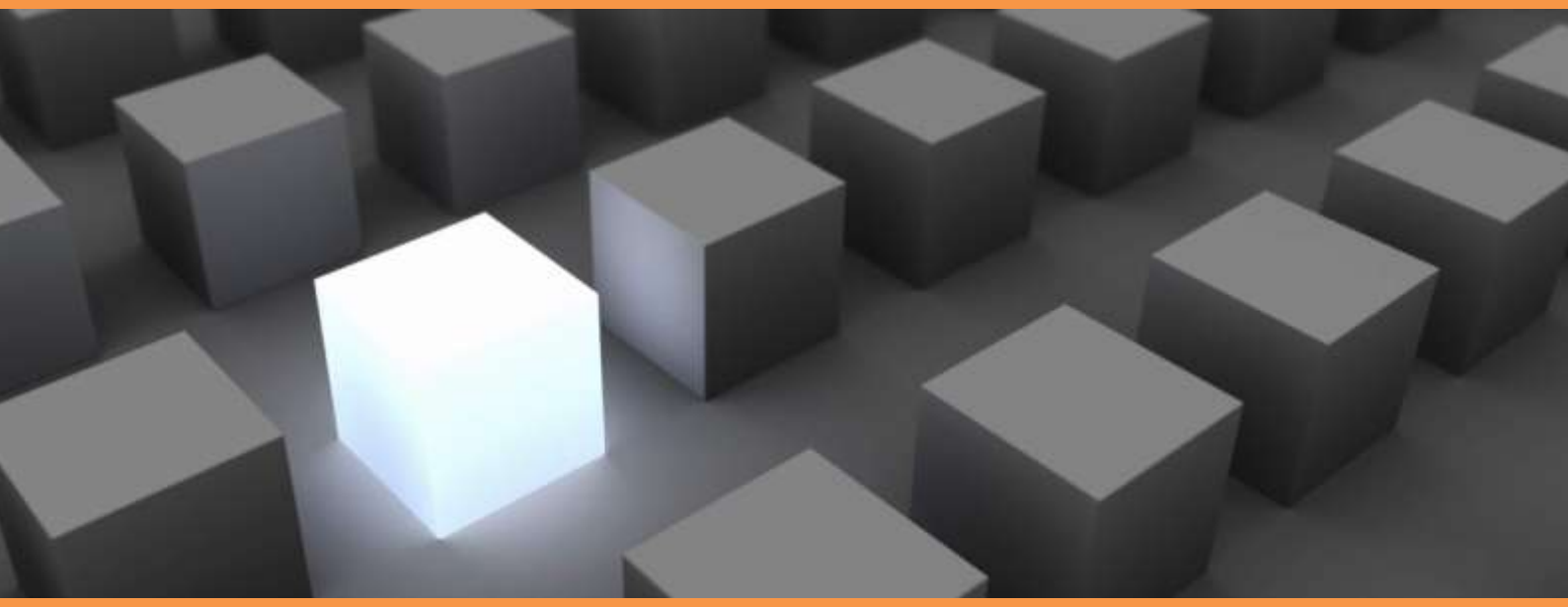
SYMEO LOCAL POSITIONING RADAR

ABSOLUTE POSITIONING

Product: LPR-1DXi

Product Documentation



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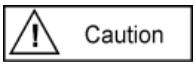
HISTORY

Version	Date	Description
1.02	17.06.2010	USB driver installation changed
1.03	06.08.2010	Added notes for FCC/IC

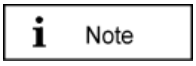
SYMBOLS USED

The following symbols are used throughout the documentation:

This symbol appears before instructions that must be followed at all times. Failure to comply with these instructions will result in personal injury.



This symbol appears before instructions that must be followed at all times. Failure to comply with these instructions will result in damage to equipment.



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1 Overview

SYMEO Industrial Local Positioning Radar (LPR) is a system for contactless, real-time determination of distances between two devices by means of radio signals.

All components are integrated in one casing. The compact station can therefore be mounted very easily and operate maintenance-free, even under harsh conditions. Dust, fog, or similar impacts do not influence the system.

The Local Positioning Radar System LPR-1DXi consists of equal stations, which are configured with the free software *Symeo-Wizard* (via Windows PC):

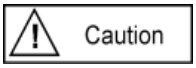
Figure 1 – LPR-1DXi station

The LPR-1DXi station has different interfaces. The unit has IP65 protection class.

Overview of Interfaces	
Power Supply	10-36 Volt via terminal block inside casing
USB	Parameter setting with *Symeo Wizard* (for Windows PC)
Relays	7 dry contact relays via terminal block inside casing
RS232	Distance reading via terminal block inside casing

1.1 Safety Instructions

LPR systems are purely tracking and assistance systems. They therefore do not satisfy the safety class 3 requirements and must not be used as standalone systems in safety-critical applications, such as automation or anti-collision.



Follow the safety instructions in this documentation!

Keep these safety instructions and other documents together with the device.

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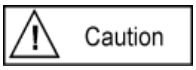
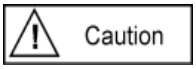
1.2 Installation



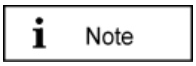
All installation, repair and servicing work must be carried out by qualified and trained technicians!

1.3 Repairs



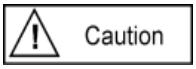
Repairs to the device must be carried out by authorized technicians. Unauthorized opening and incorrect repairs could result in severe danger to the user (danger of electric shock, radiated energy, fire hazard).

1.4 Transport and Storage



Use the original packaging or other suitable packaging for returns and whenever the system is to be transported. This ensures protection from crushing, impacts, moisture and electrostatic discharge.
During setup and before operation, refer to the instructions for environmental conditions included in the operating instructions for the device.
Route the wires in such a way that they do not cause a hazard and are not damaged. When connecting the wires, refer to the corresponding instructions in the operating instructions for the device.
Do not drop the device and do not expose it to strong vibrations.

1.5 Power Supply



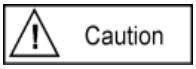
A safety-inspected power cable that satisfies the regulations of the country of use is required for the device. Devices with metal housings must only be connected to a grounded, shock proof socket.

The device must not be operated unless the nominal voltage of the device matches the local supply voltage. Check the supply voltage of the device in stationary devices.

When connecting and disconnecting wires, refer to the instructions in the operating instructions for the device.

Do not use any damaged wires (damaged insulation, exposed wires). A faulty wire poses a risk of electric shock or fire hazard.

1.6 Setup and Operation



During installation, make sure that no objects or fluids get inside the device (risk of electric shock, short circuit).

In emergencies (e. g. if there is damage to the housing, control elements or the mains cable, if fluids or foreign bodies have infiltrated the equipment), switch off the power supply to the device immediately and notify your SYMEO Service.

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Protect the contacts of all of the device's sockets and plugs from static electricity. Do not touch the contacts. If it is ever necessary to touch the contacts, take the following precautionary measures: Touch a grounded object or carry a ground strap before touching the contacts. This will divert static charges.

Proper operation (in accordance with IEC60950/EN60950) of the device is only assured if the housing and integral covers for mounting slots are fully installed (electric shock, cooling, fire protection, noise suppression). If necessary, refer to the corresponding instructions in the operating instructions for the device.

In the case of high outside temperatures and intense, direct solar radiation or other radiant heat, it may be necessary to provide a sun or heat shield.

1.7 System Extensions and Accessories

Note

Data links to peripheral devices must be provided with adequate shielding.

The warranty shall be voided if you cause defects to the device by installing or exchanging system extensions.

1.8 Additional Instructions

Caution

The LPR-1DXi unit must not be opened except for installation. The LPR-1DXi unit contains no serviceable components.

When opening, ensure that no fluid gets into the housing. When sealing the station, ensure that the seal is included in the cover and that the LPR-1DXi unit is completely closed. Otherwise, moisture can penetrate the station and damage it.

Please take note of the safety and operating instructions in the operating instructions for the system in which you want to install the component.

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2 System Description

2.1 Mode of Operation

The distance is determined by measuring the transit time of radio signals. One unit initiates the measurement and the second unit replies.

With the software *Symeo-Wizard* (via Windows PC) the distances for adjustable switching points are determined and transferred to the LPR-1DXi device. Upon reaching a switching threshold, on-board relays open dry contacts. Relays are available on both units. Remote units can be configured via the built-in radio interface. Optional the distance reading is also available on both of the units.

