# SYMEO LPR®

ABSOLUTE POSITIONING

Product Documentation

*Product: LPR-1D*

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## HISTORY

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|---|---|---|
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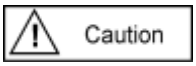
| 3.18 | 11.02.2009 | Added all single documents to one master document |
| 3.19 | 30.03.2009 | Added notes for FCC/IC conformity |
| 3.20 | 13.07.2010 | Corrections FCC notes |

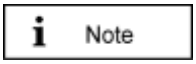
## SYMBOLS USED

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.

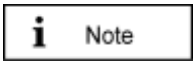



This symbol appears before instructions that must be followed at all times. Failure to comply with these instructions will result in damage to equipment.




This symbol appears before information of particular importance.



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# 1 Overview

SYMEO Industrial LPR® is a system for contactless, real-time determination of distances and positions.

LPR® 1D is a distance measurement system which is particularly well suited for use in very harsh, industrial environments, in which other systems such as mechanical rotary encoders or lasers cannot function for long periods.

The Local Positioning Radar System LPR® 1D consists of equal components, which are configured as (depending on customer's application):

LPR® Base Station or LPR® Transponder

*Figure 1 – LPR® hardware: transponder or base station in the design "Compact Station"*

The difference is between a LPR® 1D transponder and a LPR® 1D Base Station is only the software but not the hardware. A LPR® 1D system consist exactly of one component transponder, named below also as station 1 or as coordinator. And it consists furthermore of one to four LPR® 1D components Base Station, subsequent named station 2, 3, 4, 5.

Depending on customer's application the LPR® 1D hardware has different interfaces. The station in the design compact station has IP65 protection.

| Overview | |
|---|---|
| Antenna Interfaces | 2, 3 or 4 |
| Power Supply | 10-36 Volt via 8-Pin Lumberg Connector |
| RS232 | Configuration and Data Interface |
| TCP/IP | Optional: Configuration and Data Interface |
| Relay | Optional: 7 Dry Contacts |

Caution

In special application cases it is also possible to get a LPR® station with an integrated antenna. This hardware is called LPR® design ”Integral Station” compared to the hardware LPR® 1D design “Compact Station”.

*Figure 2 – LPR® Hardware – Special Case: Transponder or Base Station with integrated antenna in the design “Integral Station”*

The LPR® 1D Station with an integrated antenna is available in a plastic housing. An installation description is delivered separately to this document.

Note

This antenna is not approved to be in compliance with part 15 of FCC rules and with RSS-210 of Industry Canada. Usage of these antennas may void the FCC/ IC authorization to operate this equipment.
Further information is found in the Appendix.

## 1.1 Safety Instructions

Warning

LPR®-B 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.

Caution

Follow the safety instructions in the operating instructions for the device and the additional documentation!

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

## 1.2 Installation

Caution

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

## 1.3 Repairs

Caution

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

Note

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

Caution

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.

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

Caution

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.

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.

For LAN cabling, the requirements in accordance with EN 50173 and EN 50174-1/2 apply. Use of either a Category 5 shielded cable for 10/100 Ethernet or Category 5e shielded cable for gigabit Ethernet is a minimum requirement. The specifications of standard ISO/IEC 11801 must be complied with.

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

## 1.8 Additional Instructions Regarding Compact Type and Integral Type Stations

Caution

The Compact type LPR® station must not be opened except for installation. The Compact station 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 Compact station is completely closed. Otherwise, moisture can penetrate the station and damage it.

In order to install the Integral type LPR® station, the hood must be detached from the serviceable components. Refer also to the instructions on installing the transponder.

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 System architecture

SYMEO Industrial LPR® is a system for contactless, real-time determination of distances and positions.

LPR® 1D is a distance measurement system which is particularly well suited for use in very harsh, industrial environments, in which other systems such as mechanical rotary encoders or lasers cannot function for long periods.

All devices have a unique identifier, via which they are actuated. In order to measure the signal transit time and thus also a corresponding distance, the two devices involved are time-synchronized (with accuracy in the picoseconds range).

LPR® 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 other reference data.

## 2.2 Technical Data

| Overview: Technical Data | |
|---|---|
| Frequency range | 5.725-5.875 GHz |
| Transmitted power *1 | Max. 0.008 W / 9 dBm output on the antenna port<br>Output power is adjustable<br>For overall output power antenna gain and cable attenuation must be added, see chapter 6 for details. |
| Range *2 | Max. 1800 m |
| Measurement accuracy *2 | Max. ± 5 cm |
| Measurement frequency *3 | Max. 30 Hz |
| Power supply | 10-36 V DC |
| Ambient temperature *4 | -40°C to +70°C |

*1 Transmitted power/ field strength can be adjusted to assure that emission limits at the antenna are within legal limits, e.g. 25 mW EIRP in the EU and 50 mV/m at a distance of 3 m in the US and Canada. For FCC /IC authorization the maximum field strength is limited by firmware.

*2 Depending on the antenna type, mounting position and environment

*3 For FCC/IC authorization a maximum measurement frequency of 10 Hz is allowed.

*4 Temperature inside the housing can range from -40°C to 85°C.

## 2.3 System Configuration

The LPR® 1D system consists of two, three, four or five LPR® units. Each of these units can be configured either as a transponder or as a base station. A system consists of exactly one LPR® unit configured as a transponder and between one and four LPR® units configured as base stations.

For pure 1D distance measurement two units are required and are arranged as shown in Figure 3. The distance information is available at both stations.

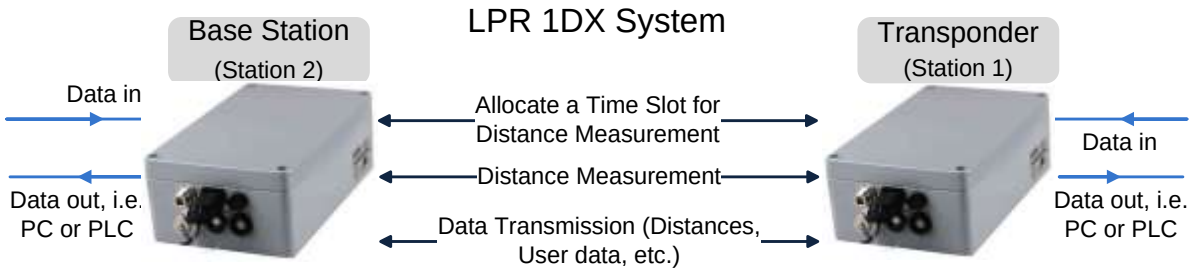



*Figure 3: 1D system*

Besides the distance information, smaller volumes of user data can also be passed between the units. These are fed in on the serial port of a unit and output in corresponding manner on the other side.

Each unit consists of a basic unit, corresponding antenna cable, antenna, as well as power supply and ports.

Further options for arranging LPR® units are described in the section 2.6 "Application Examples".

## 2.4 System Design

Each LPR® 1D 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:

### 2.4.1 Station-ID (SID)

Each station has an explicit Identification Number in one system. If using more than one LPR® 1D systems in your environment same station numbers could be used. BUT: In one system all station numbers are different.

A system consists at least of 2 stations, at most of 5 stations. The first station has the station number 1 (SID 1), die second station has the station number 2 (SID 2), etc.

Station 1 (SID 1) is the LPR® Transponder, also known as the coordinator of the system. Stations 2 – 5 (SID 2-5) are LPR® Base Stations. A transponder (SID 1) can only measure with a base station (SID 2 – SID 5) and vice versa, but NEVER with another transponder or a base station with another base station. But the transponder (coordinator) can measure with up to 4 base stations.

Keep in mind:

| | |
|---|---|
| Station 1 | Transponder |
| Station 2 | Base Station |
| Station 3 | Base Station |
| Station 4 | Base Station |
| Station 5 | Base Station |

Note

The hardware of a transponder and base station looks like the same. The only difference is the configuration software. The transponder organizes the measurements. It allocates time slots to the base stations to identify when these stations are allowed to start with a measurement.

### 2.4.2 Group-ID (GID)

A system is identified clearly by its group number. All stations in one system have the same group number. If there is used a second, a third or more systems in your environment, all additional systems must have then a different group number (see Figure 5).

### 2.4.3 FSK Channel (FSK)

The measurement of the round trip of flight (RTOF) happens in a frequency band width of 5,725 to 5,875 GHz. In this band width the LPR® system gets a frequency channel. 18 frequency channels are available. All stations in one LPR® systems have the same frequency channel.

Caution

If there are more LPR® systems in your environment each further LPR® system has another frequency channel (see Figure 5).

Note

If you commission the system with the LPR® commissioning tool LPR® 1D Wizard you cannot choose the frequency channel. The frequency channel is linked to a group ID. Therefore it is really important to use different group IDs for different LPR® systems.

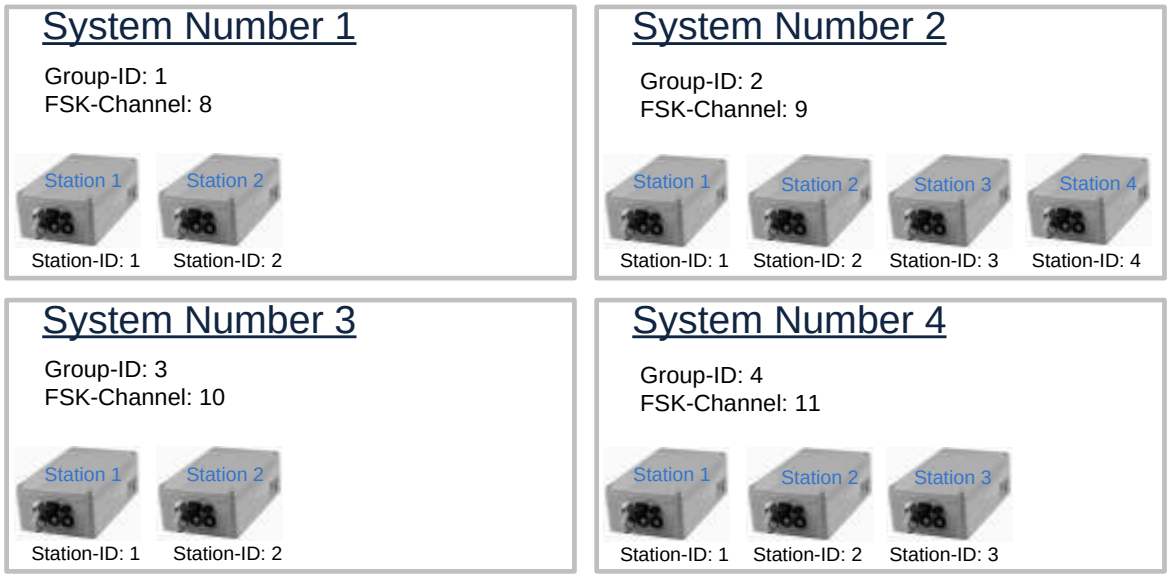



*Figure 4 – Example of the relation Station-ID, Group-ID und Frequency Channel*

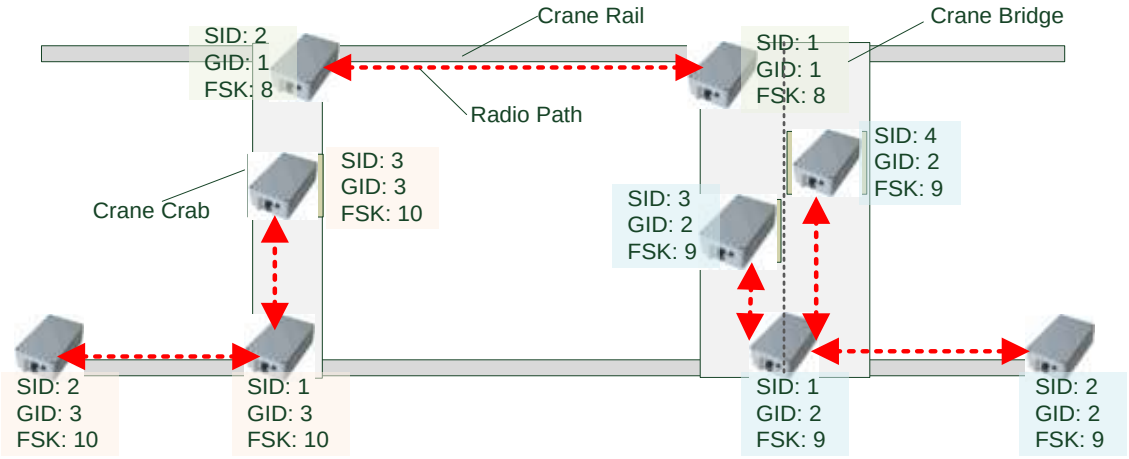



*Figure 5 – Example of multiple LPR®-systems in one crane environment*

## 2.5 Mode of Operation of the System

The distance is determined by measuring the transit time of radio signals. For this, the transponder unit first sends a communication packet to the base station that is to carry out the measurement. The station that is addressed in this way sends a response sequence and a special, wideband response signal which is ideal for making distance measurements. The transponder synchronizes itself with this signal and after a precisely known time replies in highly synchronized manner with exactly the same signal. The base station receives this signal and uses the signal transit time to determine its distance from the transponder.

The distance can be output after the measurement by any of the units participating. As an option, if the distance falls below a given value, a switch (dry contact) can be actuated to trigger a warning signal, for example.

Besides distance measurement, the system's communication can be used for transmitting user data in the intervals between measurements. Transmission is asynchronous, i.e. the data is requested and transmitted when the measurement has been completed. To transmit data over the system, first a send data request is sent by the LPR® unit to the user. Then the user data is received and transmitted to the second LPR® station. The data channel has a channel capacity of 8byte/measurement cycle. This means, the overall capacity depends on the chosen measurement frequency. I.e. if a measurement frequency of 10Hz is chosen, the capacity is 80 byte/s

## 2.6 Application Examples

Figure 3 in shows the simplest arrangement of LPR® units (LPR® 1DX). This is used for measuring the distance between two LPR® units. The abbreviation means distance measurement without positioning.

Some more complex arrangements are illustrated in the following text.

### 2.6.1 Redundant arrangement (2xLPR-1DX)

For reasons of operational safety, it may be necessary to combine two systems in a redundant arrangement. Figure 4 shows two base stations and two transponders installed in a redundant arrangement on two crane bridges. Each base station communicates with the opposite transponder. Both systems measure independently from each other. After the measurement, the distance from the respective partner can be output at each of the participating stations. Optionally, a switching contact may also be actuated depending on the distance, e.g., to trigger a warning signal for example if the crane bridges come too close to one another and there is a danger that they may collide.

**i Note**

If more than one LPR® system is used, each system has its own group ID and its own frequency channel. So both systems do not disturb each other.

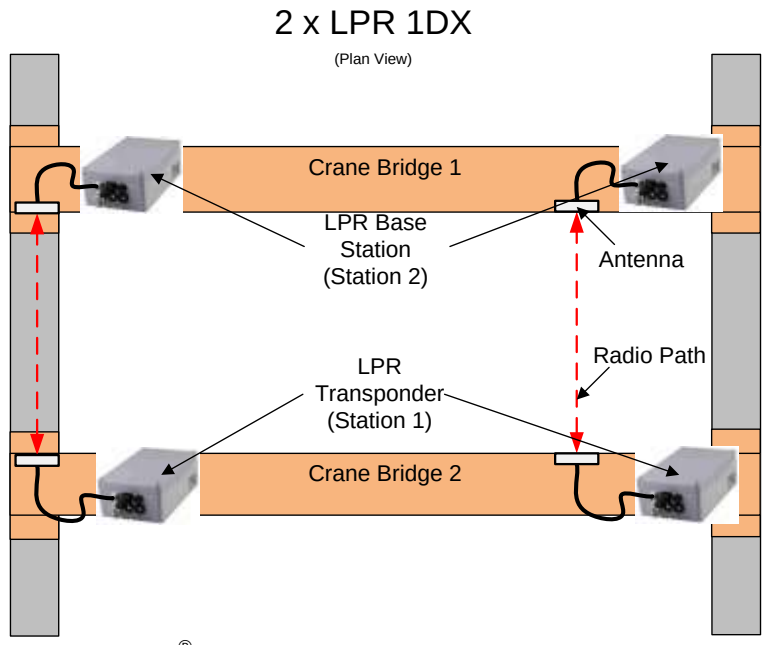



*Figure 6: LPR® 1DX Redundant arrangement*

### 2.6.2 Positioning of Crane Crab (LPR® 1DP2)

In order to determine positions in two dimensions (x-y coordinates), three LPR® units can be arranged in an L-shape (see Figure 7). In this case, the unit that is configured as the transponder (station 1) is equipped with 2 antennas. This unit measures against the first base station (station 2) with the first antenna, and against the second base station (station 3) with the other antenna, for example. In this way, the position of a crane crab can be determined, for example.

