

SYMEO LOCAL POSITIONING RADAR



Product: LPR[®]-1DXi

Product Documentation



Content

1	OVERVIEW	5
1.1	Safety Instructions.....	5
1.2	Installation.....	6
1.3	Repairs.....	6
1.4	Transport and Storage.....	6
1.5	Power Supply	6
1.6	Setup and Operation.....	6
1.7	System Extensions and Accessories	7
1.8	Additional Instructions	7
2	SYSTEM DESCRIPTION	8
2.1	Mode of Operation	8
2.2	Technical Data.....	8
2.3	System Configuration.....	9
2.4	System Design	9
2.4.1	Station-ID (SID).....	9
2.4.2	Group-ID (GID)	9
2.4.3	Frequency Channel.....	10
2.5	Versions of LPR®-1DXi Units.....	10
3	HARDWARE	11
3.1	Component Setup of the LPR®-1DXi Unit	11
3.2	Cable Glands, Interfaces and LED Display of the LPR®-1DXi Unit	12
3.3	Opening Angle of the integrated Antenna.....	13
4	INSTALLATION.....	14
4.1	Important Instructions for Installation.....	14
4.2	Power Connection	14
4.3	RS 232 Connection	15

4.4	Relay Connection.....	15
4.5	Mounting.....	16
4.6	Installation Notes for Antennas	17
4.6.1	Fresnel Zone.....	17
4.6.2	Alignment of LPR®-1DXi Units.....	18
5	COMMISSIONING	18
5.1	Requirements	18
5.2	Commissioning Tool – LPR®-1DXi Wizard	19
5.2.1	Installation of USB driver.....	19
5.2.2	Installation of the <i>Symeo Wizard</i>	19
5.2.3	Utilization of LPR® 1DXi Wizard	20
6	PROTOCOL DESCRIPTION	32
6.1	General Description.....	32
6.1.1	Structure of Data Packet	32
6.1.2	Byte Stuffing	32
6.1.3	CRC.....	33
6.2	Data Types.....	33
6.2.1	Type 0x00 – Distance Data.....	33
6.2.2	Example of Distance Data.....	33
6.3	Remarks.....	34
6.3.1	LPR®-1DXi Address	34
6.3.2	Status Field.....	34
6.3.3	Error Messages.....	35
7	APPENDIX A: AGENCY CERTIFICATIONS	36
	United States (FCC) and Canada (Industry Canada).....	36
	United States (FCC).....	37
	Canada (Industry Canada)	37

8	APPENDIX B: TABLE OF COUNTRIES AND REGULATIONS	FEHLER! TEXTMARKE NICHT DEFINIERT
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The documentation for the LPR®-1DXi Local Positioning Radar System is published by:

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HISTORY

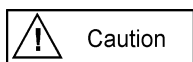
Version	Date	Description
1.02	17.06.2010	USB driver installation changed
1.03	06.08.2010	Added notes for FCC/IC
1.04	18.05.2011	New Product ID with Production Codes
1.05	15.03.2012	New Wizard v4.x
1.06	29.07.2014	Updated FCC/IC notes

SYMBOLS USED

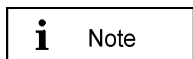
The following symbols are used throughout the documentation:



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.



This symbol appears before information of particular importance.

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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 unit 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 units, which are configured with the software *Symeo-Wizard* (via Windows PC with USB connection):



Figure 1 – LPR®-1DXi unit

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

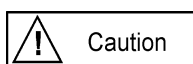
Overview of Interfaces

Power Supply	10-36 Volt via terminal block inside casing
USB	Parameter setting with <i>Symeo Wizard</i> (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



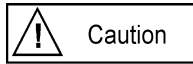
LPR® systems are purely tracking and assistance systems. They therefore do not satisfy special requirements for personal safety, e.g. performance level c.



Follow the safety instructions in this documentation!

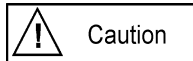
Keep these safety instructions and other documents together with the device.

1.2 Installation



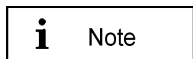
All installation, repair and servicing work must be carried out by qualified and trained technicians!

1.3 Repairs



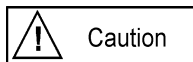
Repairs to the device must be carried out by authorized technicians. Unauthorized opening and incorrect repairs could result in severe danger to the user (danger of electric shock, radiated energy, fire hazard).

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.

1.5 Power Supply



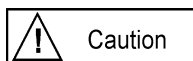
A safety-inspected power cable that satisfies the regulations of the country of use is required for the device.

The device must not be operated unless the nominal voltage of the device matches the values in the data sheet, described below. 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. 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.

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 is fully installed (electric shock, cooling, fire protection). 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

i 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 unit, ensure that the seal is included in the cover and that the LPR®-1DXi unit is completely closed. Otherwise, moisture can penetrate the unit 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.

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)
Weight LPR 1DXi	1,5 kg
Weight mounting bracket	1 kg
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. 60 VDC, max. 2 A
Compliance	CE mark, part 15 FCC ^{*2} , RSS-210 ^{*2}

^{*1} Depending on distance and application parameters

^{*2} Only valid for FCC labeled units

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.

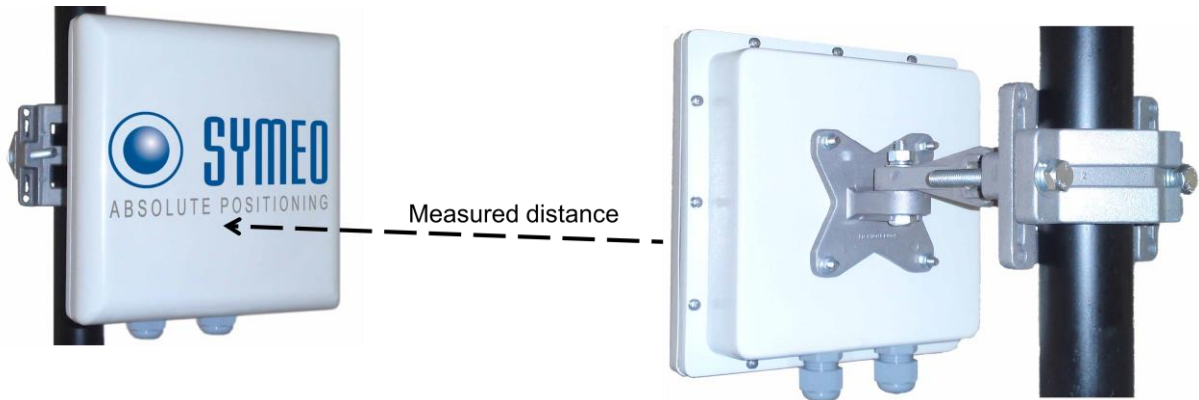
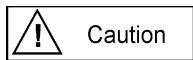


Figure 2: LPR®-1DXi system

2.4 System Design

Each LPR® 1DXi unit 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:



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)

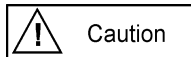
Each unit has an explicit identification Number in one system. A system consists of 2 units. The first unit has the station number 1 (SID 1), the second unit has the station number 2 (SID 2).

