	0=Activation Input: Disregard; 1=Activation Input: Regard	UINT8	1
0x0BBC	Enabling of the cascading output	0=Cascading Output: Disable; 1=Cascading Output: Enable	UINT8	1
0x0BBD	Exposure duration of the laser	0 = Normal (approx. 261µs) 1 = Bright Objects (approx. 97µs) 2 = Dark Objects (approx. 655µs) 3 = Normal to Bright Objects (approx. 328µs) 4 = Manual Setting (the exposure time is set using parameter ID 0x0BBE)	UINT8	1
0x0BBE	Manual adjustment of the exposure duration	Permissible value range LPS 36HI/EN: 739…13109; LPS 36, LPS 36/EN: 973…13109 (exposure time unit in 1/10 µs). The duration of exposure is set incrementally in the sensor. The actual duration of exposure can deviate slightly from the parameter value transmitted. The exposure duration set can be accessed with the "Get Single Inspection Task Parameter" (0x006F) command in combination with parameter ID 0x0BBD.	UINT16	1
0x0BBF	X-coordinate detection range	2 signed X-values for Field of View, Value 1: Minimum X Value, Value 2: Maximum X Value, Permissible value range LPS 36HI/EN: -700…700; LPS 36, LPS 36/EN: -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, Permissible value range LPS 36HI/EN:1950…6100; LPS 36, LPS 36/EN: 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 LPS (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

Meaning of the bits:

Parameter ID	Parameter meaning	Valid parameter values	Parameter data type	Number of parameter values
0x0BB8	Number of the active inspection task	0-15	UINT8	1
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 ranges LPS 36HI/EN: 739…13109; LPS 36, LPS 36/EN: 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 LPS 36HI/EN: -700…700; LPS 36, LPS 36/EN: -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 LPS 36HI/EN: 1950…6100; LPS 36, LPS 36/EN: 1900…8100, (Unit in 1/10mm)	UINT16	2

10.3.4 Commands in measure mode

NOTE

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

The following commands are available in measure mode:

Command from control to LPS 36			Answer from LPS 36 to control		
Command no.	Meaning	Number of user data words	Command no.	Meaning	Number of user data words
0x4554	**Ethernet trigger** *With the Ethernet Trigger command, a single measurement is triggered in measure mode, similar to triggering via the trigger input.* *Prerequisite is that the LPS 36 be configured with* **LPSsoft** *under* ***Operation Mode*** *to* **Input Triggered**. *A connection to the sensor must exist before the Ethernet Trigger command can be used.*	0	0x5A5A and 0x5858	With **activated** output of **X-coordinates**: The response is initially given with command number 0x5A5A. In the user data area, a data packet with Z-coordinates is output. A response then follows with command number 0x5858 and a data packet containing X-coordinates is output in the user data area.	2 packets @ 376
			0x5A5A	With **deactivated** output of **X-coordinates**: The response is given with command number 0x5A5A. In the user data area, a data packet with Z-coordinates is output.	1 packet @ 376
			0x5A58	Only with LPS 36HI, when HI-Connect is activated. In the user data area, a data packet with Z- and X-coordinates is output.	1 packet @ 480
			0x414E	The transmitted command was not processed.	0

Table 10.5: Commands in measure mode

Command from control to LPS 36			Answer from LPS 36 to control		
Command no.	Meaning	Number of user data words	Command no.	Meaning	Number of user data words
0x4541	**Ethernet Activation** The Ethernet Activation command is used to switch the measurement operation on and off corresponding to the user data word. Prerequisite is that the LPS be configured with **LPSsoft** under **Activation Input Mode** to **Regard**. A connection to the sensor must exist before the command can be used.	1	0x5A5A and 0x5858	With **activated** output of **X-coordinates**: The response is initially given with command number 0x5A5A. In the user data area, a data packet with Z-coordinates is output. A response then follows with command number 0x5858 and a data packet containing X-coordinates is output in the user data area. [1)]	2 packets @ 376
			0x5A5A	With **deactivated** output of **X-coordinates**: The response is given with command number 0x5A5A. In the user data area, a data packet with Z-coordinates is output. [1)]	1 packet @ 376
			0x5A58	Only with LPS 36HI, when HI-Connect is activated. In the user data area, a data packet with Z- and X-coordinates is output. [1)]	1 packet @ 480
			0x414E	The transmitted command was not processed. [1)]	0

Table 10.5: Commands in measure mode

1) The answer listed in the table applies only for the activated state, in FreeRun mode or in the triggered mode, if triggered. In the deactivated state, there is no response to the command.