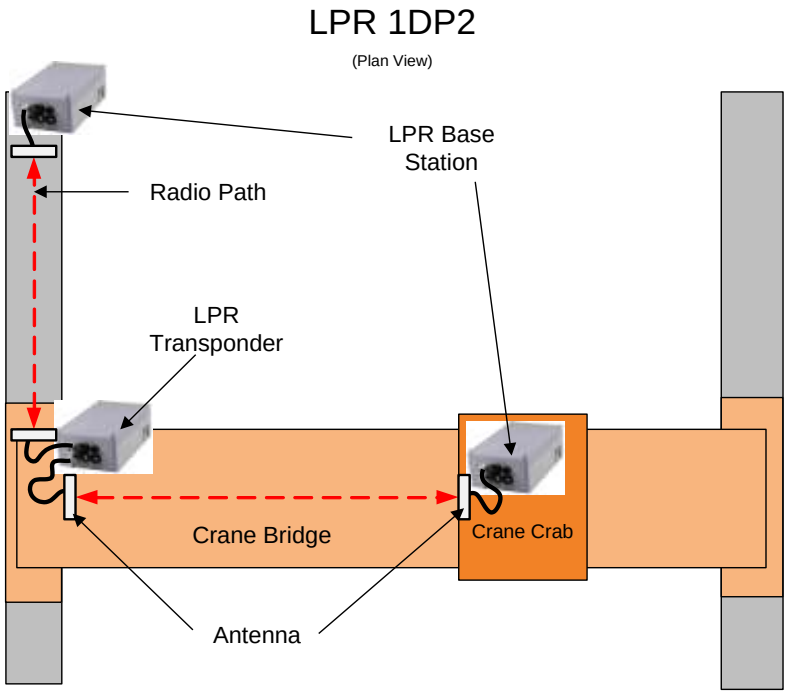



*Figure 7: LPR® 1DP2 L-shaped arrangement*

### 2.6.3 Positioning of 2 Cranes on two Runways (LPR® 1DP)

The Y-shaped arrangement can be used to determine the position of two cranes on different crane runways, for example. In the arrangement shown in Figure 8, the transponder unit (station 1) is equipped with two antennas. One base station (station 2 and station 3) is installed on each of the two cranes. The two antennas are secured to the wall at the same height as the respective base stations installed on the cranes. In this way, the distance of both cranes from the wall can be calculated. By comparing these two distances, a warning may be output before the two cranes cross each other's path, for example.

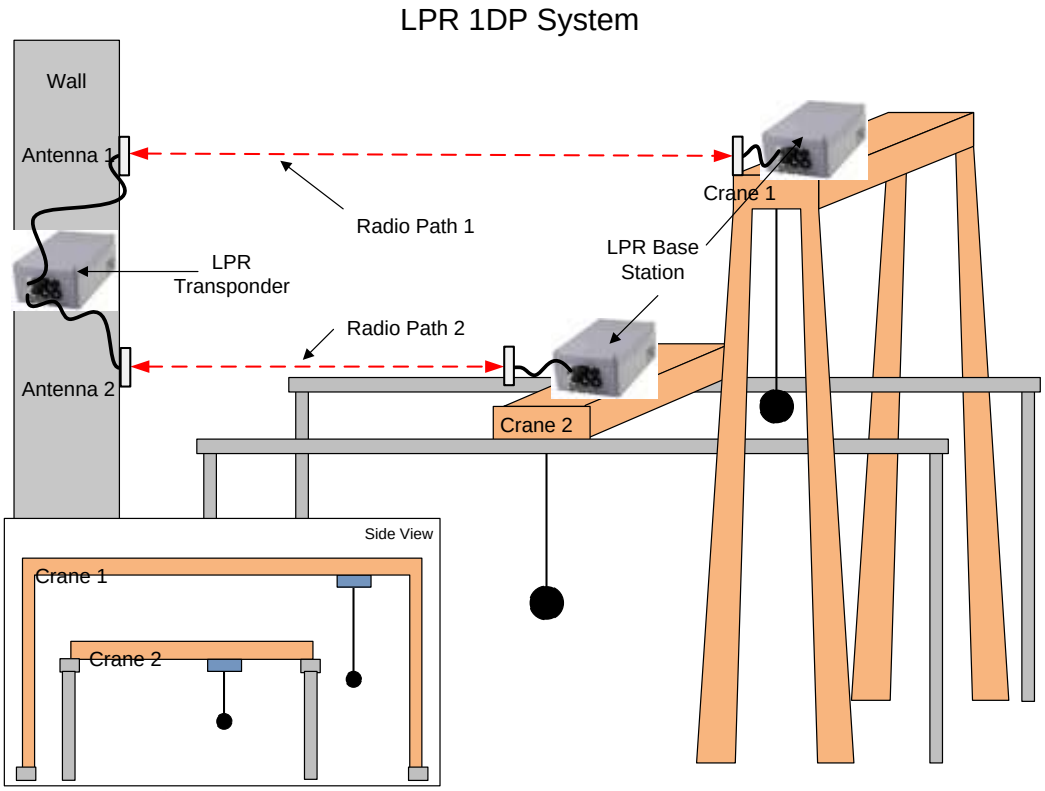



*Figure 8: LPR® 1DP Y-shaped arrangement*

# 3 Hardware

Warning

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

Note

Using beside the LPR® station with design “Compact Station” a LPR® station with design “Integral Station” a separate document with hardware and installation description is provided.

## 3.1 LPR® Station (Design Compact Station)

The Compact type LPR® station is factory configured variously according to different requirements:

- With  or without TCP/IP (ARM9 board)
- With or without switching outputs for up to 7 relays
- 2 or 4 antenna ports

Note

The option for additional relay outputs is not provided with 4 antenna outputs.

| Technical Data and Description of Interfaces | |
|---|---|
| Power draw | Voltage range 10-36VDC<br>RS232 port, with / without relay: 7 W / 4 W<br>TCP/IP port, with / without relay: 8 W / 6 W |
| Dimensions (LxWxH) | 260 x 160 x 91 mm |
| Type of protection | IP 65 with appropriate cable connectors |
| Connections | Power-Supply and Communication: Plugged connection<br>Antenna: Screwed cable gland<br>Ethernet: Plugged connection |
| Antennas | Connection of up to 4 independent antennas |
| Compliance | CE mark, part 15 FCC(1), RSS-210(1) |

(1) Only valid for FCC labeled stations.

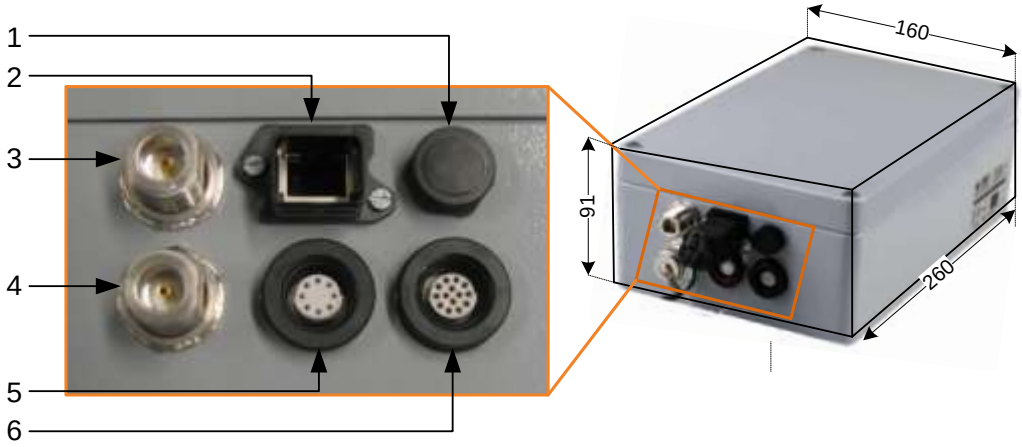
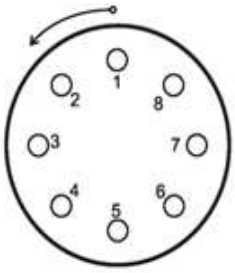



*Figure 9 LPR® Station (with network interface, dry contacts and 2 antenna interfaces)*

| Description of Interfaces | |
|---|---|
| Nr. 1 | Pressure equalization membrane.<br>The membrane prevents forming of condensation water inside the Compact Station. The pressure equalization membrane must not be changed or covered! |
| Nr. 2 | Network (optional).<br>The standard industrial Ethernet port of the station is designed as a Harting type push pull connector. |
| Nr. 3, 4 | Antenna connections.<br>The antennas are connected to the Compact Station via a specially converted low-loss HF cable with N-plug.<br>3: Antenna port no. 1,<br>4: Antenna port no. 2. |
| Nr. 5 | Power supply with integrated communication ports.<br>Power is supplied via a Lumberg Type 0233 08 push pull connector. There is no power switch because of the intended area of application. A 3 Ampere (slow blow) fuse is mounted inside the Compact Station. |
| Nr. 6 | Connection for relay outputs (optional).<br>The relays are connected by means of a type 0233 14 Lumberg push pull connector. |

### 3.1.1 PIN-Assignment of Lumberg Type 0233 08 (Power Supply, RS232-Interface)




| Pin | Function |
|---|---|
| 1 | UBB (+) |
| 2 | UBB (-) |
| 3 | LPR® data port RXD |
| 4 | LPR® data port TXD |
| 5 | Network diagnostic port RXD |
| 6 | Network diagnostic port TXD |
| 7 | GND-RS232 |
| 8 | GND RS232 |

*Table 1 : Solder side view of the pin assignment of the Lumberg power connector plug (power supply with integrated service port)*

**Note**

For configuration of the connector with cables, you have to identify the matching pin assignment on the solder side.

The connectors have an anti twist device.

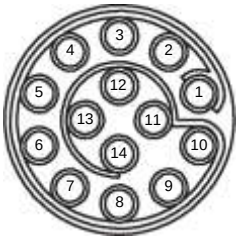
Option 1: It is possible to order cables (length: 5 m) by Symeo with integrated Lumberg connector and cut cable head (see chapter 3.2.1).

Option 2: It ispossible to order a connection box for wire all cables (see chapter 0).

**Note**

When plugging the push pull connectors into their sockets check that the plug doesn’t slip out of the socket when pulling slightly at the cable.

### 3.1.2 PIN-Assignment of Lumberg Typ 0233 14 (Relays)




| Pin | Name | Function |
|---|---|---|
| 1 | R1P | The function of the relay 1 to 7 can be individually programmed with the LPR® 1D Wizard. |
| 2 | R1N | |
| 3 | R2P | |
| 4 | R2N | |
| 5 | R3P | |
| 6 | R3N | |
| 7 | R4P | |
| 8 | R4N | |
| 9 | R5P | |
| 10 | R5N | |
| 11 | R6P | |
| 12 | R6N | |
| 13 | R7P | |
| 14 | R7N | |

*Table 2 : Solder side view of the pin assignment of the Lumberg relay connector (relay outputs)*

Note

For configuration of the connector with cables, you have to identify the matching pin assignment on the solder side.

The connectors have an anti twist device.

Option 1: It is possible to order cables (length: 5 m) by Symeo with integrated Lumberg connector and cut cable head (see chapter 3.2.2).

Option 2: It ispossible to order a connection box for wire all cables (see chapter 0).

Note

When plugging the push pull connectors into their sockets check that the plug doesn't slip out of the socket when pulling slightly at the cable.

## 3.2 Cables for LPR® Station

### 3.2.1 Assembled Cable for power supply and service port

Cables are delivered with a cable length of 5m and can be cut to the required length.

*Figure 10 Cable for power supply with integrated interface*

| PIN-Assignment of Cable Lumberg Connector 0223 08 | | |
|---|---|---|
| Plug | Lumberg 0223 08 | |
| Cable | 8-wire AWG24 UL/CSA; cladding diameter = 6.4mm | |
| Color (DIN 47100) | Pin / color | Function |
| | 1 – white | UBB (+) |
| | 2 – brown | UBB (-) |
| | 3 – green | LPR® Dataport RXD |
| | 4 – yellow | LPR® Dataport TXD |
| | 5 – grey | Network diagnostics port RXD |
| | 6 – pink | Network diagnostics port TXD |
| | 7 – blue | GND-RS232 |
| | 8 – red | GND-RS232 and shielding |

Warning

Consider the dependency of the maximum baud rate according to the cable length:

15m: 19.200baud
5m: 57.600baud
<2m: 115.200baud

According to the cable length the baud rate at the stations has to be adjusted.

Warning

If this cable is only used for power supply, the RXD-wires of the cable must be terminated. Otherwise signals from other systems can disturb the

system via the RXD-wire. Then measurements can fail. You have to ground the RXD-wires (PIN 3 and PIN 5) with PIN 7 and 8.

### 3.2.2 Assembled Cable for relays

Cables are delivered with a cable length of 5m and can be cut to the required length.

*Figure 11 cable for relays*

| PIN-Assignment of cable Lumberg Stecker 0223 14 | | |
|---|---|---|
| Plug | Lumberg 0223 14 | |
| Cable | 16-wire (14 wires are only used!)<br>AWG24 UL/CSA; cladding diameter = 6.4mm | |
| Color (DIN 47100 | Pin / color | name |
| | 1 – white | R1P |
| | 2 – brown | R1N |
| | 3 – green | R2P |
| | 4 – yellow | R2N |
| | 5 – grey | R3P |
| | 6 – pink | R3N |
| | 7 – blue | R4P |
| | 8 – red | R4N |
| | 9 – black | R5P |
| | 10 – violet | R5N |
| | 11 – grey-pink | R6P |
| | 12 – red-blue | R6N |
| | 13 – white-green | R7P |
| | 14 – brown-green | R7N |

## 3.3 LPR® Connection Box

The connection box is configured with 14 clamps. Therefore the connector box can be used either for power supply or for relays.


*Figure 12 Connection Box*

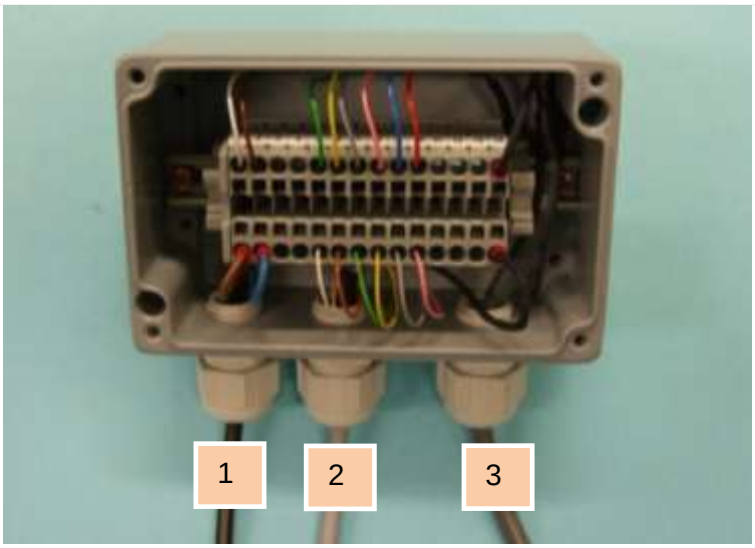
| Connection Box | |
|---|---|
| Size (LxWxH) | 125mm x 80mm x 57mm (without cable bushing) |
| Position mounting holes | 4 x diameter 4.3mm; 52 x 113mm |
| Clamps | Wago 870-911 for cable diameter 0.08 till 2,5mm² ( till 4mm² if flexible cables) |
| Cable bushing | 3 x PG Connection for cladding diameter 5 – 10 mm<br>1 x sealing cap |
| Protection category | IP65<br>If usage of appropriate cables (diameter 5 till 8mm) and correct connection of cap and cable bushing is assured |

**i Note**

If the cable bushing are not used the sealing cap (including the sealing ring) has to be mounted to keep the protection category IP65.

### 3.3.1 Example Connector Box

**Connection of a 8-pin cable**




1: Power consumption (by customer)
2: Serial Interface (by customer)
3: From LPR®

*Figure 13 Example for wiring connector box with 8 pins*

In this example the power supply is at pin1 and 2. The serial interface is at pin 5 to 10 and the shielding at pin 14.

Note

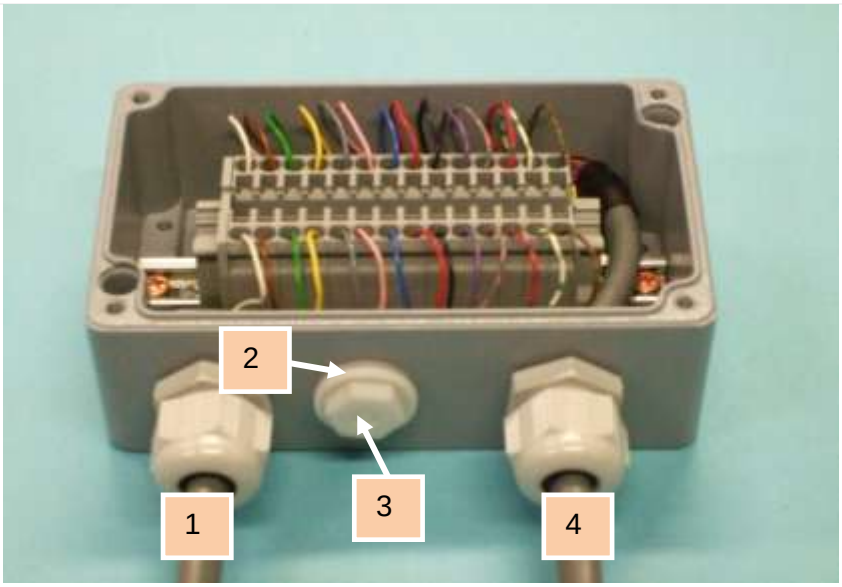
The shielding has to be allocated.

For safety of clamping use appropriate wires end sleeves according to AWG24. Zur Sicherung der Klemmung ist die Verwendung geeigneter Adern Endhülsen, passend zu AWG24 bzw. gemäß den kundenseitig verwendeten Kabeln, vorzusehen.

Warning

If this cable is only used for power supply, the TXD-wires of the cable must be terminated. Otherwise signals from other systems can disturb the system via the TXD-wire. Then measurements can fail. You have to ground the TXD-wires (PIN 4 and PIN 6) with PIN 7 and 8.