LPR-1DXi units use the same frequency band and the same hardware for communicating as for measuring distance. This means that no external WLAN or cable networks are needed for transmitting measurement values and setting switching relays.

2.2 Technical Data

Overview: Technical Data	
Frequency range	5.725-5.875 GHz, ISM band
Transmitting power	Max. 0.025 W / 14 dBm
Positive signal control to opposite unit	up to 1800 m
Switch thresholds /distance reading	0 to 120 m (option – extended distance reading 0 to 500 m)
Distance output	0,5 m increments (option – higher resolution: up to ± 5 cm *[1])
Repeat rate	Up to 30 Hz
Power supply	10-36 V DC
Power consumption	6 W
Ambient temperature	-40°C to +75°C
Protection class	IP 65
Casing dimensions	190 x 190 x 80 mm (without supplied mounting bracket)
Interfaces	USB for parameter setting with Symeo Wizard (for Win PC); Serial RS 232 with binary protocol (terminal block inside casing); 7x dry contact relays (terminal block inside casing), each max. 2500VA / 300 W, max. 60 VDC, max. 10 A
Compliance	CE mark, part 15 FCC*[2], RSS-210*[2]

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*[1] Depending on distance and application parameters
*[2] Only valid for FCC labeled stations

2.3 System Configuration

The LPR-1DXi system consists of two LPR-1DXi units. For distance measurement and collision-avoidance, the two units are arranged as shown in Figure 2. The distance readings and relays are available at both of the paired units.

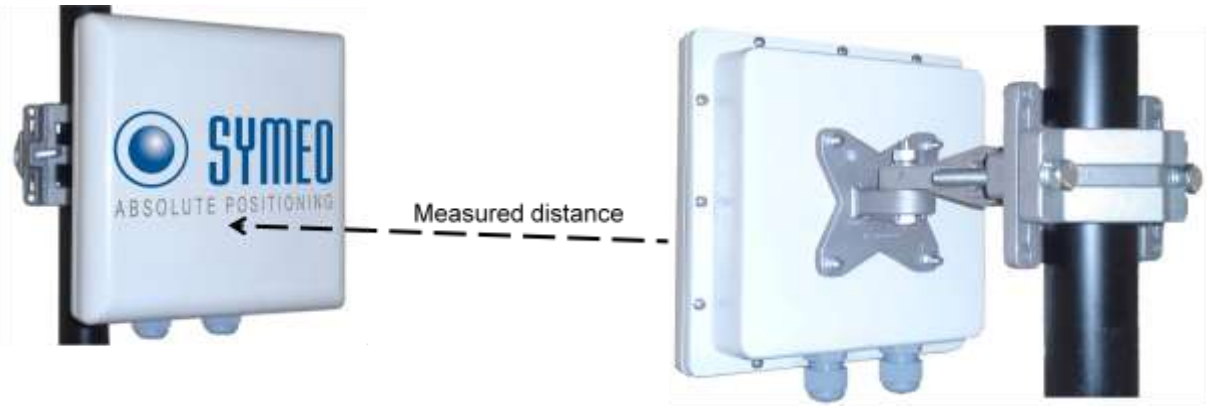

Figure 2: LPR-1DXi system

2.4 System Design

Each LPR 1DXi station has parameters to provide an explicit allocation to a system and also to ensure the functionality of a system. These parameters are explained in the following:

Caution

Parameters may only be set with the commissioning tool Symeo Wizard as described in chapter 5.4. Do not change parameters manually in the configuration files.

2.4.1 Station-ID (SID)

Each station has an explicit identification Number in one system. A system consists of 2 stations. The first station has the station number 1 (SID 1), the second station has the station number 2 (SID 2).

2.4.2 Group-ID (GID)

A pair of LPR-1DXi stations is identified clearly by its group number. The two units in one system have the same group number. If there is used a second, a third or more system in your environment, all additional systems must have a different group number.

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2.4.3 Frequency channel

The measurement takes place in a frequency band width of 5,725 to 5,875 GHz. In this band width a frequency channel is assigned to the LPR-1DXi system. 30 different frequency channels are available. Two units in one LPR-1DXi system need the same frequency channel.

Caution

If there are more LPR-1DXi systems in your environment each further LPR-1DXi system needs different frequency channels. The frequency channel is linked to the group ID. Therefore it is required to use different group IDs for different LPR-1DXi systems in the same environment. You can set the group IDs with the commissioning tool LPR-1DXi *Symeo Wizard* (see chapter 5).

2.5 Versions of LPR-1DXi stations

For the LPR-1DXi stations several different versions are available:

Overview: Options			
	ID	**Switching threshold / distance reading**	**Distance output resolution**
Basic device	BSB000719	0 to 120 m	0,5m increments
Option 1	BSB000754	0 to 500 m	0,5m increments
Option 2	BSB000755	0 to 120 m	Resolution up to ±5 cm
Option 3	BSB000756	0 to 500 m	Resolution up to ±5 cm
Basic device [*1]	BSB000900	0 to 120 m	0,5m increments
Option 1 [*1]	BSB000901	0 to 500 m	0,5m increments
Option 2 [*1]	BSB000902	0 to 120 m	Resolution up to ±5 cm
Option 3 [*1]	BSB000903	0 to 500 m	Resolution up to ±5 cm

[*1] in compliance with part 15 off FCC rules and with RSS-210 of Industry Canada

Caution

Please take care that the distances for the switching points in your application are within the maximum possible distance range of your version of LPR-1DXi.

Note

The distance for positive signal control, monitoring the functionality of two stations, is possible up to 1800m.

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3 Hardware

Warning

All corresponding installation, repair and servicing work must be carried out by qualified and trained technicians.

3.1 Component setup of the LPR-1DXi station

The LPR-1DXi station consists of mounting bracket A, casing with electronic devices B and antenna C as shown in *Figure 3*.

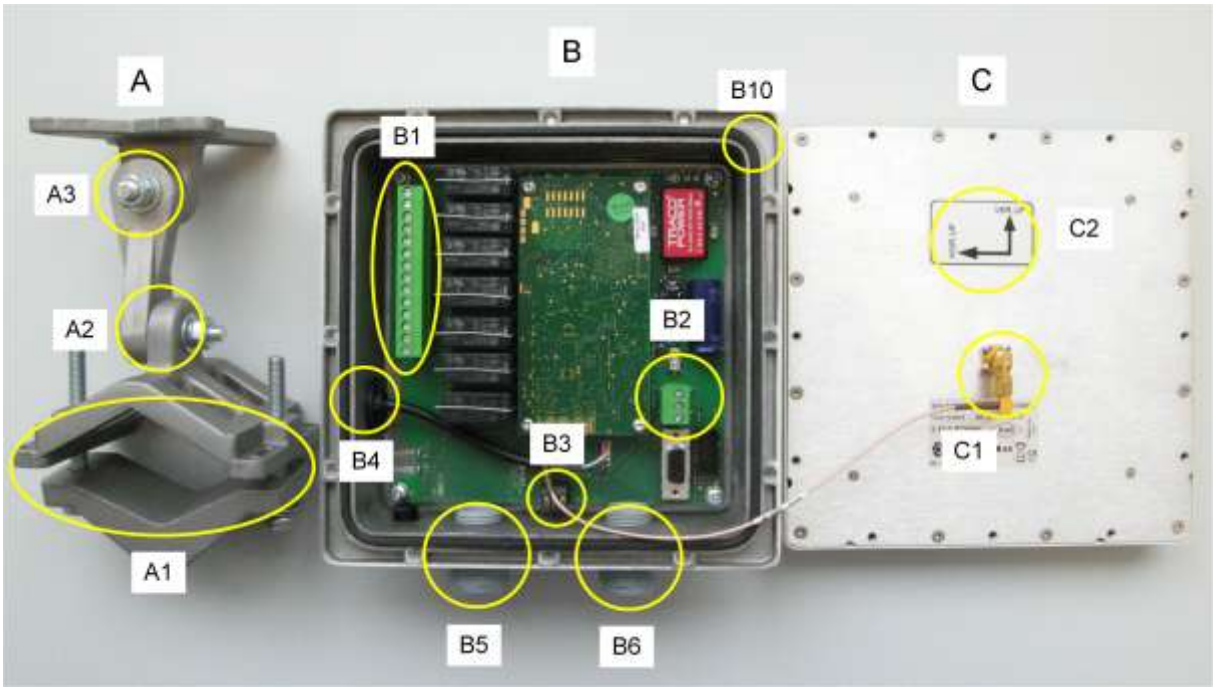

Figure 3 *Components of the LPR-1DXi: mounting bracket A, casing with electronic devices B and antenna C*

A: mounting bracket
- A1 mounting kit for pole and wall mounting
- A2 adjustment of elevation angle
- A3 adjustment of azimuth angle

B: casing with electronic device
- B1 terminal block for relays
- B2 terminal block for power connection
- B3 terminal block for serial RS232 (distance output, binary protocol)
- B4 USB port for parameter setting
- B5 cable gland for relay cable to relay connector
- B6 cable gland for power supply cable and optional serial RS232 cable
- B10 seal

C: Antenna
- C1 connector for antenna cable
- C2 orientation of antenna polarization

Caution

- The seal (B10) seals front and rear element when it is mounted correctly. Otherwise the housing will not be sealed in a water-proof manner.