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

Ethernet Activation

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

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

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

10.4 Working with the protocol

NOTE

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

Command without user data

`Connect to Sensor`

PC to LPS 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

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

PC to LPS 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

LPS 36 to PC (command executed):

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

10.5 Operation with LxS_Lib.dll

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

The DLL can control several light section sensors via Ethernet.

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

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

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

Access

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

10.6 Operation with native C++ DLL

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

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

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

10.7 Operating with HALCON® image processing software

Benefits

The HALCON® image processing library from MVtec Software GmbH® (http://www.mvtec.com) can be used to evaluate the recorded 2D profiles.

To simplify the data import step for the user, an **Image Acquisition Interface** is available that directly controls the LPS 36 sensors and can read the measurement data (X, Z-coordinates and encoder values).

Access

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

	NOTE
	For error-free operation of LPS 36/EN (encoder devices) in combination with the HALCON® Vision Acquisition Interface, use the following settings: • Encoder overflow on 0xFEFF FFFF (corresponds to the factory settings of firmware V01.10, see chapter 9.4.2).

10.8 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 Care, maintenance and disposal

11.1 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 LPS 36 with a soft cloth; use a cleaning agent (commercially available glass cleaner) if necessary.

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

11.2 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.

11.3 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.

12 Diagnostics and troubleshooting

12.1 General causes of errors

Error	Possible error cause	Measures
Control receives no measurement data	Ethernet connection interrupted	Check connection with LPSsoft. See "Commissioning" on page 41.
	Control not connected to sensor	Use "To sensor" command.
Object contours not detected	Occlusion	See "Occlusion" on page 14.
	Contamination of the optics covers	Clean optics covers, see "Cleaning" on page 72.
	Ambient light	Avoid extraneous light, shield the sensor, see "Selecting a mounting location" on page 24. Restrict the detection area with LPSsoft, see "Field of View" on page 51.
	Reflections	Avoid reflections. Restrict the detection area with LPSsoft, see "Field of View" on page 51.
	Unsuitable exposure setting	Adapt exposure duration to the reflective properties of the objects to be detected. See "Light Exposure" on page 51.
	Object not in measurement range	Visual assessment with LPSsoft, reduce the working distance/position of the sensor to the object. See "Standard tab – Task Parameters panel" on page 50.
	Detection range selected too small	Configure detection range with LPSsoft. See "Field of View" on page 51
	Wrong inspection task selected	Change inspection task with LPSsoft or use Ethernet command “Set Actual Inspection Task”. See "Set Actual Inspection Task" on page 63.
Sensor does not respond to commands	Sensor in measure/menu mode	Exit menu view on OLED display. Connect sensor to control. Switch sensor to command mode if necessary.
	Sensor not connected	Check settings of the Ethernet interface. Connect sensor to control
	Sensor not activated	Activate sensor via PIN 2 on X1. Switch off activation input. See "Activation" on page 50.
No laser line	Sensor not activated	Activate sensor via PIN 2 on X1.
	Laser was deactivated in command mode with the "Set Laser Gate" command	Switch on laser. See "Set Laser Gate" on page 63.
	Sensor in trigger mode	Activate single measurement by means of Ethernet trigger or via PIN 5 on X1.

Table 12.1: General causes of errors

Error	Possible error cause	Measures
Sensor does not respond to trigger	Sensor in command mode	Exit command mode with the "Exit Command Mode" command.
	Triggering too fast.	Reduce trigger rate. The shortest possible interval between two successive trigger signals is 10 ms. See "Triggering – Free Running" on page 18.
Sensor cannot be deactivated via the activation input	Activation Input set to "Disregard"	Use LPSsoft to configure the activation input to “Regard”. See "Activation" on page 50.