**Connection of a 14 pin cable.**




1: By customer
2: Sealing ring
3: Sealing cover
4: From LPR®

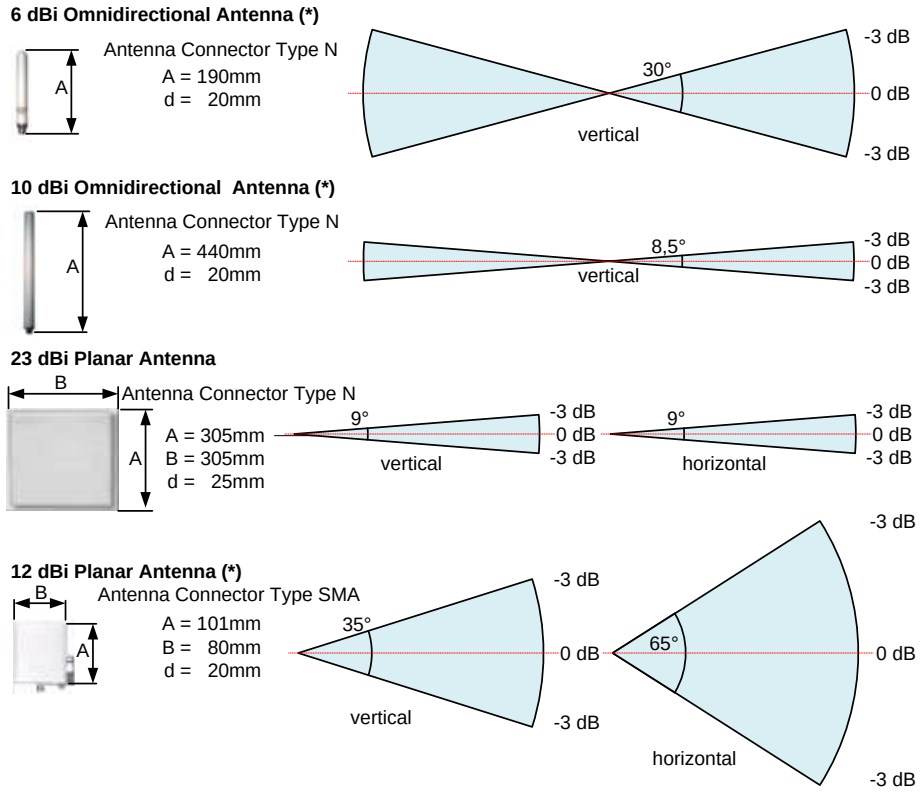
*Figure 14 example for wiring of connector box with 14 pins*

The dry contacts have to be connected to the clamps 1-14. The cable gland in the middle has to be protected with a sealing cap to keep protection category IP65.

## 3.4 LPR® Antenna Types

There are different antennas that can be installed depending on the required directional characteristic.

Figure 15 shows the typical LPR® antennas, which are applied in an LPR® System.



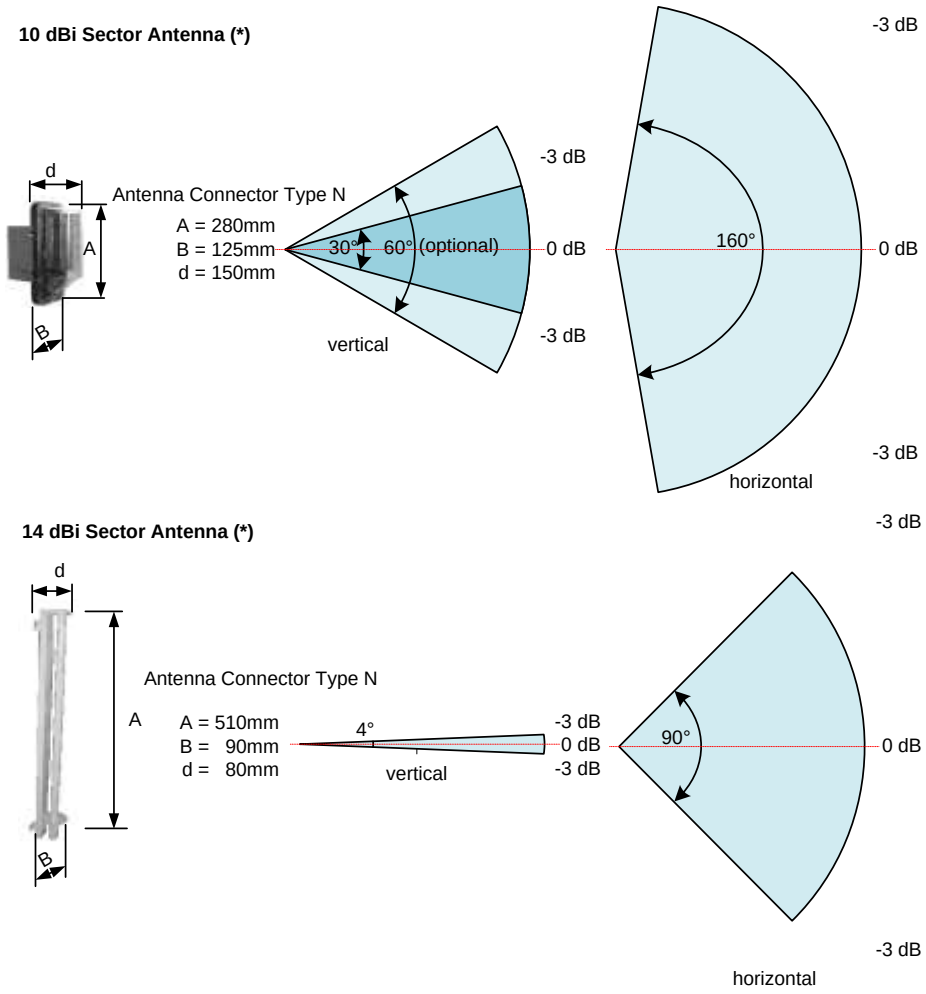



*Figure 15: Example of directional characteristic of typical LPR® antennas*

(*) These antennas are NOT approved to be in compliance with part 15 of FCC rules and with RSS-210 of Industry Canada. Usage of these antennas may void the FCC/IC authorization to operate this equipment.
Further information is found in the Appendix.

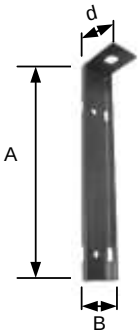
**i Note**

Installation and exchange of antenna or antenna cables must be carried out by qualified and trained technicians!
Usage of antennas or antenna cables which are not listed to be in compliance with FCC and IC rules is strictly prohibited!

### 3.4.1 Adapter for different LPR® Antennas

Depending on the required antenna, different adapters are available

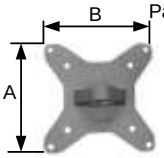
**6 dBi and 10 dBi Omnidirectional Antenna**




applicable for wall and pole mounting

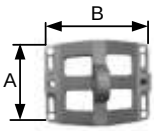
A = 228mm
B = 38mm
d = 50mm

**23 dBi Planar Antenna**




Part 1: mounting at antenna

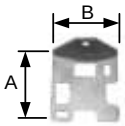
A = 115mm
B = 115mm




Part 2: applicable for wall and pole mounting

A = 80mm
B = 110mm
d = 70mm
applicable for pole diameter of 25mm-76mm

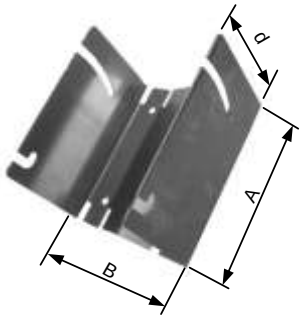
**12 dBi Planar Antenna**




applicable for wall mounting

A = 50mm
B = 44mm
d = 22mm

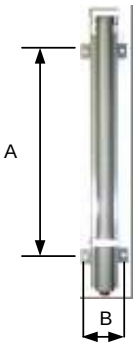
**10 dBi Sector Antenna**




applicable for wall and pole mounting

A = 150mm
B = 128mm
d = 100mm

**14 dBi Sektor Antenna**




applicable for wall and pole mounting
(pole diameter 30mm -60mm)

A = 410mm
B = 70mm

*Figure 16: Available Adapters for different Antenna Types*

# 4 Installation

## 4.1 Installation of LPR® Station Design Compact Station

### 4.1.1 Important Instructions for Installation

Caution

During Installation, the Compact Station has to be opened. Therefore it is important to avoid ingress of moisture, dust or any particles into the housing during the installation process. Make sure that there is enough room for the connectors, and particularly that the antenna cable is accessible; pay attention to the permitted bending radius (center of radius to cable core) for standard cables of 10,5cm (for multiple bending under mechanical load) and 4cm (unloaded and static bending).

The Compact Station should preferably be installed so that the connecting sockets point downwards. In this way, the connections are protected from rain and dust.

### 4.1.2 Installation

Note

To install the Compact Station, you require
4 round head M6 x 30 screws (at least).

⇨ Check the position of the station on the device on which the Compact Station is to be installed (e.g. a crane bridge). Bear in mind the installation instructions listed above.

⇨ Drill holes in the device on which the Compact Station is to be installed. Drill-hole distances: 11 cm wide, 24 cm high (see figure 7).

⇨ Open the Compact Station: With a Phillips screwdriver (Size 0), loosen the top four screws of the Compact Station lid.

⇨ Screw the Compact Station tightly to the device. The installation holes shown in figure 2 are provided for this purpose. Check that the station is mounted securely.

⇨ Close the station: Place the cover of the Compact Station on top and fasten the cover with the four screws. Make sure that the cover is securely attached to the housing.

⇨ Commission the Compact Station (see chapter "Base Station Initialization")

## 4.2 Installation of LPR® Antennas

### 4.2.1 Connecting and Wiring up the Antenna and Cable

Connect the antennas to the antenna port at the LPR® station.

Caution

When using several antennas, ensure that they are connected to the correct ports.

| | Transponder Station 1 | Base Station Station 2 | Base Station Station 3 | Base Station Station 4 | Base Station Station 5 |
|---|---|---|---|---|---|
| Measured Distance 1 | Antenna Port 1 | Antenna Port 1 | x | x | x |
| Measured Distance 2 (optional) | Antenna Port 2 | x | Antenna Port 1 | x | x |
| Measured Distance 3 (optional) | Antenna Port 3 | x | x | Antenna Port 1 | x |
| Measured Distance 4 (optional) | Antenna Port 4 | x | x | x | Antenna Port 1 |

⇨ When installing the cable, ensure that electrostatic charging does not occur.

⇨ Make sure that the cable is not kinked or trapped during installation. The minimum bending radius must always be maintained. With the standard antenna cables delivered, the minimum bending radius (center of radius to cable core) for standard cables is 10,5cm (for multiple bending under mechanical load) and 4cm (unloaded and static bending). The cable must not be attached in a way that alters its cross-section. On demand, cables with different flexibility characteristics are available.

⇨ The antenna plug must not be removed (e.g. for installation purposes) or repaired because the specified electrical properties can only be achieved with mechanical installation assistance.

⇨ When installing the antenna cable, ensure that the screw connection is seated properly. The antenna cable plugs should be finger-tightened before tightening with an appropriate tool to no more than 1.3 Nm tightening torque.

### 4.2.2 Installing the Antenna(s)

**Note**

The line of sight between the antennas on each unit must not be obstructed. Therefore, when installing the antenna fixture, ensure that no components are blocking the line of sight between the antennas. If necessary, contact the SYMEO technical department.

Depending on the antenna type used, offsetting the corresponding antennas (either vertically or horizontally) may degrade the signal strength to the point that communication is lost. Accordingly, corresponding antenna pairs should be installed with as little offset with respect to each other as possible, and preferably none. If necessary, contact the SYMEO technical department.

If you change the position of one antenna, this will affect the measurement data that is output.

For installation of the Planar Antennas, it is important to keep the same orientation of polarization for corresponding antennas (see Figure 17).

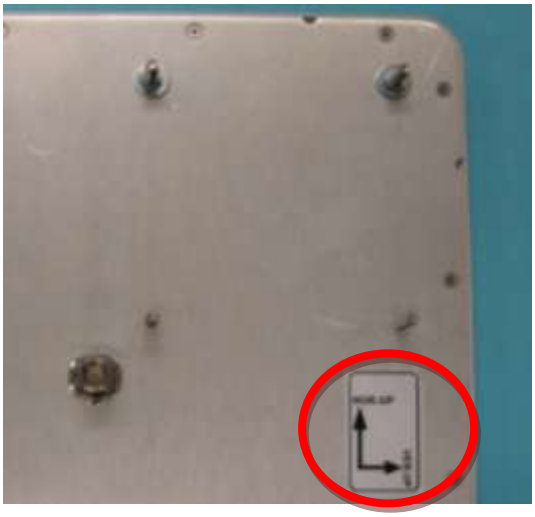


*Figure 17: Backside of 23 dBi Planar Antenna*

⇨ Install the antenna fixture according to the accompanying operating instructions.

⇨ Secure the antenna in the fixture.

⇨ Connect the antenna to the antenna cable.

### 4.2.3 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:

is the wave length and the distance between the two antennas. For a frequency of 5.8 GHz a wave length of approx. 0.05 m is calculated. The maximum radius between the two antennas is indicated with . For different distances the maximum radius is given in Figure 18.

| 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 |

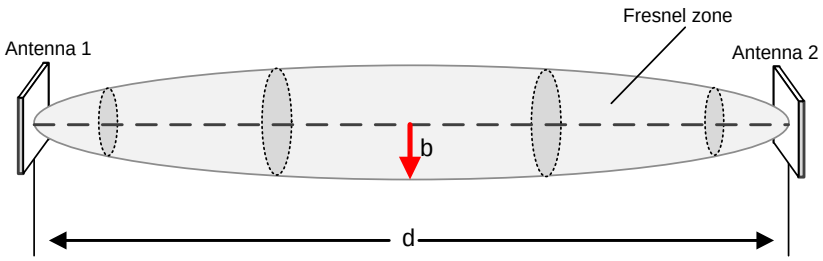


*Figure 18 Calculation and figure of Fresnel zone*

### 4.2.4 Installation of Planar Antennas

Note

Each antenna type has its own opening angle. To communicate with the opposite antenna the relative antennas has to be located in the opening angles of the opposite antennas.

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 19).

If an offset is not inevitable the antennas have to be tilted (compare picture 3 vs. picture 4 in Figure 19).

Caution

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

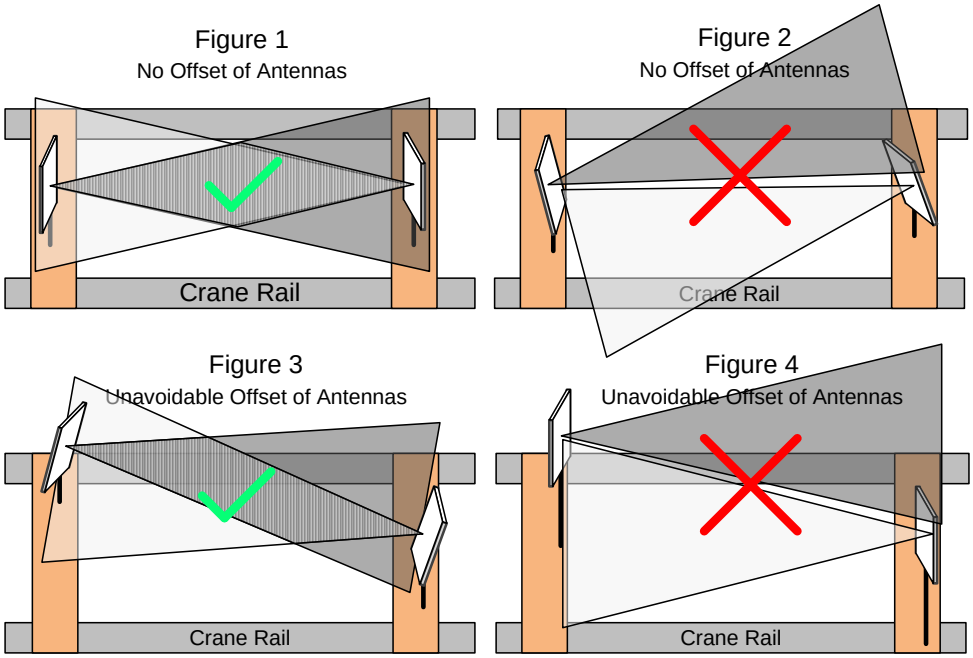



Figure 19 Antenna Position with and without Offset

# 5 Commissioning

## 5.1 Requirements

In order for a station to be successfully commissioned, the LPR® components must have been installed correctly:

⇨ The station has been installed.

⇨ The station has been connected to the power supply.

⇨ Antenna(s) and antenna cables for the station have been installed.

⇨ Data link has been established serially or via TCP/IP.

Once these prerequisites have been fulfilled you can connect the station either serially to a PC or as an option (TCP/IP option) to the network and commission the LPR® 1D system. How to do this is explained in the following chapter.

### 5.1.1 General

Commissioning is carried out via the serial port or the TCP/IP port depending on the LPR® station model you have.

- Each LPR® unit is equipped with the following interfaces:
- An RS232 port for data transmission to downstream systems (PC, S7),
- A second RS232 port for parameterization and software updates
- Optionally, a TCP/IP port for data transmission and parameterization.
- The radio interface at 5.8 GHz for data transmission, communication and measuring with other LPR® units,

The two RS232 ports are incorporated in the Lumberg plug, the radio interface functions via the system antenna.

