

SYMEO LPR®



SYMEO

ABSOLUTE POSITIONING

Product Documentation

Product: LPR® -1D



CONTENT

1	OVERVIEW	7
1.1	Safety Instructions	8
1.2	Installation	8
1.3	Repairs	9
1.4	Transport and Storage	9
1.5	Power Supply	9
1.6	Setup and Operation	9
1.7	System Extensions and Accessories.....	10
1.8	Additional Instructions regarding Compact Type and Integral Type Units	10
2	SYSTEM DESCRIPTION	11
2.1	System architecture	11
2.2	Technical Data	11
2.3	System Configuration	12
2.4	System Design.....	13
2.4.1	Station-ID (SID)	13
2.4.2	Group-ID (GID).....	14
2.4.3	FSK Channel (FSK).....	14
2.5	Mode of Operation of the System.....	15
2.6	Application Examples	15
2.6.1	Redundant arrangement (2 x LPR-1DX).....	15
2.6.2	Positioning of Crane Crab (LPR® 1DP2).....	17
2.6.3	Positioning of 2 Cranes on two Runways (LPR® 1DP)	18
3	HARDWARE	19
3.1.1	Casing	19
3.1.2	General internal connections	21
3.2	LPR® - 1D unit with TCP/IP interface	23
3.2.1	Front elements.....	23
3.2.2	Overview internal connectors.....	23
3.2.3	Mode of operation.....	24
3.3	LPR® - 1D unit with Profibus interface	24
3.3.1	Front elements.....	24

3.3.2	Overview internal connectors.....	26
3.3.3	Connection to Profibus	26
3.3.4	Connection of service port with serial interface.....	27
3.3.5	Termination of Profibus.....	28
3.3.6	Addressing the Profibus.....	29
3.3.7	Measurement frequency	30
3.3.8	Mode of operation.....	30
3.4	LPR® - 1D unit with RS232 interface.....	30
3.4.1	Front elements.....	30
3.4.2	Overview internal connectors.....	31
3.4.3	Connection of service and data port with serial interface	32
3.4.4	Mode of operation.....	33
3.5	LPR® Antenna Types	34
3.5.1	Adapter for different LPR® Antennas.....	36
4	INSTALLATION	37
4.1	Installation of LPR® Unit Design Compact Unit.....	37
4.1.1	Important Instructions for Installation	37
4.1.2	Installation	38
4.2	Installation of LPR® Antennas	38
4.2.1	Connecting and Wiring up the Antenna and Cable	38
4.2.2	Installing the Antenna(s)	39
4.2.3	Fresnel zone.....	40
4.2.4	Installation of Planar Antennas	40
5	COMMISSIONING.....	41
5.1	Requirements.....	41
5.1.1	General.....	41
5.2	Connection to LPR® Unit with TCP/IP Interface.....	42
5.3	Connection to LPR® Unit with serial RS232 interface or Profibus interface.....	44
5.4	Commissioning Tool – LPR® 1D Wizard.....	45
5.4.1	Installation	45
5.4.2	Utilization of LPR® 1D Wizard	45
6	WEB SERVER.....	58
6.1	Open Web Server.....	58
6.2	Settings	59
6.2.1	„LAN“ area.....	60
6.2.2	„Network“ Area	60
6.2.3	„Serial-to-Ethernet“ Area.....	61
6.2.4	„Remote Access“ Area.....	63

6.2.5	„Miscellaneous“ Area	64
6.2.6	„Special Functions“ Area	64
6.2.7	Accept settings / System Reboot	64
6.3	System Status	66
6.4	Diagnostics	67
6.5	Update Firmware	68
6.5.1	Step 1 – File system	69
6.5.2	Step 2 – Linux Kernel	71
6.5.3	Step 3 – Optional: Userspace	73
6.5.4	Step 4 – Restart	73
6.6	System Log	74
7	PROTOCOL DESCRIPTION BINARY XP (1D MESSAGES)	76
7.1	General Description	76
7.1.1	Direction of Data	76
7.1.2	Structure of Data Packet	76
7.1.3	Byte Stuffing	77
7.1.4	CRC	77
7.2	Data Types	78
7.2.1	Type 0x00 – Distance Data	78
7.2.2	Type 0x01 – User Data	79
7.2.3	Type 0x02 – Send Request	80
7.2.4	Type 0x03 – Relays Switching Command	80
7.3	TCP/IP option: Fixed Frame Protocol	81
7.3.1	Detailed description TCP Fixed-Frame Protocol	81
7.3.2	Detailed description UDP Fixed-Frame Protocol	81
7.4	Remarks	82
7.4.1	LPR® 1D Address	82
7.4.2	Distance Error codes	82
8	PROTOCOL DESCRIPTION FOR PROFIBUS INTERFACE	83
8.1	Profibus data structure	83
8.2	Error messages	84
9	TROUBLE SHOOTING	85
9.1	Programs	85
9.1.1	Terminal Program	85
9.1.2	Command Window (only for LPR unit with TCP/IP interface)	85
9.1.3	Telnet (only for LPR unit with TCP/IP interface)	85
9.1.4	Browser (only for LPR unit with TCP/IP interface)	85

9.1.5	Network Scanner (only for LPR unit with TCP/IP interface).....	85
9.2	Hardware	85
9.3	Connection to LPR units with RS232 or Profibus interface.....	85
9.3.1	RealTerm (for service port)	87
9.4	Connection to the LPR unit with TCP/IP interface.....	87
9.4.1	LAN Settings of your PC.....	88
9.4.2	Check TCP/IP connection.....	88
9.4.3	RealTerm (for service port)	89
9.4.4	Web Interface	90
9.5	No Measurements.....	92
10	APPENDIX A: AGENCY CERTIFICATIONS	94
	United States (FCC) and Canada (Industry Canada)	94
	United States (FCC)	94
	Canada (Industry Canada).....	96
11	APPENDIX B: TABLE OF COUNTRIES AND REGULATIONS	97

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HISTORY

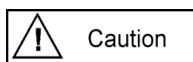
Overview		
3.17	14.12.2008	New Layout
3.18	11.02.2009	Added all single documents to one master document
3.19	30.03.2009	Added notes for FCC/IC conformity
3.20	13.07.2010	Corrections FCC notes
3.21	14.03.2012	Merge of all versions, new release Wizard 4.x

SYMBOLS USED

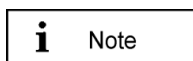
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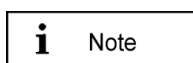
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Overview

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[®] Slave Unit or LPR[®] Group Master Unit



Figure 1 – LPR[®] hardware: Group Master Unit or Slave Unit in the design “Compact Unit”

The difference between a LPR[®] 1D Group Master Unit and a LPR[®] 1D Slave Unit is only the configuration but not the hardware. A LPR[®] 1D system consist exactly of one component Group Master Unit. And it consists furthermore of one to four LPR[®] 1D components Slave Unit, subsequent named slave unit 1, 2, 3, 4.

Depending on customer's application the LPR[®] 1D hardware has different interfaces. The unit in the design Compact Unit has IP65 protection.

Overview interfaces	
Antenna ports	2 or 4
Power Supply	10-36 Volt DC
RS232	Configuration and Data Interface
TCP/IP	Optional: Configuration and Data Interface
Profibus	Data Interface
Relay	Optional: 7 Dry Contacts


i Note

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



Figure 2 – LPR® Hardware – Special Case: Group Master Unit or Slave Unit with integrated antenna in the design "Integral Unit"

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


 Caution

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®-1D systems are purely tracking and assistance systems. They therefore do not satisfy special requirements for personal safety, e.g. performance level c.

 Caution

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

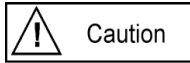
Keep these safety instructions and other documents together with the device.

1.2 Installation

 Caution

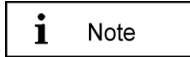
All installation, repair and servicing work must be carried out by qualified and trained technicians!

1.3 Repairs



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

1.4 Transport and Storage

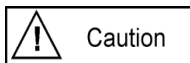


Use the original packaging or other suitable packaging for returns and whenever the system is to be transported. This ensures protection from crushing, impacts, moisture and electrostatic discharge. During setup and before operation, refer to the instructions for environmental conditions included in the operating instructions for the device.

Route the wires in such a way that they do not cause a hazard and are not damaged. When connecting the wires, refer to the corresponding instructions in the operating instructions for the device.

Do not drop the device and do not expose it to strong vibrations.

1.5 Power Supply



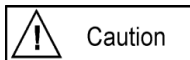
A safety-inspected power cable that satisfies the regulations of the country of use is required for the device. Devices with metal housings must only be connected to a grounded, shock proof socket.

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

Connecting and disconnecting wires refer to the instructions in the operating instructions for the device.

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

1.6 Setup and Operation



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

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

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


i 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 Units

 Caution

The Compact type LPR® unit must not be opened except for installation. The Compact Unit contains no serviceable components.

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

In order to install the Integral type LPR® unit, the hood must be detached from the serviceable components. Refer also to the instructions on installing the Group Master Unit.

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	
Power supply	10 - 36 V DC
Power consumption	max. 8W
Housing dimensions (LxWxH)	260 x 160 x 91 mm
Weight	2.5 kg
Connections	Power-Supply: Terminal block Antenna: N-connector Ethernet: Plugged connection Relays (optional): Terminal block Profibus/RS232: Terminal block
Antennas	Up to 4 independent antennas, N-Connector
Hardware interface	Serial RS232, TCP/IP (optional), Profibus (optional) 7x dry contacts (optional, rating: max. 60 VDC, max. 2 A)
Data interface	Data port (Symeo binary protocol), Service port (ASCII protocol) Profibus (optional)
User data transfer rate	8 bytes/cycle, up to 800 byte/s
Frequency range	5.725 - 5.875 GHz, ISM-band

Transmitted power *1	Output power is adjustable Max. 0.025 W EIRP
Measuring distance *2	Max. 1800 m
Measurement accuracy *2	Max. ±5 cm
Measurement frequency *3	Max. 30 Hz
Ambient temperature *4	-40 °C to +75 °C
Protection class	IP 65 with appropriate cable and connectors
Compliance	CE mark, part 15 FCC *5, RSS-210 *5

*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 (FCC labeled units only).

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

*3 For FCC/IC authorization a maximum measurement frequency of 10 Hz is allowed (FCC labeled units only).

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

*5 FCC labeled units only.

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 Group Master Unit or as a Slave Unit. A system consists of exactly one LPR® unit configured as a Group Master Unit and between one and four LPR® units configured as Slave Units.

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

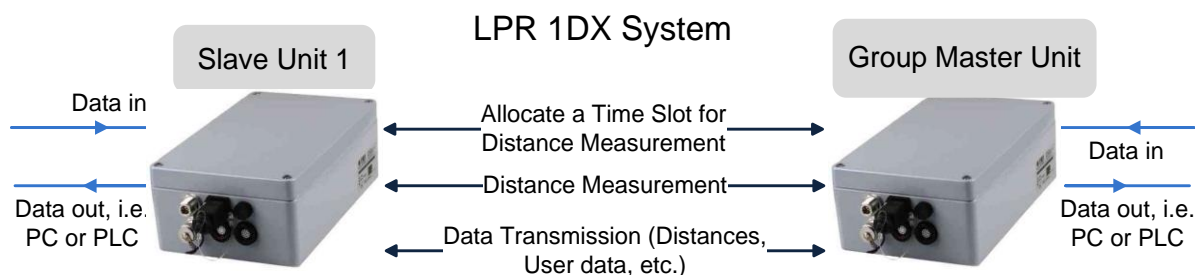


Figure 3: 1D system

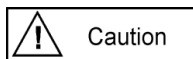
Besides the distance information, smaller volumes of user data can also be passed between the units. These are fed in on the serial port of a unit and output in corresponding manner on the other side.

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 unit has parameters to provide an explicit allocation to a system and also to ensure the functionality of a system. These parameters are explained in the following:



Caution

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

2.4.1 Station-ID (SID)

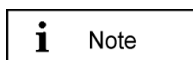
Each unit has an explicit Identification Number in one system. If using more than one LPR[®] 1D systems in your environment same station numbers could be used. BUT: In one system all station numbers are different.

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

Unit 1 (SID 1) is the LPR[®] Group Master Unit, as a coordinator of the system. Units 2 – 5 (SID 2 – 5) are LPR[®] Slave Units. A Group Master Unit (SID 1) can only measure with a Slave Unit (SID 2 – SID 5) and vice versa, but NEVER with another Group Master Unit or a Slave Unit with another Slave Unit. But the Group Master Unit (coordinator) can measure with up to 4 Slave Units.

Keep in mind:

SID 1	Group Master Unit
SID 2	Slave Unit 1
SID 3	Slave Unit 2
SID 4	Slave Unit 3
SID 5	Slave Unit 4



Note

There is no difference in the hardware of a Group Master Unit and a Slave Unit. The only difference is the configuration software. The Group Master

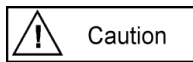
Unit organizes the measurements. It allocates time slots to the Slave Units to identify when these units are allowed to start with a measurement.

2.4.2 Group-ID (GID)

A system is identified clearly by its group number. All units 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 a different group number (see Figure 5).

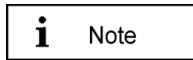
2.4.3 FSK Channel (FSK)

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. 30 frequency channels are available. All units 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, the frequency channel is linked to a group ID. Therefore it is really important to use different group IDs for different LPR® systems.

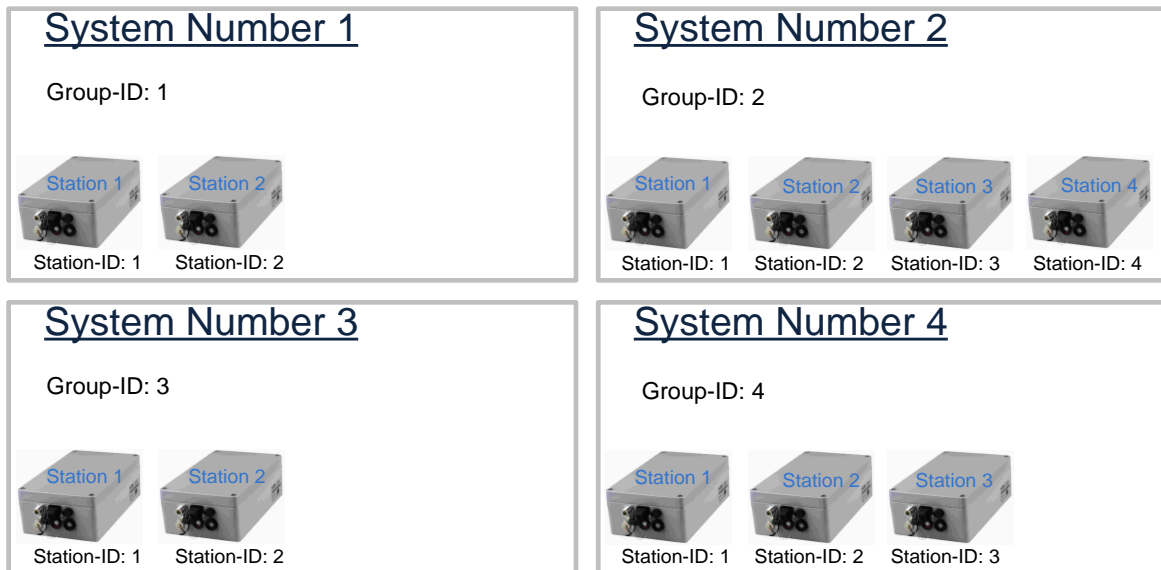


Figure 4 – Example of the relation Station-ID and Group-ID

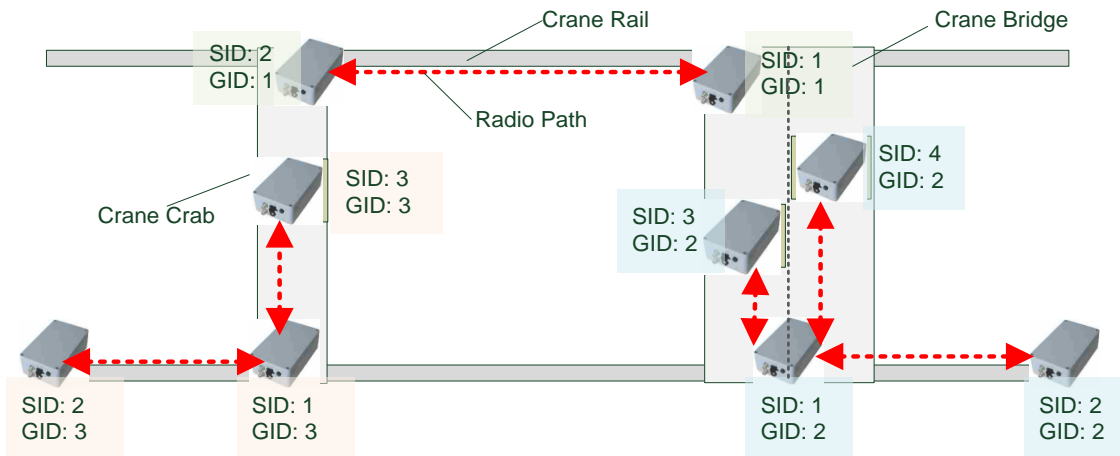


Figure 5 – Example of multiple LPR[®]-systems in one crane environment

2.5 Mode of Operation of the System

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

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[®] unit. The data channel has a channel capacity of 8 byte/measurement cycle. This means, the overall capacity depends on the chosen measurement frequency. I.e. if a measurement frequency of 10 Hz is chosen, the capacity is 80 byte/s

2.6 Application Examples

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

Some more complex arrangements are illustrated in the following description.

2.6.1 Redundant arrangement (2 x LPR-1DX)

For reasons of operational safety, it may be necessary to combine two systems in a redundant arrangement. Figure 4 shows two Slave Units and two Group Master Units installed in a redundant arrangement on two crane bridges. Each Slave Unit communicates

with the opposite Group Master Unit. Both systems measure independently from each other. After the measurement, the distance from the respective partner can be output at each of the participating units. 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.

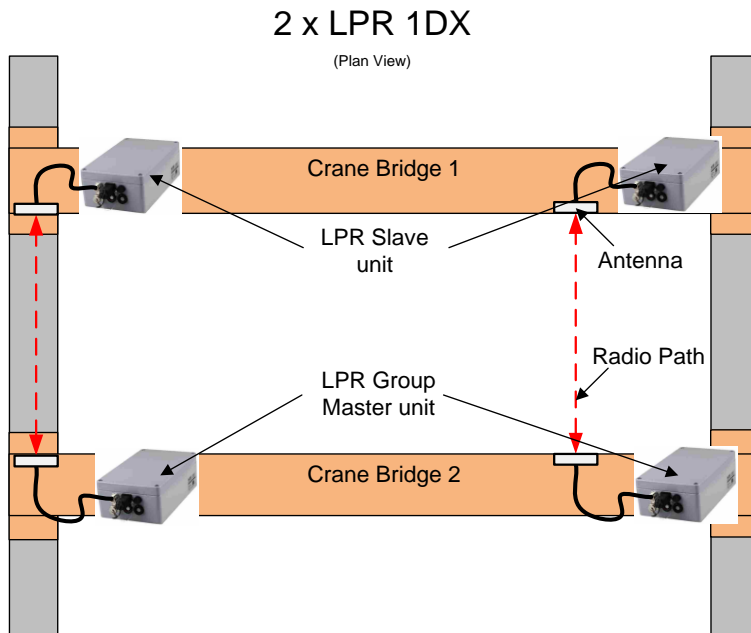


Figure 6: LPR® 1DX Redundant arrangement

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 Group Master Unit (unit 1) is equipped with 2 antennas. This unit measures against the first Slave Unit (unit 2) with the first antenna, and against the second Slave Unit (unit 3) with the other antenna, for example. In this way, the position of a crane crab can be determined.