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- The antenna C has to be mounted in correct polarization (C2) as shown in *Figure 3*

3.2 Cable glands, interfaces and LED display of the LPR-1DXi station

The casing B has two cable glands for power cable (B6) and cable for the connection to the on-board relays (B5). Additionally the pressure equalization membran (B7) is shown.

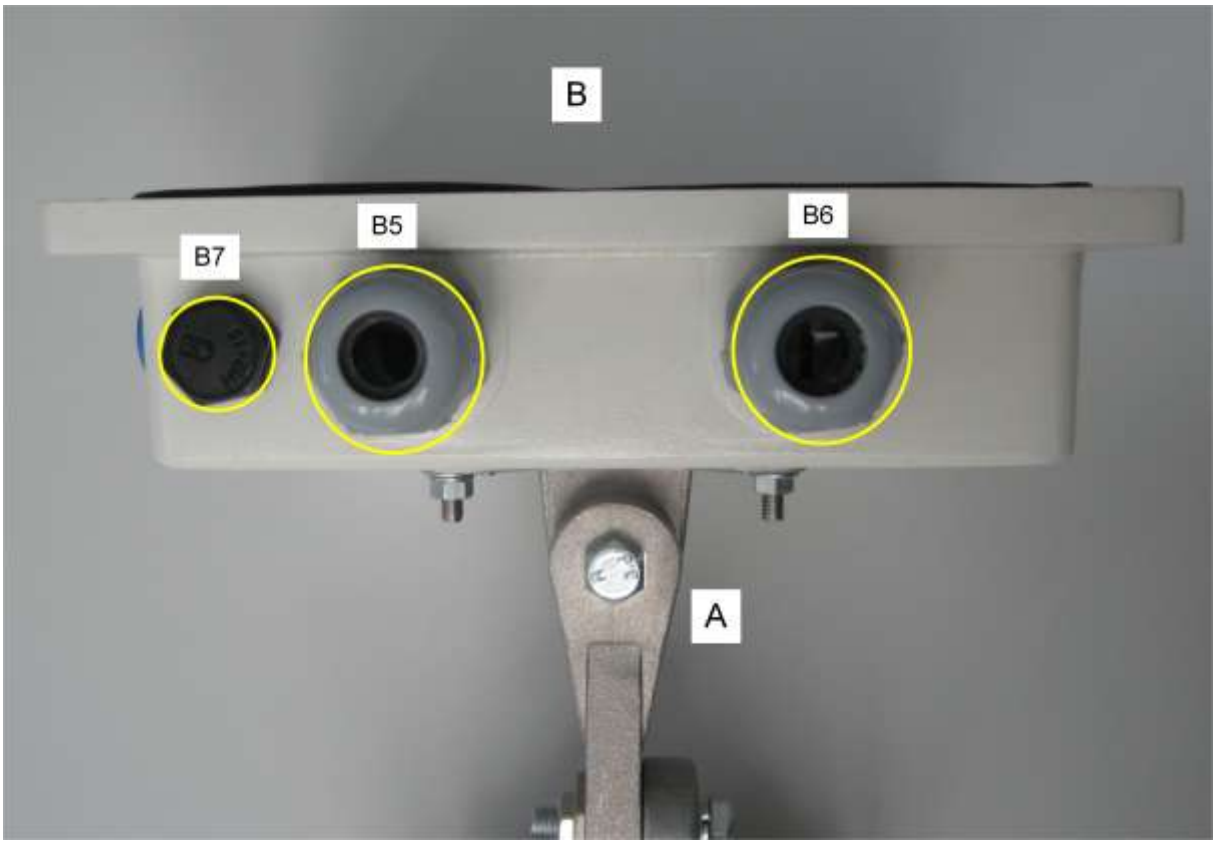

Figure 4: Casing B side view with cable glands and mounting bracket A
B5 Cable gland for cable to relays
B6 Cable gland for power cable with optional wires for serial RS232
B7 pressure equalization membrane

Caution

- Pressure equalization membran (B7) must not be removed or loosened. Otherwise the housing will not be sealed in a water-proof manner.
- Power supply cable must be within 5 to 9 mm diameter, and relay cable must be within 7 to 13 mm diameter, both with a round cross-section.

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On the side of the casing the USB port (B4) for parameter setting with the software *Symeo-Wizard* and two two-colored LED (B8, B9) are located, displaying different statuses of the device.

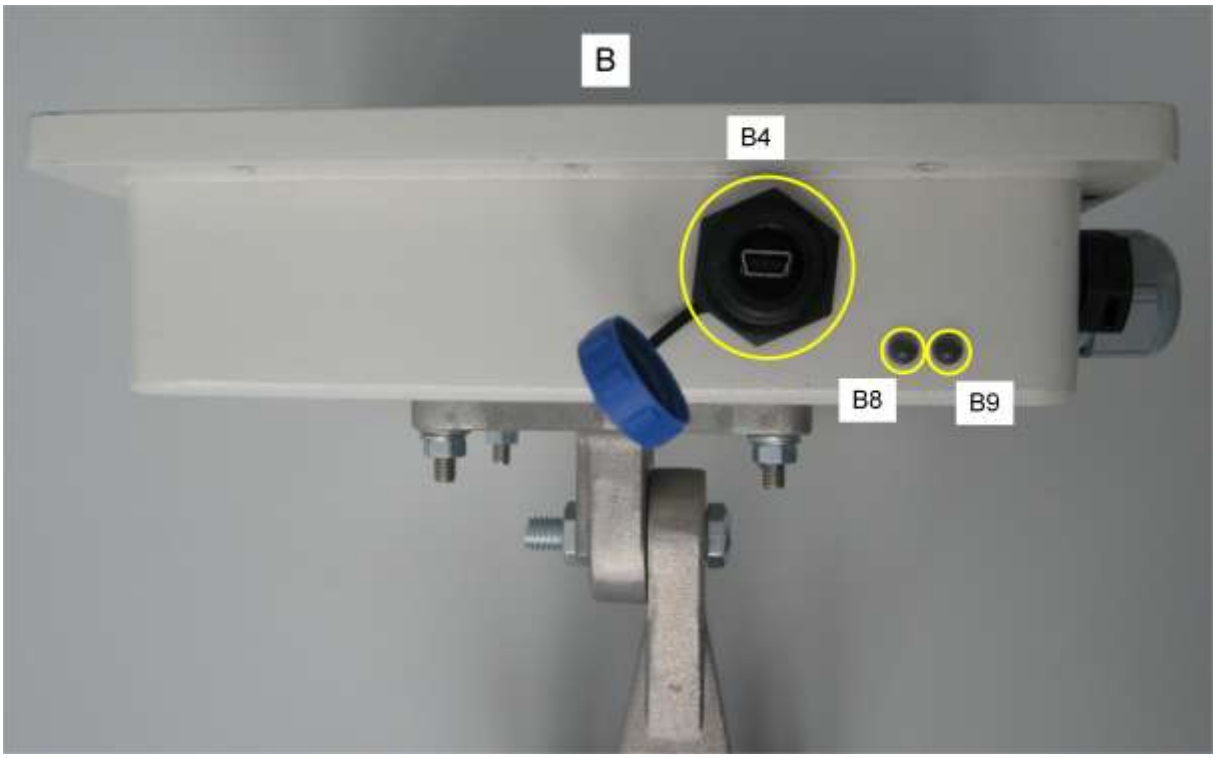

Figure 5 Casing B side view
B4 USB port for parameter setting with software *Symeo Wizard*
B8 two-colored LED, green=switching status of relay 1 / blue=switching status of relay 2
B9 two-colored LED, red=power / green=measurement activity