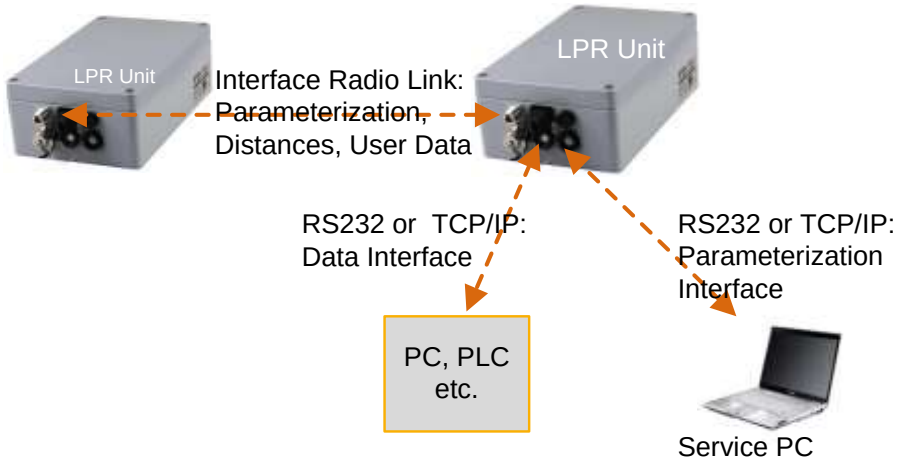



*Figure 20: LPR® Unit with Interfaces for Parameterization and Protocol Data Interface (Binary data)*

| Possible Connection to the LPR® Station via PC | | | |
|---|---|---|---|
| | RS232 | TCP/IP | Wireless-Access (via another LPR® Station) |
| Parameterization (ASCII-Data) | YES (ASCII-Port) | YES (ASCII-Port) | YES (ASCII-Port) |
| Distance Data (Binary Data) | YES (Binary Port) | YES (Binary Port) | NO |

*In one LPR® system all distance data (binary data/ protocol) is available at each station. Also if you have several stations in one system (crane bridge, crane crab, wall) you get the binary data at each LPR® station in this system.*

## 5.2 Connection to LPR® Station with TCP/IP Interface

Note

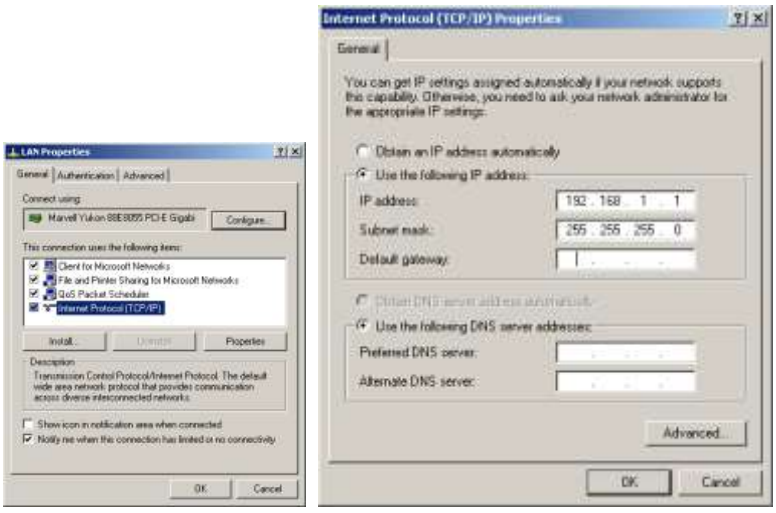
With delivery the LPR® stations have the fixed IP-Address **192.168.1.99**, if no other IP-Address is labeled outside the LPR® station.

You can change the IP-Address of the LPR® Station via the web interface of the LPR® Station.

Note

To get a connection between your PC and the LPR® station it is maybe neccessary to change the network parameters of your computer. Both units must be located in the same network. That means in this example that the first three numeric pads of both IP-addresses must be the same.

Disconnect your PC from the network. Connect the LPR® station and the computer with a network cable. Open your network settings of your computer.




Enter the following fixed IP-Address i.e. **192.168.1.1**. The subnet mask should be set to **255.255.255.0**.

Click in both windows **OK**.

*Figure 21 – Network Settings*

Note

If you firewall settings are too restrictive, you may not get access to the LPR® station. In this case deactivate temporarely the firewall under the tab „Advanced“ in the window LAN Properties.

The LPR® Station should be available via your PC now. You can check the connection with a „ping” to the LPR® station:

Open the Command-Window:

⇨ Windows Start Button

⇨ Choose Run

⇨ Enter cmd and click OK

⇨ Enter in the cmd.exe window: ping 192.168.1.99 or the IP-address of the LPR® station.

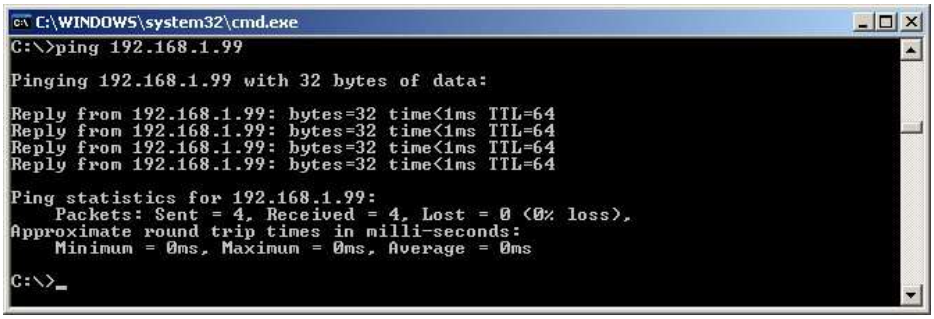



*Figure 22 – Ping LPR® Station*

The LPR® Station should answer with a ‚Reply‘.

## 5.3 Connection LPR® Station with serial Interface

Note

The interface RS232 is only available for station without TCP/IP interface. If a RS232 interface for station with TCP/IP interface is desired, please contact the Symeo Service.

The commissioning could either be done via the serial interface of the 8-pin Lumberg connector (Figure 23) or the serial interface inside the box (Figure 25).

Warning

Consider the dependency of the maximum baud rate according to the cable length:

15m: 19.200baud
5m: 57.600baud
<2m: 115.200baud

According to the cable length the baud rate at the stations has to be adjusted.

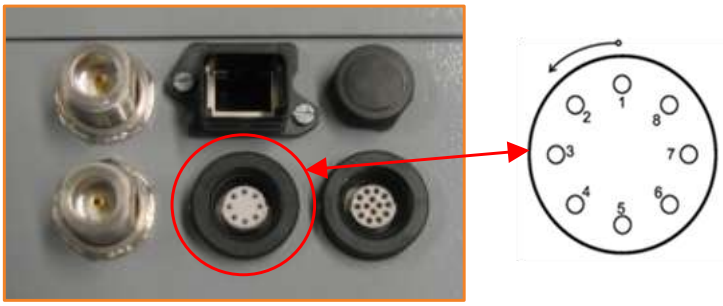



*Figure 23 – Lumberg-Interface for Serial Interface*

| Pin | Function |
|---|---|
| 1 | UBB (+) |
| 2 | UBB (-) |
| 3 | LPR® data port RXD |
| 4 | LPR® data port TXD |
| 5 | Network diagnostic port RXD |
| 6 | Network diagnostic port TXD |
| 7 | GND-RS232 |
| 8 | GND RS232 |

*Figure 24 – Lumberg-Connector Cable for Serial Interface*

| Pin / Color | Function |
|---|---|
| 1-ws | UBB (+) |
| 2-bn | UBB (-) |
| 3-gn | LPR® Dataport TXD |
| 4-ge | LPR® Dataport RXD |
| 5-gr | Network diagnostic port RXD |
| 6-rs | Network diagnostic port TXD |
| 7-bl | GND-RS232 |
| 8-rt | GND-RS232 |

To commission the system via the internal serial interface you must use the internal configuration port. Therefore a standard RS232 cable of a max cable length of 2 m is required.

Warning

Using the internal serial interaces it is important to avoid ingress of moisture, dust or any particles into the housing during the process

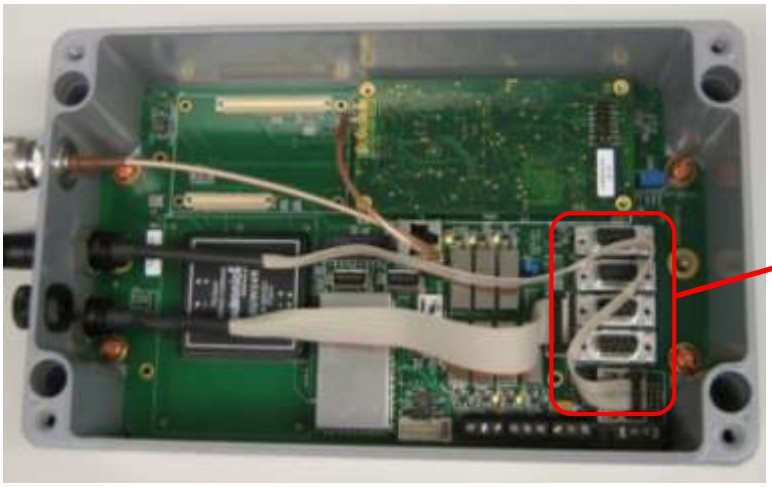


*Figure 25 Internal view of LPR® Station*


*Figure 26 – Internal Data Interfaces*

| Internal Data Interfaces | |
|---|---|
| S4 | Configuration Port/ ASCII Port |
| S3 | A9 serial |
| S2 | Binary Port (Protocol XP) |
| S1 | ARM9 serial |

Connect one side of RS232 cable of a cable length of 2 m with your PC and the other side with the LPR® station (ASCII Port S4). Check the right port of your COM-Port in the device manager of your computer.

## 5.4 Commissioning Tool – LPR® 1D Wizard

### 5.4.1 Installation

Install the provided LPR® 1D Wizard on your computer.



*Figure 27 – Installation File LPR® 1D Wizards*

*Figure 28 – Setup 1*


*Figure 29 – Setup 2*

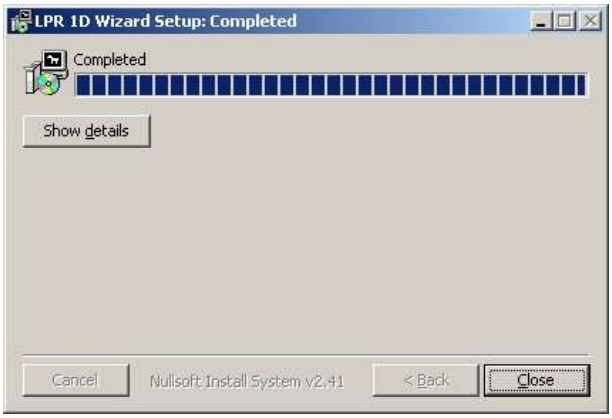



*Figure 30 – Setup 3*

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

### 5.4.2 Utilization of LPR® 1D Wizard

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

- ⇨ Selection of the desired application
- ⇨ Settings of parameters for selected application
- ⇨ General setting of LPR® 1D System (ID, Antenna parameters, etc.)
- ⇨ Connection to LPR® Station(s)
- ⇨ Download of currently applied application as Backup-file
- ⇨ Upload of new selected application to the LPR® Station(s)
- ⇨ Antenna Calibration
- ⇨ Check distance data

⇨ Start the LPR® 1D Wizard. The following window appears:


*Figure 31 – Start LPR® 1D Wizard*

The construction of the menu looks like the following:

Menu ‚File': open and save configuration files.

Menu ‚Application': Selection of application and settings for LPR®-Systems (IDs, allocation of relays,…)

Menu ‚Connection': Connection to LPR® system.

| Note |
|---|

You find many Info buttons. These info buttons explain in more detail the functionality of an action.

## Selection of application

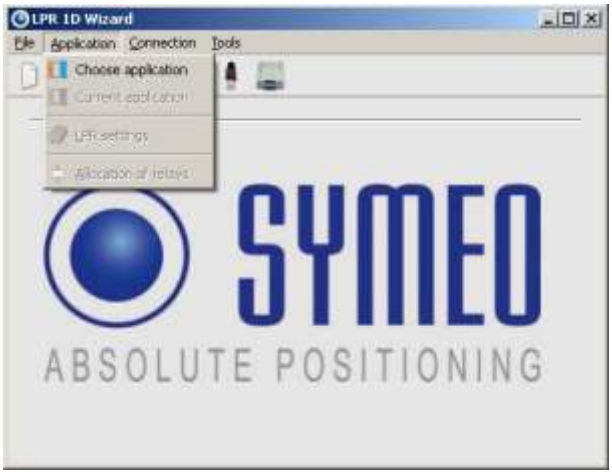



*Figure 32 – Selection of application*

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.

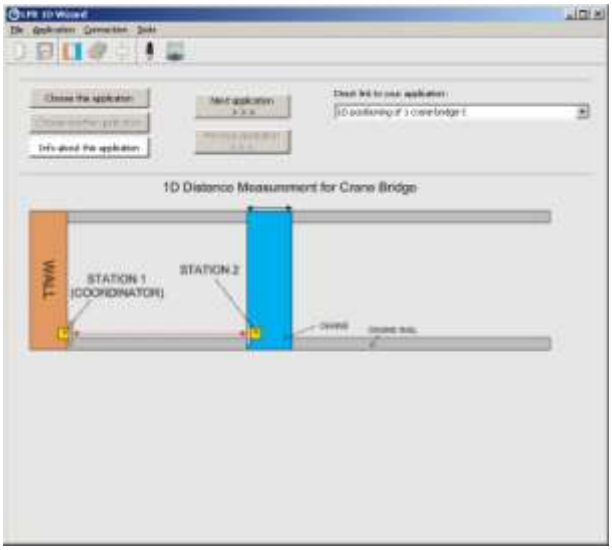



*Figure 33 – Overview of application*

The first possible application is shown.

You can see other application with the buttons ‚Next application' or previous application'.

Or you can open a known application via the selection list ‚Direct link to your application'.

| Note |
|---|

Not till then you have pressed the button ‚Choose this application' the applicationi selected.

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

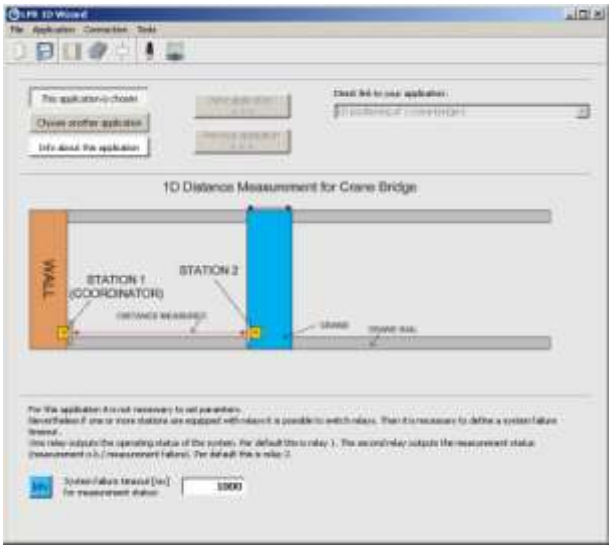



*Figure 34 –Settings of parameters of selected application*

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

| Note |
|---|

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

## Settings of LPR® System Parameters

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

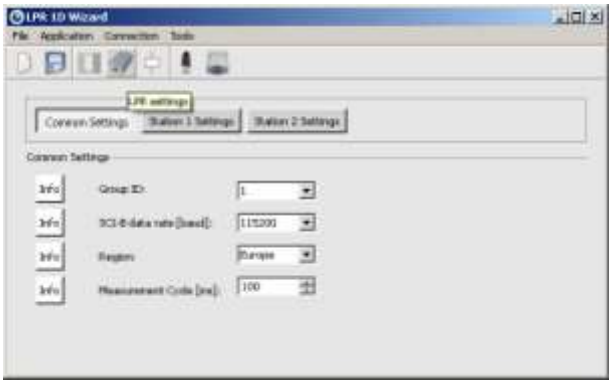


*Figure 35 – General settings 1 of LPR® system*

The ‚Common Settings' include settings of LPR® Systems. You have to make these settings.

Group ID: Clear ID of the LPR® system. All station in one LPR® system have the same group ID.

SCIB-data rate: Transmission rate of the LPR® system. Per default this value iss et to 115200 baud.

| Caution |
|---|

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

*Figure 36 – General settings 2 of LPR® system*

Region: Choose the region where the system is installed. This is important to calculate the allowed transmission power.

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

| Caution |
|---|

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

| Note |
|---|

You cannot select in the Wizard the frequency channel because this is linked to the group ID of the system.

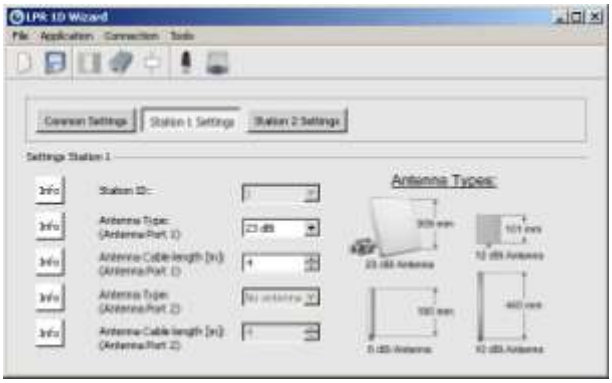


*Figure 37 – General settings 3 of LPR® –B system*

‚Station 1 Settings' and ‚Station 2 Settings' (optional ‚Station 3 Settings') include the settings of the antenna parameters.

This is important to calculate the allowed transmission power.

| Note |
|---|

It is important to note the right allocation the antenna cables to the right antenna ports. Station 2 and 3 always use only antenna port 1. At station the antenna which measures with station 2 is connected to port 1, the antenna which measures with station 3 is connected to port 3.


*Figure 38 – Antenna ports of LPR® Station*

## Optional: Usage of Relays

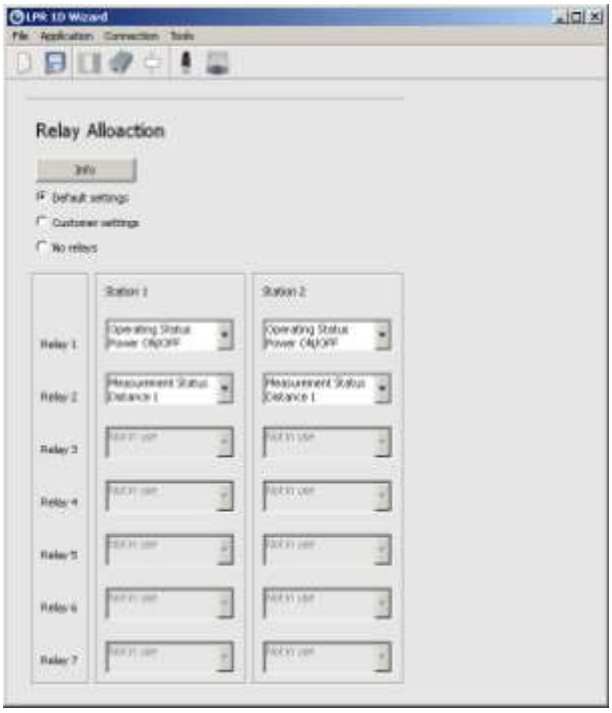



*Figure 39 – Allocation of relays*

If realys are used at one or more LPR® stations you can allocate functionalities to each relay depending on the selected application.