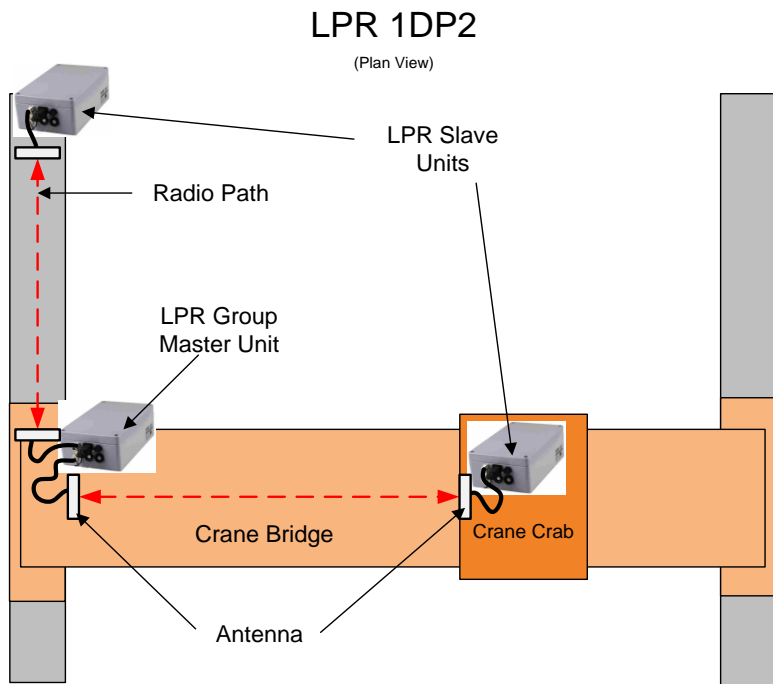


Figure 7: LPR[®] 1DP2 L-shaped arrangement

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 Group Master Unit (unit 1) is equipped with two antennas. A Slave Unit (unit 2 and unit 3) is installed on each of the two cranes. The two antennas are mounted at the wall at the same height as the respective Slave Units 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.

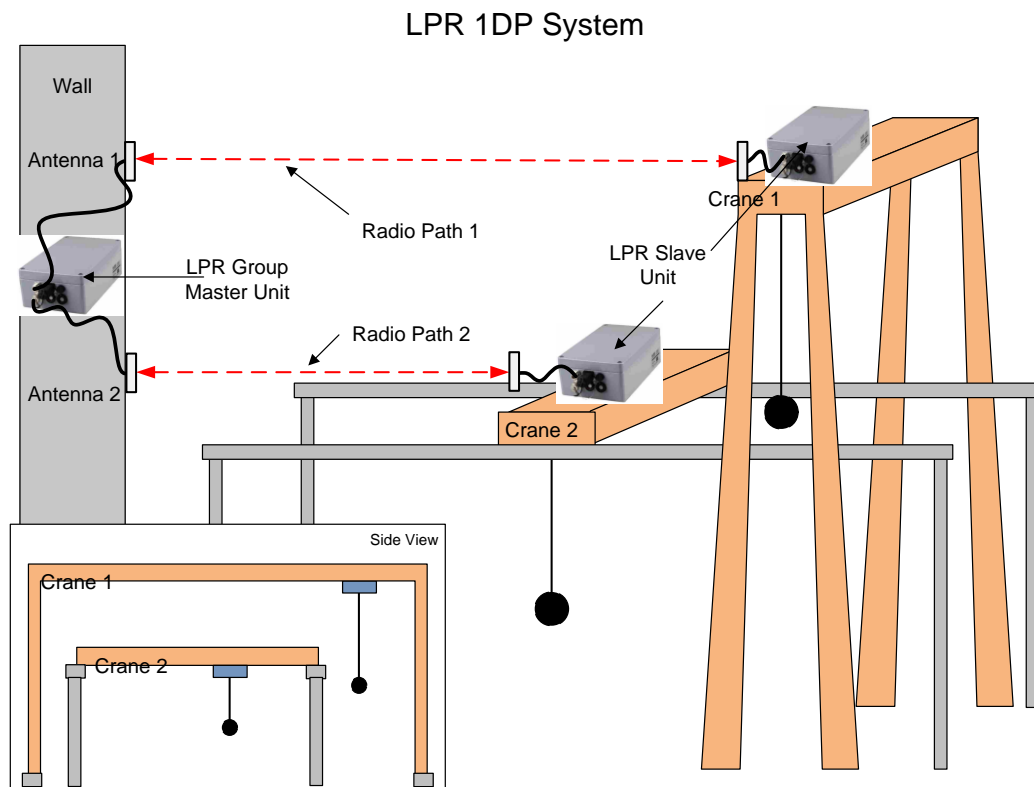


Figure 8: LPR[®] 1DP Y-shaped arrangement

3 Hardware

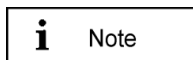


Warning

All corresponding installation, repair and servicing work must be carried out by qualified and trained technicians. LPR[®] - 1D unit (Design Compact Unit)

The compact type LPR[®] - 1D unit is available with different interface options:

- Interfaces for data output : TCP/IP or Profibus or RS232
- Optional: switching outputs for up to 7 relays
- 2 or optional 4 antenna ports



Note

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

3.1.1 Casing

LPR[®] - 1D units are provided in die-cast aluminum housings.

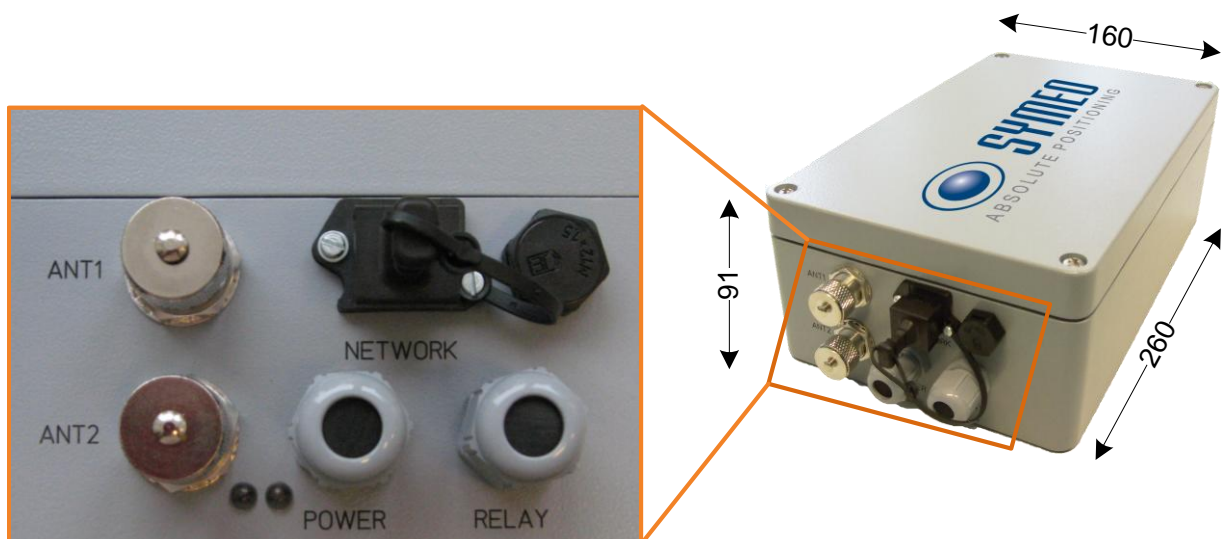


Figure 9: LPR[®]-1D unit front and side view

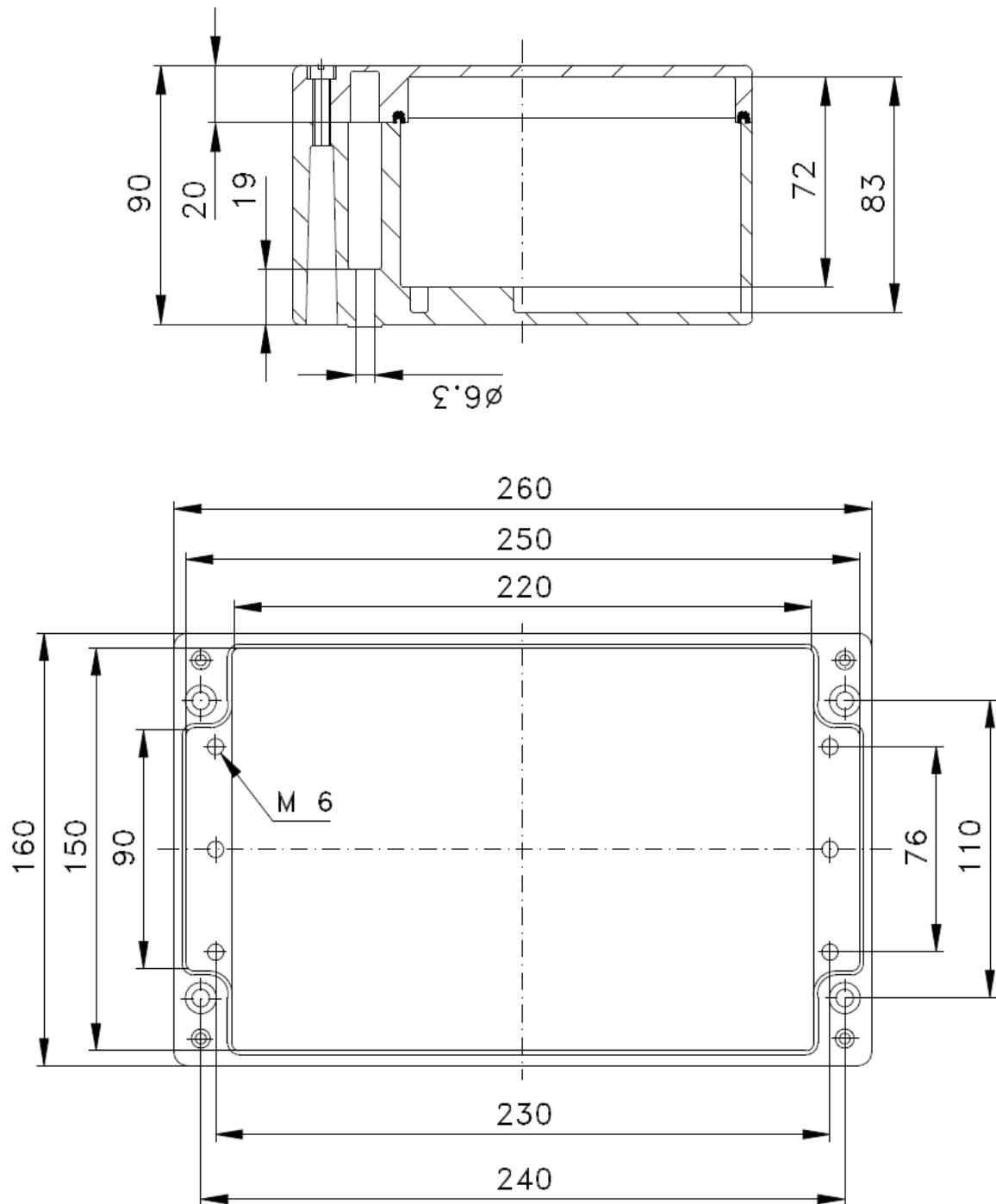
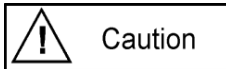


Figure 10: Dimensions in mm of the LPR®-1D unit

3.1.2 General internal connections

Power supply

Power supply (10 - 36 VDC) is connected using the power supply terminal (C1) Figure 11 depicts the pin assignment. Positive voltage can be connected either at pin 1 or 3, the negative or ground voltage is connected to pin 2.



Caution

Polarity reversal or otherwise faulty connection can damage the LPR® unit. In that case the unit must be send to the SYMEO service.

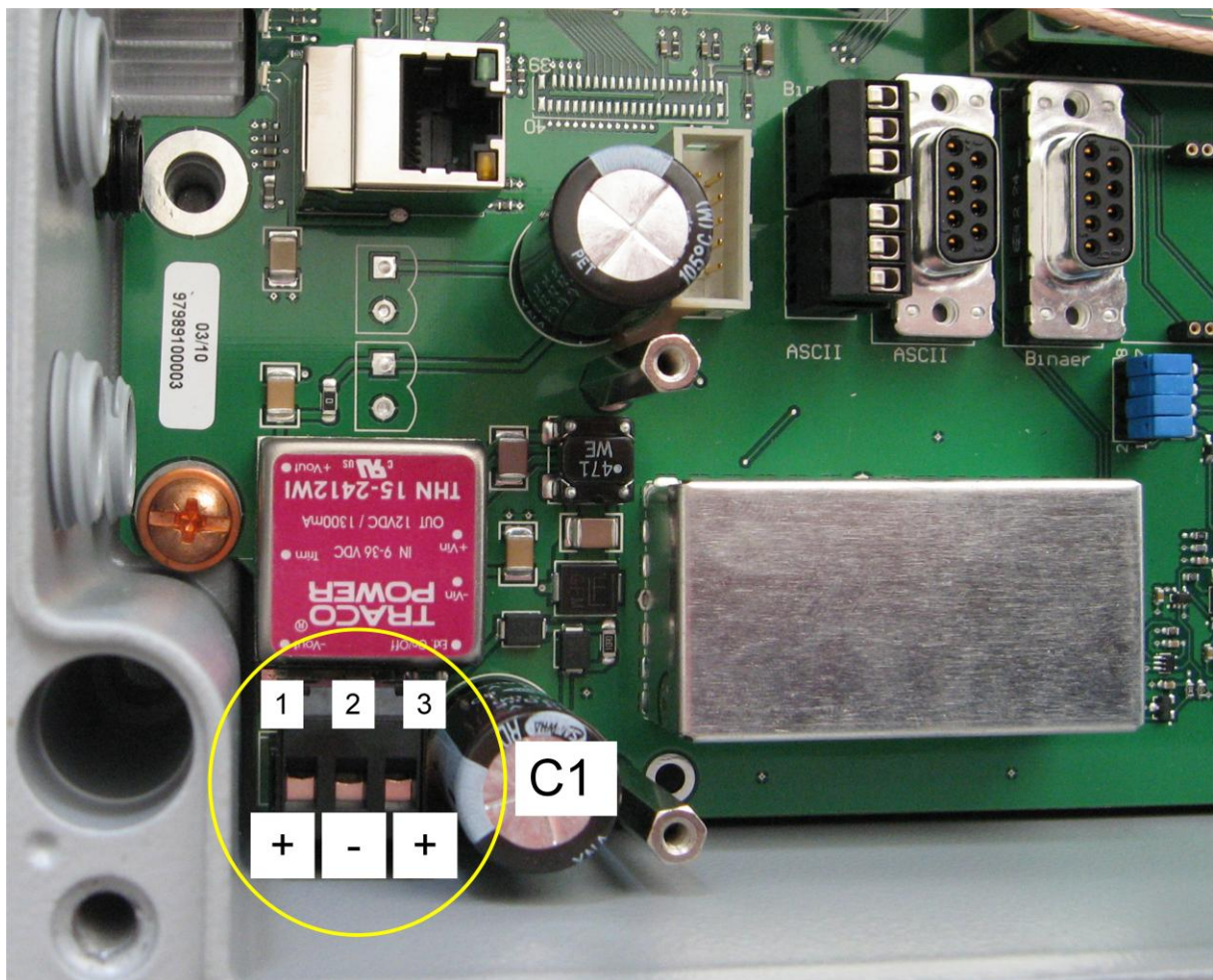


Figure 11 Pin assignment power supply

Relay connections (optional)

Relays are connected using the relay terminal block (C6). Figure 12 shows the pin assignment for the seven switch relays with dry contacts.

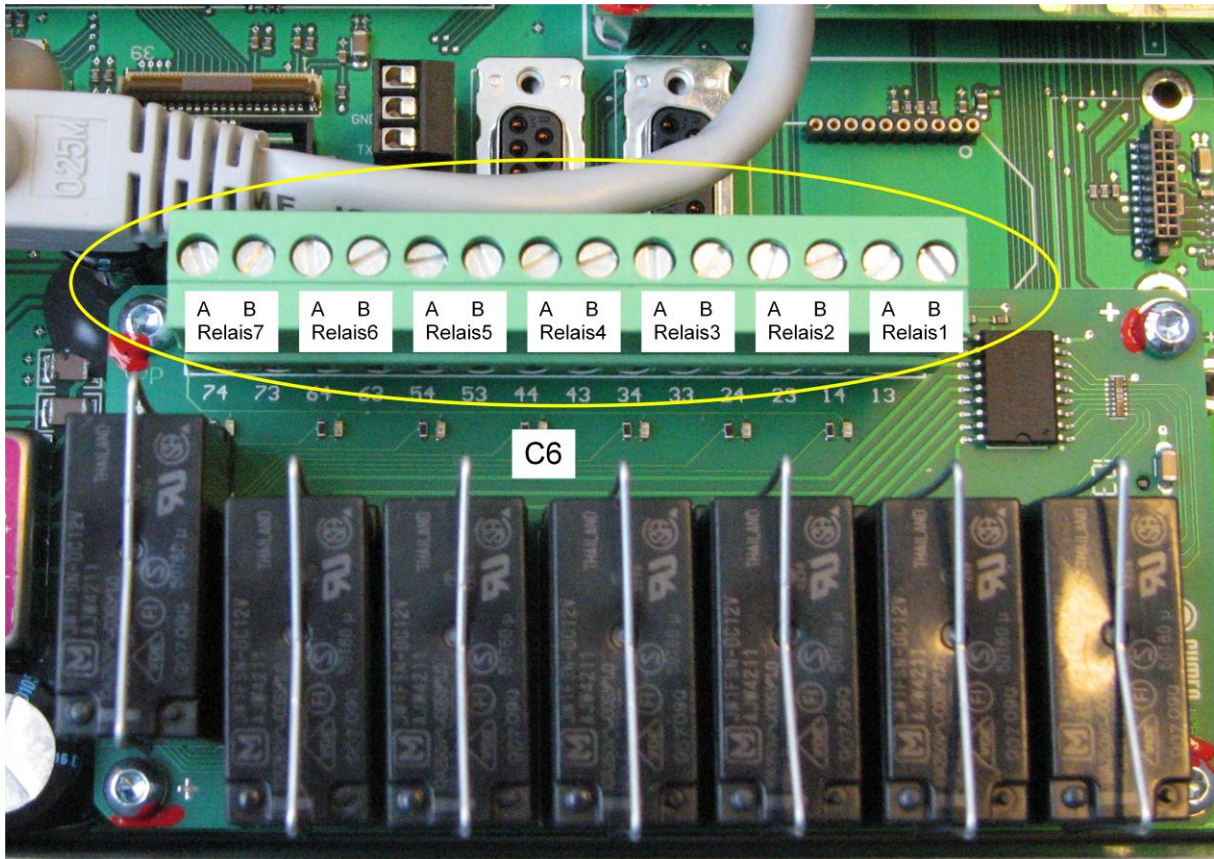


Figure 12 Relay terminal block (C6)

3.2 LPR[®] - 1D unit with TCP/IP interface

3.2.1 Front elements

The casing has cable glands for power cable (B1) and for the relays connection (B10). Figure 13 shows the front of the LPR[®]-1D casing in detail.