3.3 Opening angle of the integrated antenna

The LPR-1DXi station has an integrated antenna with 18° opening angle

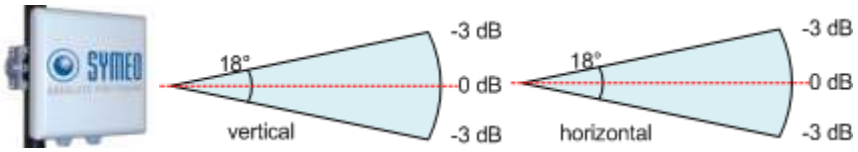

Figure 6: Opening angle LPR-1DXi station

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4 Installation

4.1 Important Instructions for Installation

Caution

- Avoid entry of foreign objects or liquids into the system unit, especially on the PCB stack in casing B.
- The seal (B10) seals front and rear element when it is mounted correctly. Otherwise the housing will not be sealed in a water-proof manner.
- The antenna C has to be mounted in correct polarization (C2) as shown in Figure 3
- To achieve operation and range as specified both system units must have the same orientation, e.g. same orientation of the writing “SYMEO” on the integrated antenna.
- Take precautionary measures against static discharges during the installation process

4.2 Power Connection

Power supply is connected using the power supply terminal block B2. Figure 7 shows the pin assignment. Positve voltage can be connected either at pin 1 or 3, the negative or ground voltage is connected to pin 2.

Caution

- Polarity reversal or otherwise faulty connection can damage the LPR-1DXi station. In that case the station must be send to the SYMEO service.

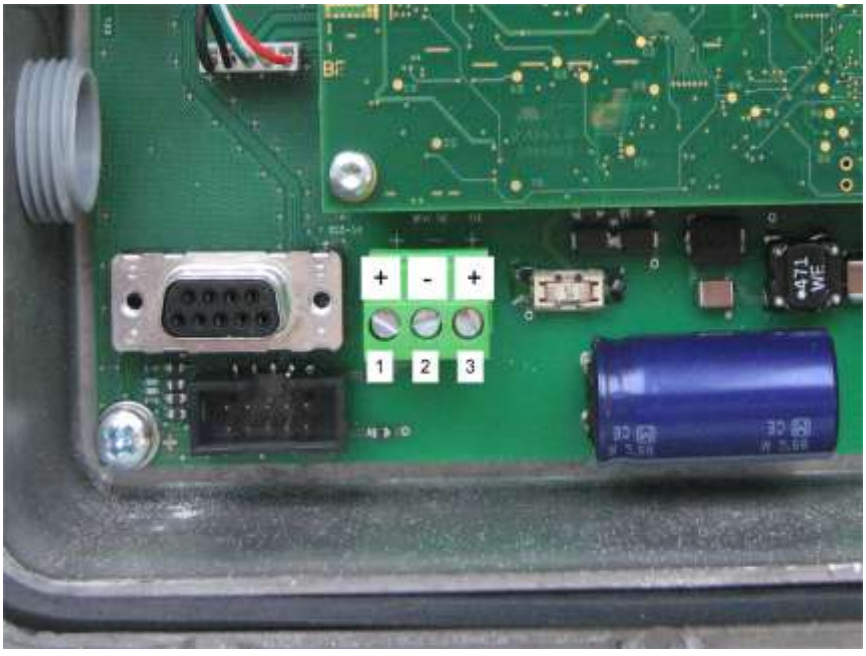

Figure 7: Power supply terminal block B2

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4.3 RS 232 Connection

For optional distance reading RS 232 is connected using the RS232 terminal block B3. Figure 8 shows the pin assignment.

Please use the same cable as for the power supply with additional three wires.

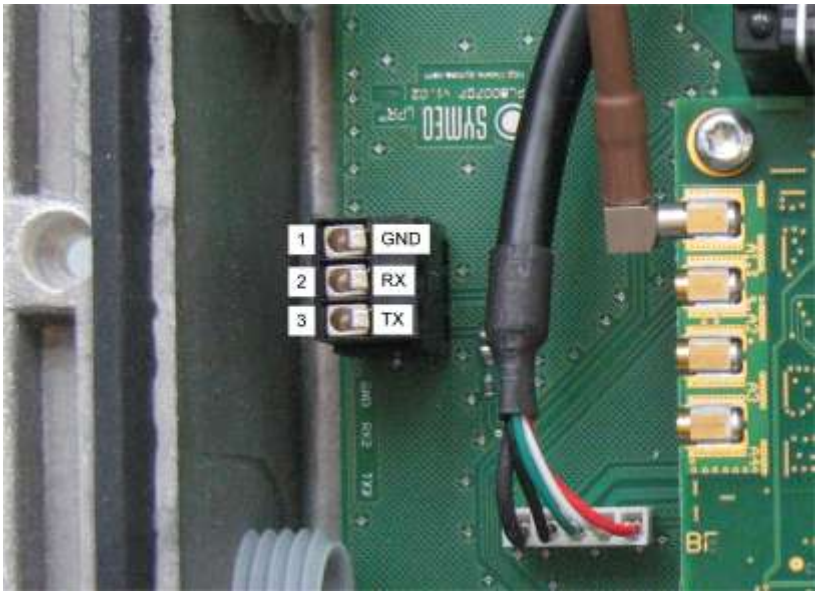

Figure 8: RS232 terminal block B3

4.4 Relay Connection

Relays are connected using the relay terminal block B1. Figure 9 shows the pin assignment for the seven switch relays with dry contacts.

Figure 9: Relay terminal block B1

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4.5 Mounting

Warning

- All installation, repair and servicing work must be carried out by qualified and trained technicians!
- When the system is mounted on fixed tubes the necessary measures to prevent slippage of the system must be taken

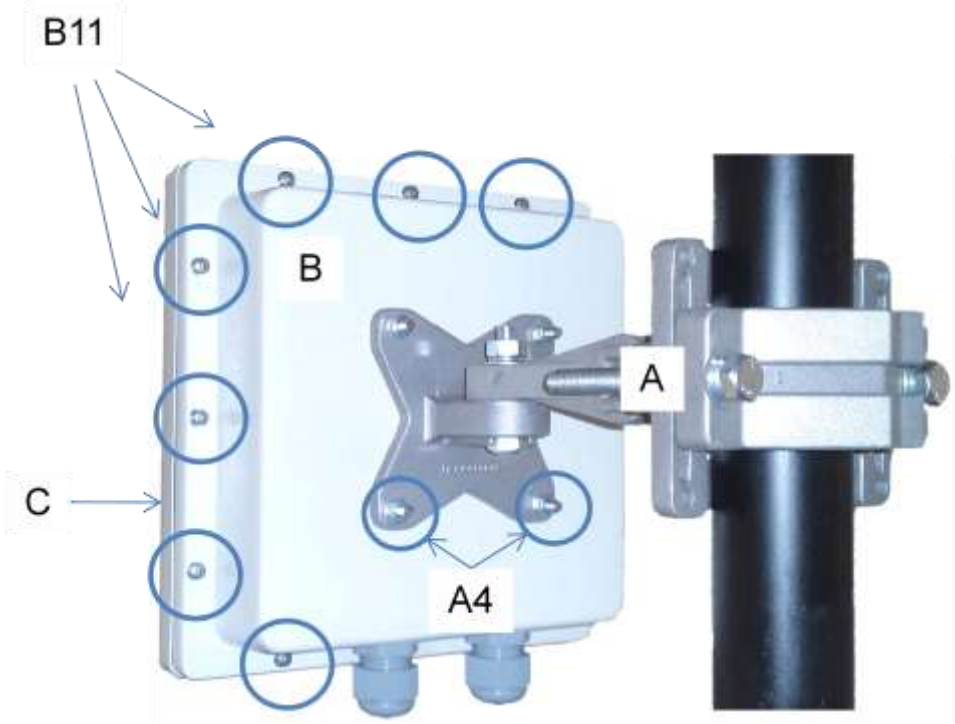

Figure 10: LPR-1DXi station rear view

The LPR-1DXi station is delivered pre-mounted (casing B and antenna C), and with a separate mounting bracket A. Figure 10 shows the complete system including mounting bracket. The mounting bracket A is applicable for wall and pole mounting. For mounting the system please proceed as follows:

⇨ Please use Phillips screwdriver to remove the antenna C from the casing B by unscrewing and removing the twelve mounting screws B11

⇨ Insert the power supply cable in the cable gland B6 and connect it to the power supply terminal block B2.