**Caution**

If the relay selection is skipped no relays are switch at the LPR® station

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

**Note**

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

## Connection to LPR® Station

*Figure 40 – Connection to LPR® station*

Having established a connection to the LPR® station as described in chapter 5.2 and 5.3 the connection can be opened.

**Note**

If you are connected to the LPR® station with TCP/IP interface, you choose this connection type. For serial connection you choose RS232.

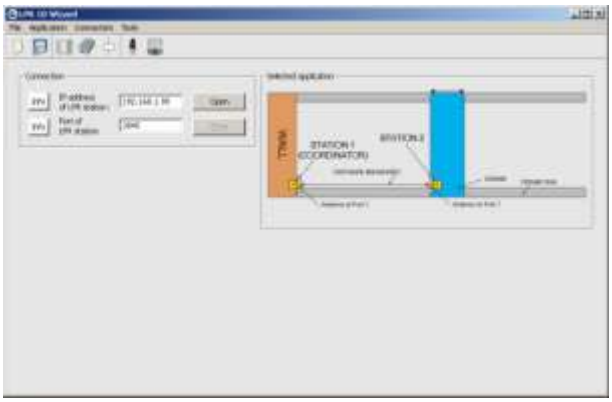


*Figure 41 – TCP/IP Connection to LPR® station*

TCP/IP Connection:

To open the TCP/IP connection you have to enter the IP-address and the port number. The configuration port is 3045 per default. It can be changed in the web interface of the LPR® station (see chapter 6).

RS232 Connection:

T open the serial connection select the right COM port of your computer.

**Note**

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

*Figure 42 – Open connection*

The following submenus appear:

Download Configuration

⇨ Download of old configuration

Upload Configuration

⇨ Upload of new selected configuration

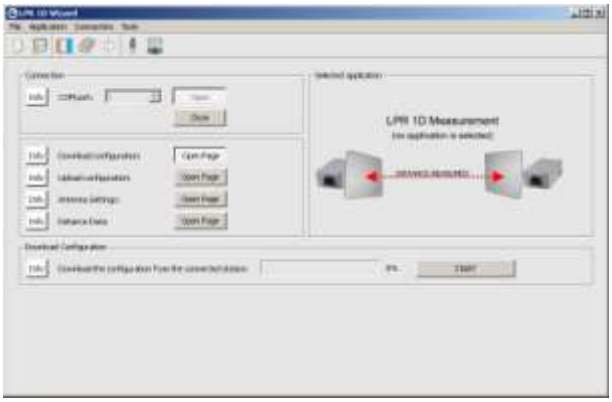
Antenna Settings

⇨ Calibration of antennas

Distance Data

⇨ Measured Distance(s)

## Download Configuration



Before uploading a new application make a download of the current application to have these files later as a backup.

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® station.

## Upload Configuration

Pressing the button ‚Upload' the application can be uploaded to each LPR® station.

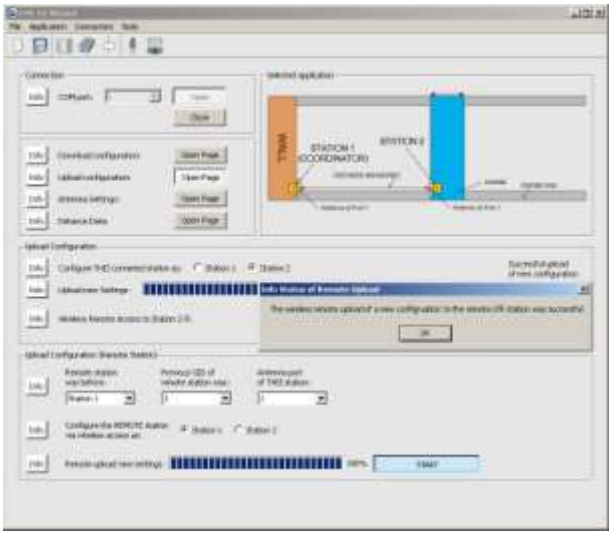
| Caution |
|---|

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

Select the station for the upload. The picture assist you which station you should select.

Press the ‚Start'-button.

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



At each LPR® station an upload must be done.

You can either connect the LPR® station direct to your computer via TCP/IP or serial interface. Or you have the possibility to get wireless access via station 1 (coordinator) via the frequency channel to the other stations

But to get wireless to other stations you have to know some parameters of the opposite station. These are the previous group ID, the previous station number and the antenna port at this station.

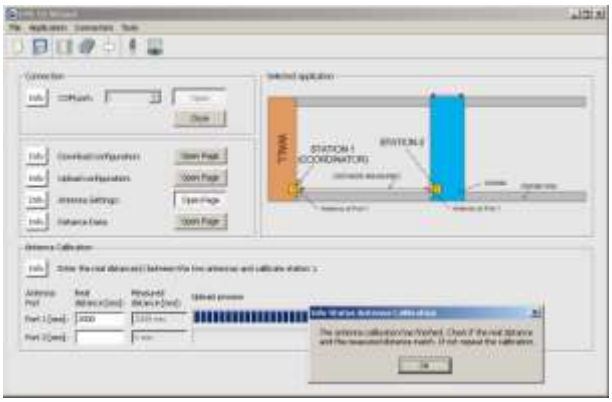
Choose first all parameters and then select the station number which the station should have after the upload. Press the Start-button.

A note appears if the uploaded 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® station. All checkboxes has to be marked.

## Antenna Calibration



After uploading all configuration files to each LPR® station, you have to calibrate the antennas.

Click the button ‚Antenna Settings'.

**Note**

In the field ‚Measured Distance' should be displayed the measured distance, which is different to the real distance.

Enter the real distance value between the two antennas in the field ‚Real distance'. Press the button ‚Calibrate'.

Port 1 is the distance between station 1 and station 2. If you have a second measurement then you enter under port 2 the real distance between station 1 and station 3. The picture assists you.

**Warning**

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

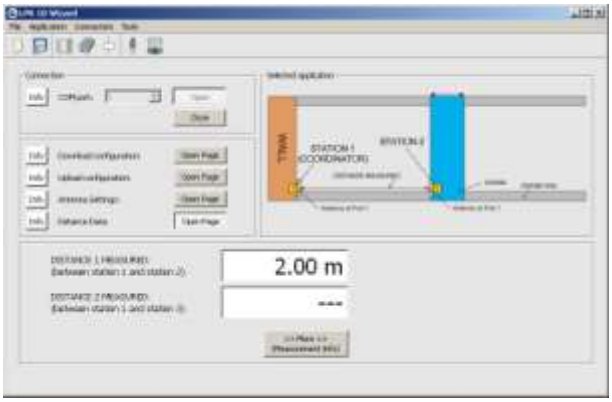
If the measured distance and the real distance are not the same after the calibration you might repeat the calibration.

**Note**

Duringthe calibration process

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

## Display of Distance Data




Click the button ‚Distance Data' and distance value(s) is/are shown.

# 6 Web Server

The network settings for a LPR® station with TCP/IP interface are described in this chapter.

Therefore it is necessary to open a TCP/IP connection between your computer and the LPR® station.

## 6.1 Open Web Server

Open your web browser. In the address bar of the web browser enter the IP-address of the LPR® station: http://192.168.1.99. Press Enter.

Note

The IP-address of the LPR® station is 192.168.1.99 per delivery status except another IP-address is labeled outside the box.

Note

You can establish a connection with your LPR® stations Web server either via HTTP or HTTPS if the station has been configured for this (see section "Settings", "HTTP" and "HTTPS" fields in the "Remote Access" area).

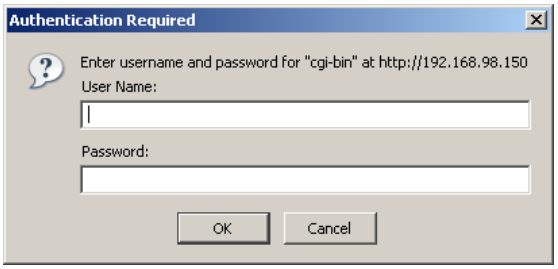
In HTTP connections, the data is transmitted unencrypted. In HTTPS connections, it is encrypted for transmission (AES-256, 256-bit encryption).


A connection is established with your LPR® station.

In the case of an HTTPS connection, you may see two dialog boxes. Confirm them both with OK.

Then the Welcome page for the LPR® station's Web server will appear.

⇨ Click the function you want in the navigation bar. The individual functions are described in the following sections.




You will be prompted to enter your information for authentication.

⇨ Enter user name "symeo" and the password, and click "OK". The password has been set to "54all2u" by the manufacturer.

Note

In order to protect your system from being reconfigured by unauthorized persons, you should change this to a company password that is only provided for authorized personnel.

## 6.2 Settings

With this function you can define the network settings on your LPR® station and the network access settings and reboot the system.

⇨ Click "Settings" in the navigation bar.

⇨ If you have not yet provided authentication information you will be prompted to do so now (see chapter 6.1).

The Settings page for the LPR® station's Web server is displayed.


The following menu is displayed:

LAN:

Overview about LAN settings of LPR® station (static or dynamic IP address) (see chapter 6.2.1)

Network:

Network settings (see chapter 6.2.2)

Serial-to-Ethernet:

Settings of parameterization port (see chapter 6.2.3)

Remote Access:

(See chapter 6.2.4)

Miscellaneous:

Setting of time zone (see chapter 0)

Special Functions:

(see chapter 6.2.6)

**i** Note

To accept the changings of the LPR® station press button „Upload changes“. Afterwards press button “Reboot System“ to reboot the LPR® station with the new settings.

### 6.2.1 „LAN“ area

| | |
|---|---|
| MAC-Address | Unique hardware address of the LPR® station on the LAN (Ethernet ID) (not editable) |
| Current Mode | Shows the current mode:<br>"Static IP-Address" or "DHCP Active".<br>In "DHCP Active" mode, the LPR® station receives a dynamic or reserved IP address from the DHCP server. You can also ask your administrator or the SYMEO technical department about this.<br>Note<br>If the LPR® station is set to „DHCP“ but does not get after the reboot within 60 sec an IP-address from the DHCP server the last applied fixed IP-address is used. |
| Change Mode | A button is labeled "DHCP" or "Static" depending on the "Current mode" field. Click this button to switch from "DHCP Active" mode to "Static IP-Address" mode or vice versa. |
| IP-Address | IP address of the LPR® station<br>Per default the IP-address is set to the static IP-address 192.168.1.99.<br>In "DHCP Active" mode, this address is assigned by the server and cannot be edited.<br>In "Static IP-Address" mode you can assign a fixed (static) address here. |
| Netmask | Net mask of the LPR® station<br>(default: 255.255.255.0)<br>In "DHCP Active" mode, the net mask is assigned by the server and cannot be edited. |
| Gateway | IP address of the standard gateway<br>(default: 192.168.98.254)<br>Other LAN segments can be reached with the standard gateway.<br>In "DHCP Active" mode this address is assigned by the server and cannot be edited. |

### 6.2.2 „Network“ Area

| | |
|---|---|
| Hostname | Hostname of the system (default: "lprb-basestation").<br>In "DHCP Active" mode, this hostname is also communicated to the DHCP/DNS server.<br>A name that will be reserved on the DNS server can be entered here. You can also ask your administrator or the SYMEO technical department about this. |
| DNS | IP address of the DNS server:<br>The DNS server is able to translate hostnames into IP addresses. |

| | |
|---|---|
| | In "DHCP Active" mode this address is assigned by the server and cannot be edited. |
| Syslog | IP address of the Syslog server (default: 0.0.0.0, i.e. this service has been disabled).<br>The Syslog server is a server on the network to which it is planned to have system messages (system log) transmitted. Transmission is packet-based (UDP) and unencrypted. |
| NTP | IP address of the NTP server (default: 0.0.0.0, i.e. this service has been disabled).<br>The NTP server is a server on the network from which the system can request the current time. |

### 6.2.3 „Serial-to-Ethernet“ Area

| | |
|---|---|
| ttyAM1 | Port number of the TCP/IP port via which the data from serial port (ttyAM1) is sent and received. ttyAM1 is the port for the parameterization interface (Service Port). (Default: 3045) |
| ttyAM2 | Port number of the TCP/IP port via which the data from serial port (ttyAM2) is sent and received. ttyAM2 is the port for the data interface (Binary Port). (default: 3046) |

Note

Per default these two ports are not enabled. Choose the Connection Type between the LPR® station and your PC or PLC for each port. Depending on the connection you select different masks are editable.

#### ttyAM1 / Parameterization Port

Network Settings Area:

| | |
|---|---|
| IP (Server) | If applying Connection Type „*TCP – Connecting to Data Port using Reserve Port*“ you enter here the IP-address of the server, to which the connection should be established. |
| Data Port | Port-Number of TCP/IP Port. Data of serial interface (ttyAM1) is sent and received. ttyAM1 is the parameterization port. Default value is 3045. |
| Reverse Port | If applying Connection Type „*TCP – Connecting to Data Port using Reverse Port*“ you enter here the port, which the server should use for the reverse channel. |

Serial Settings Area

| | |
|---|---|
| Speed | Baud rate of serial interface (ttyAM1). The baud rate of the parameterization port is set to 115200 baud per default. |
| Options | Settings of serial interface ttyAM1 for the data protocol. These settings are not necessary to change and are set per default to *raw –echo –ixon* (Raw data, no echo, no control character). |

Connection Type Area

| | |
|---|---|
| Disabled | The port is disabled and not reachable via TCP/IP. |
| TCP – Listening on Data Port | The LPR® station is waiting for incoming connection on the *"Data Port"*. If the connection is opened successful you can open the parameterization port. |
| TCP – Connection to Data Port using Reserve Port | The LPR® station establishes the connection to the entered server address. Setting *"Random"* means both communication partners arrange the reverse channel autonomously. If the connection is opened successful you get access to the parameterization port. |

## ttyAM2 / Binary Port

Network Settings Area:

| | |
|---|---|
| IP (Server) | For all active Connection Types the IP-address of the server is required to which the connection should be established. |
| Data Port | Port-Number of TCP/IP Port. Data of serial interface (ttyAM2) is sent and received. ttyAM2 is the binary port. Default value is 3046. |
| Reverse Port | For all active Connection Types a reverse channel for data transmission is required. |

Serial Settings Area:

| | |
|---|---|
| Packet Filter | If selected type "*Fixed Frame*" it is possible to filter packed data. Default value is „*none"*. Example: "*2,3*" filters the data type 0x02 (Send request) and data type 0x03 (relay switching command). |
| Receive Size | If selected type "*Fixed Frame*" it is possible to set the frame size of the received data packed. Example: For 1D-application a frame size of 15 Byte is sufficient. A smaller telegram must me filled with 0x00. |
| Send Size | If selected type "*Fixed Frame*" it is possible to set the frame size of the sent data packet. Example: For 1D-applicaiton a frame size of 21 Byte is sufficient. A smaller telegram is filled with 0x00 by the LPR® station. |

Connection Type Area:

| | |
|---|---|
| Disabled | The port is „Disabled" and not be reachable via TCP/IP. |
| TCP – Variable Frame – Listening on Data Port | The LPR® station is waiting for incoming connection on the *"Data Port"*. If the connection is opened successful you can open the binary port. „*Variable Frame"* means activated „*Byte Stuffing*" (no fixed protocol length). |
| TCP – Variable Frame – Connecting to Data Port | The LPR® station establishes the connection to the entered server IP-address. Setting *"Random"* means both communication partners arrange the reverse channel autonomously. If the connection is opened successful you get access to the binary port. „*Variable Frame"* means |

| | |
|---|---|
| | activated „*Byte Stuffing*“ (no fixed protocol length). |
| TCP – Fixed Frame – Listening on Data Port | The LPR® station is waiting for incoming connection on the *“Data Port”*. If the connection is opened successful you can open the binary port. „*Fixed Frame“* means deactivated „*Byte Stuffing*“ (fixed protocol length). |
| TCP – Fixed Frame – Connecting to Data Port | The LPR® station establishes the connection to the entered server IP-address. Setting *“Random”* means both communication partners arrange the reverse channel autonomously. If the connection is opened successful you get access to the binary port. „ *Fixed Frame“* means deactivated „*Byte Stuffing*“ (fixed protocol length). |
| UDP – Fixed Frame – Sending to Data Port | The LPR® station sends and receives data (UDP) to and from the entered server IP-address. The reverse channel uses also the data port. „*Fixed Frame*“ means deactivated „*Byte Stuffing*“ (fixed protocol length). |

### 6.2.4 „Remote Access“ Area

| | |
|---|---|
| Telnet | Click this checkbox to allow or prevent console accesses to port 23 via Telnet (checked: accesses are allowed). The port number is not editable. See also section "Extended system access". |
| SSH/SCP/SFTP | Click this checkbox to allow or prevent console accesses to port 22 via SSH (Secure SHell and data transmission via SCP (Secure CoPy) or SFTP (Secure File Transfer Protocol) (checked: accesses are allowed). The port number is not editable. See also section "Extended system access". |
| HTTP | Click this checkbox to permit or forbid accesses to the LPR® station's Web server via HTTP (unencrypted transmission) (checked: accesses are allowed). You must also enter the corresponding port number as appropriate. The port number is set to 80 (http protocol standard) by the manufacturer. |
| HTTPS | Click this checkbox to permit or forbid accesses to the LPR® station's Web server via HTTPS (encrypted transmission) (checked: accesses are allowed). You must also enter the corresponding port number as appropriate. The port number is set to 443 (http protocol standard) by the manufacturer. |
| User | User ID for access to the TCP/IP port. It has been set to "symeo" by the manufacturer and cannot be changed. |
| Password | Enter the new password here if you want to change the password. The password has been set to "54all2u" by the manufacturer. |
| Repeat | Enter the new password again here if you want to change the password. |

| | |
|---|---|
| Password | |

Extended system access („*Remote Access*“) enables console access via Telnet, SSH (Secure SHell), SCP (Secure CoPy) and via the serial port. This enables extended system information to be retrieved and troubleshooting to be carried out. We recommend that you disable all functions that are not required, see section "Settings".