2.4.2 Group-ID (GID)

A pair of LPR®-1DXi units 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.

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.



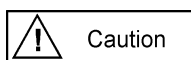
If there are more LPR®-1DXi systems in your environment each further LPR®-1DXi system needs different frequency channels. The frequency channel is linked to the group ID. Therefore it is required to use different group IDs for different LPR®-1DXi systems in the same environment. You can set the group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

2.5 Versions of LPR®-1DXi Units

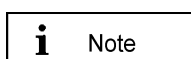
For the LPR®-1DXi units several different versions are available:

Overview: Options				
	ID	Production Code	Measurement distance	Distance output resolution
Basic device	BSB000900	src	0 to 120 m	0,5m increments
Option 1	BSB000900	srl	0 to 500 m	0,5m increments
Option 2	BSB000900	scp	0 to 120 m	Resolution up to ±5 cm
Option 3	BSB000900	slp	0 to 500 m	Resolution up to ±5 cm
Basic device ^{*1}	BSB000900	srcf	0 to 120 m	0,5m increments
Option 1 ^{*1}	BSB000900	srlf	0 to 500 m	0,5m increments
Option 2 ^{*1}	BSB000900	scpf	0 to 120 m	Resolution up to ±5 cm
Option 3 ^{*1}	BSB000900	slpf	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



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.



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

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 Unit

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

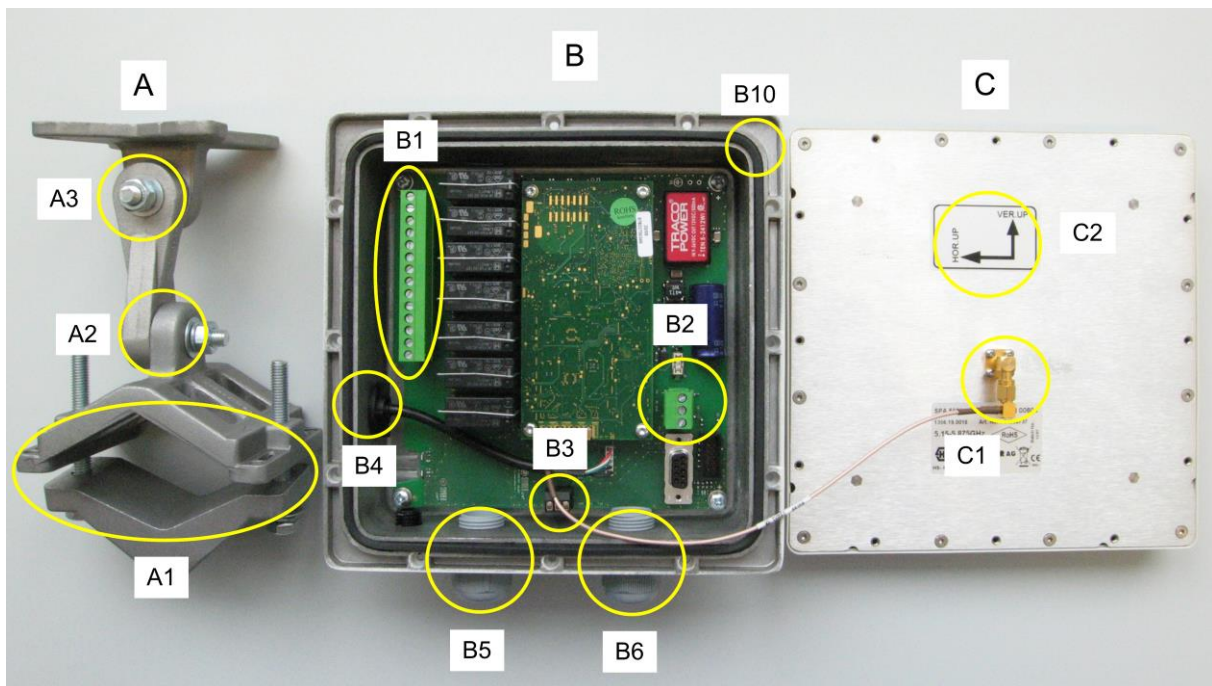
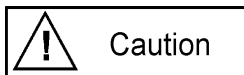


Figure 3 Components of the LPR®-1DXi: mounting bracket A, casing with electronic devices B and antenna C

- 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.

- 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 Unit

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 membrane (B7) is shown.

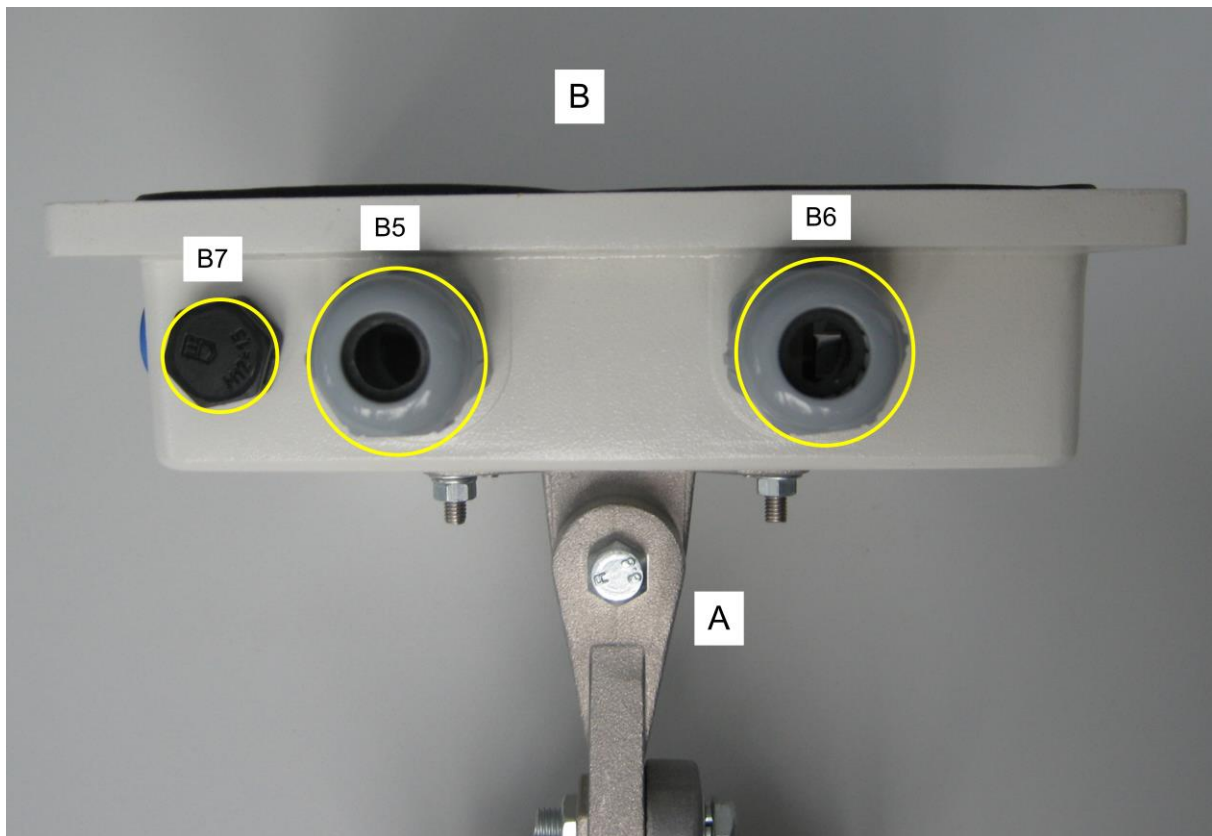
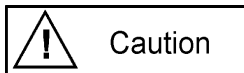


Figure 4: Casing B side view with cable glands and mounting bracket A
B5 Cable gland for cable to relays
B6 Cable gland for power cable with optional wires for serial RS232
B7 pressure equalization membrane



Caution

- Pressure equalization membrane (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.