⇨ If you need distance reading please use additional 3 wires within your power supply cable and connect these wires to the RS232 terminal block B3

⇨ Insert the cable for relay connection in the cable gland B5 and connect it to the relay terminal block B1.

⇨ Fix the antenna C on the casing B with the twelve housing screws B11 using a Phillips screwdriver. Take care that the seal B10 is carefully mounted.

⇨ Carefully tighten the cable glands with flat wrench SW24.

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⇨ Mount the mounting bracket A on a pole or wall at a suitable place. Do not tighten the screws of the adjustment yet, the system must be aligned first.

⇨ Mount the LPR-1DXi casing on the mounting bracket A with 4 hex nuts A4 using flat wrench SW8.

⇨ Carefully align both units (refer to chapter 4.6).

Note

- When the system is powered, the red LED B9 of the display element is turned on.
- When both units are connected to the supply power and valid measurements are made additionally the green LED B9 (two-colored LED) is blinking at high frequency. Provided that both units are configured properly with the configuration tool *Symeo-Wizard* delivered with your LPR-1DXi station (described in chapter 5)

4.6 Installation notes for antennas

4.6.1 Fresnel zone

The area for radio transmission between two antennas is called Fresnel zone. The main part of energy is concentrated in the first Fresnel zone.

Note

This area has to be free of any obstacles otherwise the signal is interrupted or attenuated.

The first Fresnel zone can be calculated as follows:

$$b = \frac{1}{2}\sqrt{\lambda \cdot d}$$

λ is the wave length and d the distance between the two antennas. For a frequency of 5.8 GHz a wave length λ of approx. 0.05 m is calculated. The maximum radius between the two antennas is indicated with b. For different distances the maximum radius is given in Figure 11.

distance d	radius b
10 m	0.36 m
50 m	0.80 m
100 m	1.14 m
250 m	1. 80 m
500 m	2.54 m
1000 m	3.60 m

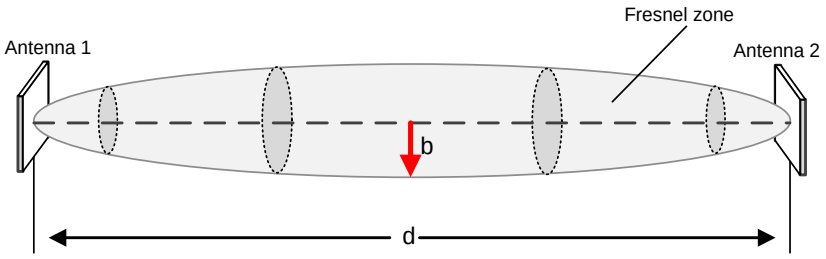

Figure 11 Calculation and figure of Fresnel zone

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4.6.2 Alignment of LPR-1DXi stations

The LPR-1DXi stations with the integrated antennas have to be mounted without any offset (no difference in height and no offset sideways). Make sure that the opening angle is symmetric to the relative direction of motion (compare picture 1 vs. picture 2 in Figure 12).

If an offset is not inevitable the stations have to be tilted (compare picture 3 vs. picture 4 in Figure 12).

Caution

Notice: If the distance goes below a fixed distance it is possible that no measurements take place any longer.

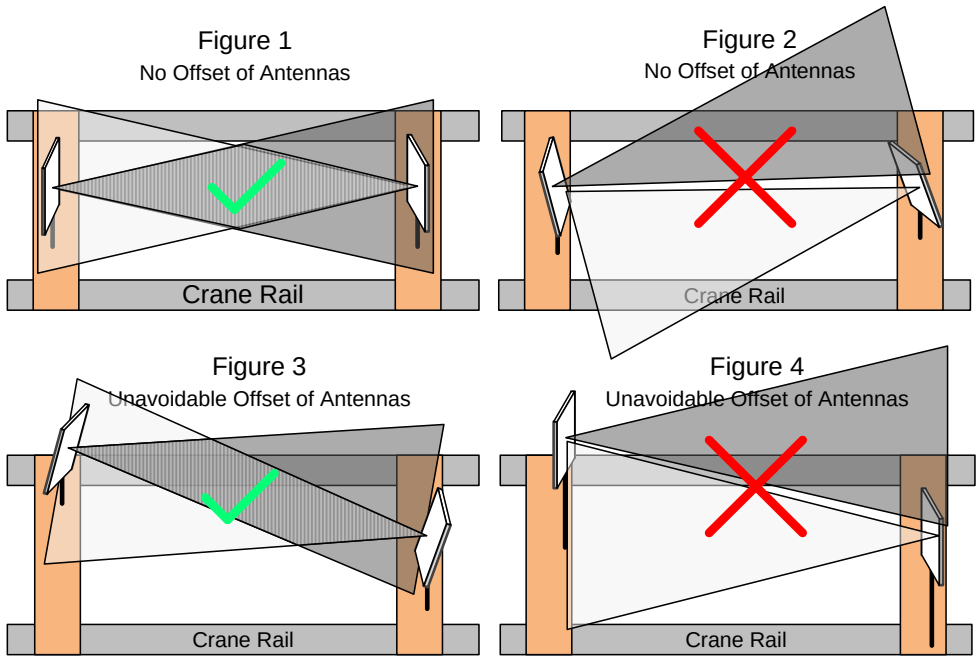

Figure 12 Antenna Position with and without Offset

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5 Commissioning

5.1 Requirements

In order for a station to be successfully commissioned, the LPR-1DXi stations must have been installed correctly:

- ⇨ The station has been installed.
- ⇨ The station has been connected to the power supply (terminal block B2)
- ⇨ Relays are connected to your application (terminal block B1)
- ⇨ Optional: For distance reading RS232 (binary protocol see chapter 6) has been connected to your application (terminal block B3)
- ⇨ Configuration software *Symeo-Wizard* and USB-driver are installed on your Windows PC, both on product documentation CD delivered with your LPR-1DXi devices.
- ⇨ Data link to your PC has been established over USB (jack B4)

Once these prerequisites have been fulfilled, you can set parameters with the software *Symeo-Wizard* for each station.

5.2 Commissioning Tool – LPR-1DXi Wizard

5.2.1 Installation of USB driver

The USB driver for the LPR-1DXi station is supplied with the product on CD.

Install the USB driver with the executable file *CDM20600.exe*.

5.2.2 Installation of the *Symeo Wizard*

Install the LPR-1DXi Wizard .exe file supplied on your product documentation CD on your computer.

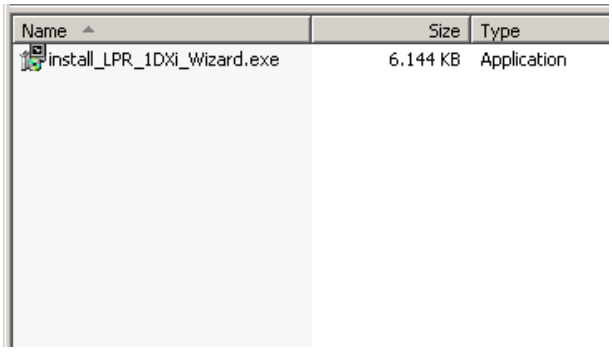

Figure 13 – Installation File LPR_1DXi_Wizard.exe

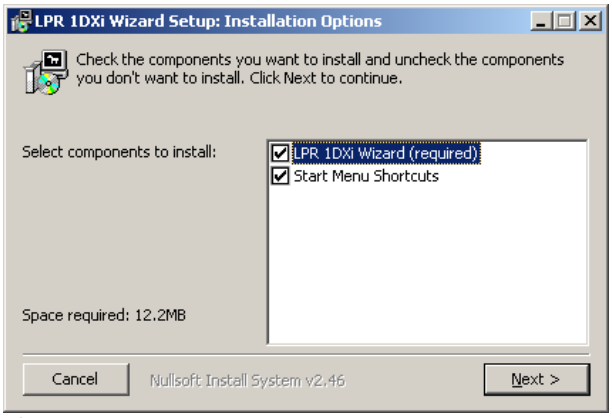

Figure 14 – Setup 1

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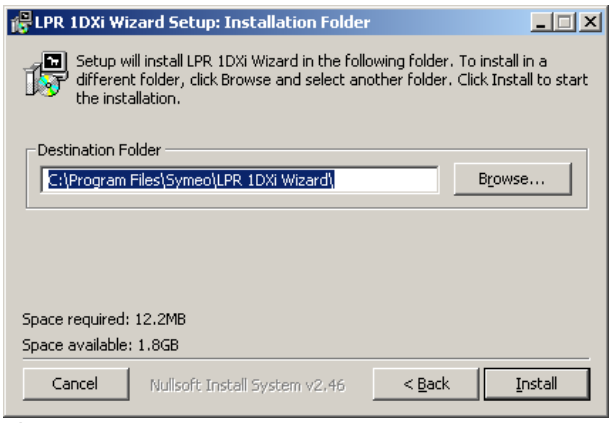