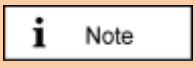
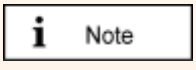

In extended system access, the user "SYMEO" has 'ROOT' privileges, i.e., full access to the system. Depending on the settings made, the system can also be damaged and such damage may or may not be reparable. If you have any questions, please contact the SYMEO technical department.

The enormous range of functions that are available to console access means that only some can be documented here. To find out more, please contact your IT administrator or Symeo Support.

### 6.2.5 „Miscellaneous“ Area

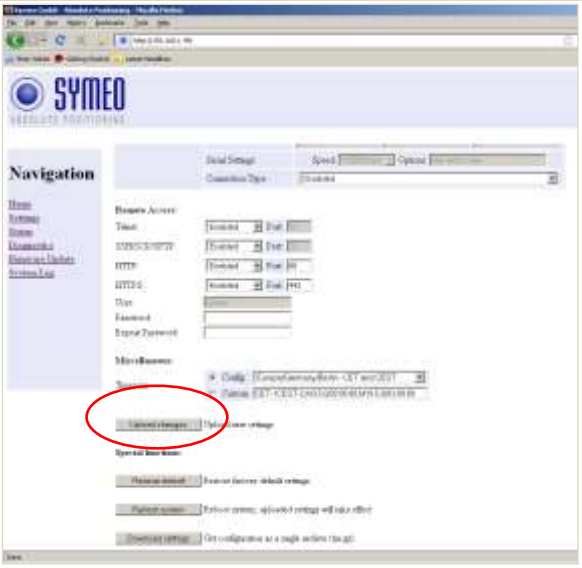
| | |
|---|---|
| Timezone | If a NTP-server is available and the IP-address of the NTP-server is entered you can choose the time zone of the LPR® station. It is also possible to enter the time zone manually. |

### 6.2.6 „Special Functions“ Area

| | |
|---|---|
| Restore default | Click this button to restore the settings made by the manufacturer.<br>⇨ Click the "Execute" button (Restore factory default settings) in the "Special functions" area to cancel all changed settings and restore the factory settings.<br>The settings made by manufacturer are activated first after a reboot of the LPR® station. This means that changes of the settings (i.e. IP-address) are possible.<br>  The settings affected will be deleted and populated directly with the factory settings.<br>  When the factory settings have been restored, it may be necessary to proceed as if commissioning the system again. |
| Reboot system | To accept the settings the LPR® station must be rebooted. Click this button to reboot the system.<br>  Before you reboot the system the settings must be loaded to the LPR® station by pressing button “Upload changes”. |
| Download settings | Press the button „Download Settings“ to download a copy of the configuration as a backup. |

### 6.2.7 Accept settings / System Reboot

As described in chapter 6.2 it is necessary to transmit the changes to the LPR® station and afterwards reboot the station.

| | |
|---|---|
|  | ⇨ Press button „Upload changes“ to load the changes. |
|  | ⇨ Scroll down to the end of the page and press „Reboot System“ to reboot the LPR® station. |

## 6.3 System Status

With this function, you can display the current system status.


⇨ Click "Status" in the navigation bar.

If you have not yet provided authentication information, you will be prompted to do so now (see section "Starting and using the Web server").

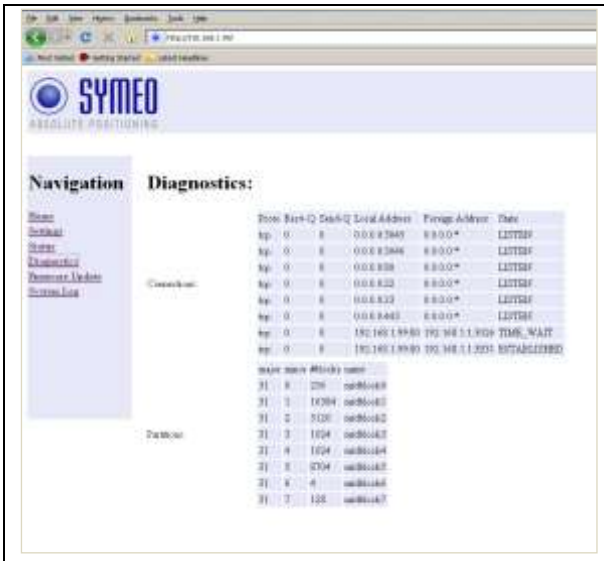
The Status page for the LPR® station's Web server is displayed.

The fields have the following meanings:

| | |
|---|---|
| Uptime | 01:27:47 – Current system time<br>up 20 min – Time since the last system start<br>load average: 0.00, 0.00, 0.00 – Average system load for the last 1, 5 and 15 minutes. The load indicates how many processes are waiting to receive computing time |
| Memory (RAM) | MemTotal: Total usable working memory (physical RAM less a number of reserved bits and the kernel code)<br>MemFree: Free working memory |
| Filesystem | Details about the active file systems and associated statistics. |
| OS Version | Operating system, kernel, compiler and compiling date |
| SVN Version | Current version of software |
| Description | Description of the system |
| System Date | Current system time |
| Watchdog | Status of the hardware watchdog, including counter of start operations since the last switch-on (connection of the power supply). A value between 2 and 127 means that the watchdog has triggered that number of system restarts. The counter is reset at 'power-on-reset' (connection of the power supply) and 'user-rest' (jumper on motherboard). In a reboot (e.g. from the Web page), the current counter status is not reset. |
| CPU Info | Serial Number: Globally unique identification number of the processor used (applied to each chip individually with a laser during production).<br>Silicon Revision: Version of the processor used |

| | |
|---|---|
| | 0x0 Rev. A<br>0x1 Rev. B<br>0x2 Rev. C<br>0x3 Rev. D0<br>0x4 Rev. D1<br>0x5 Rev. E0<br>0x6 Rev. E1<br>0x7 Rev. E2 |

## 6.4 Diagnostics

| | |
|---|---|
|  | Connections: State of the active and inactive connection to the LPR® station<br><br>Partitions: Size and name of available partition of non-volatile memory. |

**Note**

The size of receive buffer (Recv-Q) and send buffer (Send-Q) should be zero if possible. A long lasting value grater zero means problems when receiving or sending data. This happens if the data cannot be readout fast enough.

Example 1 – waiting for incoming connection:

| Proto | Recv-Q | Send-Q | Local-Address | Foreign Address | State |
|---|---|---|---|---|---|
| tcp | 0 | 0 | 0.0.0.0:3045 | 0.0.0.0:* | LISTEN |

If Connection Type „TCP - Listening on Data Port“ (ttyAM1) is enabled this table shows further connection information.

Proto: Protocol (TCP, UDP)

Recv-Q: Number of buffered Bytes, which are received from the LPR® station

Send-Q: Number of buffered Bytes, which the LPR® station should send

Local-Address: LPR® Interface address (0.0.0.0 – listening to all interfaces)

Foreign Address: IP-address of opposite station

State: Status of connection

Example 2: - successful established connection

| Proto | Recv-Q | Send-Q | Local-Address | Foreign Address | State |
|---|---|---|---|---|---|
| tcp | 0 | 1 | 192.168.1.99:3045 | 192.168.1.1:1333 | ESTABLISHED |

Of Connection Type „TCP - Listening on Data Port“ (ttyAM1) is enabled this table shows further connection information.

Proto: Protocol (TCP, UDP)

Recv-Q: Number of buffered Bytes, which are received from the LPR® station

Send-Q: Number of buffered Bytes, which the LPR® station should send

Local-Address: LPR® Interface address (192.168.1.99) with port (3045)

Foreign Address: IP-address of opposite station (192.168.1.1) with port (1333)

State: Status of connection

## 6.5 Update Firmware

With this function you can update the firmware.

The firmware can be updated for example when a firmware with improved functional scope is available for the LPR® system.

Caution

But the system can also be irreparably damaged by a firmware update. Please make absolutely sure that the files are correct (file names and the version has been released by SYMEO), and proceed carefully and methodically. If the firmware update has not been carried out properly, or if problems arise of the system can no longer be accessed, contact Symeo Support.

Note

For FCC/IC authorization: Only firmware delivered for the U.S./ Candian market is allowed to install. Other firmaware may violate the FCC/IC authorization.

⇨ Click "Firmware Update" in the navigation bar.

If you have not yet provided authentication information, you will be prompted to do so now.

The Firmware Update for the LPR® station's Web server is displayed.


The page Firmware Update of the Web-Servers of the LPR® station is displayed.

A firmware update is performed in several steps:

Step 1: File system

Step 2: Linux-Kernel

Step 3: Optional (2D Application)

Step 4: Restart

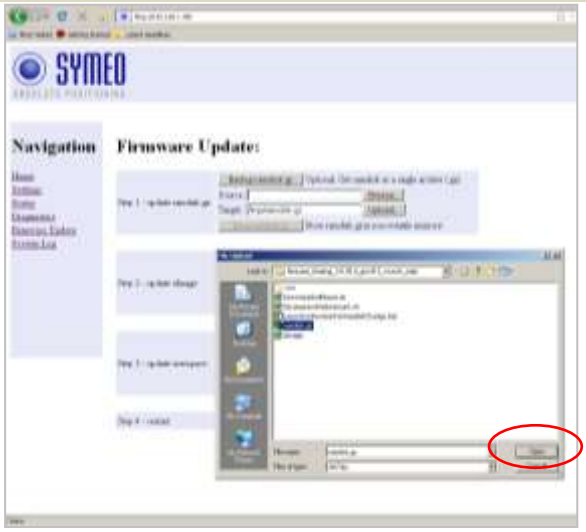
Note

Step 3 is exclusively for an update for 2D application. Otherwise this part can be skipped.

### 6.5.1 Step 1 – File system

Note

It is possible to make a copy of the actual firmware by downloading the firmware from the LPR® station. Click the button „Backup ramdisk.gz“.

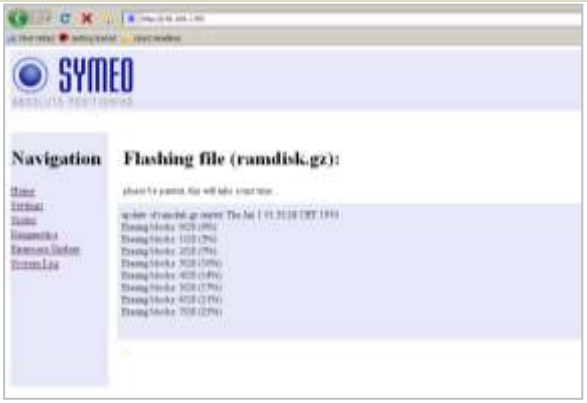



⇨ Click the "Browse" button in the "Step 1 – flash ramdisk.gz" area.

A file browser window will open.

⇨ Navigate to the file you want and click "Open".

| | |
|---|---|
|  | ⇨ Click the "Upload" button in the "Step 1 – flash ramdisk.gz" area. |
|  | The file has been transferred.<br>⇨ Click the "back: Firmware Update" link. |
|  | ⇨ Click the "Execute" button in the "Step 1 – flash ramdisk.gz" area to transfer the file to the non-volatile memory. |




Transfer progress is displayed in a message window.


You will know when this operation is complete because a message: "... done, file ramdisk.gz removed" will be output and a link "back: Firmware Update" is provided

⇨ Click the "back: Firmware Update" link.

### 6.5.2 Step 2 – Linux Kernel

**i** Note

It is possible to make a copy of the actual firmware by downloading the firmware from the LPR® station. Click the button „Backup zImage “.


⇨ Click the "Browse" button in the "Step 2 – flash zImage" area.

A file browser window will open.

⇨ Navigate to the file you want and click "Open".

| | |
|---|---|
|  | ⇨ Click the "Upload" button in the "Step 2 – flash zImage" area. |
|  | ⇨ The file has been transferred.<br>⇨ Click the "back: Firmware Update" link. |
|  | ⇨ Click the "Execute" button in the "Step 2 – flash zImage" area to transfer the file to the non-volatile memory. |

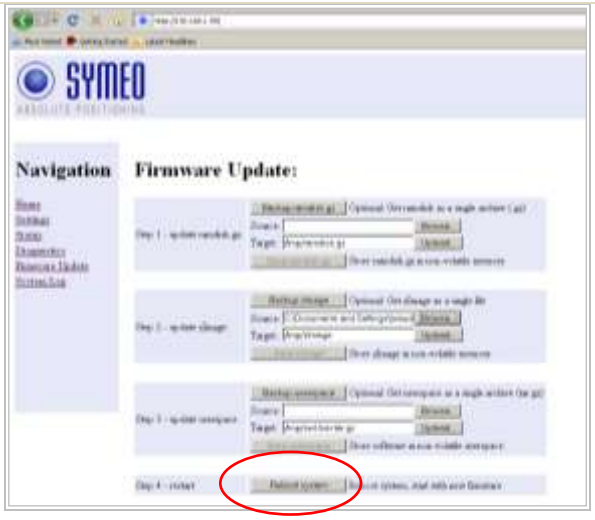
| | |
|---|---|
|  | Transfer progress is displayed in a message window. |
|  | You will know when this operation is complete because a message: "... done, file zImage removed" will be output and a link "back: Firmware Update" is provided<br>⇨ Click the "back: Firmware Update" link. |

### 6.5.3 Step 3 – Optional: Userspace

This step is exclusively for 2D-applications necessary and is executed the same way as described before.

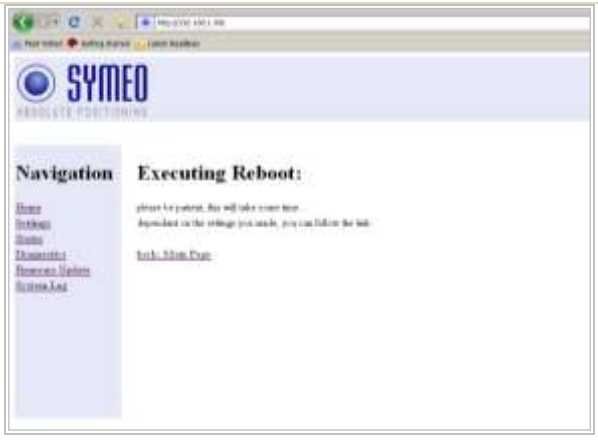
### 6.5.4 Step 4 – Restart

To complete the firmware update, you must restart the system.




⇨ To do this, click the "Execute" button in the "Step 3 – Restart" button.

The system will be restarted.




**Note**

If the new firmware contains additional configuration files the settings you made are set to factory settings. This would be also applied for the IP-address which is et the tot he default value 192.168.1.99.

Symeo recommends restoring the factory settings after a firmware update and reenter the customer settings.

## 6.6 System Log

With this function, you can display the system messages (system log). The system messages are written to a 200KB capacity memory. When the memory is full, the oldest messages are overwritten. All messages are deleted upon restart.

**Note**

The system messages can also be transmitted to a server on the network at the same time, see the "Syslog" field in the "Network" area in section "Settings".


⇨ Click "System Log" in the navigation bar.

⇨ If you have not yet provided authentication information, you will be prompted to do so now (see chapter 6.1).

The last 10 system messages will be displayed. The message window is updated about once per second.

# 7 Protocol Description Binary XP (1D messages)

## 7.1 General Description

This protocol describes the interface between a LPR®-B station and the user. The binary protocol XP 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 XP can either be a serial (RS232) interface or a TCP/IP or UDP interface. The baudrate of the serial interface must be set to 115200 baud.

### 7.1.1 Direction of Data

The interface can be applied bidirectional. However certain data types are defined for one direction. Furthermore it is only allowed to send data to a LPR®-B station after the LPR®-B station has sent a send request (type 0x02). Table 1 shows an overview which data packets can be applied in which direction.

| Data Type | direction | |
|---|---|---|
| | from LPR®-B | to LPR®-B |
| 0x00 Distance Data | + | |
| 0x01 User Data | + | + |
| 0x02 Send Request | + | |
| 0x03 Relay Switching Command | | + |

*Tab. 1: direction of data*

Sending data to the LPR®-B station is only possible after receiving a send request (Type `0x02`). The send request type guarantees the “ready-to-receive” status of the LPR®-B station. The LPR®-B can only handle one data packet from one user.

If nevertheless data is sent to the LPR®-B station without a previous send request, it can result in a reboot of the LPR®-B station.

Per one send request the user can send only one data set to the LPR®-B station.

### 7.1.2 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 1 shows the general structure of the data packet.

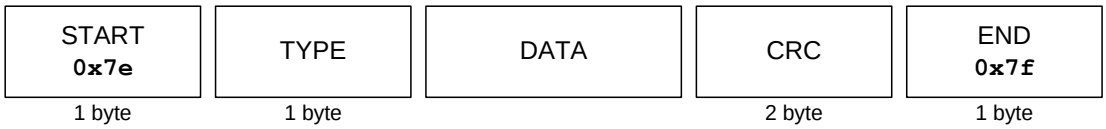



*Figure 1: Structure of data the packet*

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). All signed integers are encoded in two's complement representation.