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.

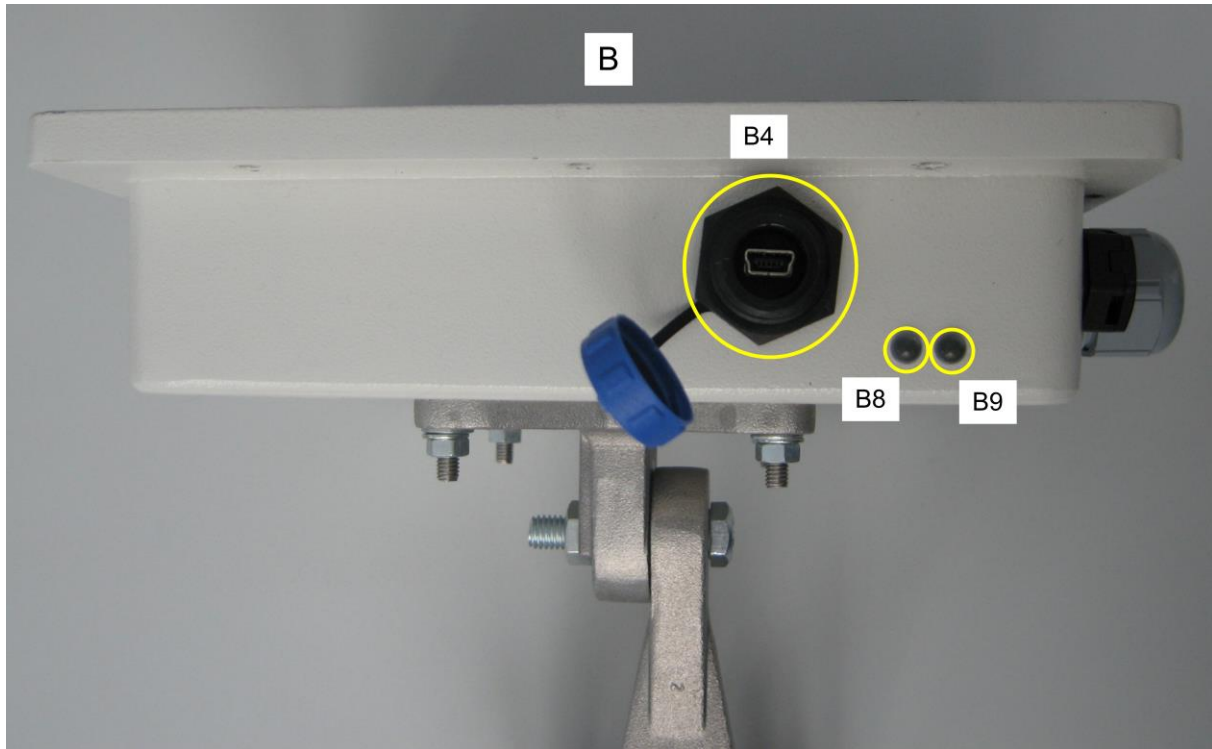


Figure 5 Casing B side view
B4 USB port for parameter setting with software *Symeo Wizard*
B8 two-colored LED, green=switching status of relay 1 / blue=switching status of relay 2
B9 two-colored LED, red=power / green=measurement activity



Note

If both colors of one LED (B8 or B9) are on, you will see the additive color.

3.3 Opening Angle of the integrated Antenna

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

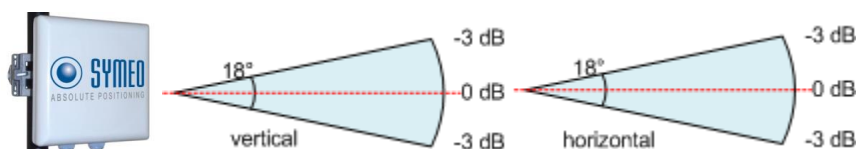
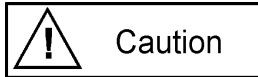


Figure 6: Opening angle LPR®-1DXi unit

4 Installation

4.1 Important Instructions for Installation

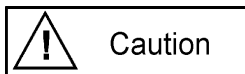


Caution

- 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. Positive 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 unit. In that case the unit must be send to the SYMEO service.

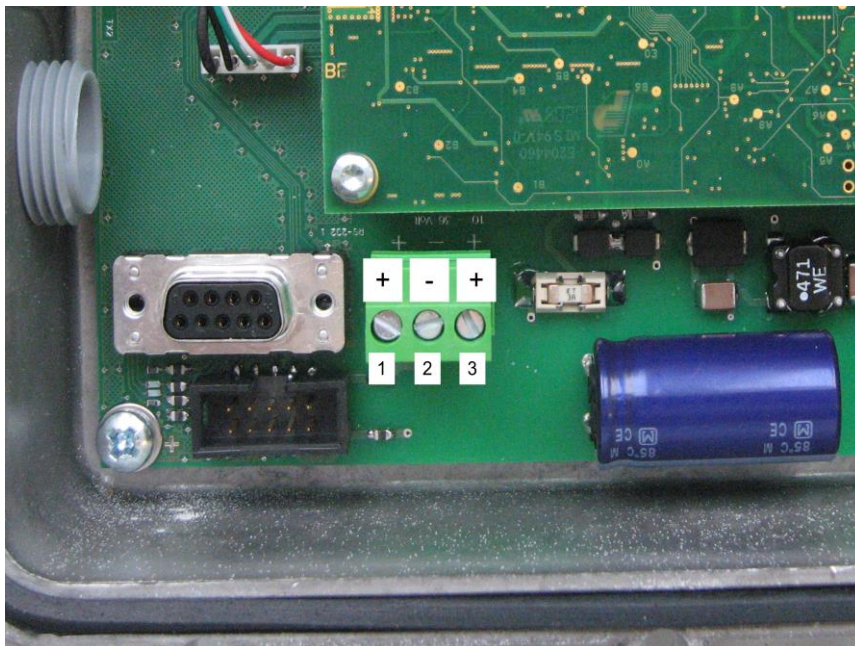


Figure 7: Power supply terminal block B2

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.