Figure 15 – Setup 2

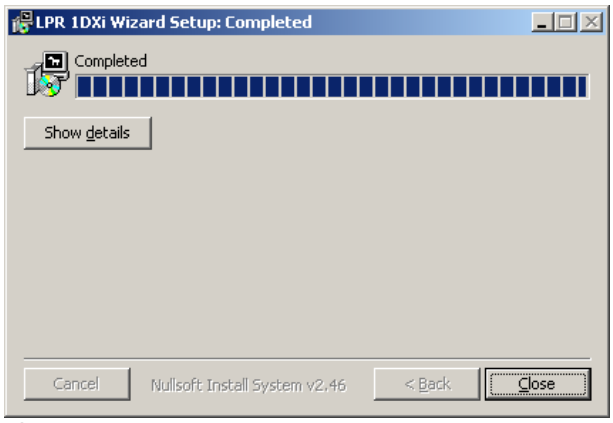

Figure 16 – Setup 3

After finishing the installation process, you can open the LPR-1DXi Wizard via the Windows menu.

5.2.3 Parameter setting with the *Symeo Wizard*

Carry out following steps with the LPR-1DXi Wizard:

1. Selection of the desired application
   - Settings of parameters for selected application
   - General setting of LPR-1DXi System (Group ID, Data Rate RS232, Measurement Cycle)
2. Relay allocation
   - Relay allocation and setting of switch-off points
3. Connection to LPR-1DXi Station
   - Upload of selected application and parameters to the LPR-1DXi station
   - Download of currently applied application as backup-files
   - Check distance data

Start the LPR 1DXi Wizard. The following window appears:

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Figure 17 – Start LPR-1DXi Wizard

The layout of the menu looks like the following:

Menu ‚File‘:
open and save configuration files.

Menu ‚Application‘:
Selection of application and settings for LPR-1DXi Systems

Menu ‚Connection‘:
Connection to LPR-1DXi system.

Note

The info buttons in the wizard explains in more detail the functionality of the action or application.

5.2.3.1 Selection of application

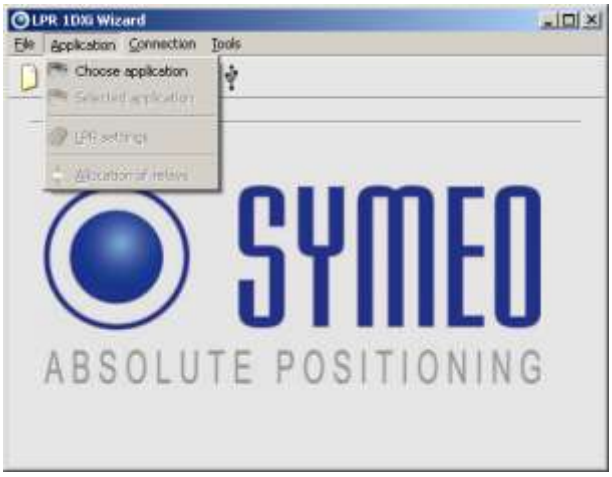

Figure 18 – Selection of application

Select in the menu ‚Application‘ the submenu ‚Choose application‘ to open possible applications..

Note

As long as no application is choosen no further submenu could be selected.

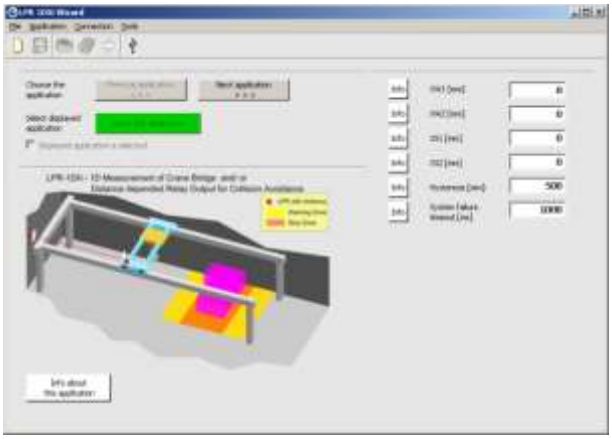

Figure 19 – Overview of application

The first application is shown.

You can see other application with the buttons ‚Next application‘ or ‘Previous application‘.

Note

The application is selected when the button ‚Select this application‘ is pressed and a tick is set.

The button ‚Info about this application‘ contains a short description of the application.

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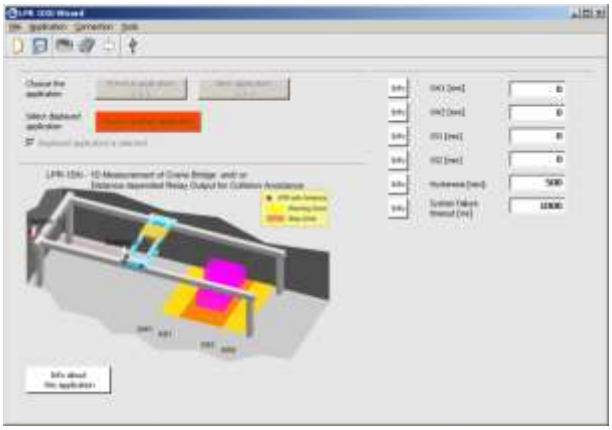

Figure 20 –Settings of parameters of selected application

If the application is selected (The button ‚Choose this application' is shown) additional fields appear. Depending on the application you have to fill out these input fields.

i Note

The meaning of each input field is available by pressing the button 'Info'.

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5.2.3.2 Settings of LPR-1DXi System Parameters

After selecting the application some common settings of the LPR-1D system must be done. Select the menu ‚Application' and the submenu ‚LPR settings'.

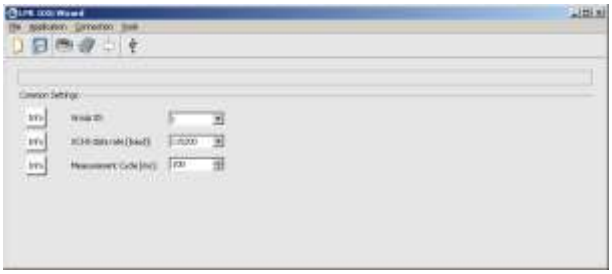

Figure 21 – General settings 1 of LPR-1D system

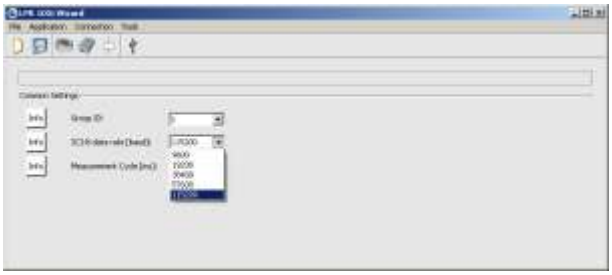

Figure 22 – General settings 2 of LPR-1D system

The ‚Common Settings' include settings of the LPR-1DXi systems. You have to set these parameters.

Group ID: Clear ID of the LPR-1DXi system. The two stations in one LPR-1DXi system must have the same group ID.

SCIB-data rate: Transmission rate of the distance reading available on the RS232 interface on terminal block B3 of the LPR-1DXi system. Per default this value is set to 115200 baud.

Caution If you change the baud rate, you should also adjust the measurement rate of the system.

Measurement rate: Adjust the desired measurement rate of the system. Depending on the application you can choose measurement rates of 35ms to 250ms.

Caution If more than one LPR-1DXi system is used in the same environment you have to use different group IDs for each pair of LPR-1DXi stations.

Note The frequency channel used for measurements is linked to the group ID of the LPR-1DXi system.