### 7.1.3 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.

Remark: Byte stuffing is deactivated for the fixed frame protocol (compare chapter 7.3).

### 7.1.4 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.

## 7.2 Data Types

The second byte in each data packet specifies the data type.

### 7.2.1 Type 0x00 – Distance Data

Direction: LPR®-B → User

| Content | Length | Data type | Value |
|---|---|---|---|
| START | 1 | unsigned integer | 0x7E |
| TYPE | 1 | unsigned integer | 0x00 |
| Source[1] (LPR® address) | 2 | see chapter 7.4.1 | 0x#### |
| Destination[1] (LPR® address) | 2 | see chapter 7.4.1 | 0x#### |
| Antenna number[2] | 1 | unsigned integer | 0x## |
| Distance [mm] | 4 | signed integer | 0x#### #### |
| Velocity [mm/s] | 4 | signed integer | 0x#### #### |
| Level [dB] | 1 | signed integer | 0x## |
| Distance Error | 1 | see chapter 7.4.2 | 0x## |
| Status[3] | 1 | unsigned integer | 0x00 |
| CRC | 2 | unsigned integer | 0x#### |
| END | 1 | unsigned integer | 0x7F |

Total length without byte stuffing: 21 byte

[1]) Any measurement is always executed by a LPR®-B base station, this means, the base station measures its distance etc. towards a transponder unit. The source field always contains the address of the LPR®-B base station. The destination field contains the address of the measured transponder. Even if the data set is transferred further on to another unit (e.g. another transponder), the value of the source and destination field is maintained.

[2]) The field antenna contains the antenna number of the base station as well as the antenna number of the measured transponder. The 4 lower bits represent the antenna number of the base station (values 1…4) and the higher ones the antenna number of the transponder (values 1…4).

3) reserved for future application. Currently set to 0.

#### Example of Distance Data

```
7E 02 C1 81 7F
7E 00 08 03 08 02 11 00 00 10 62 00 00 00 7A E6 00 00 AF C4 7F
```

*Figure 43 - Protocol for a single 1D measurement: request data and following distance data*

This protocol shows a simple example for 1D measurement. A distance data set (or also 2 distance data sets) alternate with a send request. The Send Request indicates that the LPR® unit is listening to a data set from the user (for example relays external commands). The Distance Data sends the data to the user (i.e. to a PLC or to a PC/software).

Send request:

```
7E 02 C1 81 7F
```

| | |
|---|---|
| 7E hex | START byte |
| 02 hex | TYPE (02; Send Request) |
| C1 81 hex | CRC |
| 7F hex | END byte |

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®-B address: SID: 1; GID: 1; BBt: 1 (base station) |
| 08 02 hex = 00001\|0000000001\|0 bin | Destination LPR®-B 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 (see chapter 7.4.2) |
| 00 hex | Status |
| AF C4 hex | CRC |
| 7F hex | END byte |

### 7.2.2 Type 0x01 – User Data

User Data can be integrated at a LPR®-B station via the serial interface and then transmitted to another LPR®-B station via the frequency channel. There the user data can be readout.

Direction: LPR®-B → User

| Content | Length | Data type | Value |
|---|---|---|---|
| START | 1 | unsigned integer | 0x7E |
| TYPE | 1 | unsigned integer | 0x01 |
| Source (LPR®-B address) | 2 | see chapter 7.4.1 | 0x#### |
| User Data | 8 | depends on application | 0x#### #### #### #### |
| CRC | 2 | unsigned integer | 0x#### |
| END | 1 | unsigned integer | 0x7F |

Total length without byte stuffing: 15 byte

### 7.2.3 Type 0x02 – Send Request

Direction: LPR®-B → User

| Content | Length | Data type | Value |
|---|---|---|---|
| START | 1 | unsigned integer | 0x7E |
| TYPE | 1 | unsigned integer | 0x02 |
| CRC | 2 | unsigned integer | 0xC181 |
| END | 1 | unsigned integer | 0x7F |

Total length without byte stuffing: 5 byte

This packet is sent from the LPR®-B station continuously. It informs the user that the LPR®-B station is able to receive data from the user. The user may only send one single data frame after receiving a send request.

### 7.2.4 Type 0x03 – Relays Switching Command

Direction: User → LPR®-B

| Content | Length | Data type | Value |
|---|---|---|---|
| START | 1 | unsigned integer | 0x7E |
| TYPE | 1 | unsigned integer | 0x03 |
| Destination (LPR®-B address) | 2 | see chapter 7.4.1 | 0x#### |
| Relay Selection (Bitmask)<br>(bit 1..7 → relay 1..7) | 1 | unsigned integer | 0x## |
| Relay Switch (Bitmask) | 1 | unsigned integer | 0x## |
| CRC | 2 | unsigned integer | 0x#### |
| END | 1 | unsigned integer | 0x7F |

Total length without byte stuffing: 9 byte

With the relay selection (bitmask) relays are selected which can be controlled. The relays that are chosen within the Relay Selection bitmask will be switched according to the Relay Switch bitmask Example: A Relay Selection value = $0x14_{hex}$ = $00010100_{bin}$ and a Relay Switch value = $0xFF_{hex}$ = $11111111_{bin}$ will switch relays 2 and 4 ON - the state of the other relays remains unchanged.

No acknowledgment of the relay switch command will be sent because this data frame can be forwarded to other LPR®-B stations and thus no reception on the destination station is guaranteed. In case of faulty data frame (e.g. invalid relays chosen or unknown destination address) the LPR®-B station will print an error message.

## 7.3 TCP/IP option: Fixed Frame Protocol

If the LPR® station has a TCP/IP interface two options are available for the protocol. Either you use the protocol as it is sent from the serial interface (with different data type lengths, byte stuffing) or you use a fixed frame protocol.

In the first case the data symbols `0x7e` und `0x7f` (which are reserved for the START and END field) are replaced (see chapter 7.1.3). Byte stuffing causes a different protocol length.

For the fixed frame protocol each LPR® data packet is filled up with zero bytes to a fixed length of bytes (i.e. 87 bytes) before the data packet is sent. Byte stuffing does not occur. The START and the END byte are still used but not clear anymore due to not applying byte stuffing. The fixed length of the data packets can be set on the web-interface of the LPR® unit.

For the fixed frame protocol the data packets which are sent to a LPR® unit has to be filled up to a fixed length (i.e. 15 bytes). The START- and the END byte have to be occurred as well and byte stuffing does not occur anymore. It is recommended to fill up the data packet with zero bytes to facilitate a troubleshooting.

If TCP/IP is used the transmitted data have already a checksum. Therefore the checksum in the protocol is not as important as for the serial interface. Two options for the fixed frame are allowed by the protocol inverter for receiving data in a fixed frame. Either 0x0000 is sent as the check sum to the LPR® unit. Then the protocol inverter is calculating the check sum itself. Or another value (differing to 0x0000) is sent as the check sum. Then this check sum is assumed to be the correct check sum. Otherwise the data packet is rejected.

### 7.3.1 Detailed description TCP Fixed-Frame Protocol

If a TCP fixed-frame protocol is used, a working TCP connection between the PC and the LPR® unit has to be guaranteed. Depending on the configuration of the LPR® protocol inverter either the connection to a port on the LPR® has to be initialized from the PC or the LPR® unit is establishing a connection to a PC.

If the connection is established, the PC has to read the data from the LPR® in fixed data length (i.e. 87 bytes). The first byte is always the START-byte and the second byte is always the TYPE-byte. The relevance of the following data is depending on the data type. Because no byte stuffing occurs the content for a special data type is always constant. For example the measured velocity of the distance data (type 0x00) is always written in the 12.-15 data byte.

Sending data from the PC to LPR® station, a fixed data length has to be chosen (i.e. 15 byte). The first byte (START byte: 0x7e) follow the TYPE-byte. The following data depends on the chosen type, following by the CRC (correct CRC or 0x0000), following by the STOP byte (0x7f). The data packed has to be filled up with zeros.

### 7.3.2 Detailed description UDP Fixed-Frame Protocol

If a UDP fixed frame protocol is used, the IP and the UDP port of the PC has to be configured in the LPR® protocol inverter. The converter sends each data packet as a UDP packet of a fixed length (87 byte) to the PC. Compared to the TCP fixed frame option the UDP fixed frame does not verify if the data packed arrived.

The content is the same as for the TCP fixed frame protocol.

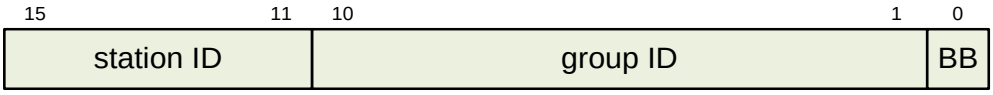
If data is sent to the LPR® unit the data has to be packed in a fixed data length (i.e. 15 bytes as for TCP fixed frame option). This data packet is sent as UDP packet to the LPR® unit. The port number of the receiver is the same as for the PC.

In general bidirectional data communication is not recommended for UDP due to loosing singular data packets.

## 7.4 Remarks

### 7.4.1 LPR®-B Address

LPR®-B station addresses are completely defined by a 16 bit value:




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

In multi cell applications, group ID is the cell ID of the cell.

### 7.4.2 Distance Error codes

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

| Value | Content | Source | Description |
|---|---|---|---|
| 0x00 | no error | | Measurement valid |
| 0x01 | no peak detected | Base Station | No measurement signal |
| 0x02 | peak too low | Base Station | Measurement signal is imprecise |
| 0x03 | nothing received | Transponder | No measurement data received |
| 0x04 | implausible speed | Base Station | Velocity is to high |
| 0x05 | measurement botched | Base Station | Measurement is not feasible. |
| 0x06 | no occupying received | Master Transponder | Measurement channel is not reserved |
| 0x07 | no results received | Master Transponder | No measurement data received |
| 0x08 | trigger | Transponder | Unit did not attend the measurement |

# 8 Trouble Shooting

This chapter will assist you for troubleshooting. For debugging circumstances it might be helpful to install a terminal program to analyze the system.

## 8.1 Programs

### 8.1.1 Terminal Program

A Terminal program is useful for analyzing the system. The recommended terminal program is RealTerm. It is Open Source Software and can be downloaded from the webpage http://sourceforge.net/projects/realterm. Install the program on your PC.

### 8.1.2 Command Window (only for LPR-B Station with TCP/IP interface)

The easiest way to check a connection between a LPR-B station with TCP/IP interface and your PC/network is the command window. The command window is preinstalled in the operating system Windows. Click on the window button →Start →Run…→ Enter cmd and click on OK.

### 8.1.3 Telnet (only for LPR-B station with TCP/IP interface)

A short way to check the functionality of the LPR-B station with TCP/IP interface is Telnet. Telnet is preinstalled in the operating system Windows. Click on the window button →Start →Run…→ Enter telnet IP-address Port and click on OK. E.g. enter telnet 192.168.1.99 3045 to open the configuration port of the LPR-B station with IP-address 192.168.1.99 and the port 3045.

### 8.1.4 Browser (only for LPR-B station with TCP/IP interface)

A webbrowser is necessary to make all settings of the LPR-B station with TCP/IP interface. You can make network settings as well as settings for the protocol.

### 8.1.5 Network Scanner (only for LPR-B station with TCP/IP interface)

A network scanner like the program SoftPerfect (http://www.softperfect.com/products/networkscanner/) is for analyzing your network useful.

## 8.2 Hardware

The following additional hardware is useful:

- Serial Cable less than 2 meters (if there is a LPR-B station without TCP/IP interface )
- LAN-cable (if there is LPR-B station with TCP/IP interface)
- USB -RS232 converter (if there is no COM-port at your computer)

## 8.3 Connection to the LPR-B station with RS232 interface

If you have a station without TCP/IP interface you only can connect your PC via the RS232 interface to the LPR-B station. For the connection you need a RS232 cable which should be less than 2 meters. A longer cable cannot guarantee a trouble-free transmission of data between the LPR-B station and the PC.

Note

If you want to use a longer serial cable you have to reduce the baud rate of the LPR-B station. Ask the Symeo Service for detailed information.

Typical values for the data rate for different length of the serial cables are:

| Max. baud rate | Max. Length of RS232 cable |
|---|---|
| **9.600** | 152 m |
| **19.200** | 15 m |
| **57.600** | 5 m |
| **115.200** | <2 m |

## 8.4 Connection inside the LPR-B station

To analyze the serial connection between your PC and the LPR-B station it is the best to connect the serial cable inside the LPR-B station. Open the LPR-B station. Make sure that you do not pollute anything inside the LPR-B station.

There are 4 serial ports for connection. One port is for the configuration of the LPR-B station (S4: parameterization port) another one is the port for the distance data (S2: binary data). Two other serial ports (S1 and S3) are not used for commissioning the system.

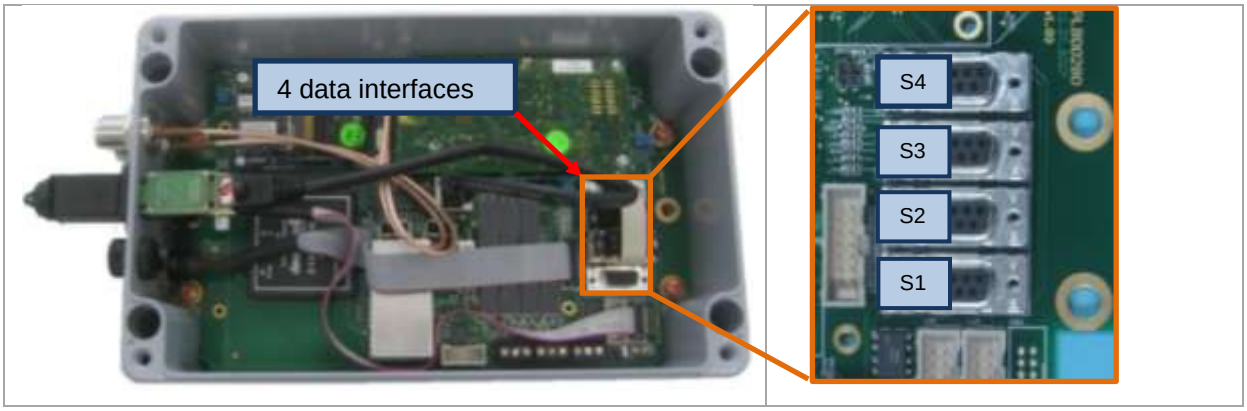



*Figure 44 Data interface RS232*

| Data interfaces | |
|---|---|
| **S1** | ARM9 serial |
| **S2** | Binary Data |
| **S3** | A9 serial |
| **S4** | Configuration ASCII (Service Port) |

For analyzing the LPR-B station use first the parameterization port (S4). Connect the serial cable with the parameterization port (S4) and the COM interface with your computer.

Note

If you use a USB-RS232 converter make sure that all necessary drivers are installed for this hardware.

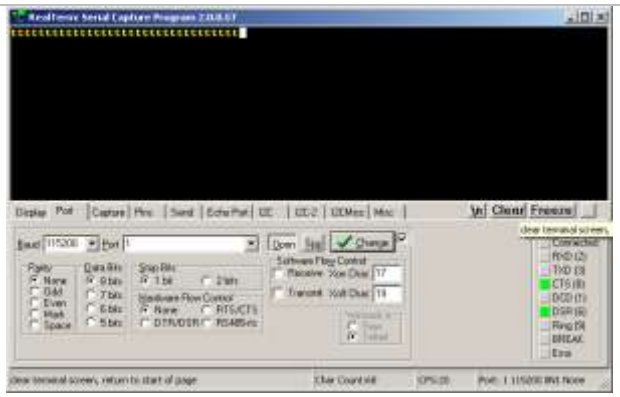
### 8.4.1 RealTerm (for parameterization port)

Open now the program RealTerm.

In two tabs you have to change the settings:

- Tab Display:
  - Choose Display As Ansi
  - Extend the Rows from 16 to 30

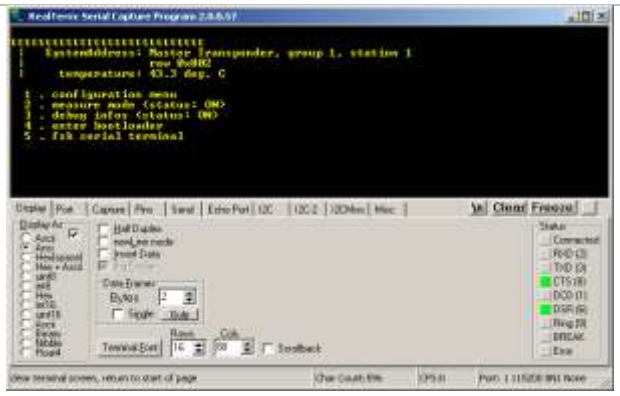
- Tab Port:
  - Change the Baud to 115.200
  - Choose the right COM port
  - Click On **Open**



Depending if you are connected to a transponder or a base station characters may appear in the window.

If you are connected to a transponder a lot of “t” characters appear. This happens because the transponder tries to make a measurement, but output a failure because the opposite station is not available/ connected. “t” means failure of measurement. A working system should output “m” characters. “m” means a working measurement.

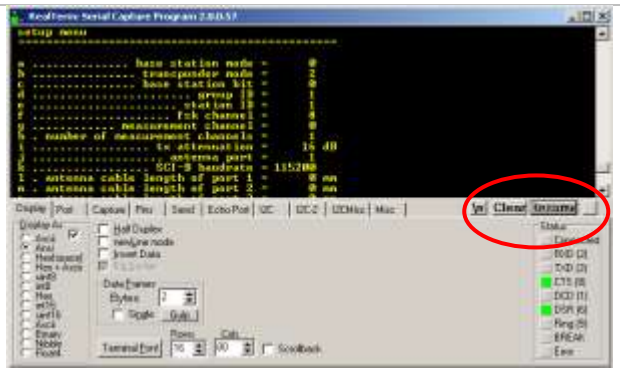
If you are connected to a base station nothing is shown.