Table 12.1: General causes of errors

12.2 Interface error

Error	Possible error cause	Measures
No connection Yellow LED does not illuminate	Wiring error	Check Ethernet cable.
No connection Yellow LED illuminates	DHCP activated in network, no fixed or alternate network address assigned.	Assign an alternative IP address, see "Establish connection to PC" on page 40.
	Incorrect IP address/subnet mask set on LPS 36.	Check IP address/subnet mask, IP addresses of LPS 36 and control must be different, but subnet mask must be the same, see Table 8.1 "Address allocation in the Ethernet" on page 40.
	Incorrect port assigned to LPS 36 / control	Using ping command check whether the sensor responds. If so, check port assignment to LPS 36 and control. The set ports must match.
	Firewall blocks ports	Switch off firewall temporarily and repeat connection test.

Table 12.2: Interface error

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

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

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

Table 12.3: 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 use Chapter 13 as a master copy should servicing be 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 13.

13 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

13.1 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
- `LPSsoft.log` file (located in the **LPSsoft** installation directory)
- Parameter file `*.lps`
- 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

14 Technical data

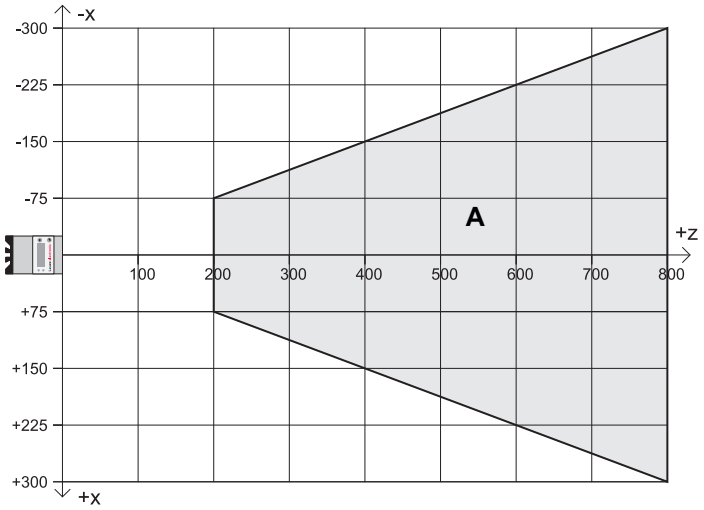
14.1 General technical data

		LPS 36…	LPS 36HI…
Optical data			
Measurement range [1]	in **X**-direction in **Z**-direction	200 … 600mm 200 … 800mm	46 … 140mm 200 … 600mm
Light source		Laser	
Laser class		2M in acc. with IEC 60825-1:2014 / EN 60825-1:2014+A11:2021	
Wavelength		658nm (visible red light)	
Max. output power (peak)		8.7mW [2]	
Pulse duration		< 3ms	
Laser line		600 x 3mm at 800mm	approx. 170 x 1.5mm at 600mm
Error limits (relative to measurement distance)			
Resolution [3] [4]	in X-direction in Z-direction	1 … 1.7mm 1 … 3mm	0.2 … 0.6mm 0.1 … 0.9mm
Linearity in Z-direction [3]		≤ ±1%	≤ ±0.5%
Repeatability in Z-direction [3]		≤ 0.5%	≤ ±0.25%
B/w detection thresholds		≤ 1% (6 ... 90% diffuse reflection	≤ ±0.5%
Time behavior			
Measurement time		10ms	
Readiness delay		approx. 1.5s	
Electrical data			
Supply voltage U_B [5]		18 … 30VDC (incl. residual ripple)	
Residual ripple		≤ 15% of VCC	
Open-circuit current		≤ 200mA	
Ethernet interface		UDP	
Switching outputs		1 (ready) / 100mA / push-pull on X1 [6]	
		1 (cascading) / 100mA / push-pull on X1 [5]	
Inputs		1 (trigger) on X1	
		1 (activation) on X1	
Signal voltage high/low		≥ (U_B-2V)/≤ 2V	
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	