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5.2.3.3 Relay allocation

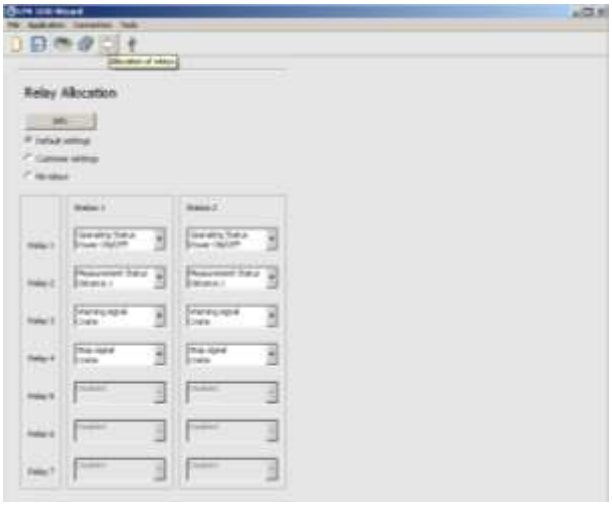

Figure 23 – Allocation of relays

You can allocate functionalities to each relay in station 1 and station 2 depending on the selected application.

Caution The relay allocation has to be done only for the parameter setting upload for station 1. If the relay selection is skipped no relays are switch at the LPR-1DXi stations.

You can choose between default settings, customer settings and no relay.

Note The possible functionalities of the relays depend on the application you have selected.

Note

- The two-colored LED B8 (see *Figure 5* Casing B side view) indicates the switching status of relay 1 (green) and the switching status of relay 2 (blue)
- The default relay setting allocates relay 1 to the operating status. Power on = green
- The default relay setting allocates relay 2 to the measurement status. Valid Measurements = blue

5.2.3.4 Connection to the LPR-1DXi Station

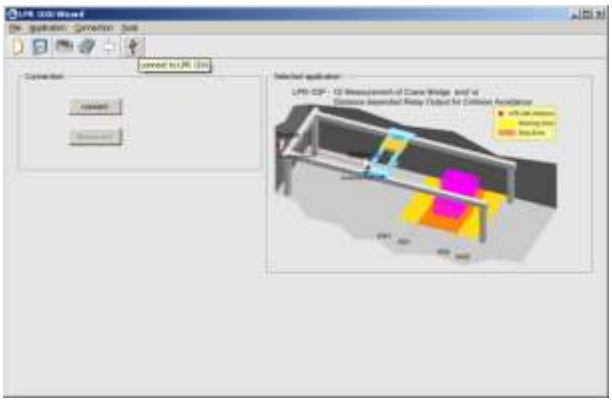

Figure 24 – USB Connection to LRB-1DXi station

To open the USB connection press the button ‘connect’

Note The USB-driver from the product documentation CD has to be installed first.

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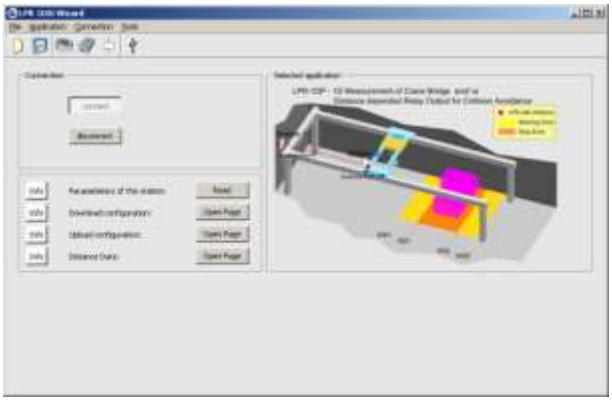

Figure 25 – Open connection

The following submenus appear:

Parameters of this station

⇨ Read out parameters of connected station

Download Configuration

⇨ Download of current configuration of LPR-1DXi station

Upload Configuration

⇨ Upload of application and parameters

Distance Data

⇨ Measured Distance

5.2.3.5 Upload Configuration

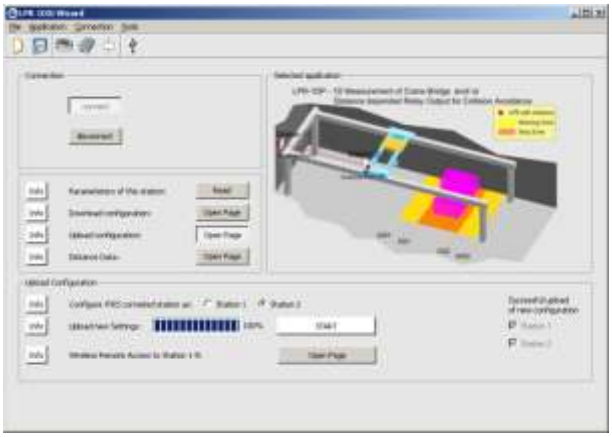

Figure 26 – Upload configuration

Pressing the button ‚Upload' the application can be uploaded to each LPR-1DXi station.

Caution	If settings were changed or a new application is chosen all stations must be updated/ uploaded.

Select the station for the upload.

Press the ‚Start'-button.

Note	A note appears if the uploaded was successful and the check box is also marked.

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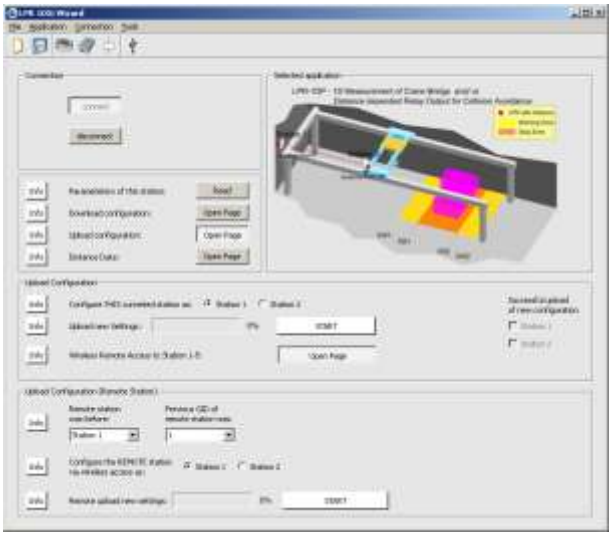

Figure 27 – Wireless remote upload

At each LPR-1DXi station an upload has to be done.

You can either connect the LPR-1DXi station directly to your computer via USB or you have the possibility to get wireless access via one station via the frequency channel to the other station

But to get wireless access to the other station you have to know the previous station ID and group ID of the other station

Choose first all parameters and then select the station number which the station should have after the upload. Press the Start-button.

A note appears if the upload was successful and the check box is also marked.

.

Note

If a new application is selected or settings are changed, you have to make an upload for each LPR-1DXi station. Both checkboxes station 1 and station 2 have to be marked.

5.2.3.6 Download Configuration

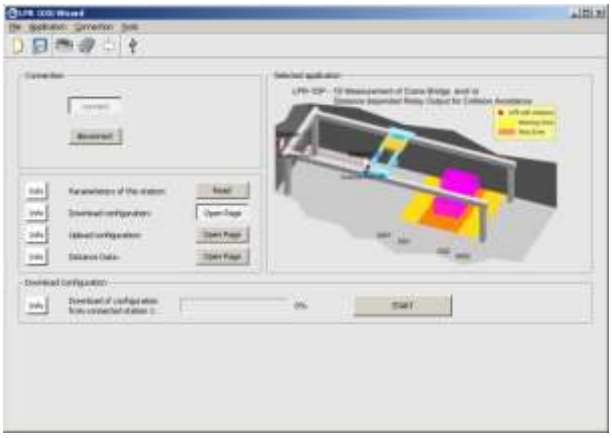

Figure 28 – Download configuration

To have the current application saved as a backup solution you should download the application of the station to your desktop.

Press the button ‚Start'. Enter the desired file name. Symeo recommends entering the station number, the group number or the serial number to distinguish later the configuration files of all stations.

Note The serial number is labeled outside the LPR-1DXi station.