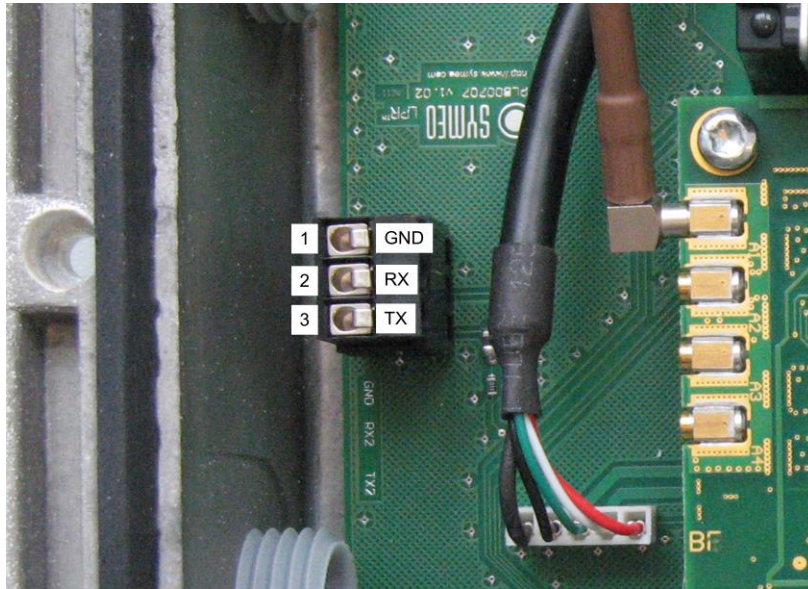


Figure 8: RS232 terminal block B3

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

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

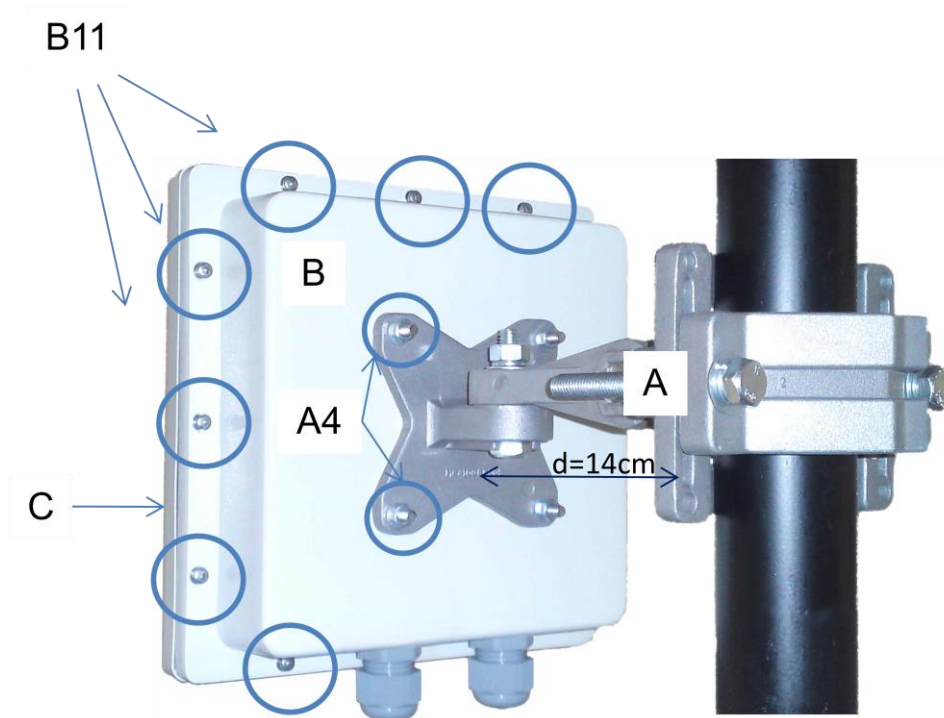


Figure 10: LPR®-1DXi unit rear view

The LPR®-1DXi unit 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 with a diameter of 25mm to 76mm. 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.

- ⇒ 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).

i 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 to the red LED for power 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 unit (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.

i 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:

$$b = 0.5 \cdot \sqrt{\lambda \cdot d}$$

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

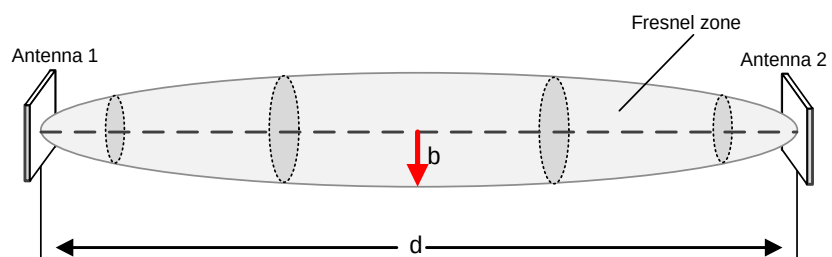
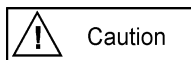


Figure 11 Calculation and figure of Fresnel zone

4.6.2 Alignment of LPR®-1DXi Units

The LPR®-1DXi units 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 units 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.

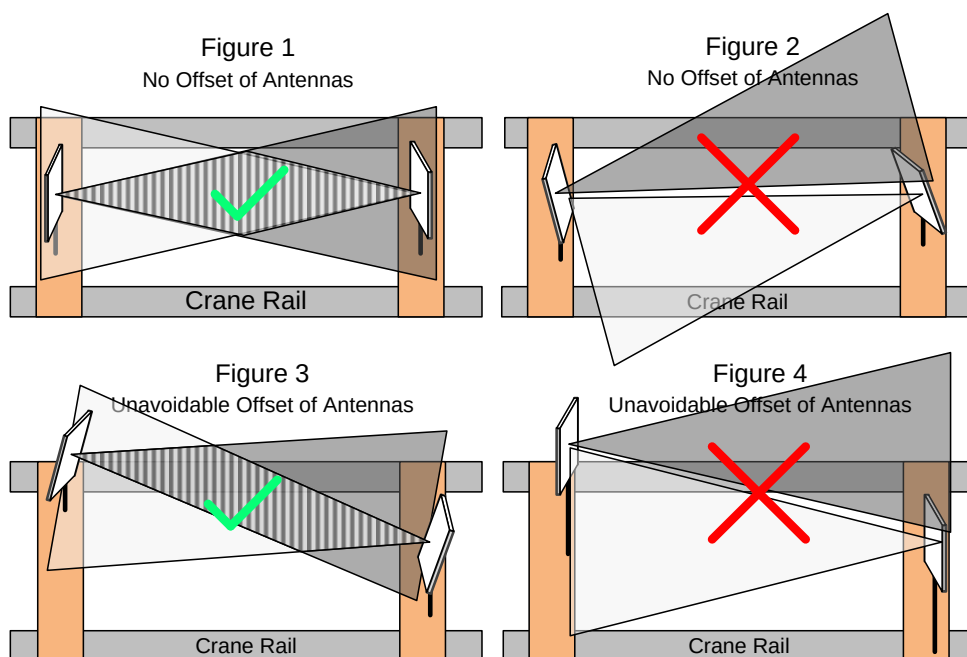


Figure 12 Antenna Position with and without Offset

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*

All files for the installation are provided on CD or USB-stick delivered together with your LPR[®] - 1DXi units. Installation can be done directly from CD or USB-stick. The files are provided in the directory “*Symeo LPR 1D Wizard V4.x*”