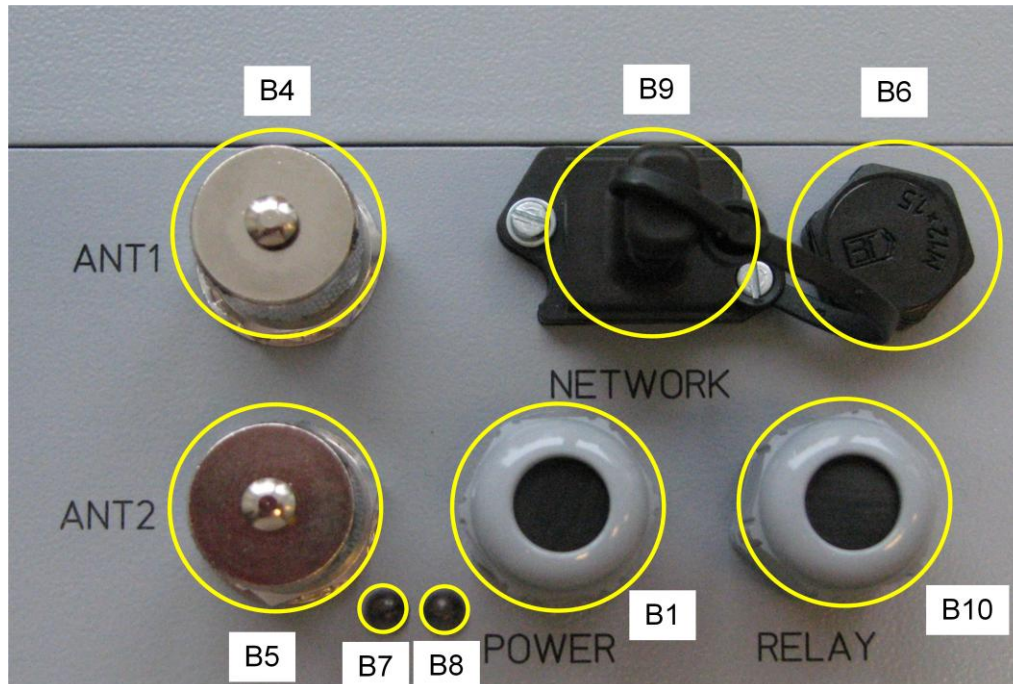
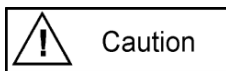
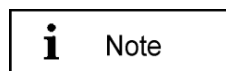


Figure 13: Connections of the LPR unit with TCP/IP interface and optional relays
 B1: cable gland for power cable
 B4: antenna port 1
 B5: antenna port 2
 B6: pressure equalization membrane
 B7: two-colored LED, green = Ethernet connected / red = data transfer
 B8: two-colored LED, red = power supply / green = measurement activity
 B9 Ethernet connector
 B10 cable gland for relay connection cable



Caution

- Power supply and relay cable diameter must be within 4,5 to 10 mm, and a round cross-section.



Note

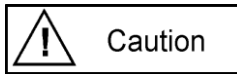
- Power on is indicated with the red LED B8.
- Valid measurements are indicated with the green LED B8 blinking provided that the units are configured properly with the parameterization software *Symeo-Wizard* (see chapter 5)

3.2.2 Overview internal connectors



Warning

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



Caution

- Avoid entry of foreign objects or liquids into the unit.
- Careful mounting of the system is required. It is important that the seal remains clean and is not damaged, otherwise the protection class cannot be guaranteed.

Figure 14 shows the electrical connections and switches of the LPR® unit, version TCP/IP.

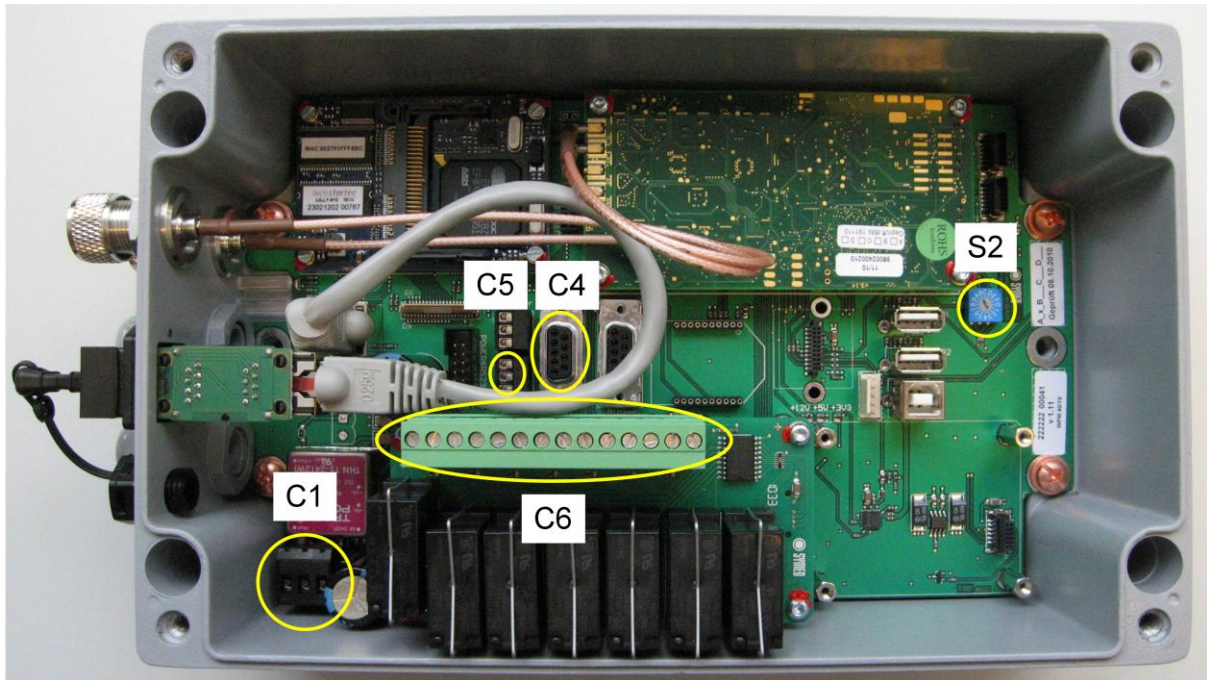


Figure 14 Overview electrical connections and switches
 C1: terminal block for power supply (10 - 36 VDC)
 C4: D-sub-socket for RS232 service port (not used in TCP/IP units !)
 C5: terminal block for RS232 service port (not used in TCP/IP units !)
 C6: terminal block for connection of relays
 S2: rotary switch for mode of operation

3.2.3 Mode of operation

For standard operation of LPR® units with TCP/IP interface the rotary switch (S2) has to be set to position „3“ (see Figure 14)

3.3 LPR® - 1D unit with Profibus interface

3.3.1 Front elements

The casing has cable glands for power cable (B1) and for the Profibus (B2, B3). Figure 15 shows the front of the LPR®-1D casing in detail.

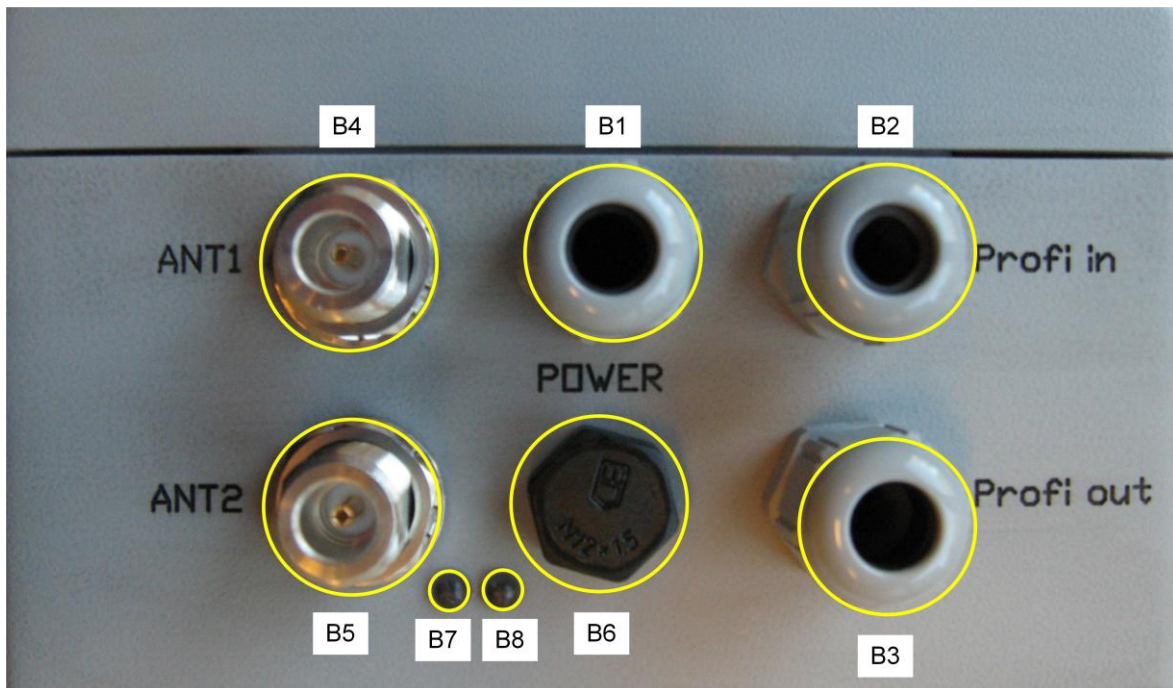
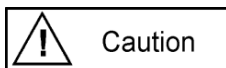


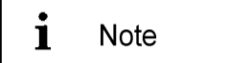
Figure 15: Connections of the LPR® unit with Profibus interface

- B1: cable gland for power cable
- B2: cable gland for Profibus In
- B3: cable gland for Profibus Out
- B4: antenna port 1
- B5: antenna port 2
- B6: pressure equalization membrane
- B7: LED blue = Profibus error
- B8: two colored LED, red = power supply / green=measurement activity



Caution

- Power supply cable diameter must be within 4,5 to 10 mm, and a round cross-section.
- If the LPR unit is at the end of a Profibus, the not used cable gland has to be closed.



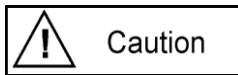
Note

- For LPR units with Profibus interface and optional relays please use one cable for relay wiring with additional wires for power supply through cable gland B1 "Power", see Figure 15.
- Power on is indicated with the red LED B8.
- Valid measurements are indicated with the green LED B8 blinking provided that the units are configured properly with the parameterization software Symeo-Wizard (see chapter 5)
- An error in the Profibus interface is indicated with the blue LED B7

3.3.2 Overview internal connectors



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



- Avoid entry of foreign objects or liquids into the unit.
- Careful mounting of the system is required. It is important that the seal remains clean and is not damaged, otherwise the protection class cannot be guaranteed.

Figure 16 shows the electrical connections and switches of the LPR unit, version Profibus.

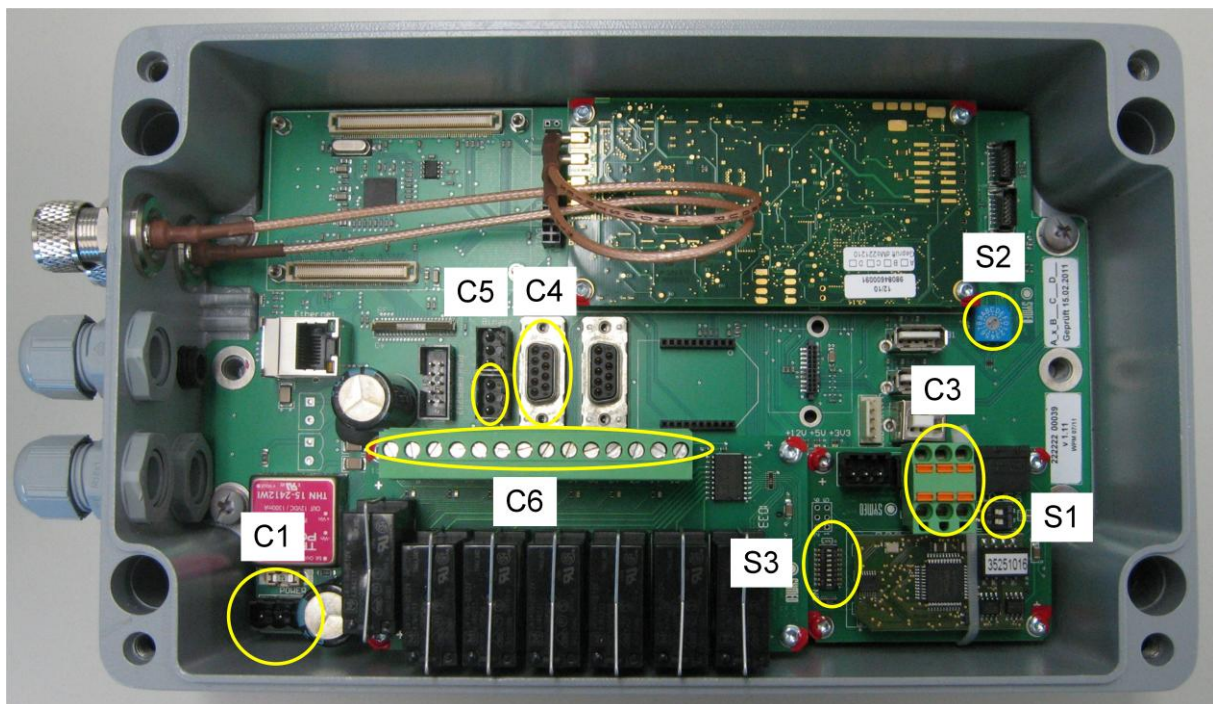


Figure 16 Overview electrical connections and switches
 C1: terminal block for power supply (10 - 36 VDC)
 C3: terminal block for connection of Profibus
 C4: D-sub-socket for RS232 service port
 C5: terminal block for connection of RS232 service port
 C6: terminal block for connection of relays (optional)
 S1: DIP-switch for termination of Profibus
 S2: rotary switch for mode of operation
 S3: DIP-switch for addressing of Profibus

3.3.3 Connection to Profibus

The LPR®-Profibus interface is connected using the terminal block (C3).

Figure 17 shows the pin assignment for the terminal block (C3). Port „A1“ and „A2“, also port „B1“ and „B2“ are connected inside the terminal block. In case of a removed terminal block the remaining Profibus system is still operative. The shield of the Profibus cable has to be connected to “Shield”.

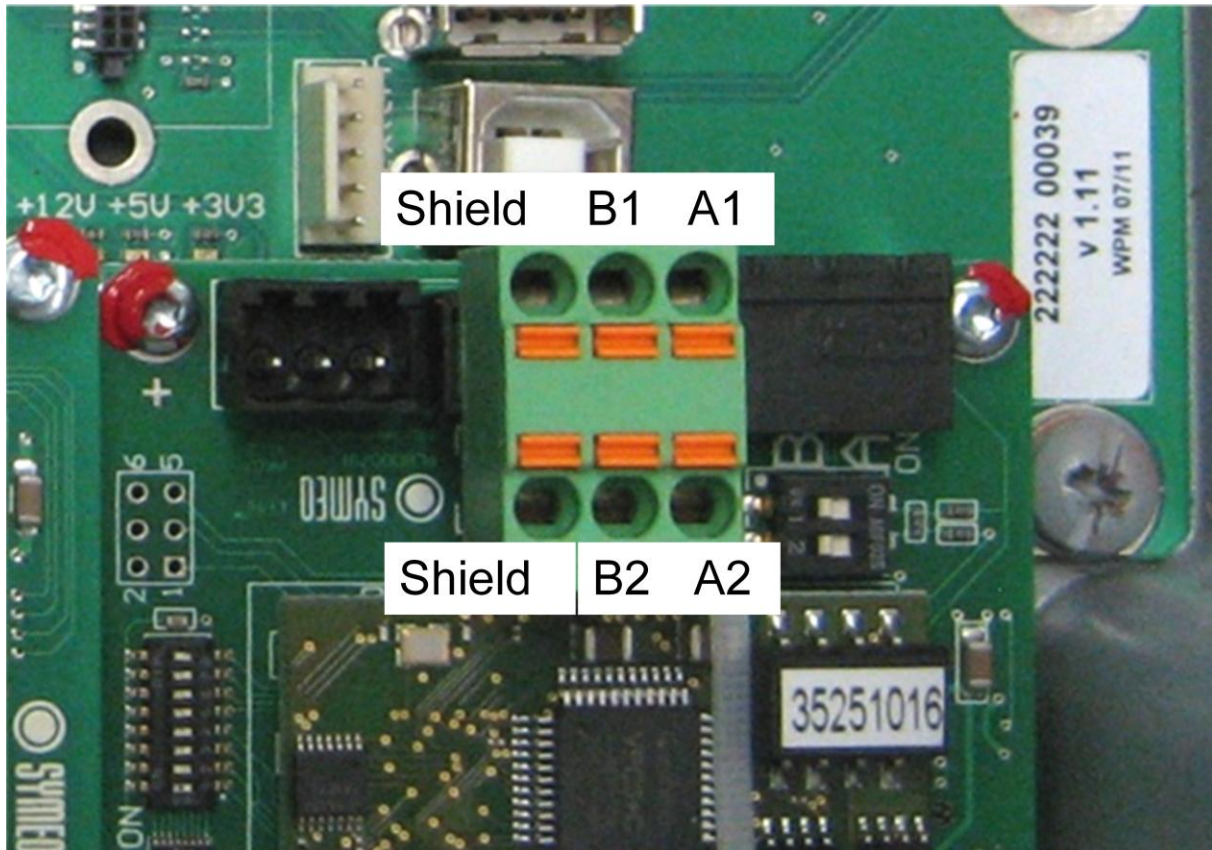


Figure 17 Profibus interface via terminal block

3.3.4 Connection of service port with serial interface

For configuration of the LPR[®]-1D station the service port (C4) or (C5) is provided (RS232).

For connecting to the D-sub socket (C4) please use a standard RS232 (1:1) cable with a maximum length of 2 meters.

Optional the RS232 connection can be established via the terminal block (C5). The pin assignment is shown in Figure 18.

The configuration of the LPR[®]-1D station is described in chapter 5.