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5.2.3.7 Display of Distance Data

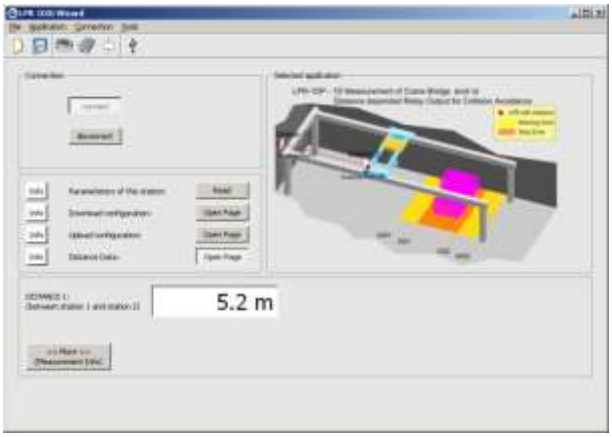

Figure 29 – Display distance data

Click the button ‚Distance Data' and the distance value is shown.

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6 Protocol Description

6.1 General Description

This protocol describes the interface between a LPR-1DXi station and the user. The binary protocol provides information in high density. Its structure ensures a simple implementation. The transfer is done in single data frames.

The interface for the binary protocol is a serial (RS232) interface. The data rate can be programmed to standard values (115200, 38400, 19200, 9600 baud). If a low data rate is chosen the measurement rate of the LPR-B system may be adapted.

6.1.1 Structure of Data Packet

To apply the protocol on a RS232 interface each data packet starts and ends with a reserved symbol. This reserved symbol cannot appear in the data stream.

Figure 30 shows the general structure of the data packet.

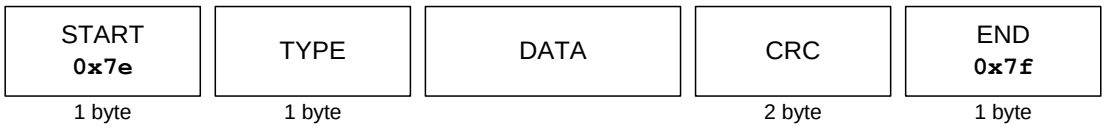

Figure 30: Structure of the data packet

The START and the STOP-field is in each data packet the reserved symbol `0x7e` and `0x7f`. TYPE indicates the type of the data packet. There can be defined up to 256 different types. The TYPE-field is following the DATA-field. The DATA field contains the real data of the packet of the type TYPE. The CRC-field contains a check sum. The check sum is applied to all previous data fields except the START data field.

All multi byte integers (e.g. CRC field) are encoded in Network-Byte-Order (Big Endian).

6.1.2 Byte Stuffing

The two symbols 0x7E and 0x7F are unique for START and STOP-fields. If those symbols occurs within any other field (TYPE, DATA or CRC), they must be replaced by the following order:

original symbol	replaced by
0x7D	0x7D 0x5D
0x7E	0x7D 0x5E
0x7F	0x7D 0x5F

This byte stuffing scheme ensures that the receiver of the protocol can identify definitely the START-field within a flow of data, even if the symbol of the start field occurs within the DATA-field.

Example: If the symbol 0x7d is read, it must be cancelled. The following symbol must be XOR combined with 0x20 to recreate the original symbol.

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6.1.3 CRC

The CRC-16-IBM with polynomial $x^{16}+x^{15}+x^2+1$ is used for the CRC. The CRC is calculated over all data fields (TYPE and DATA), but not for the START and END field.

The CRC-calculation is only applied to the original symbols. The appropriate calculation for coding must applied before byte stuffing. If receiving the data from the LPR-B system the byte stuffing must be reserved to get the original symbol. Then the CRC is updated with the original symbol.

6.2 Data Types

6.2.1 Type 0x00 – Distance Data

Direction: LPR-1DXi → User

Content	Length	Value	Data type
START	1	0x7E	
TYPE	1	0x00	
Source* (LPR address 6.3.1)	2	0x####	see chapter 6.3.1
Destination* (LPR address 6.3.1)	2	0x####	see chapter 6.3.1
Antenna number	1	0x11	unsigned integer
Distance [mm]	4	0x#### ####	signed integer
Velocity [mm/s]	4	0x#### ####	signed integer
Level [dB]	1	0x##	signed integer
Error 6.3.3	1	0x##	unsigned integer
Status 6.3.2	1	0x0#	unsigned integer
CRC	2	0x####	
END	1	0x7F	

Total length without byte stuffing: 21 byte

*) Measurements are always executed by a LPR-1DXi base station (station 1), this means, the base station measures its distance towards a transponder unit (station 2). The source field always contains the address of the LPR-1DXi base station (station 1). The destination field contains the address of the measured transponder (station 2).

6.2.2 Example of Distance Data

```
7E 00 08 03 08 02 11 00 00 10 62 00 00 00 7A E6 00 00 AF C4 7F
```

Figure 31 - Protocol for a measurement of distance data

This protocol shows a simple example for 1D measurement. The Distance Data sends the data to the user (i.e. to a PLC or to a PC/software).

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Distance data:

7E	00	08	03	08	02	11	00	00	10	62	00	00	00	7A	E6	00	00	AF	C4	7F

$7E_{hex}$	START byte
00_{hex}	TYPE (00: Distance Data)
$08\ 03_{hex} = 00001\|0000000001\|1_{bin}$	Source LPR address: SID: 1; GID: 1; BBt: 1 (base station)
$08\ 02_{hex} = 00001\|0000000001\|0_{bin}$	Destination LPR address: SID: 1; GID: 1; BBt: 0 (transponder)
$11_{hex} = 0001\|0001_{bin}$	Antenna port base station: 1 antenna port transponder: 1
$00\ 00\ 10\ 62_{hex} = 4194_{dec}$	Distance: 4194 mm
$00\ 00\ 00\ 7A_{hex} = 122_{dec}$	Velocity: 122 mm/s
$E6_{hex} = 230_{dec}$	Level: 230 – 256 = -26 dB
00_{hex}	Error status: 0 means no error; unequal 0 means error
00_{hex}	Status
$AF\ C4_{hex}$	cyclic redundancy check
$7F_{hex}$	END byte

6.3 Remarks

6.3.1 LPR-1DXi Address

LPR-1DXi station addresses are completely defined by a 16 bit value:

BB – Base station Bit:	Indicates, if the LPR station is defined as a base station (station 1) or as a transponder (station 2) BB: 1=base station, 0=transponder
group ID:	group ID of the station (1..1022)
station ID:	station ID of the station (0..30)

6.3.2 Status field

The status field indicates that the measured distance is inside or outside the maximum possible distance range of the applied version of LPR-1DXi station. If the real distance of the LPR-1DXi stations is outside the maximum distance range the distance reading remains at the maximum value. Depending on the applied version of LPR-1DXi the distance value remains at 120m or 500m. (see chapter 2.5)

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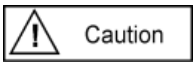
Content	Description	Value
inside range	Distance inside maximum distance range	0x00
outside range	Distance outside maximum distance range	0x01



Please take care that the distances for the switching points in your application are within the maximum possible distance range of your version of LPR-1DXi (see chapter 2.5)

6.3.3 Error messages

The distance data contains an error field which indicates the status of the message. The following errors can occur:

Content	Source	Description	Value
no error		Measurement valid	0x00
no peak detected	Base Station	No measurement signal	0x01
peak too low	Base Station	Measurement signal is imprecise	0x02
nothing received	Transponder	No measurement data received	0x03
implausible speed	Base Station	Velocity is to high	0x04
measurement botched	Base Station	Measurement is not feasible.	0x05
no occupying received	Master Transponder	Measurement channel is not reserved	0x06
no results received	Master Transponder	No measurement data received	0x07

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7 Appendix A: Agency certifications

United States (FCC) and Canada (Industry Canada)

Radiofrequency radiation exposure Information:
This equipment complies with FCC/IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

i Note

Changes or modifications made to this equipment not expressly approved by SYMEO GmbH may void the FCC/IC authorization to operate this equipment.

i Note

This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada.
Operation is subject to the following two conditions:

- ⇨ this device may not cause harmful interference, and
- ⇨ this device must accept any interference received, including interference that may cause undesired operation.

i Note

Installation:

All installation, repair and servicing work must be carried out by qualified and trained technicians!

Repairs:

Repairs to the device must be carried out by authorized technicians. Unauthorized opening and incorrect repairs could result in severe danger to the user (danger of electric shock, radiated energy, fire hazard).

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United States (FCC)

Note

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- ⇨ Reorient or relocate the receiving antenna.
- ⇨ Increase the separation between the equipment and receiver.
- ⇨ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- ⇨ Consult the dealer or an experienced radio/TV technician for help

Canada (Industry Canada)

Note

This Class [B] digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe [B] est conforme à la norme NMB-003 du Canada.

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