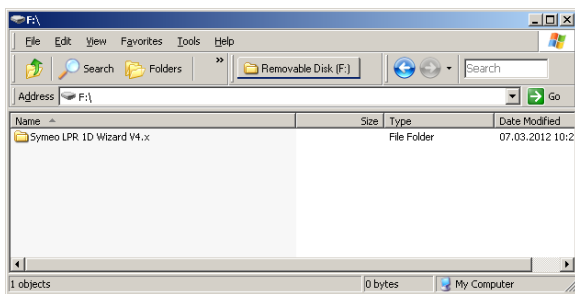


Figure 13 – Installation directory for the LPR[®] 1D Wizard

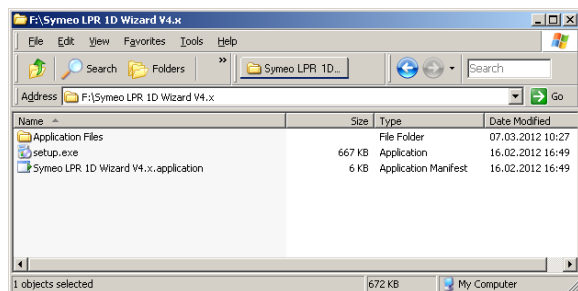


Figure 14 – Start “*setup.exe*” for installation of the LPR[®] 1D Wizard

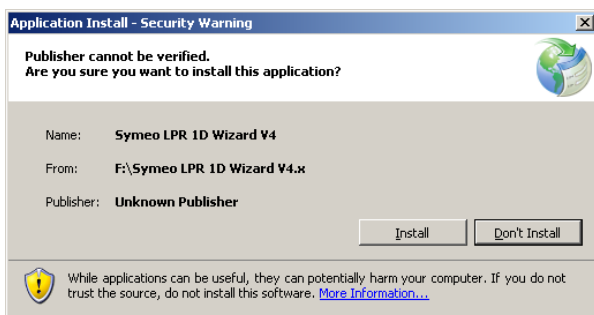


Figure 15 – Press “*Install*” for installation of the LPR[®] 1D Wizard



Figure 16 – LPR[®] 1D Wizard starts after installation

After finishing the installation process the LPR®-1D Wizard starts automatically. A Shortcut was created on your desktop and you can find the Symeo LPR®-1D Wizard in your start menu.

5.2.3 Utilization of LPR® 1DXi Wizard

The commissioning of the LPR® 1DXi system with the LPR®-1DXi Wizard proceeds the following:

- ⇒ Selection of the desired application
- ⇒ Settings of parameters for selected application
- ⇒ General setting of LPR® 1DXi System
- ⇒ Connection to LPR® 1DXi unit
- ⇒ Upload of selected application to the LPR® unit
- ⇒ Check distance data
- ⇒
- ⇒ Start the LPR® 1DXi Wizard. The following window appears:

Edit project

All parameters and configuration files for one LPR® 1DXi System are handled in one project file. The format of this project file is "customers defined application name.symproj"



Figure 17 – Start LPR® 1DXi Wizard

⇒ ,New project‘

Select this button to create a new project for a LPR® 1DXi System

⇒ ,Open existing project‘

Select this button to open an already created project for an LPR® 1DXi System



Note

Moving the cursor above a button or input field shows a tool tip.

New project

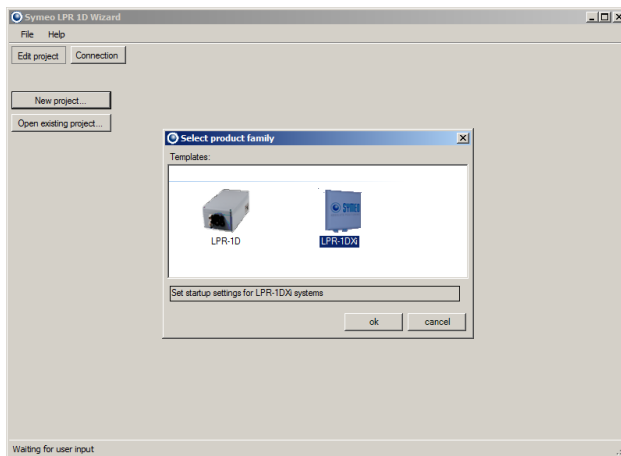


Figure 18 – New project / Select product family

To start a new configuration

⇒ push 'New project'.

Select the product family of the system LPR-1DXi.

Open existing project

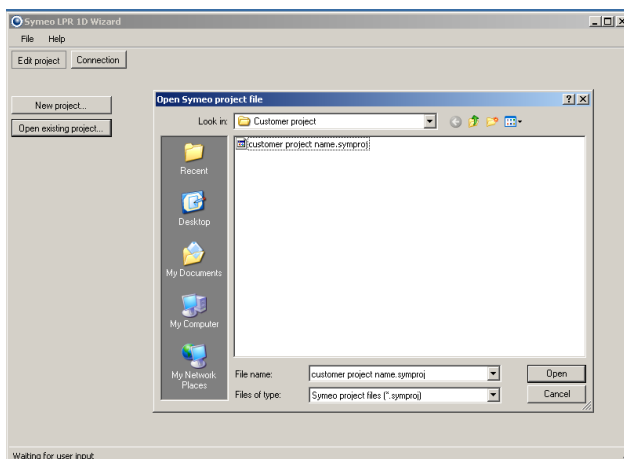


Figure 19 – Open existing project

If you already saved a project file you can open this project file for further settings.

⇒ Push 'Open existing project'.

Select your already created project file and push 'Open'.

Select application

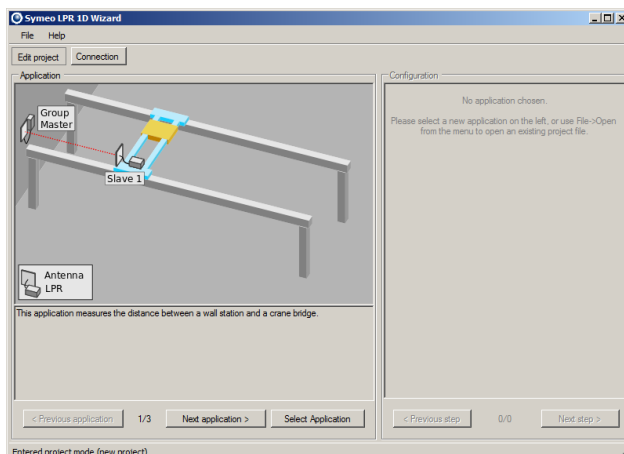


Figure 20 – Select Application Selection of

⇒ Push 'Edit project'.

- The first possible application is shown.
- You can see other application with the buttons 'Next application' or 'Previous application'.

⇒ Push 'Select application'. On the right side of the window the first step to configure the settings of the selected application appears ('Common settings').

i Note

As long as no application is selected, no step to configure the

Commissioning

application

settings can be selected.