	LPS 36… LPS 36HI…
Mechanical data	
Housing	Aluminum frame with plastic cover
Optics cover	Glass or plastic (see chapter 15.1)
Weight	620g
Connection type	M12 connector
Environmental data	
Ambient temp. (operation/storage)	-30°C … +50°C/-30°C … +70°C
Protective circuit 7)	1, 2, 3
VDE protection class	III, protective extra-low voltage
Degree of protection	IP 67 8)
Standards applied	IEC/EN 60947-5-2, UL 508

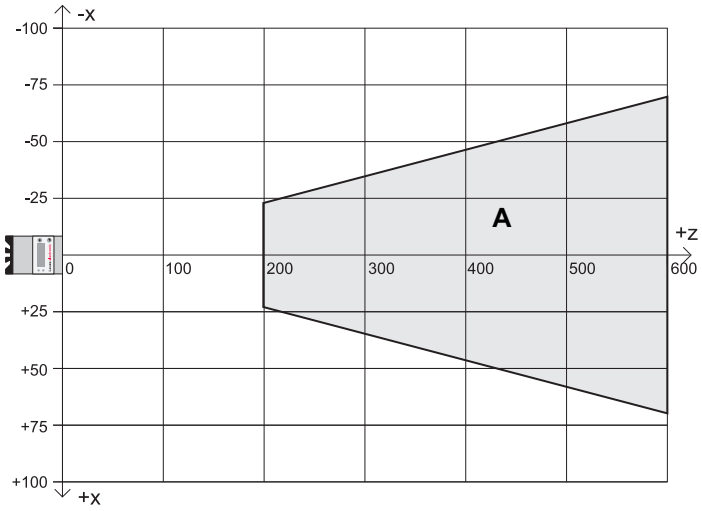
1) Degree of remission: 6% ... 90%
2) Max. accessible emission according to measurement condition 3 laser standard IEC 60825-1 (measuring aperture with 7 mm diameter at 100 distance from the virtual source)
3) Minimum and maximum value dependent on the measurement distance, at 20°C after 30min. warmup time, average range U_B, **z** resolution at factory setting median “3”
4) Degree of remission 90%, identical object, identical environment conditions, measurement object ≥ 20x20mm²
5) For UL applications: use is permitted exclusively in Class 2 circuits according to NEC
6) The push-pull switching outputs must not be connected in parallel
7) 1=transient protection, 2=polarity reversal protection, 3=short circuit protection for all outputs
8) Only if the connectors and caps are screwed into place

14.2 Typical measurement range



A Measurement range
X line length

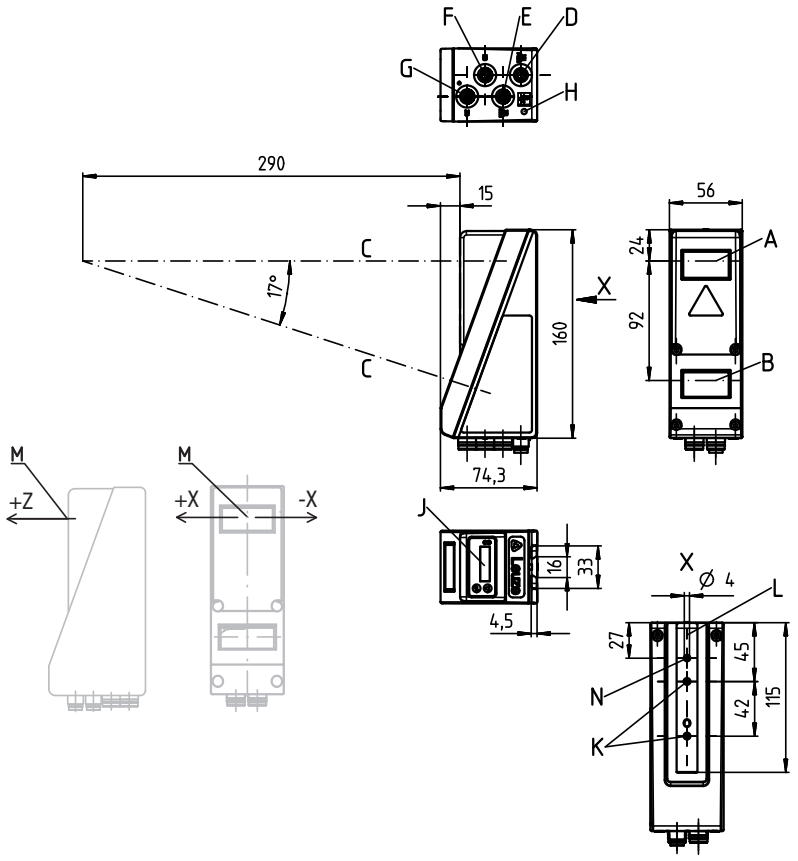
Figure 14.1: Typical measurement range LPS 36