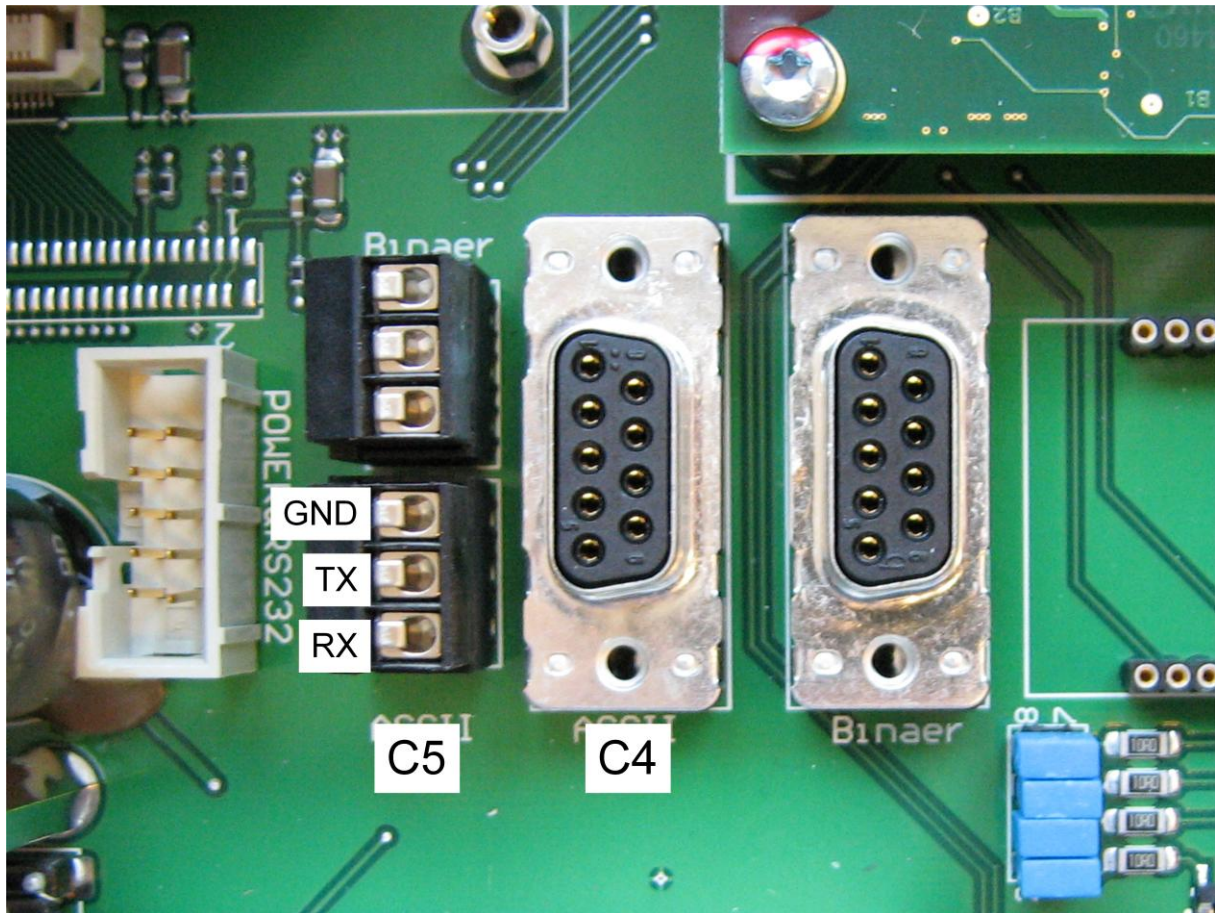


Figure 18 Internal serial configuration port (RS232)



Warning

Using the internal serial interface it is important to avoid moisture, dust or any particles into the housing during the process.

3.3.5 Termination of Profibus

The Profibus system has to be terminated at the last device on the bus. DIP switch (S1) terminates the Profibus. Both switches of switch S1 has to be set to “ON” (see Figure 19) for termination.



Note

A termination applies only with connected terminal block on C3, using the on board termination with DIP switch S1.

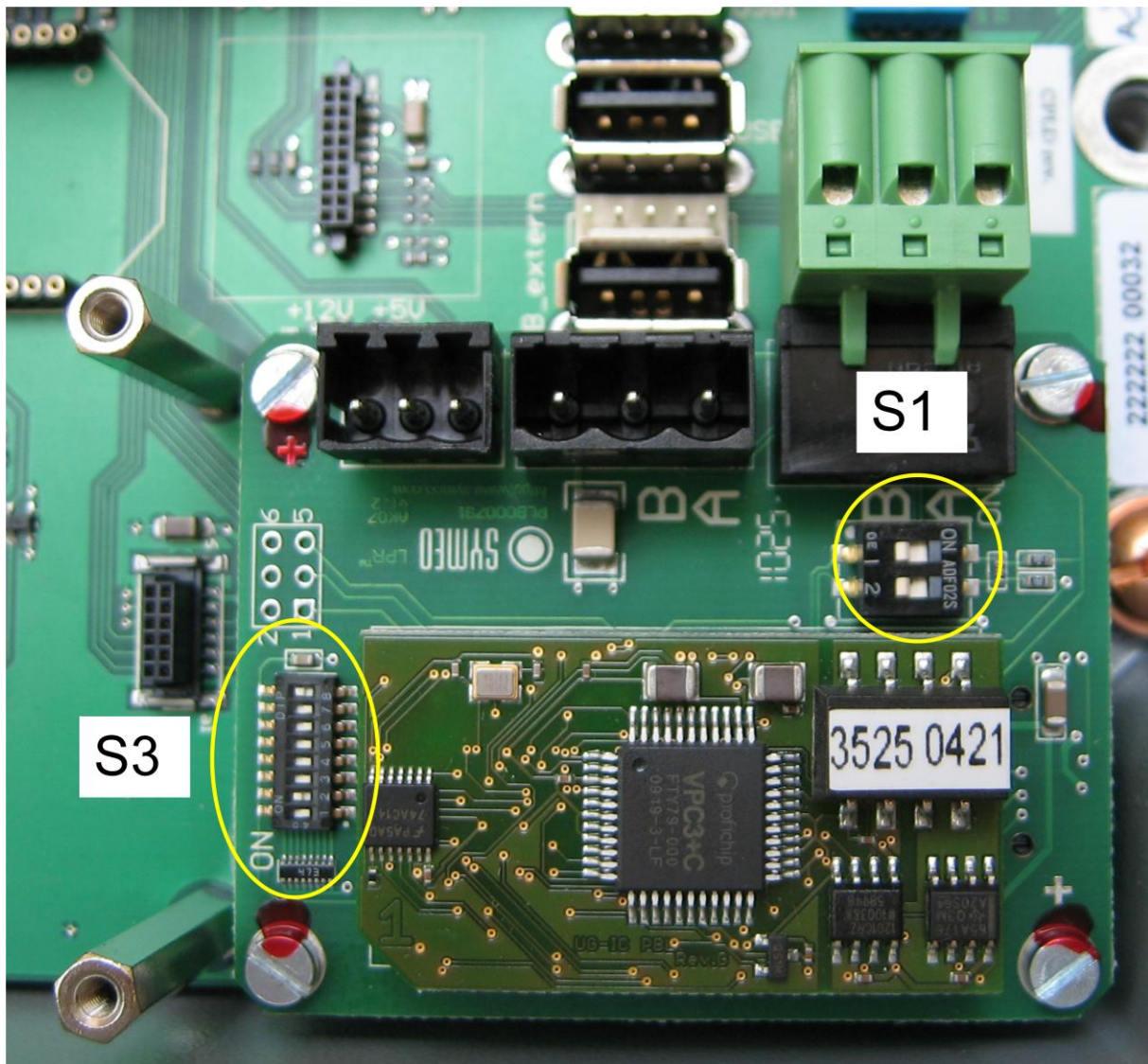


Figure 19 DIP-switch for termination (S1) und addressing (S3)

3.3.6 Addressing the Profibus

The address of the Profibus module is set with DIP switch (S3), see Figure 19 DIP-switch for termination (S1) und addressing (S3).

DIP-switch	Content
1 to 8	Binary PROFIBUS address
8	Least significant bit (2^0)
1	Most significant bit (2^7)

Example for addressing

Address decimal	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Switch 7	Switch 8
1	off	off	off	off	off	off	off	on
5	off	off	off	off	off	on	off	on
21	off	off	off	on	off	on	off	on

3.3.7 Measurement frequency

The maximum possible measurement frequency of 30 Hz is only available for a system with 2 stations (one distance measurement).

For a system with 3 stations (two distance measurements) the maximum possible measurement frequency is 10 Hz per station.

i Note

- For a system with 3 stations the measurement cycle has to be configured accordingly. With the parameterization software *Symeo-Wizard* (see chapter 5) the value for the measurement cycle has to be set to minimal 100ms. The setting is shown in the menu “LPR settings”.
- The baud rate for the data port is set by default within the parameterization software *Symeo-Wizard* (see chapter 5) to a value of 19200 baud for units with Profibus interface.

3.3.8 Mode of operation

For standard operation of LPR units with Profibus interface the rotary switch (S2) has to be set to position „6“ (see Figure 16).

3.4 LPR[®] - 1D unit with RS232 interface

3.4.1 Front elements

The casing has cable glands for power cable (B1) and for the relays connection (B10). Figure 20 shows the front of the LPR-1D casing in detail.

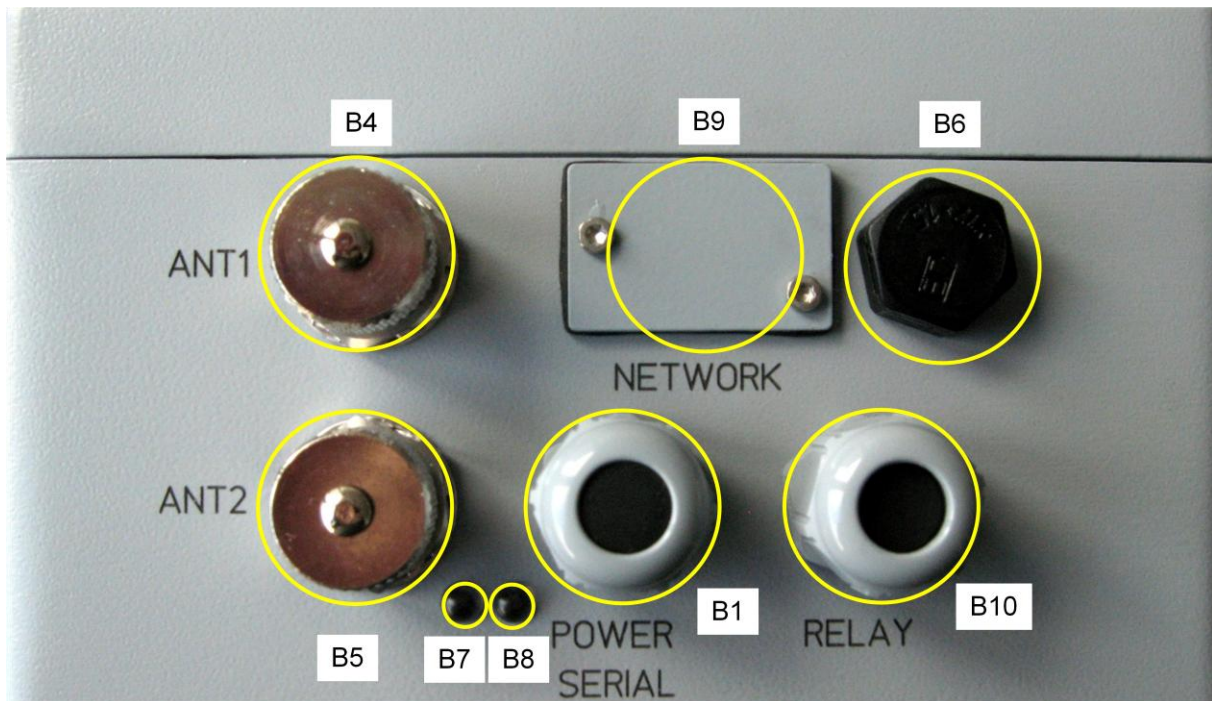
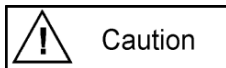
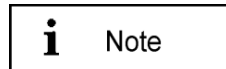


Figure 20 Connections of the LPR-1D unit with RS232 interface and optional relays
 B1: cable gland for power cable and serial data port (RS232)
 B4: antenna port 1
 B5: antenna port 2
 B6: pressure equalization membrane
 B7: not used for LPR-1D units with RS232 interface
 B8: two-colored LED red=power supply / green=measurement activity
 B9 not used for RS232 version
 B10 cable gland for relay connection cable



Caution

- Power supply and relay cable diameter must be within 4,5 to 10 mm, and a round cross-section.



Note

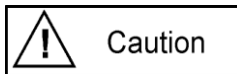
- Power on is indicated with the red LED B8.
- Valid measurements are indicated with the green LED B8 blinking provided that the units are configured properly with the parameterization software *Symeo-Wizard* (see chapter 5)

3.4.2 Overview internal connectors



Warning

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



Caution

- Avoid entry of foreign objects or liquids into the unit.
- Careful mounting of the system is required. It is important that the seal remains clean and is not damaged, otherwise the protection class cannot be guaranteed.

Figure 21 shows the electrical connections and switches of the LPR unit, version RS232.

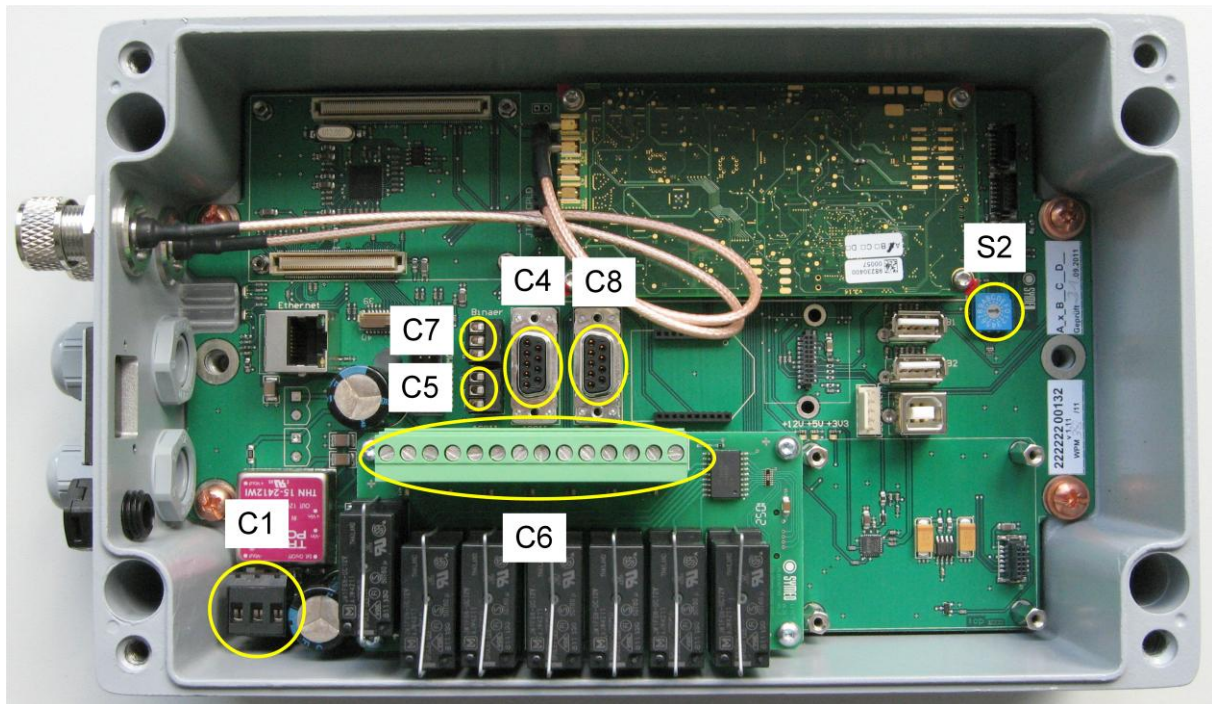


Figure 21 Overview electrical connections and switches
 C1: terminal block for power supply (10 - 36 VDC)
 C4: D-sub-socket for RS232 service port
 C5: terminal block for connection of RS232 service port
 C6: terminal block for connection of relays (optional)
 S2: rotary switch for mode of operation
 C7: terminal block for connection of RS232 data port
 C8: D-sub-socket for RS232 data port

3.4.3 Connection of service and data port with serial interface

For configuration of LPR-1D units with RS232 interface the service port (C4) or (C5) is provided (RS232).

For connecting to the D-sub socket (C4) please use a standard RS232 (1:1) cable with a maximum length of 2 meters.

Optional the RS232 connection can be established via the terminal block (C5) for configuration with a maximum cable length of 2 meters. The pin assignment is shown in Figure 22.

The configuration of the LPR-1D station is described in chapter 5 Commissioning.

Distance data are available on the RS232 data port (C7) or (C8). The pin assignment for (C7) is shown in Figure 22.

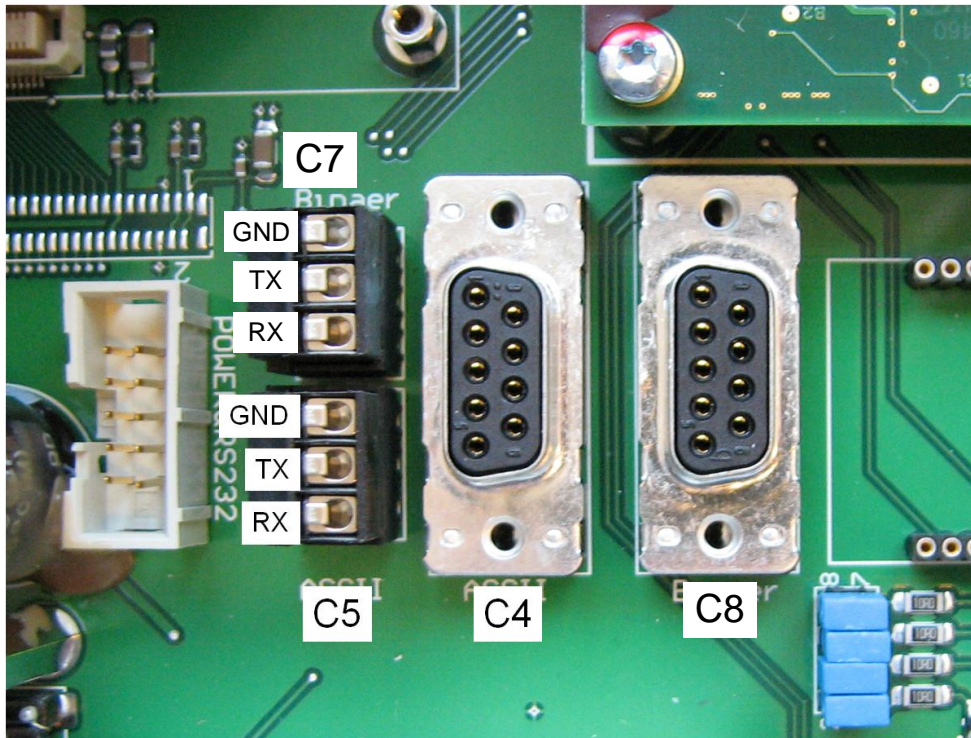


Figure 22 Internal serial service port and data port (RS232)



Warning

Using the internal serial interface it is important to avoid moisture, dust or any particles into the housing during the process.

Consider the dependency of the maximum baud rate for the **data port** according to the cable length:

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

According to the cable length the baud rate for the data port at the units has to be adjusted as described in chapter 5 Commissioning.