Settings of LPR® System Parameters

After selecting the application common settings of the LPR® system has to be entered.

Figure 21 – Common settings Input fields of the common settings of LPR® system

The 'Common settings' include settings for the complete LPR® System.

⇒ Fill in the input fields on the right side of the window. The fields depend on the selected application.



Note

Move the cursor above an input field to see more information about it.

Group ID: Unique ID of the LPR® system. All units in one LPR® system have the same group ID.



Caution

If more than one LPR® system is used in your environment you have to use a different group ID for each system.



Note

The frequency channel is linked to the group ID of the system.

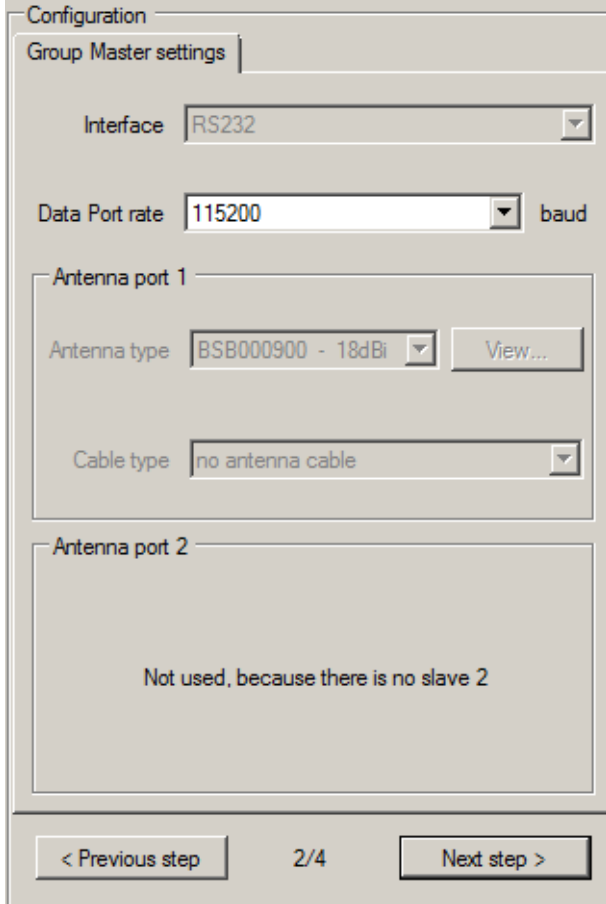
Region / regulations: Choose the region/regulation where the system is installed. This is important to calculate the allowed transmission power, please see appendix B in this documentation for assignment of countries and regulations.



Note

For FCC labeled units only use the setting "USA(FCC)". For not FCC labeled units only use the setting "Europe (ETSI EN)".

Measurement cycle: Adjust the desired measurement cycle of the system. Please choose a minimum



Configuration
Group Master settings

Interface: RS232

Data Port rate: 115200 baud

Antenna port 1

Antenna type: BSB000900 - 18dBi View...

Cable type: no antenna cable

Antenna port 2

Not used, because there is no slave 2

< Previous step 2/4 Next step >

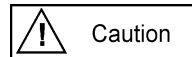
Figure 22 – Group Master setting - Input fields of the Group Master settings of LPR® system

measurement cycle of 35 ms.

- ⇒ Push ,Next step'. The ,Group Master settings' are displayed.
- ⇒ Fill in the input fields of the ,Group Master settings'.

Interface: Cannot be changed.

Data Port rate: Transmission rate of the LPR® system on the RS232 data port.



Caution

If you change the baud rate to 9600 you should also adjust the measurement cycle of the system to values >50ms.

Antenna port 1 and Antenna port 2: Cannot be changed.

Antenna type: Cannot be changed.

Cable type: Cannot be changed.

- ⇒ Push ,Next step'. The ,Slave 1 settings' are displayed.

⇒ Fill in the input fields of the 'Slave 1 settings' as already described in the 'Group Master settings'.

Figure 23 – Slave settings - Input fields of the 'Slave 1 settings' of LPR® system

Setting the X and Y dimensions for warning and stop areas

For LPR® 1DXi units you can set the distances for warning and stop areas for relay switching in this menu .

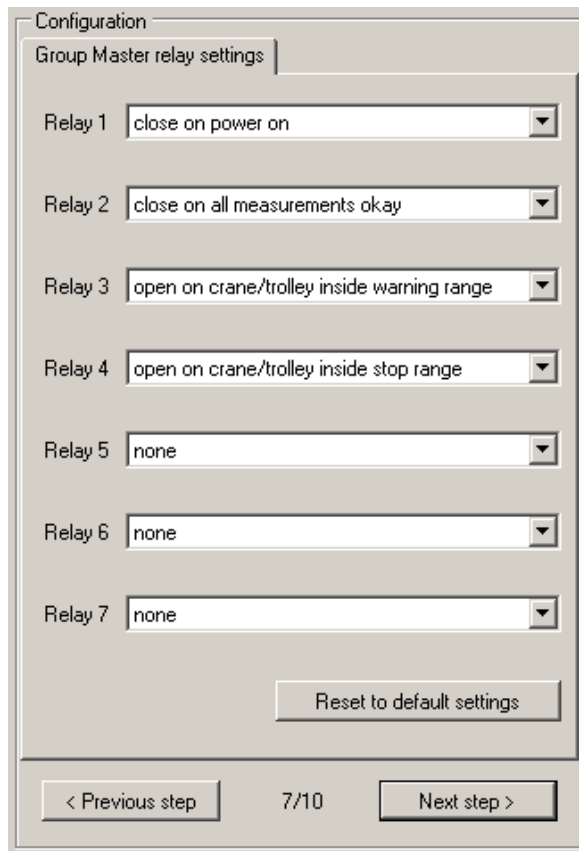
⇒ Fill in the values of the warning and stop distances for your application in meters.

System failure timeout: Length of time without valid measurements before a system failure is indicated.

Relay reenabling time: Use this value to setup hysteresis. "Open relay" is always done immediately. "Close relay" can be delayed to inhibit unwanted relay toggling. This value sets the delay time. The relay will only be closed if the "Close relay" condition has been valid for this delay time.

Figure 24 –Input fields of the ,X dimension settings' for warn and stop areas

Usage of Relays



You can allocate functionalities to each of the seven relays in the LPR® 1DXi unit. Each LPR® 1DXi unit in one system can have a different assignment of relays.

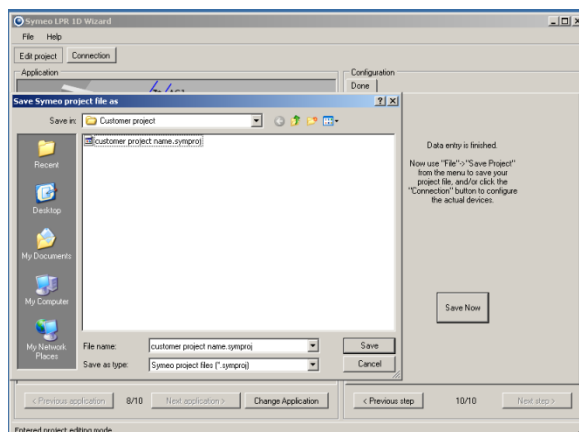
You can choose between default settings, customer settings and no relay assignment.

i Note

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

Figure 25 – Allocation of relays

Save Project



The last step of the menu 'Configuration' is to save all settings in one project file.