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

Figure 14.2: Typical measurement range LPS 36HI

14.3 Dimensioned drawing



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

Figure 14.3: LPS 36 dimensioned drawing

15 Type overview and accessories

15.1 Type overview

15.1.1 LPS

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

Table 15.1: Overview of LPS types

15.1.2 LRS

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

Table 15.2: Overview of LRS types

15.1.3 LES

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

Table 15.3: Overview of LES types

15.2 Accessories

15.2.1 Fastening

Mounting devices

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

Table 15.4: Mounting devices for the LPS 36

15.2.2 Accessories – Preassembled cables for voltage supply X1

Contact assignment for X1 connection cable

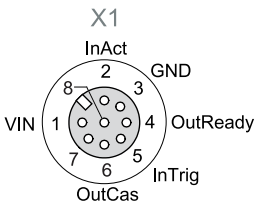
X1 connection cable (8-pin socket, A-coded)			
 **M12 socket (A-coded)**	**Pin**	**Name**	**Core color**
	1	VIN	wh
	2	InAct	br
	3	GND	gn
	4	OutReady	ye
	5	InTrig	gr
	6	OutCas	pi
	7	**Do not connect!**	bu
	8	**Do not connect!**	RD

Table 15.5: 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 15.6: X1 cables for the LPS 36

15.2.3 Accessories for Ethernet interface X2

Preassembled cables with M12 connector/open cable end

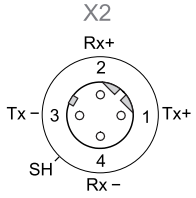
M12 Ethernet connection cables (4-pin connector, D-coded, open cable end)				
 **M12 connector (D-coded)**	**Name**	**Pin (M12)**	**Core color**	
	Tx+	1	ye	
	Rx+	2	wh	
	Tx-	3	OR	
	Rx-	4	bu	
	SH	Shield (thread)	-	

Table 15.7: 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 15.8: Ethernet connection cables featuring M12 socket/open cable end

Preassembled cables with M12 connector/RJ-45 connector

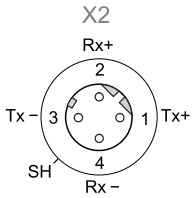
M12 Ethernet connection cables (4-pin connector, D-coded, M12 to RJ-45)				
 **M12 connector (D-coded)**	**Name**	**Pin (M12)**	**Core color**	**Pin (RJ-45)**
	Tx+	1	ye	1
	Rx+	2	wh	3
	Tx-	3	OR	2
	Rx-	4	bu	6
	SH	Shield (thread)	-	

Table 15.9: Cable assignment KSS ET-M12-4A-RJ45-A-P7-…

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

Table 15.10: Ethernet connection cables M12 connector/RJ-45

Pre-assembled cables with M12 connector/M12 connector

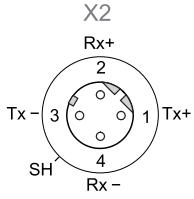
M12 Ethernet connection cables (4-pin connector, D-coded, on both sides)				
 **M12 connector (D-coded)**	**Name**	**Pin (M12)**	**Core color**	**Pin (M12)**
	Tx+	1	ye	1
	Rx+	2	wh	2
	Tx-	3	OR	3
	Rx-	4	bu	4
	SH	Shield (thread)	-	Shield (thread)

Table 15.11: 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 15.12: Ethernet connection cables M12 connector/M12 connector