3.4.4 Mode of operation

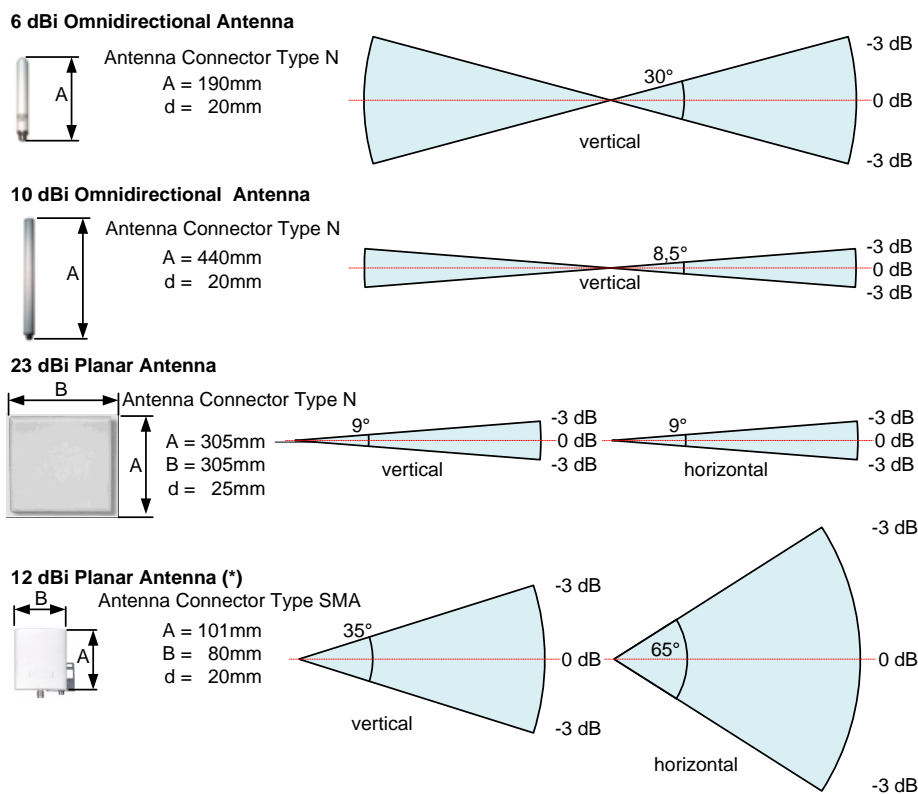
For standard operation of LPR units with RS232 interface the rotary switch (S2) has to be set to position „0“ (see Figure 21)

3.5 LPR[®] Antenna Types

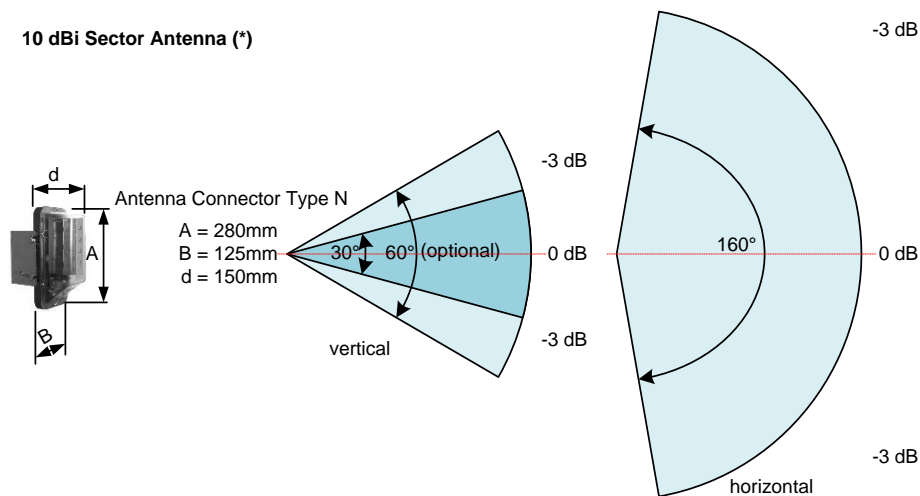
There are different antennas that can be installed depending on the required directional characteristic.

Figure 23 shows the typical LPR[®] antennas, which are applied in an LPR[®] System.

For standard applications the 23dBi planar antenna is used.



10 dBi Sector Antenna (*)



13 dBi Sector Antenna

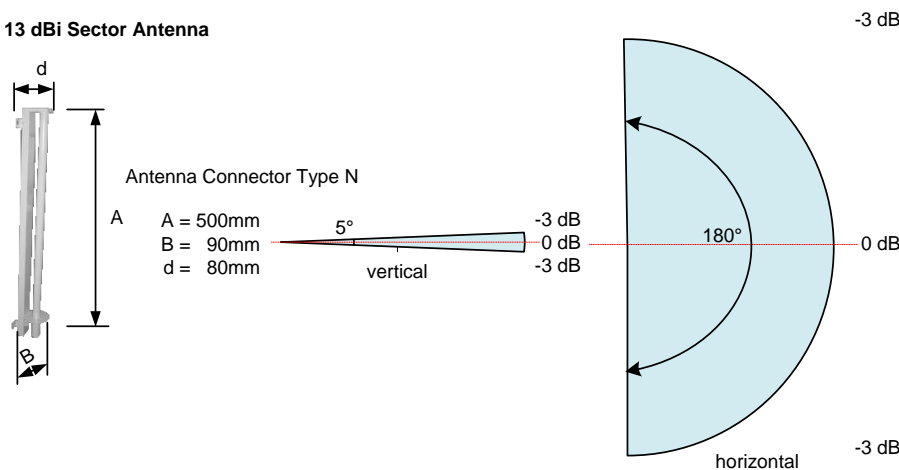


Figure 23: Example of directional characteristic of typical LPR[®] antennas

(*) 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.

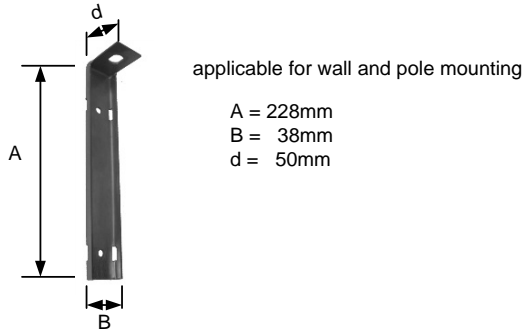
i Note

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!

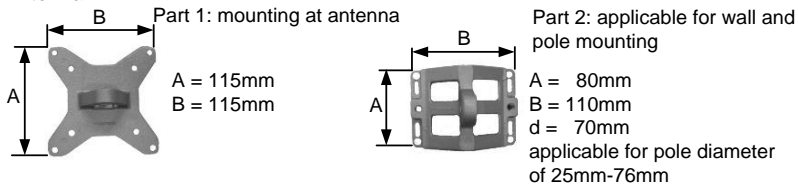
3.5.1 Adapter for different LPR[®] Antennas

Depending on the required antenna, different mounting brackets are available

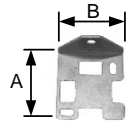
6 dBi and 10 dBi Omnidirectional Antenna



23 dBi Planar Antenna



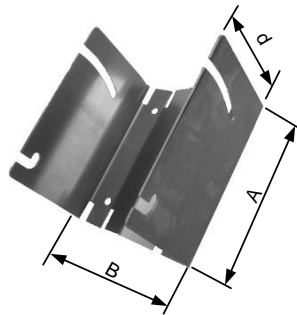
12 dBi Planar Antenna



applicable for wall mounting

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

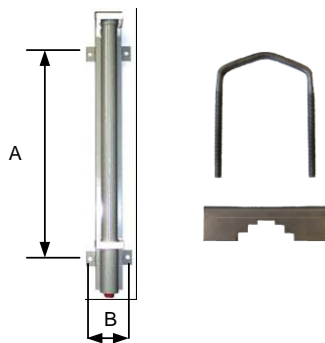
10 dBi Sector Antenna



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)

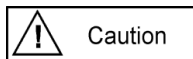
A = 410mm
B = 70mm

Figure 24: Available Adapters for different Antenna Types

4 Installation

4.1 Installation of LPR® Unit Design Compact Unit

4.1.1 Important Instructions for Installation



Caution

During Installation, the Compact Unit 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 Unit 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

i Note

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

- ⇒ Check the position of the unit on the device on which the Compact Unit 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 Unit is to be installed. Drill-hole distances: 11 cm wide, 24 cm high (see Figure 10).
- ⇒ Open the Compact Unit: With a Phillips screwdriver (Size 0), loosen the top four screws of the Compact Unit lid.
- ⇒ Screw the Compact Unit tightly to the device. The installation holes shown in Figure 10 are provided for this purpose. Check that the unit is mounted securely.
- ⇒ Close the unit: Place the cover of the Compact Unit on top and fasten the cover with the four screws. Make sure that the cover is securely attached to the housing.
- ⇒ Commission the Compact Unit (see chapter 5)

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[®] unit.

⚠ Caution

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

	Group Master	Slave Unit 1	Slave Unit 2	Slave Unit 3	Slave Unit 4
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

10,5 cm (for multiple bending under mechanical load) and 4 cm (unloaded and static bending). The cable must not be attached in a way that squeezes 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 and not tilt. 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)

i 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.

For installation of the planar antennas, it is important to keep the same orientation of polarization for corresponding antennas (see Figure 25).

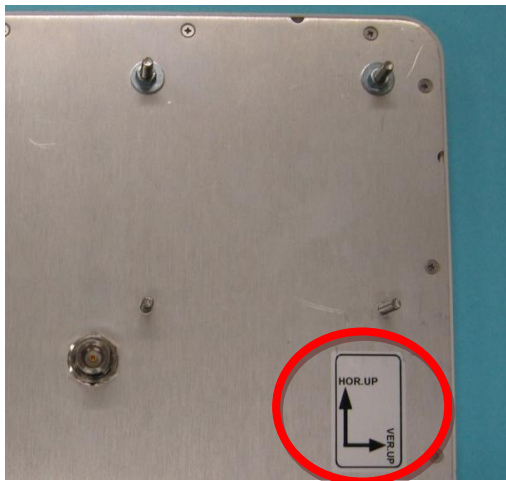


Figure 25: Backside of 23 dBi planar antenna

- ⇒ Install the antenna bracket according to the accompanying operating instructions.
- ⇒ Secure the antenna in the bracket.
- ⇒ 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.

i Note

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

The first Fresnel zone can be calculated as follows:

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

λ is the wave length and d the distance between the two antennas. For a frequency of 5.8 GHz a wave length λ of approx. 0.05 m is calculated. The maximum radius between the two antennas is indicated with b . For different distances the maximum radius is given in Figure 26

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

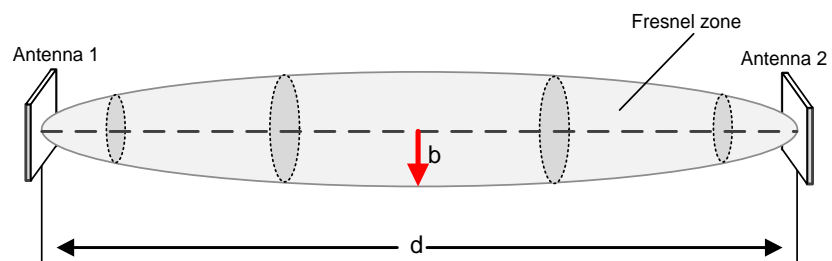


Figure 26 Calculation and figure of Fresnel zone

4.2.4 Installation of Planar Antennas

i 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 27).

If an offset is not inevitable the antennas have to be tilted (compare picture 3 vs. picture 4 in Figure 27).

! Caution

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

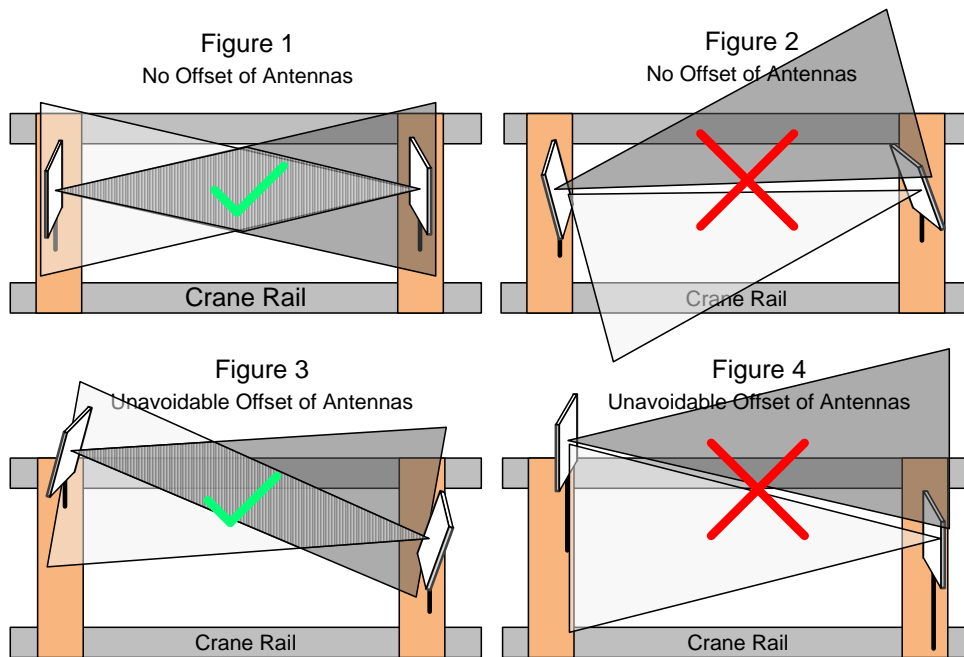


Figure 27 Antenna position with and without offset

5 Commissioning

5.1 Requirements

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

- ⇒ The unit has been installed.
- ⇒ The unit has been connected to the power supply.
- ⇒ Antenna(s) and antenna cables for the unit have been installed.
- ⇒ Data link has been established via TCP/IP or RS232.

Once these prerequisites have been fulfilled you can connect the unit 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 service port or the TCP/IP port depending on the LPR® unit model you have:

- Model with TCP/IP data interface: Configuration via TCP/IP
- Models with Profibus or RS232 data interface: Configuration via service port C5 or C4

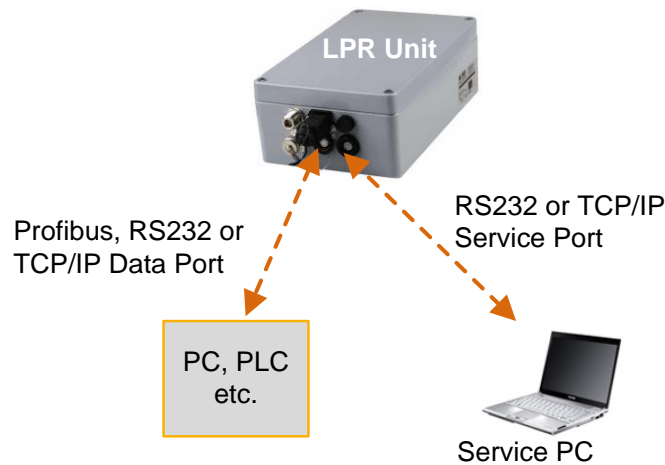


Figure 28: LPR® Unit with Interfaces for Parameterization at Service Port and Distance Data Protocol (Binary data) at Data Port

In one LPR® system all distance data (binary data/ protocol) are available at each unit. Also if you have several units in one system (crane bridge, crane crab, wall) you get the binary distance data at each LPR® unit at the data port in this system.

5.2 Connection to LPR® Unit with TCP/IP Interface

i Note

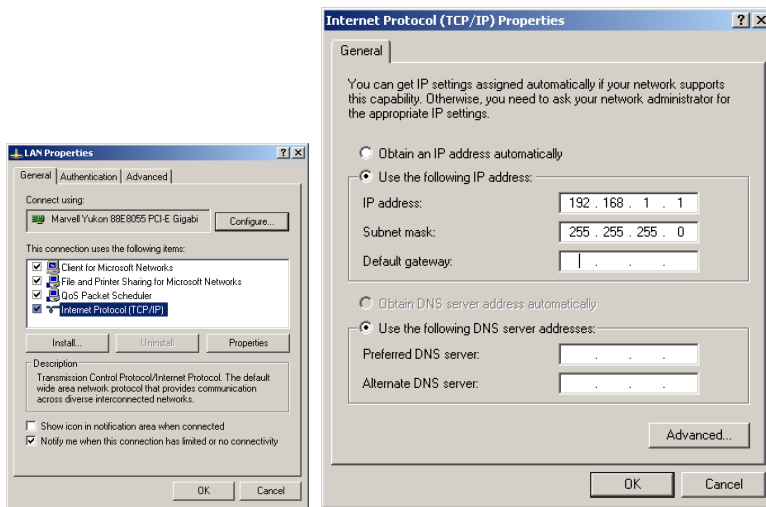
With delivery the LPR® units have the fixed IP-Address **192.168.1.99**, if no other IP-Address is labeled outside the LPR® unit.

You can change the IP-address of the LPR® Unit via the web interface of the LPR® Unit as described in chapter 6.

i Note

To get a connection between your PC and the LPR® unit it is maybe necessary 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® unit 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 29 – Network Settings

i Note

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

The LPR® Unit should be available via your PC now. You can check the connection with a „ping“ to the LPR® unit:

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® unit.

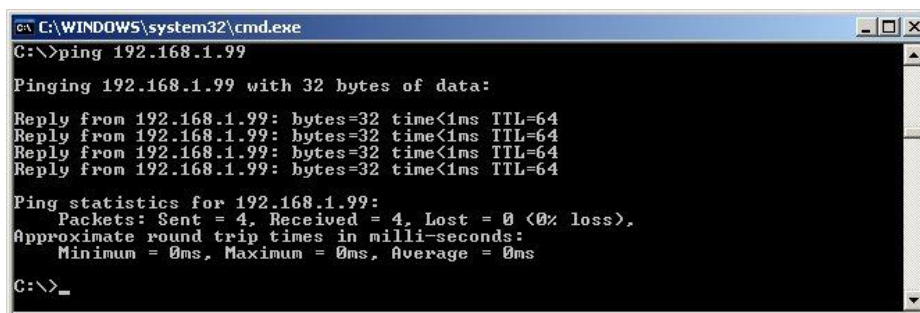


Figure 30 – Ping LPR® Unit

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

i Note

The network settings of LPR® units with TCP/IP Interface have to be set before configuration and operation. The network settings are explained in chapter 6.

5.3 Connection to LPR[®] Unit with serial RS232 interface or Profibus interface

i Note

The RS232 service port is only available for units with RS232 or Profibus data interface.

The commissioning can be done via the serial interfaces C4 (D-sub-socket) and C5 (terminal block); see Figure 31.

To commission the system via the internal serial interface you must use the internal service port C5 / C4. A standard RS232 (1:1) cable of a maximum cable length of 2 m is required. The standard RS232 cable can be plugged into the D-sub-socket of service port C4.