In both cases you can click inside the window and press the button 3. If nothing appears than there is something wrong with the connection between the LPR-B station and your computer or the station has no power.

Normally it shows you some system information:

In the upper line is written the System Address: The system address indicates if the station is a transponder or a base station and which group ID the station has.



If you press button “1” (configuration menu) and button “6” (setup) then you can get more detail about the system. Click maybe on freeze to enable the scroll bar and scroll up to setup menu. Note the point f……..fsk channel.

With the character “x” you return to the main menu.

Note here the information the station has/ stations have:

Master Transponder/ Base Station: _____

Station ID: _____

Group ID: _____

FSK channel: _____

---

Master Transponder/ Base Station: _____

Station ID: _____

Group ID: _____

FSK channel: _____

---

Master Transponder/ Base Station: _____

Station ID: _____

Group ID: _____

FSK channel: _____

If you compare later the settings with the other stations in the systems, following settings must be made. You need exactly one master transponder. The other stations must be base stations.

- The group ID must be identical for all stations in the system.
- The FSK channel must be identical for all stations in the system.
- The base stations must have different station IDs.

## 8.5 Connection to the LPR-B station with TCP/IP interface

If you have a station with TCP/IP interface you only can connect your PC via the TCP/IP interface to the LPR-B station. For the connection you need a Ethernet cable.

The IP-address is set to the fixed IP address 192.168.1.99 when delivering the system to the customer.

To get access to the station you need to set your PC in the network as the LPR-B station.

### 8.5.1 LAN Settings of your PC

First you need to disconnect your PC from your network to avoid trouble when changing the IP address of your computer. Now you connect the LPR-B station via an Ethernet cable with your PC. If you are not in the same net as the LPR-B station you have to change temporary the network settings of your PC. Both IP-address must be in the same network, i.e. the first three fields of the IP-address must match.



Open your network connection and set a fixed IP address to your computer, i.e. 192.168.1.1. The subnet mask should be set to 255.255.255.0.

Click in both windows “OK”.

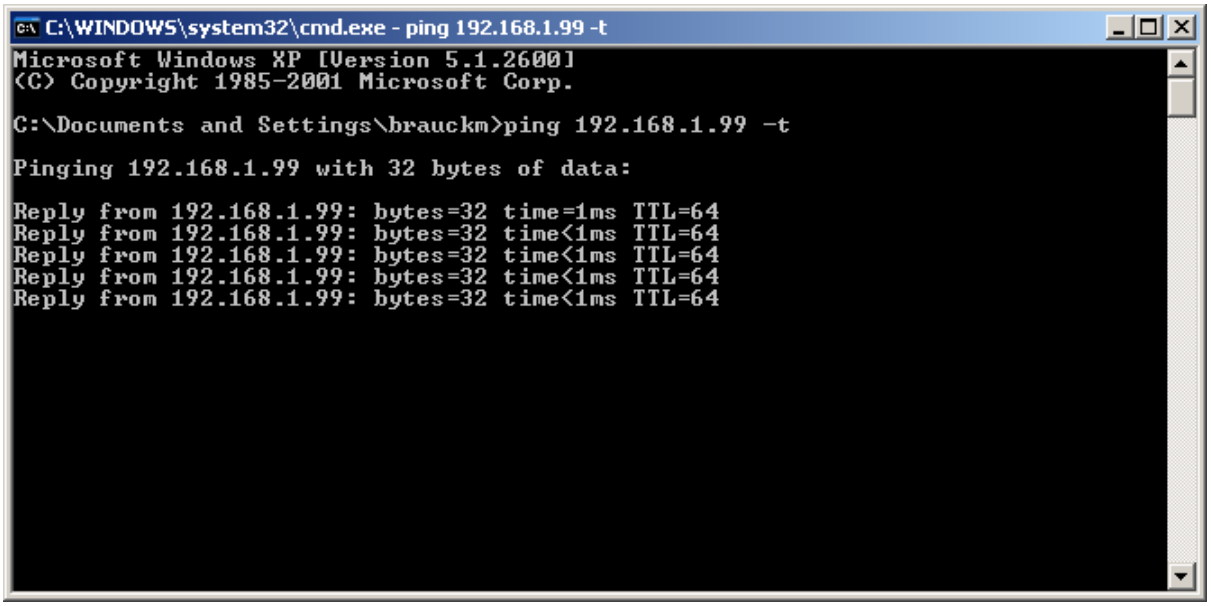
**i** Note

If your firewall is enabled and set to restrictive, it might happen that you cannot access the LPR-B station. In this case disable the firewall settings temporary in the tab Advanced in the window Network properties.

### 8.5.2 Check TCP/IP connection

The first way to check the IP-connection from your computer to the LPR-B station is to “ping” the LPR-B station. Open the command window (Window button Start → Run → Enter cmd and click on OK).

Enter in the window *192.168.1.99 –t* and click Enter.



You should get a reply from the LPR-B station with the fixed IP-address 192.168.1.99

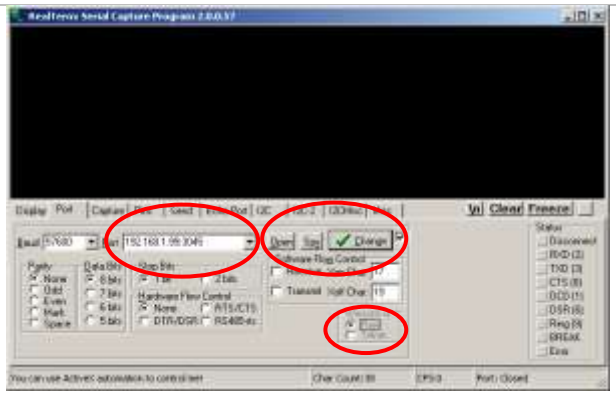
If the connection failed probably your firewall settings of your PC are set to restrictive or the IP-address of the LPR-B station is probably not 192.168.1.99. Please check the settings. Compare also the hint in chapter 8.5.1.

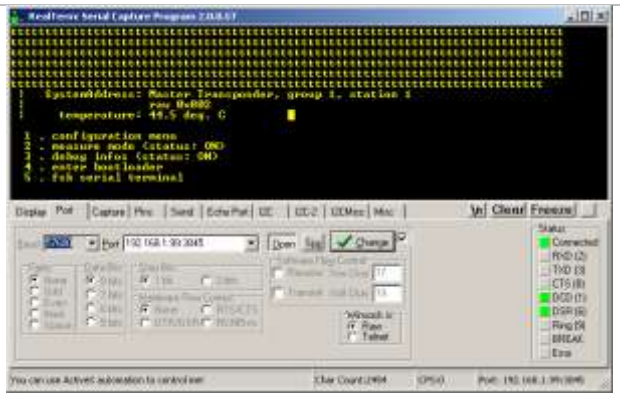
If you have changed the IP address without bearing in mind the IP address the IP-address could be detected with the program NetworkScanner.

### 8.5.3 Check TCP/IP connection

### 8.5.4 RealTerm (for parameterization port)

Open now the program RealTerm.

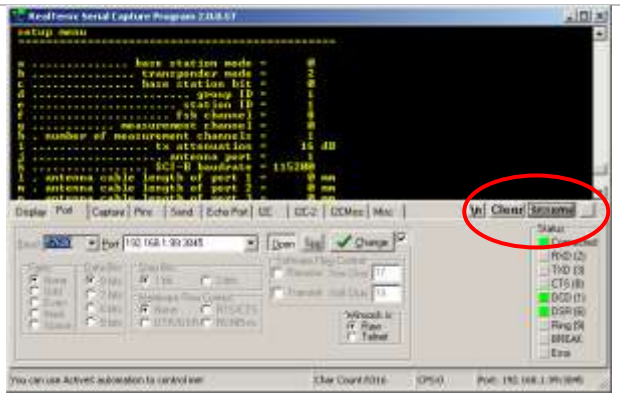
<table>
<tr><td>  </td><td>In two tabs you have to change the settings:<br><br>▪ Tab Display:<br>- Choose Display As Ansi<br>- Extend the Rows from 16 to 30</td></tr>
<tr><td>  </td><td>▪ Tab Port:<br>- Enter the IP-address of the LPR-B station and the port: IP-address:port<br>- I.e.: 192.168.1.99:3045<br>- Click on WinSock is RAW<br>- Open the connection</td></tr>
<tr><td>  </td><td>Depending if you are connected to a transponder or a base station characters may appear in the window.<br><br>If you are connected to a transponder a lot of “t” characters appear. This happens because the transponder tries to make a measurement, but outputs a failure because the opposite station is not available/ connected. “t” means failure of measurement. A working system should output “m” characters. “m” means a working measurement.<br><br>If you are connected to a base station nothing is shown.</td></tr>
</table>



In both cases you can click inside the window and press the button **3**. If nothing appears than there is something wrong with the connection between the LPR-B station and your computer or the station has no power.

Normally it shows you some system information:

In the upper line is written the System Address: The system address indicates if the station is a transponder or a base station and which group ID the station has.



If you press button **1** (configuration menu) and button **6** (setup) then you can get more detail about the system. Click maybe on freeze to enable the scroll bar and scroll up to setup menu. Note the point f……..fsk channel.

With the character x you return to the main menu.

Note here the information the station has/ stations have.

Master Transponder/ Base Station: _____

Station ID: _____

Group ID: _____

FSK channel: _____

---

Master Transponder/ Base Station: _____

Station ID: _____

Group ID: _____

FSK channel: _____

---

Master Transponder/ Base Station: _____

Station ID: _____

Group ID: _____

FSK channel: _____

If you compare the settings with the other stations in the systems, following settings must be made. You need exactly one master transponder. The other stations must be base stations.

- The group ID must be identical for all stations in the system.
- The FSK channel must be identical for all stations in the system.
- The base stations must have different station IDs.

If you do not get access to the LPR-B station check if the port is open. The port for the parameterization is 3045 per default. But it might be possible that you have changed it or did not open it (see chapter 8.5.5).

### 8.5.5 Web Interface

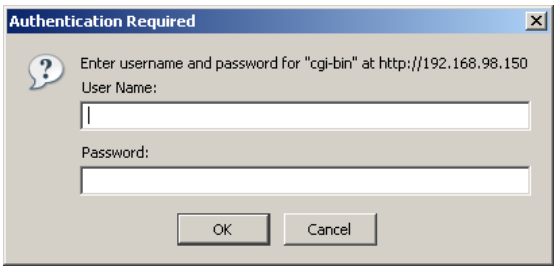
If you can “ping” the IP-address of the LPR-B station but do not get data (either via the parameterization port or the binary port or both ports) you have to check the settings on the web page of the LPR-B station.

Open a web browser and enter the IP-address of the LPR-B station (i.e. http://192.168.1.99).


You get access to the LPR-B station. If you are connected via HTTPS-connection, it might appear to dialogue boxes which you have to confirm with “OK”.

You see the Start-page of the LPR-B station.

→ Click on Settings.




You have to authorize yourself.

⇨ Enter the username „symeo“ and the password and click „OK“. The password is per default „54all2u“.

The Settings page of the Web-interface of the LPR-B station looks like the following.


Scroll down to the section:

Serial-to-Ethernet:

Here you enter the connection type for the parameterization port (ttyAM1) and the binary port (ttyAM2).

Both ports should be not disabled. Choose the right connection type and enter the data port. The data port is per default 3045 for the parameterization port and 3046 for the binary port.

If you have made changes click on “Upload changes” and then on “Reboot system”.

After the reboot try again to get access to the LPR-B station as described in chapter 8.5.4.

## 8.6 No Measurements

You can get data on two ports: Parameterization port (S4) which is useful for the setup of the system and the Binary Port (S2) – compare figure Figure 44). The binary port is necessary if you want to use the distance data for a system behind the LPR-B system. You will then use Binary protocol and have to check that the binary port provides proper measurements.

Check List:

1) You have access with the program RealTerm to all stations. (If pressing the button 1 the LPR-B configuration menu is shown.)
2) The antennas are connected to the right port of the LPR-B station.

| | Transponder Station 1 | Base Station Station 2 | Base Station Station 3 |
|---|---|---|---|
| measurement 1 | Antenna an Port | Antenna an Port | x |

| | | | |
|---|---|---|---|
| | 1 | 1 | |
| measurement 2 (optional) | Antenna an Port 2 | x | Antenna at Port 1 |

3) If you use planar antennas the orientation of the antenna must be correct. A small label on the backside of the antenna indicates the horizontal and vertical alignment.
4) For a distance measurement always two stations are involved. It has to be a transponder unit and a base station unit. Make sure that never two base stations or two transponders a measuring with each other.
5) Check if the binary port works. Open the program RealTerm. If connected to a LPR-B station with TCP/IP interface open the binary port 3046: Enter for example 192.168.1.99:3046. The display should be set to Hex[space] to "see" binary data. If you use a LPR-B station without TCP/IP connection connect the serial cable to the binary port S2 (compare Figure 44)

If you can enter all questions with "Yes" then measurements should be made. That means you should see in the program RealTerm "m" or the real measured distance when pressing button 3.

If no measurement appear something is wrong with the setup. Check the following:

1) If you use a USB stick then disconnect the stick.
2) If you have LPR-B station with TCP/IP interface you also can connect the serial cable to the parameterization port (S4). It is not possible to send data to the LPR-B station then but you can receive data. Normally "m" should appear for a working measurement. If "m" appear then in general the system is working but something is wrong with forwarding the data to the TCP/IP interface. Check the settings in the web interface (compare chapter 8.5.5). Compare also the settings for the jumpers (compare Figure 45). Only in the picture "Jumper allocation for TCP (LPR unit has ARM9 board)" both ports are available at the TCP/IP interface. If using the jumper allocation on the left side (2 jumpers) only the binary port is available via TCP/IP. If using the Jumper allocation for RS232 no data can be available at a TCP/IP interface (normally the station then has no TCP/IP interface).
3) Check if jumpers are set correct:

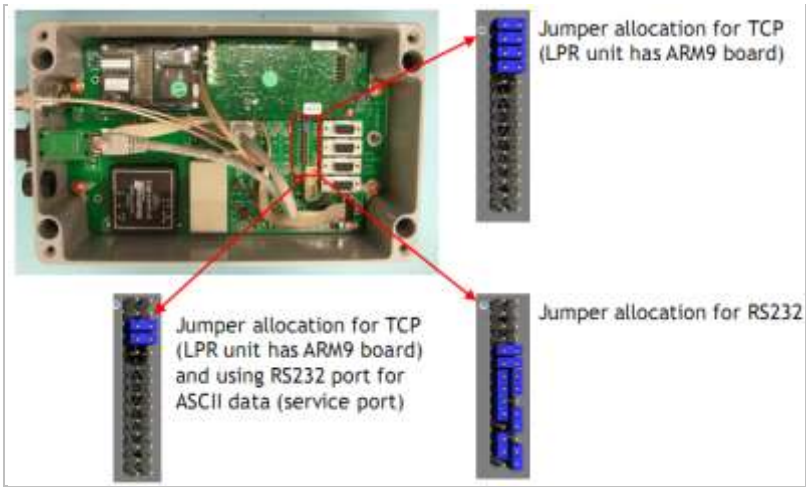



*Figure 45 Jumper allocation inside the LPR-B station*

If you use LPR-B stations with and without TCP/IP jumpers are set differently. To make the parameterization via serial connection jumpers has to be changed (only the both lower pictures are set for configuration the LPR-B station via the serial cable).

4) Overwrite the configuration with the program LPR 1D wizard for all stations.

# 9 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.

Note

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

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.

Note

A direct connection between the external power supply unit and AC power line is strictly prohibited. A line filter (e.g. EPCOS B84113-C-B30 or similar characteristics) shall be used to connect the power supply unit and AC power line.

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)

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

Note

This device has been designed to operate with the antennas listed below. Antennas not included in this list are strictly prohibited for use with this device. Only antenna cables delivered by Symeo are allowed to use. Usage of other antenna cables may void the FCC authorization to operate this equipment.

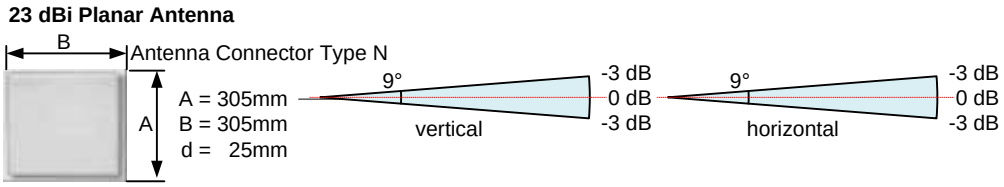



*Figure 46: LPR® 1D antenna*

## 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.

Note

This device has been designed to operate with the antennas listed below and having a maximum gain of 23 dBi. Antennas not included in this list or having a gain greater than 23 dBi are strictly prohibited.
The required impedance for antenna and antenna cable is 50 ohms.
Only antenna cables delivered by Symeo are allowed to use. Usage of other antenna cables may void the IC authorization to operate this equipment.

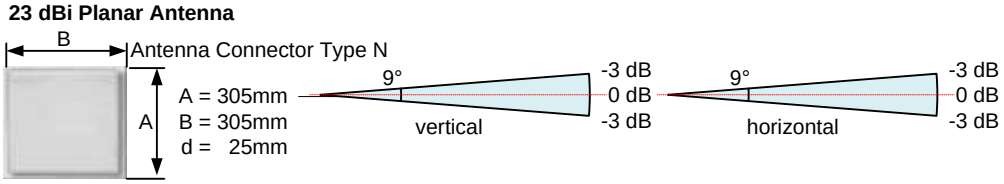



*Figure 47: LPR® 1D antenna*