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

Table 15.12: Ethernet connection cables M12 connector/M12 connector

Connectors

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

Table 15.13: Connectors for the LPS 36

15.2.4 Accessories – Preassembled cables for X3

Contact assignment for X3 connection cables

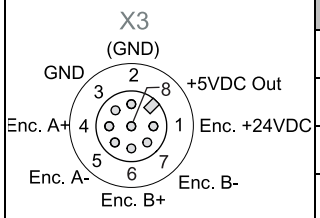
X3 (8-pin connector, A-coded)			
 **M 12 connector (A-coded)**	**Pin**	**Name**	**Core color**
	1	**Enc. +24VDC**	wh
	2	**(GND)**	br
	3	**GND**	gn
	4	**Enc. A+**	yw
	5	**Enc. A-**	gr
	6	**Enc. B+**	pk
	7	**Enc. B-**	bl
	8	**+5VDC Out**	RD

Table 15.14: Cable assignment KS S-M12-8A-P1-…

Order code of X3 connection cables

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

Table 15.15: X3 cables for the LPS 36/6

15.2.5 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.

15.2.6 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 15.16: 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 15.2.2). 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.

16 Appendix

16.1 Glossary

2D view	Graphical presentation of the X/Z-coordinate values of an object within the detection range.
3D view	Graphical presentation of chronologically arranged 2D data.
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.
Cascading	Triggered series connection of several sensors. A master sensor takes over the control (synchronization) of up to 9 slaves.
Data reduction	Reduction of the measurement rate by: • Setting the value for `Prescaler Value` in the display menu. • Triggering the sensor • Deactivating X-values in command mode • Measurement value query in command mode
Detection range (Field of view – FoV)	The detection range is defined via configuration software. Without changing the predefined range it extends trapezoidally according to the maximum detection range specifications. If the maximum detection range is not required to solve the application task, it is recommended to reduce the detection range to a minimum.
Display	Display/Control panel directly at the sensor.
Exposure	Time span of light striking the CMOS receiver, while being reflected off the object to be detected.
File	Task set, which can be stored or accessed via the user interface of the PC or the control.
Inspection task	All settings for the application are made in the configuration software and are stored in up to 16 inspection tasks. It is possible to easily adapt to different tasks by changing over the inspection task.
IP address	Address in network
Measurement time	Time between two individual measurements.
Object	Medium to be detected by sensor.
Offline	LPSsoft is operated without sensor
Online	LPSsoft is operated with sensor

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

16.2 Revision History / Feature list

16.2.1 Firmware

Firmware	Function range	Meaning	required Configuration software
V01.10 2 or later	Multiple inspection tasks for the LPS 36	Up to 16 different configurations can be stored in the sensor; switch between configurations by means of a command	LxSsoft V1.20 (LPSsoft V1.20, LRSsoft V1.04)
Beginning with V01.20	Optimized encoder interface	LPS 36/EN: single-channel encoders are also supported, encoder options, new factory settings	LxSsoft V1.20 (LPSsoft V1.20, LRSsoft V1.10)
	Deactivation of data output – X-coordinates	LPS 36: Reduction of data quantity (useful for PLC evaluation)	
	Extension of the transmission pause between the Z- and X-data packets	LPS 36: Improved reading of data packets (useful for PLC evaluation)	
	Ethernet trigger	Reduction of data quantity (useful for PLC evaluation), reduction in cabling	
Beginning with V01.25	Supports PROFIBUS	Other LRS 36/PB device types with PROFIBUS	LxSsoft V1.30 (LPSsoft V1.30, LRSsoft V1.20)
	Ethernet sensor activation	Activation now possible via Ethernet. Reduction in cabling	
	Factory setting – analysis depth 1 for LRS 36	LRS 36: the maximum detection rate can be achieved with this setting.	
Beginning with V01.30	Supports LES 36	Additional device types LES 36/PB with PROFIBUS and LES 36/VC with analog output	LxSsoft V1.40 (LPSsoft V1.33, LESsoft V1.10, LRSsoft V1.20)

Table 16.1: Revision History – Firmware

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

Table 16.1: Revision History – Firmware

16.2.2 Configuration software

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

Table 16.2: Revision History – Configuration software

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

Table 16.2: Revision History – Configuration software

Index