⇒ Press 'Save Now' and define a file name for your project.

i Note

All settings and parameters of your LPR® system is stored in this project file.

Figure 26 – Save project

Connection to LPR® -1DXi unit

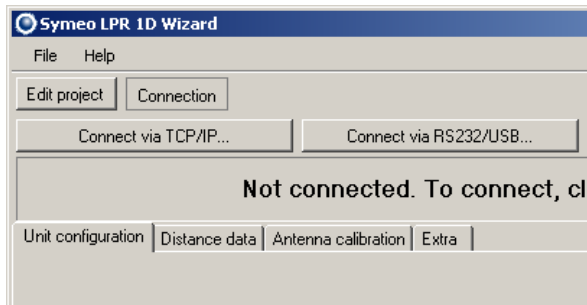


Figure 27 – Connection to LPR® unit

Having established a connection to the LPR®-1DXi unit via USB with your PC the connection can be opened by pushing the 'Connection' button, followed by pushing 'Connect via RS232/USB'.

i Note

The USB-driver from the product CD(or USB-Stick) has to be installed first...

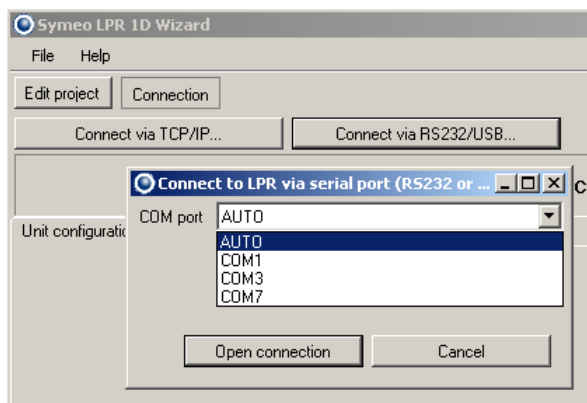


Figure 28 –RS232/USB connection to LPR® unit

Connect via RS232/USB:

To open the serial connection, select the right COM port of your computer. If you do not know the COM port, select AUTO

i Note

You can control the COM port number in the device manager of your computer.

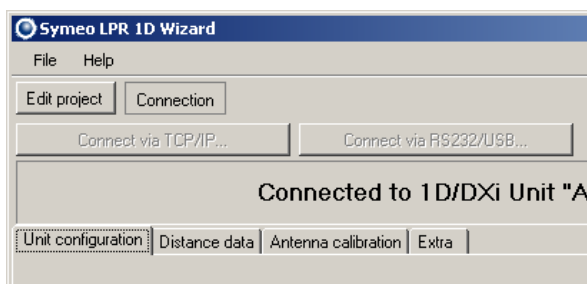


Figure 29 –Submenus if connection is established

Once the connection is established, the following submenus appear:

Unit configuration:

Configure the connected unit as Group Master or Slave 1.

Distance Data:

View the measured distance(s)

Antenna calibration:

Calibrate the real measured distance

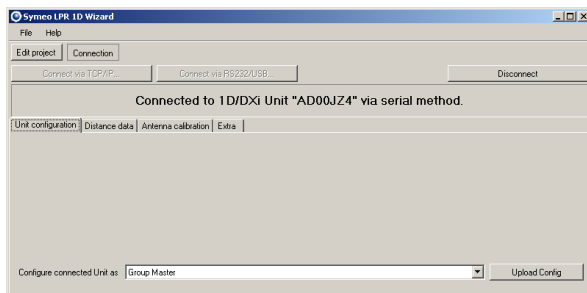
Extra:

Download the current raw configuration file, upload an existing raw configuration file to the unit or upgrade LPR-1DXi firmware.

i Note

The Extra menu is only required for service issues. Please contact Symeo service for further instructions.

Unit configuration:



- ⇒ Push 'Unit configuration'.
- ⇒ Select an entry from the 'Configure connected unit as' pull-down list.
- ⇒ Push 'Upload Config'

Figure 30 – Unit configuration

i Note

If a new application is selected or settings are changed, you have to make an upload for each LPR® unit of one system.

Display of Distance Data

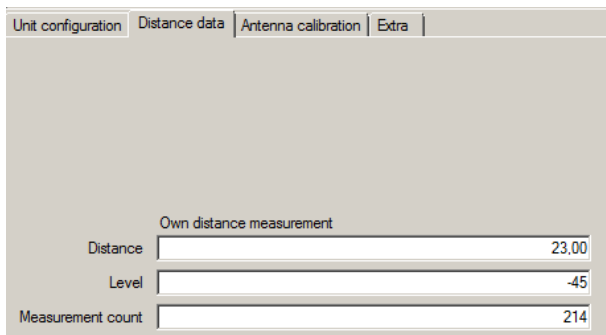


Figure 31 – Display of Distance Data

Click the button 'Distance Data'. The following information is shown about the distance between Group Master and Slave1:

Distance

The measured distance in meters.

Level

Receive Level of the radio signal in dBm. This level depends on the distance of the two antennas. The receive level for valid measurements is in a range of -28dBm and -85dBm.

Measurement count

The number of performed measurements

Checkbox 'Distance filtering'

Only the display of the distance data is filtered for better reading. This does not affect the measurement.

Antenna Calibration

Figure 32 – Antenna calibration

After uploading all configuration files to each LPR® unit, you have to calibrate the measured distance.

⇒ Push ,Antenna calibration‘.

i Note

In the field ,Measured Distance‘ the measured distance is displayed in meters, which is different to the real distance.

⇒ Enter the real distance value between the two antennas in the field ,Real distance‘.

⇒ Push ,Calibrate‘.

The ,Antenna port 1‘ area relates to the distance between Group master and Slave unit 1.

! Warning

The crane is not allowed to move during the calibration process.

If the measured distance and the real distance are not the same after the calibration you might repeat the calibration.

i Note

During the calibration process the antennas should have a real distance to each other of 5 to 20 m.

Download Configuration

Download and upload of raw configuration files is only required for service issues. All configuration files are already saved in your project file as described above.

Figure 33 – Download configuration

⇒ Push ,Extra‘.

⇒ Push ,Download‘ in the ,Download configuration to raw config file‘ area.