! Warning

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

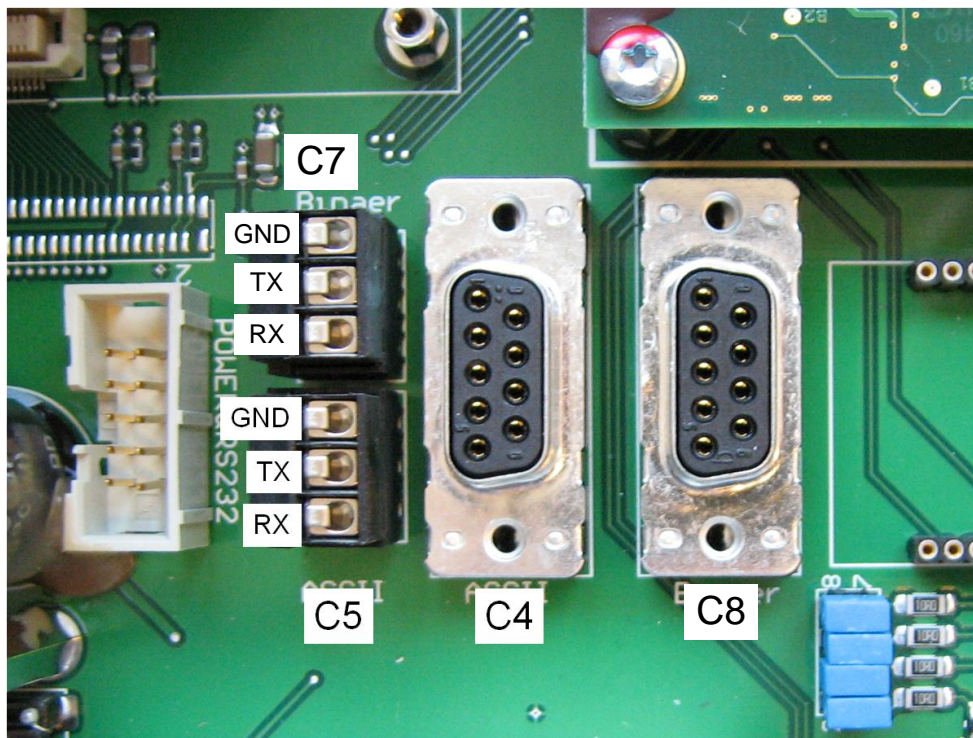


Figure 31 Internal serial ports (RS232)
C4: D-sub-socket for RS232 service port
C5: terminal block for RS232 service port
C7: terminal block for RS232 data port
C8: D-sub-socket for RS232 data port

Connect one side of RS232 cable of a cable length of 2 m with your PC and the other side with the LPR[®] unit (Service port C4 or C5). 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

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

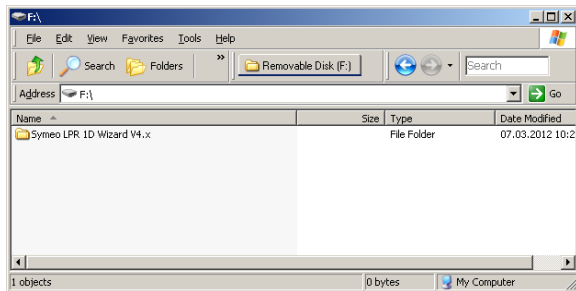


Figure 32 – Installation directory for the LPR[®] 1D Wizard

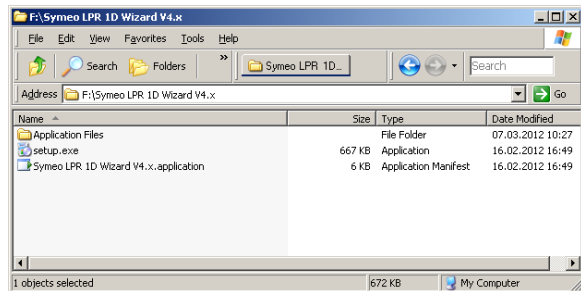


Figure 33 – Start “setup.exe” for installation of the LPR[®] 1D Wizard

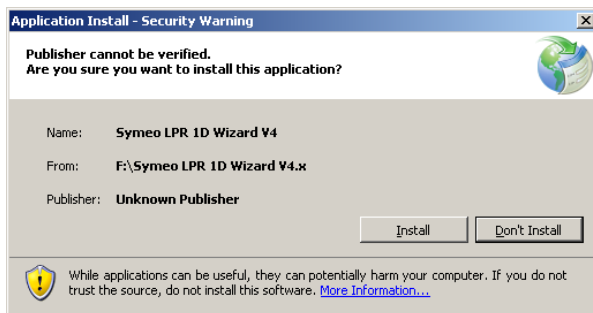


Figure 34 – Press “Install” for installation of the LPR[®] 1D Wizard

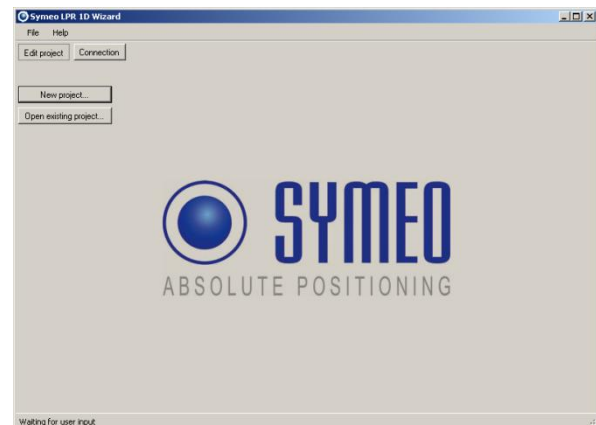


Figure 35 – LPR[®] 1D Wizard starts after installation

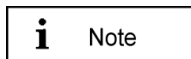
After finishing the installation process the LPR[®]-1D Wizard starts automatically. A shortcut was created on your desktop and you can find the Syмео LPR[®]-1D Wizard in your start menu.

5.4.2 Utilization of LPR[®] 1D Wizard

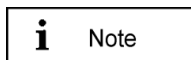
The Syмео LPR[®]-1D Wizard provides the following functions for commissioning the LPR[®] - 1D system:

- ⇒ Selection of the desired application
- ⇒ Settings of parameters for selected application
- ⇒ General setting of LPR[®] 1D System (ID, Antenna and cable parameters, etc.)
- ⇒ Connection to LPR[®] Units

- ⇒ Antenna Calibration
- ⇒ Check distance data
- ⇒ Download of currently applied configuration files for service purposes
- ⇒ Upload of configuration files to the LPR[®] -1D units for service purposes



The network settings of LPR[®] units with TCP/IP Interface have to be set **before** configuration and operation. The network settings are explained in chapter 6.



With the Symeo LPR[®] 1D Wizard you can setup LPR[®] 1D systems with maximal 3 units. For other applications please contact Symeo support.

- ⇒ Start the LPR[®] 1D Wizard. The following window appears:

Edit project

All parameters and configuration files for one LPR[®] 1D system are handled in one project file. The format of this project file is “customers defined application name.symproj”

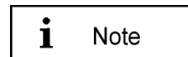


- ⇒ ,New project'

Select this button to create a new project for an LPR[®] 1D System

- ⇒ ,Open existing project'

Select this button to open an already created project for an LPR[®] 1D System



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

Figure 36 – Start LPR[®] 1D Wizard

New project

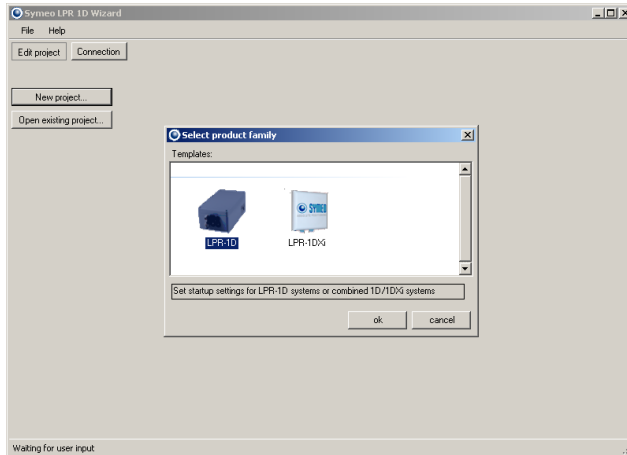


Figure 37 – New project / Select product family

To start a new configuration

⇒ push ,New project‘.

Select the product family of the system used in your application.

Open existing project

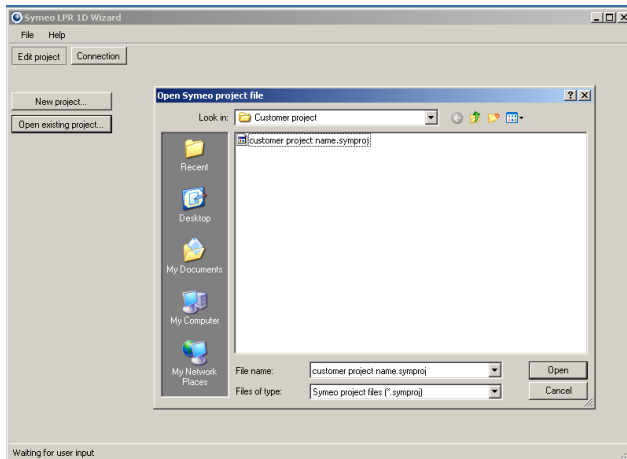


Figure 38 – Open existing project

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

⇒ Push ,Open existing project ‘

Select your already created project file and push ,Open‘

Select application

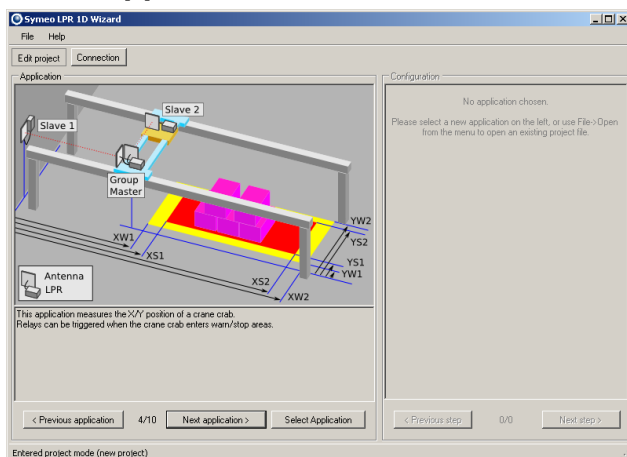


Figure 39 – Select Application

⇒ Push ,Edit project‘.

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

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

i Note

As long as no application is selected, no step to configure the settings can be selected.

Settings of LPR® System Parameters

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

Figure 40 – Common settings - Input fields of the common settings of LPR® system

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

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

i Note

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

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

! Caution

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

i Note

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

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

i Note

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

Measurement cycle: Adjust the desired measurement cycle of the system. Depending on the application you should choose a minimum measurement cycle of 35 ms for 2 units or 70 ms for 3 units in one system.

⇒ Push ,Next step'. The ,Group Master settings' are displayed.

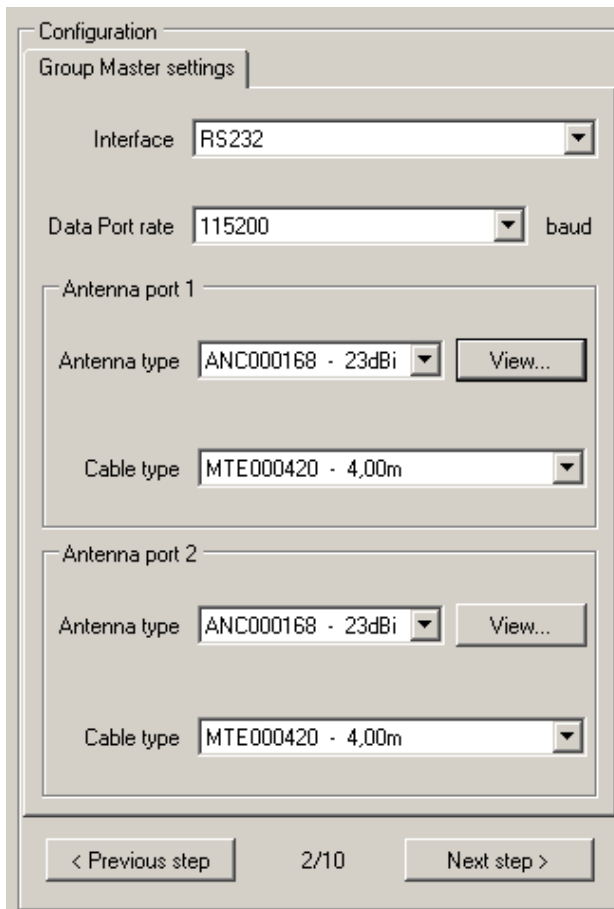
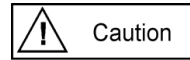


Figure 41 – Group Master setting - Input fields of the Group Master settings of LPR® system

⇒ Fill in the input fields of the 'Group Master settings'.

Interface: The unit's type of data interface.

Data Port rate: Transmission rate of the LPR® system on the data port. The data rate for the data port can only be set for LPR® units with RS 232 interface.



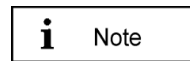
Caution

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

Antenna port 1 and **Antenna port 2:** Settings of the antenna parameters. This is important to calculate the allowed transmission power. The number of antenna ports depends on the selected application.

Antenna type: Select the type of the antenna you use. The 'View' button displays a selection of available antennas.

Cable type: Select the antenna cable connected to the antenna ports.



Note

Antenna port 1 is assigned to the measurement with slave unit 1. Antenna port 2 is assigned to the measurement with slave unit 2.

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

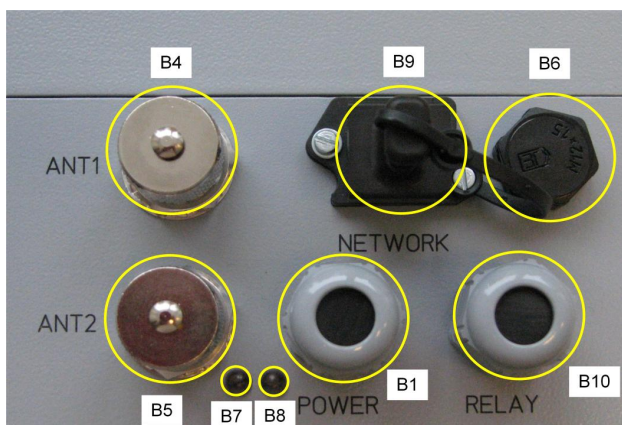


Figure 42 – Front view Antenna ports of LPR® Unit
B4: antenna port 1
B5: antenna port 2

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

i Note

For LPR® System with three units the settings has also be done for the Slave 2 unit. After pushing the button 'Next step' the Slave 2 settings are displayed.

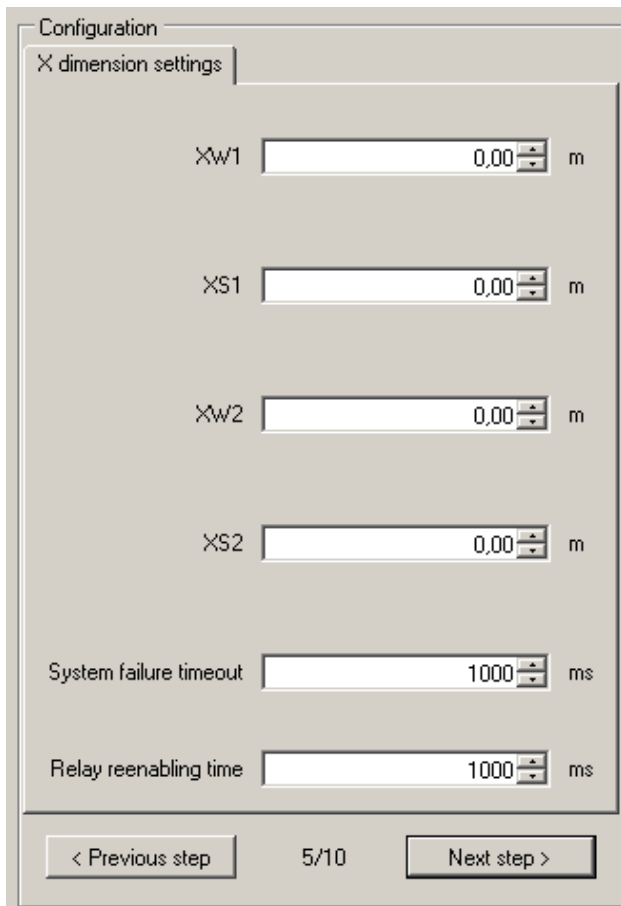
i Note

For Slave units only antenna port 1 is used.

Figure 43 – Slave settings - Input fields of the 'Slave 1 settings' of LPR® system

Optional: Setting the X and Y dimensions for warning and stop areas

For LPR® units with optional relays you can set the distances for warning and stop areas in this menu.



Configuration
X dimension settings

XW1 m

XS1 m

XW2 m

XS2 m

System failure timeout ms

Relay reenabling time ms

< Previous step 5/10 Next step >

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

i Note

Depending on your selected application also Y dimensions have to be set within the next menu 'Y dimensions setting' after selecting 'Next step'.

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

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

Figure 44 –Input fields of the 'X dimension settings' for warn and stop areas

Optional: Usage of Relays

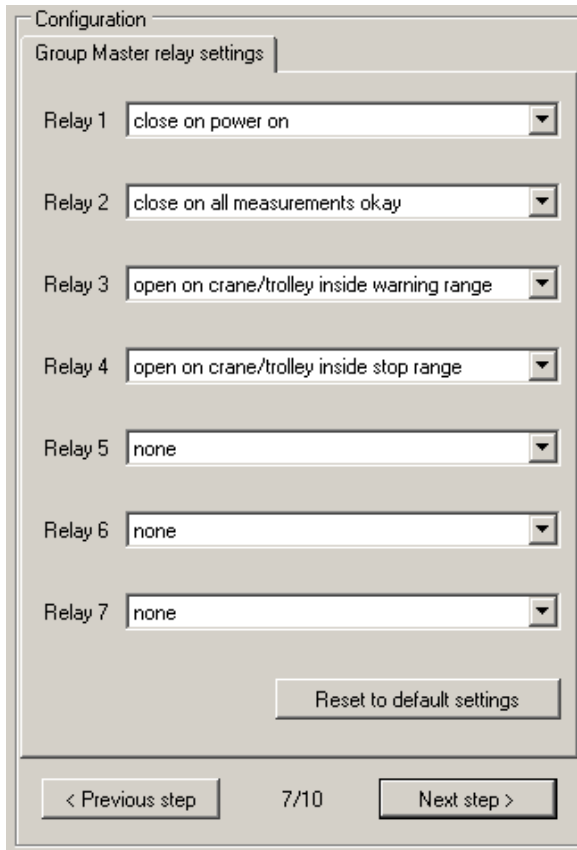


Figure 45 – Allocation of relays

If relays are used at one or more LPR[®] unit you can allocate functionalities to each of the seven relays in the LPR[®] unit. Each LPR[®] unit in one system can have a different assignment of relays.

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

i Note

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

Save Project

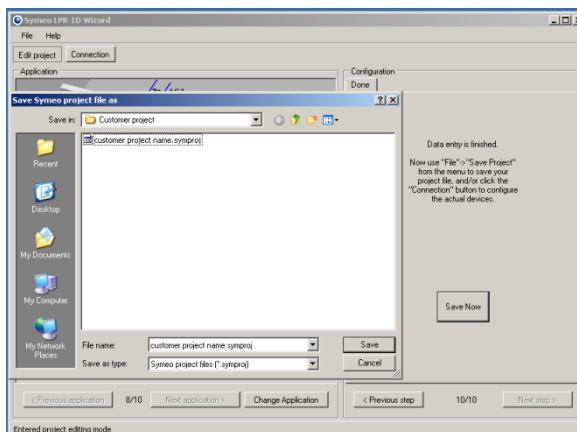


Figure 46 – Save project

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

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

i Note

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

Connection to LPR® Unit

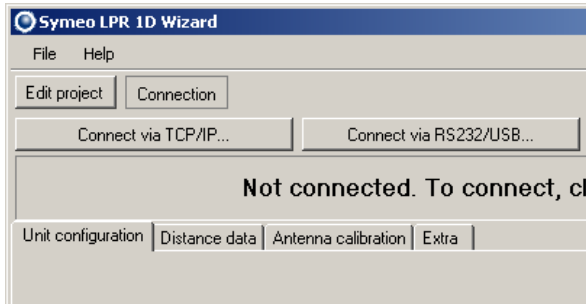


Figure 47 – Connection to LPR® unit

Having established a connection to the LPR® unit as described in chapter 5.2 and 5.3 the connection can be opened by pushing the 'Connection' button.

i Note

If you are connected to the LPR® unit with TCP/IP interface, push 'Connect via TCP/IP'. For serial connection push 'Connect via RS232/USB'.