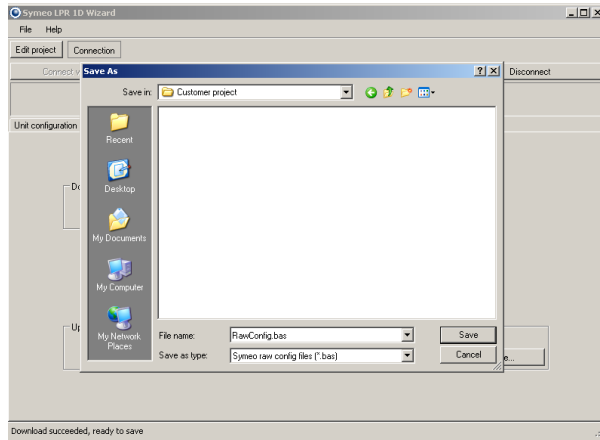


Figure 34 –Enter file name

⇒ Enter the desired file name for the raw configuration file and save the file. The format of this raw configuration file is “customers defined file name.bas”

i Note

The download of raw configuration files is only required for service issues. Please contact Symeo service for further instructions.

Upload Configuration

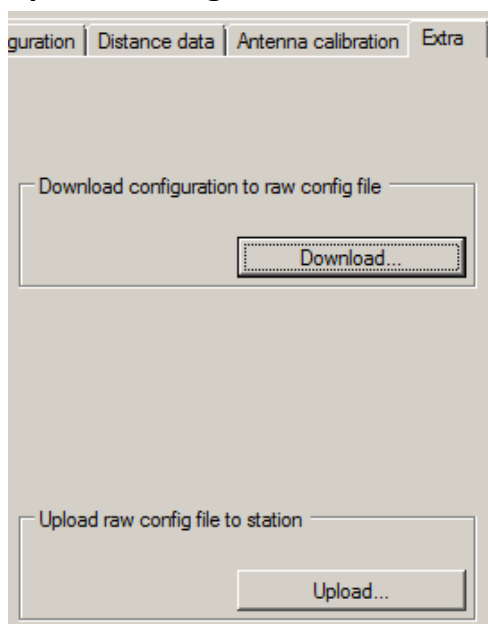
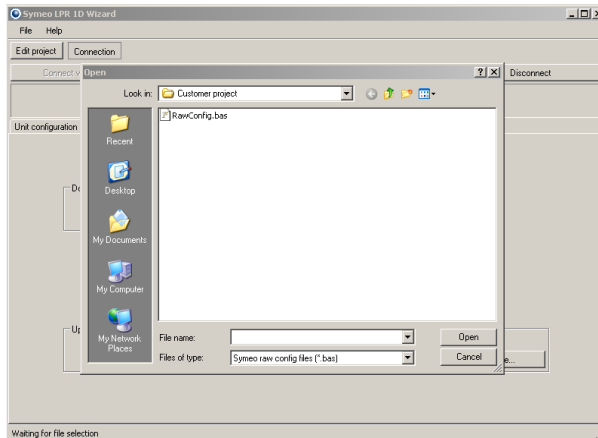


Figure 35 –Upload raw configuration file

Pressing the button ,Upload' a raw configuration file can be uploaded to each LPR® unit.



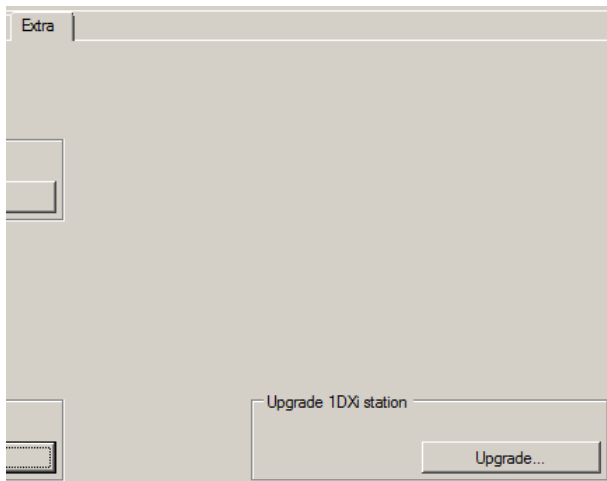
⇒ Press the 'Open'-button. The selected raw configuration file will be uploaded to the connected LPR® unit.

i Note

The upload of raw configuration files is only required for service issues. Please contact Symeo service for further instructions.

Figure 36 –Upload raw configuration file

Upgrade 1DXi Firmware



Pressing the button 'Upgrade' an upgrade file can be loaded to each LPR®-1DXi unit.

⇒ Select the upgrade file you received from Symeo.

i Note

For upgrading your LPR®-1DXi unit contact Symeo service for further instructions.

Figure 37 –Load an upgrade file

6 Protocol Description

6.1 General Description

This protocol describes the interface between a LPR[®]-1DXi unit 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[®]-1DXi 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 38 shows the general structure of the data packet.

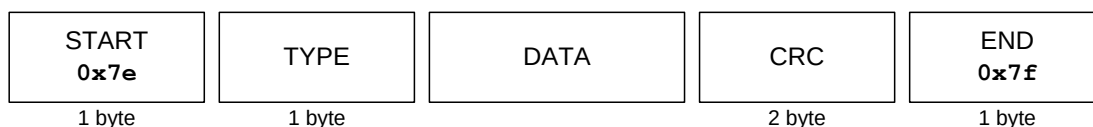


Figure 38: Structure of the data packet

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.

6.1.3 CRC

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

The checksum-calculation is only applied to the original symbols. The appropriate calculation for coding must be applied before byte stuffing. If receiving the data from the LPR[®]-1DXi system the byte stuffing must be reserved to get the original symbol. Then the checksum 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 Slave unit, this means, the Slave unit measures its distance towards a Group Master unit. The source field always contains the address of the LPR[®]-1DXi Slave unit. The destination field contains the address of the measured Group Master unit.

6.2.2 Example of Distance Data

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

Figure 39 - Protocol for a measurement of distance data

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

Distance data:

7E 00 10 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)
10 03 _{hex} = 00010 0000000001 1 _{bin}	Source LPR address: SID: 2; GID: 1; BBt: 1 (Slave unit)
08 02 _{hex} = 00001 0000000001 0 _{bin}	Destination LPR address: SID: 1; GID: 1; BBt: 0 (Group Master unit)
11 _{hex} = 0001 0001 _{bin}	Antenna port Slave unit: 1 antenna port Group Master unit: 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 unit addresses are completely defined by a 16 bit value:

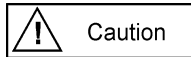
15	11	10	1	0	
station ID		group ID			BB

BB – Slave unit Bit:	Indicates, if the LPR® unit is defined as a Slave unit or as a Group Master unit BB: 1=Slave unit, 0=Group Master unit
group ID:	group ID of the unit (1..1022)
station ID:	station ID of the unit (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 unit. If the real distance of the LPR®-1DXi units 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)

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	Slave Unit	No measurement signal	0x01
peak too low	Slave Unit	Measurement signal is imprecise	0x02
nothing received	Group Master unit	No measurement data received	0x03
implausible speed	Slave Unit	Velocity is to high	0x04
measurement botched	Slave Unit	Measurement is not feasible.	0x05
no occupying received	Group Master unit	Measurement channel is not reserved	0x06
no results received	Group Master unit	No measurement data received	0x07

7 Appendix A: Agency certifications

i Note

For FCC labeled versions only

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 not expressly approved by the party responsible for compliance could void the user's authority to operate the 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:

- (1) this device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

i Note

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes :

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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).

United States (FCC)

i 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)

i 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.