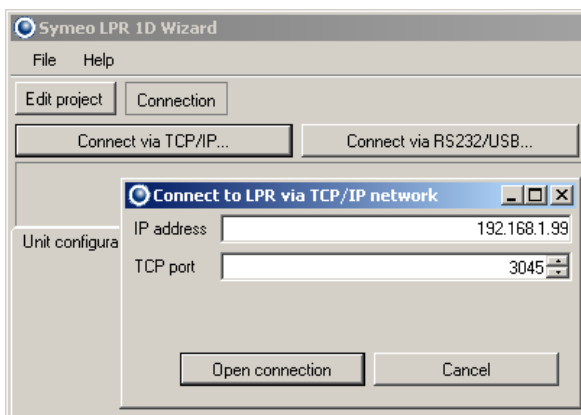


Figure 48 – TCP/IP connection to LPR® unit

Connect via TCP/IP:

To open the TCP/IP connection you have to enter the IP-address and the port number. The service port is 3045 per default. The IP address is 192.168.1.99. IP address and TCP port can be changed in the web interface of the LPR® unit (see chapter 6).

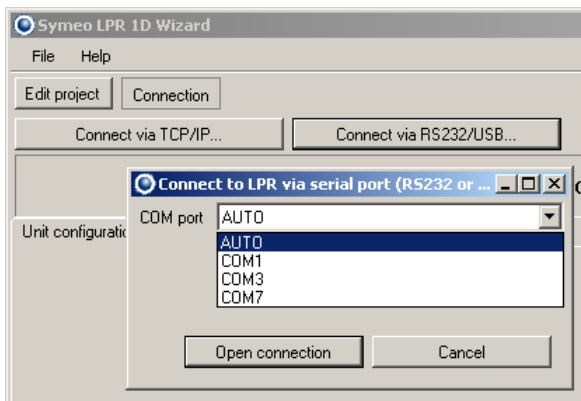


Figure 49 –RS232/USB connection to LPR® unit

Connect via RS232/USB:

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

i Note

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

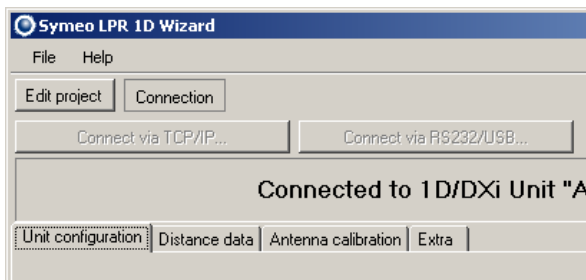


Figure 50 –Submenus if connection is established

Once the connection is established, the following submenus appear:

Unit configuration:

Configure the connected unit as Group Master, Slave 1 or Slave 2.

Distance Data:

View the measured distance(s)

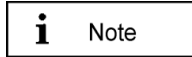
Antenna calibration:

Calibrate the real measured distance

Commissioning

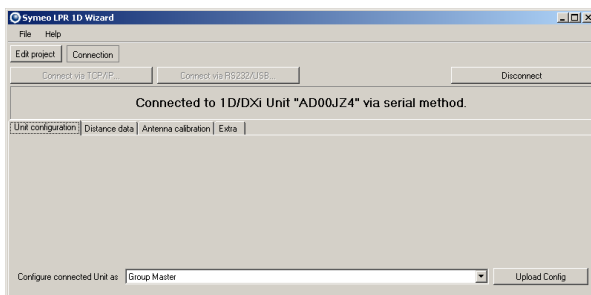
Extra:

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



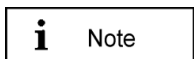
The Extra menu is only required for service issues. Please contact Symeo service for further instructions.

Unit configuration:



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

Figure 51 – Unit configuration



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

Display of Distance Data

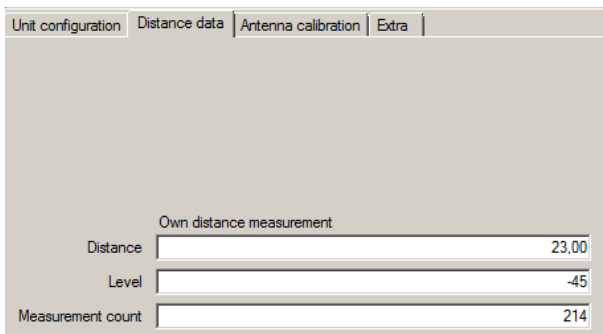


Figure 52 – Display of Distance Data

Click the button ,Distance Data’. The following information is shown about the distance between Group Master and Slave1 (and optional between Group Master and Slave2):

Distance

The measured distance in meters.

Level

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

Measurement count

The number of performed measurements

Checkbox ,Distance filtering’

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

Antenna Calibration

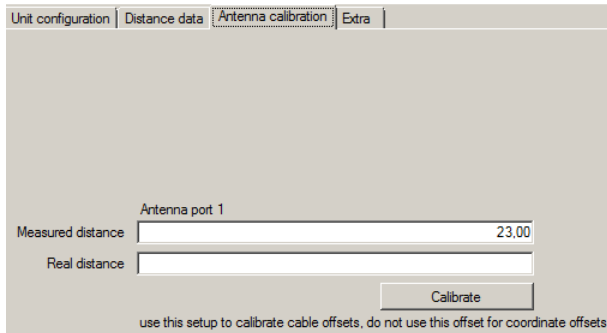


Figure 53 – Antenna calibration

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

⇒ Push ,Antenna calibration‘.

i Note

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

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

⇒ Push ,Calibrate‘.

The ,Antenna port 1‘ area relates to the distance between Group master and Slave unit 1. If you have a system with three LPR® units with a second distance measurement then you enter the real distance value in ,Antenna port 2‘.

! Warning

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

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

i Note

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

Download Configuration

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

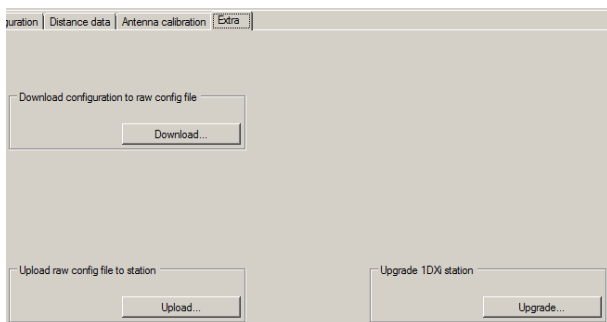


Figure 54 – Download configuration

⇒ Push ,Extra‘.

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

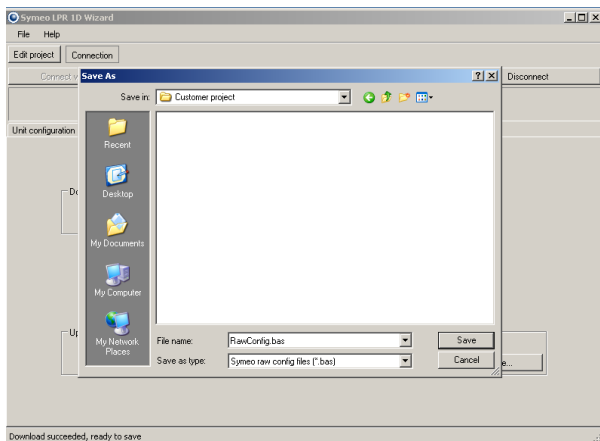


Figure 55 –Enter file name

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

i Note

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

Upload Configuration

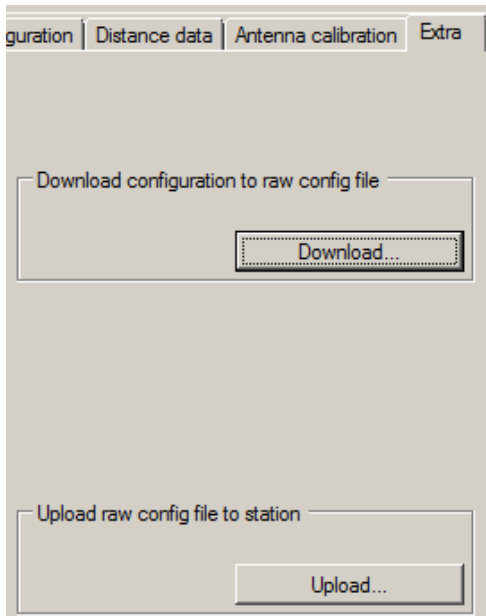
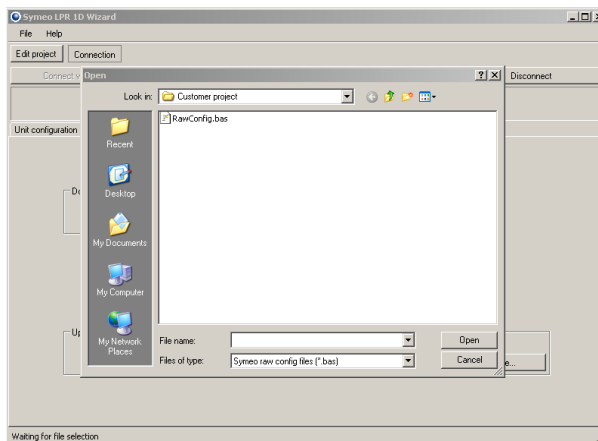


Figure 56 –Upload raw configuration file

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



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

i Note

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

Figure 57 –Upload raw configuration file

Upgrade 1DXi Firmware

This function is only applicable for LPR-1DXi units, please see “*LPR-1DXi product documentation*”.

6 Web Server

The network settings for a LPR[®] unit 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[®] unit.

6.1 Open Web Server

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

i Note

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

i Note

You can establish a connection with your LPR[®] units Web server either via HTTP or HTTPS if the unit 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).

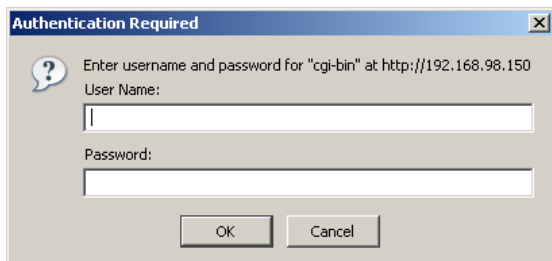


A connection is established with your LPR[®] unit.

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[®] unit'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.

i Note

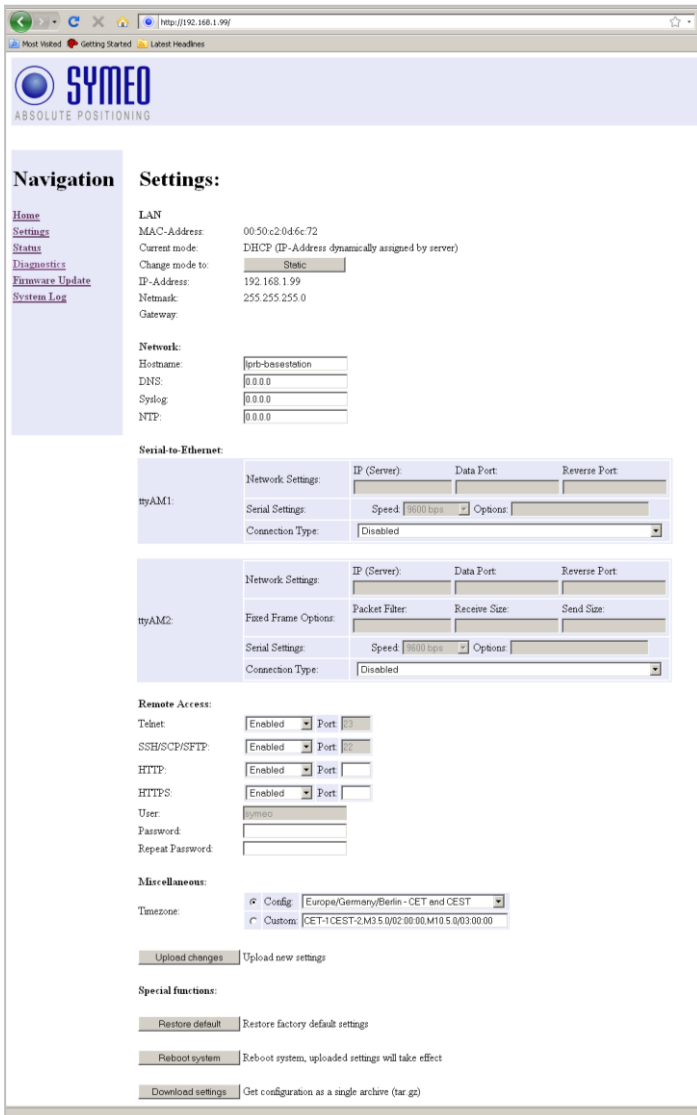
In order to protect your system from being reconfigured by unauthorized persons, you should change this to a company password that is only provided for authorized personnel.

6.2 Settings

With this function you can define the network settings on your LPR® unit 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® unit's Web server is displayed.



The screenshot shows the SYMEO web interface with the following sections:

- Navigation:** Home, Settings, Status, Diagnostics, Firmware Update, System Log.
- Settings:**
 - LAN:** MAC-Address: 00:50:c2:04:6c:72; Current mode: DHCP (IP-Address dynamically assigned by server); Change mode to: Static; IP-Address: 192.168.1.99; Netmask: 255.255.255.0; Gateway: (empty).
 - Network:** Hostname: lprb-besestation; DNS: 0.0.0.0; Syslog: 0.0.0.0; NTP: 0.0.0.0.
 - Serial-to-Ethernet:**
 - ttyAM1:** Network Settings: IP (Server), Data Port, Reverse Port; Serial Settings: Speed 9600 bps, Options; Connection Type: Disabled.
 - ttyAM2:** Network Settings: IP (Server), Data Port, Reverse Port; Fixed Frame Options: Packet Filter, Receive Size, Send Size; Serial Settings: Speed 9600 bps, Options; Connection Type: Disabled.
 - Remote Access:** Telnet: Enabled, Port; SSH/SCP/SFTP: Enabled, Port; HTTP: Enabled, Port; HTTPS: Enabled, Port; User: symeo; Password; Repeat Password.
 - Miscellaneous:** Timezone: Config (Europe/Germany/Berlin - CET and CEST), Custom (CET-1-CEST-2-M3.5.0/02:00:00.M10.5.0/03:00:00).
 - Special functions:** Upload changes (Upload new settings); Restore default (Restore factory default settings); Reboot system (Reboot system, uploaded settings will take effect); Download settings (Get configuration as a single archive (tar.gz)).

The following menu is displayed:

LAN:

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

Network:

Network settings (see chapter 6.2.2)

Serial-to-Ethernet:

Settings of service 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® unit press button „Upload changes“. Afterwards press button “Reboot System“ to reboot the LPR® unit with the new settings.

6.2.1 „LAN“ area

MAC-Address	Unique hardware address of the LPR [®] unit on the LAN (Ethernet ID) (not editable)
Current Mode	<p><u>Shows the current mode:</u> "Static IP-Address" or "DHCP Active".</p> <p>In "DHCP Active" mode, the LPR[®] unit receives a dynamic or reserved IP address from the DHCP server. You can also ask your administrator or the SYMEO technical department about this.</p> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <p>i Note</p> </div> <p>If the LPR[®] unit 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.</p>
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	<p>IP address of the LPR[®] unit</p> <p>Per default the IP-address is set to the static IP-address 192.168.1.99.</p> <p>In "DHCP Active" mode, this address is assigned by the server and cannot be edited.</p> <p>In "Static IP-Address" mode you can assign a fixed (static) address here.</p>
Netmask	<p>Net mask of the LPR[®] unit (default: 255.255.255.0)</p> <p>In "DHCP Active" mode, the net mask is assigned by the server and cannot be edited.</p>
Gateway	<p>IP address of the standard gateway (default: 192.168.98.254)</p> <p>Other LAN segments can be reached with the standard gateway.</p> <p>In "DHCP Active" mode this address is assigned by the server and cannot be edited.</p>

6.2.2 „Network“ Area

Hostname	<p><u>Hostname of the system</u> (default: "lprb-basestation").</p> <p>In "DHCP Active" mode, this hostname is also communicated to the DHCP/DNS server.</p> <p>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.</p>
DNS	<p>IP address of the DNS server:</p> <p>The DNS server is able to translate hostnames into IP addresses.</p> <p>In "DHCP Active" mode this address is assigned by the server and cannot</p>

	be edited.
Syslog	<p><u>IP address of the Syslog server</u> (default: 0.0.0.0, i.e. this service has been disabled).</p> <p>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.</p>
NTP	<p><u>IP address of the NTP server</u> (default: 0.0.0.0, i.e. this service has been disabled).</p> <p>The NTP server is a server on the network from which the system can request the current time.</p>

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 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 data port. (default: 3046)

i Note

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

ttyAM1 / Service 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 service 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 service 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 <i>raw –echo –ixon</i> (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	The LPR [®] unit is waiting for incoming connection on the

Port	"Data Port". If the connection is opened successful you can open the service port.
TCP – Connection to Data Port using Reserve Port	The LPR [®] unit 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 service port.

ttyAM2 / Data 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 data 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-applicaion a frame size of 21 Byte is sufficient. A smaller telegram is filled with 0x00 by the LPR [®] unit.

Connection Type Area:

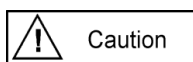
Disabled	The port is „Disabled“ and not be reachable via TCP/IP.
TCP – Variable Frame – Listening on Data Port	The LPR [®] unit is waiting for incoming connection on the "Data Port". If the connection is opened successful you can open the data port. „Variable Frame“ means activated „Byte Stuffing“ (no fixed protocol length).
TCP – Variable Frame – Connecting to Data Port	The LPR [®] unit 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 data port. „Variable Frame“ means activated „Byte Stuffing“ (no fixed protocol length).
TCP – Fixed Frame –	The LPR [®] unit is waiting for incoming connection on the "Data Port". If the connection is opened successful you can

Listening on Data Port	open the data port. „Fixed Frame“ means deactivated „Byte Stuffing“ (fixed protocol length).
TCP – Fixed Frame – Connecting to Data Port	The LPR® unit 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 data port. „ Fixed Frame“ means deactivated „Byte Stuffing“ (fixed protocol length).
UDP – Fixed Frame – Sending to Data Port	The LPR® unit 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® unit'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® unit'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 Password	Enter the new password again here if you want to change the 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 repairable. 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

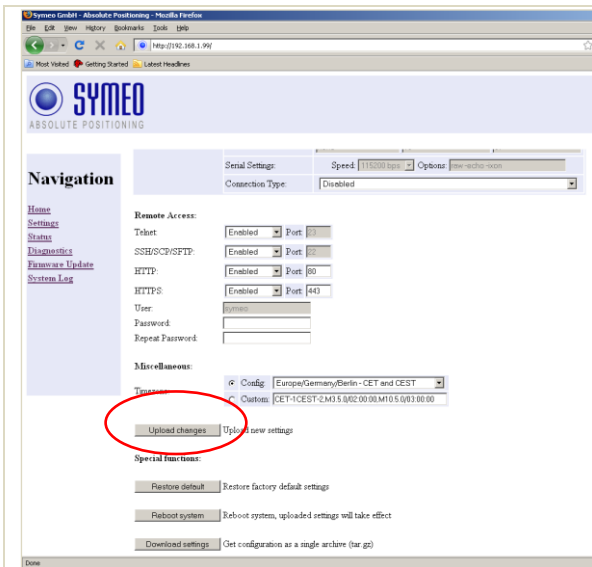
Timezone	If a NTP-server is available and the IP-address of the NTP-server is entered you can choose the time zone of the LPR® unit. It is also possible to enter the time zone manually.
----------	--

6.2.6 „Special Functions“ Area

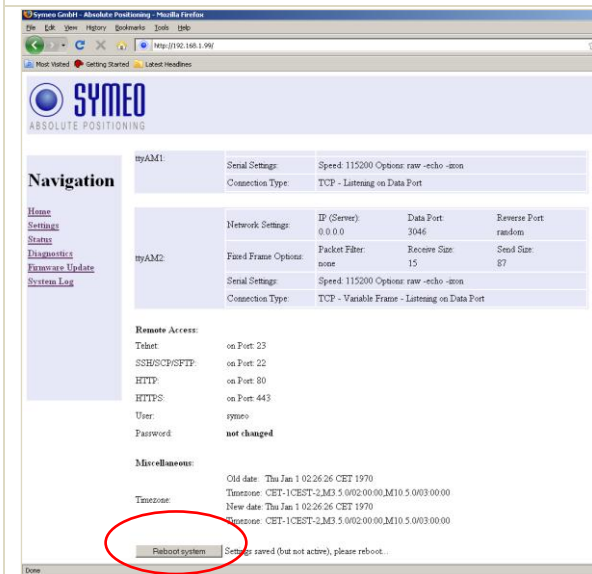
Restore default	<p>Click this button to restore the settings made by the manufacturer.</p> <p>⇒ Click the "Execute" button (Restore factory default settings) in the "Special functions" area to cancel all changed settings and restore the factory settings.</p> <p>The settings made by manufacturer are activated first after a reboot of the LPR® unit. This means that changes of the settings (i.e. IP-address) are possible.</p> <div data-bbox="395 1133 587 1191" data-label="Image">  <p>Caution</p> </div> <p>The settings affected will be deleted and populated directly with the factory settings.</p> <div data-bbox="395 1245 587 1303" data-label="Image">  <p>Note</p> </div> <p>When the factory settings have been restored, it may be necessary to proceed as if commissioning the system again.</p>
Reboot system	<p>To accept the settings the LPR® unit must be rebooted. Click this button to reboot the system.</p> <div data-bbox="395 1476 587 1534" data-label="Image">  <p>Note</p> </div> <p>Before you reboot the system the settings must be loaded to the LPR® unit by pressing button "Upload changes".</p>
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® unit and afterwards reboot the unit.



⇒ Press button „Upload changes“ to load the changes.



⇒ Scroll down to the end of the page and press „Reboot System“ to reboot the LPR® unit.

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").

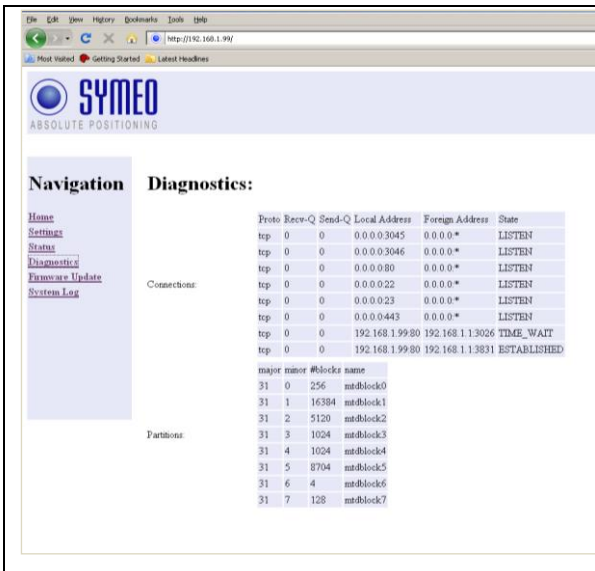
The Status page for the LPR® unit's Web server is displayed.

The fields have the following meanings:

Uptime	01:27:47 – Current system time up 20 min – Time since the last system start 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) 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). Silicon Revision: Version of the processor used

0x0 Rev. A
0x1 Rev. B
0x2 Rev. C
0x3 Rev. D0
0x4 Rev. D1
0x5 Rev. E0
0x6 Rev. E1
0x7 Rev. E2

6.4 Diagnostics



Connections: State of the active and inactive connection to the LPR® unit

Partitions: Size and name of available partition of non-volatile memory.

i Note

The size of receive buffer (Recv-Q) and send buffer (Send-Q) should be zero if possible. A long lasting value greater 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® unit

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

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

Foreign Address: IP-address of opposite unit

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[®] unit

Send-Q: Number of buffered Bytes, which the LPR[®] unit should send

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

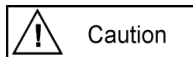
Foreign Address: IP-address of opposite unit (192.168.1.1) with port (1333)

State: Status of connection

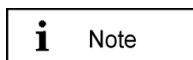
6.5 Update Firmware

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.



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.

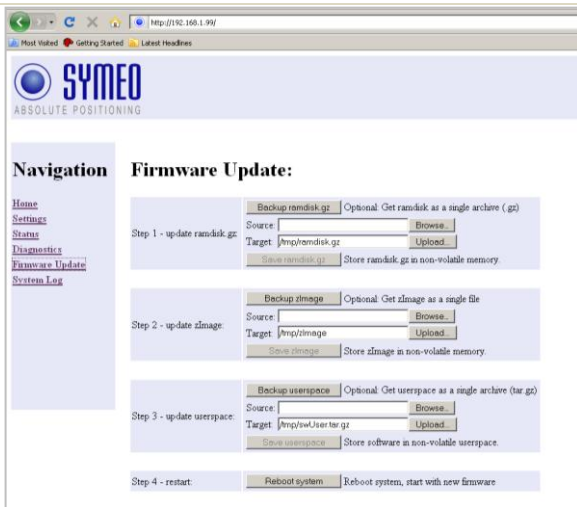


For FCC/IC authorization: Only firmware delivered for the U.S./ Candian market is allowed to install. Other firmware may violate the FCC/IC authorization.

⇒ 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[®] unit's Web server is displayed.



The page Firmware Update of the Web-Servers of the LPR® unit 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

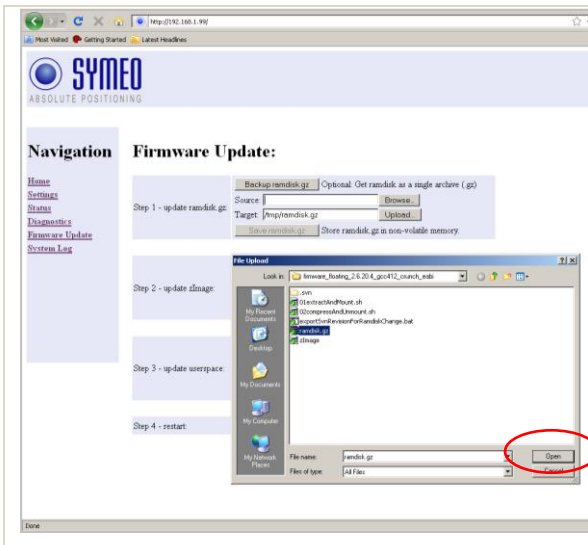
i Note

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

6.5.1 Step 1 – File system

i Note

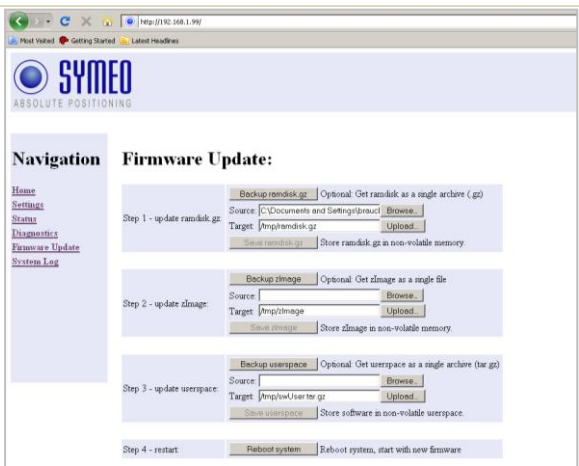
It is possible to make a copy of the actual firmware by downloading the firmware from the LPR® unit. Click the button „Backup ramdisk.gz“.



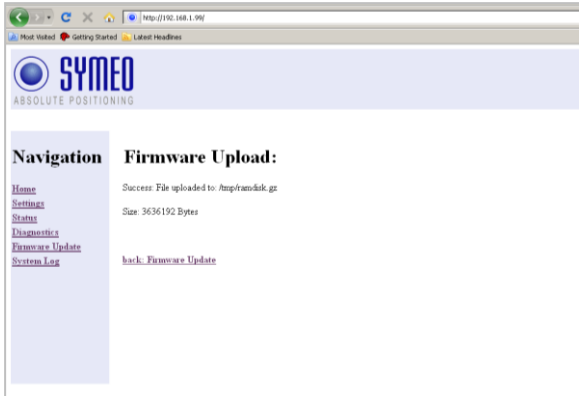
⇒ Click the "Browse" button in the "Step 1 – flash ramdisk.gz" area.

A file browser window will open.

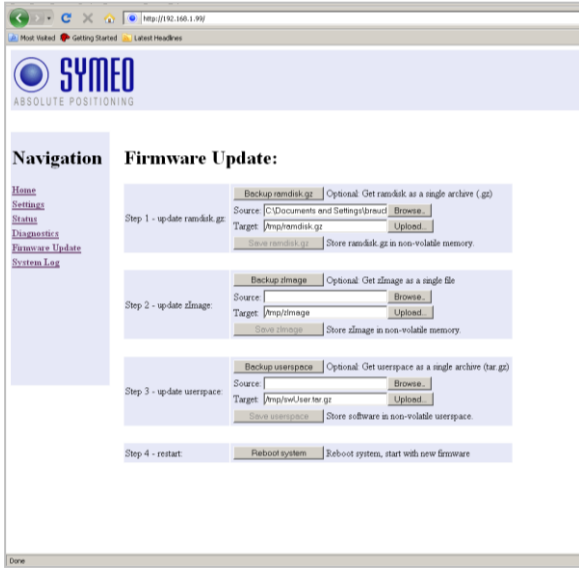
⇒ Navigate to the file you want and click "Open".



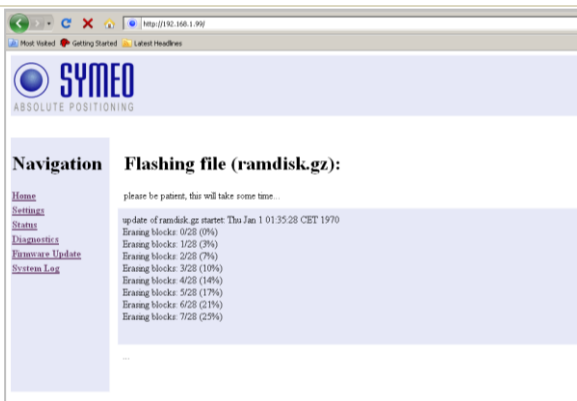
⇒ Click the "Upload" button in the "Step 1 – flash ramdisk.gz" area.



The file has been transferred.
⇒ 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

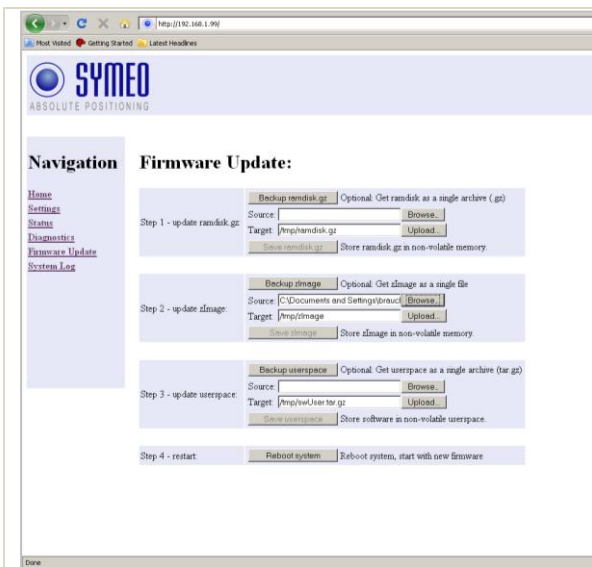
It is possible to make a copy of the actual firmware by downloading the firmware from the LPR[®] unit. Click the button „Backup zImage“.



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

A file browser window will open.

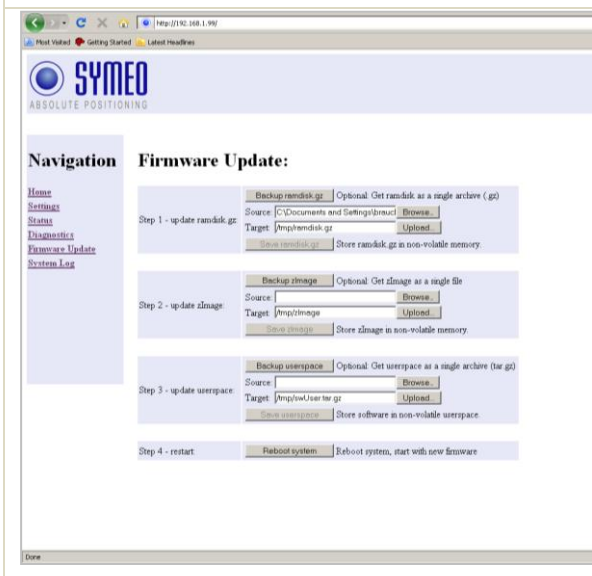
⇒ Navigate to the file you want and click "Open".



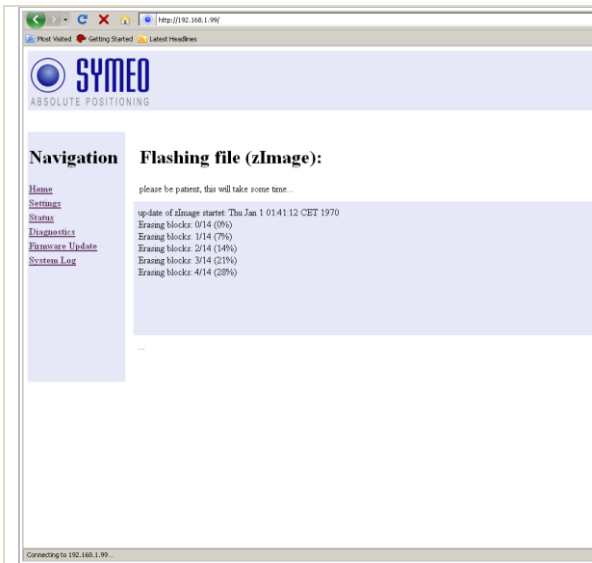
⇒ Click the "Upload" button in the "Step 2 – flash zImage" area.



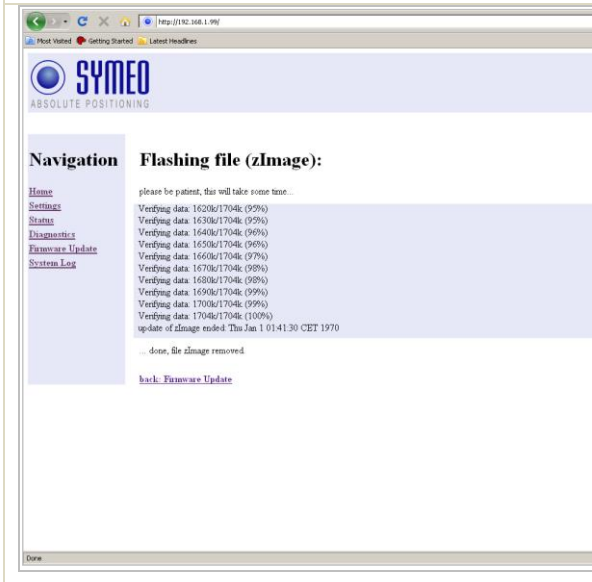
⇒ The file has been transferred.
⇒ Click the "back: Firmware Update" link.



⇒ 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

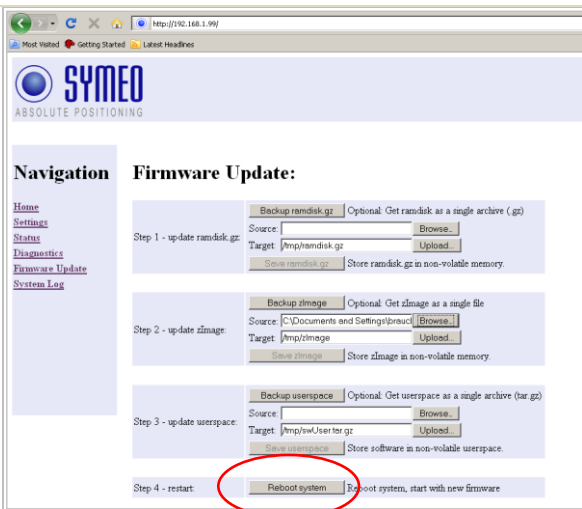
⇒ Click the "back: Firmware Update" link.

6.5.3 Step 3 – Optional: Userspace

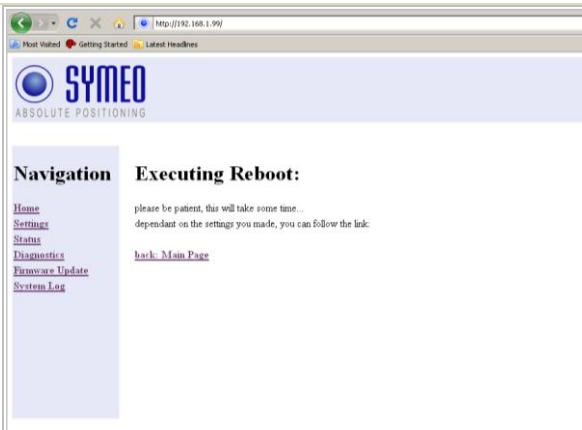
This step is exclusively for 2D-applications necessary and is executed the same way as described before.

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.



i 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 set to the default value 192.168.1.99.

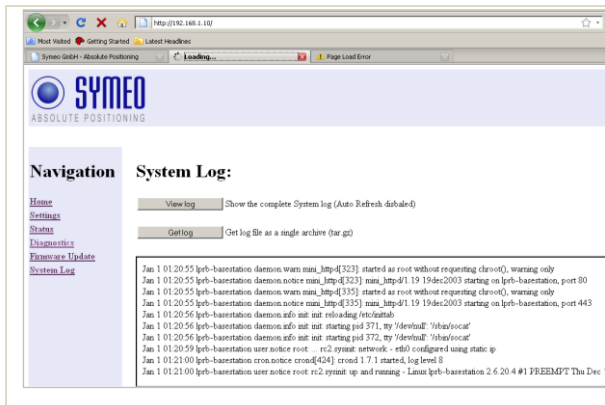
SyMEMO recommends restoring the factory settings after a firmware update and reenter the customer settings.

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.

i 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[®] 1D unit 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 baud rate 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[®] 1D unit after the LPR[®] 1D unit 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 [®] 1D	to LPR [®] 1D
0x00 Distance Data	+	
0x01 User Data	+	+
0x02 Send Request	+	
0x03 Relay Switching Command		+

Tab. 1: direction of data

Sending data to the LPR[®] 1D unit is only possible after receiving a send request (Type 0x02). The send request type guarantees the “ready-to-receive” status of the LPR[®] 1D unit. The LPR[®] 1D can only handle one data packet from one user.

If nevertheless data is sent to the LPR[®] 1D unit without a previous send request, it can result in a reboot of the LPR[®] 1D unit.

Per one send request the user can send only one data set to the LPR[®] 1D unit.

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 58 shows the general structure of the data packet.



Figure 58: Structure of data packet

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

All multi byte integers (e.g. CRC field) are encoded in Network-Byte-Order (Big Endian). 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 checksum 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[®] 1D 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[®] 1D → 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[®] 1D Slave Unit, this means, the Slave Unit measures its distance etc. towards a Group Master Unit. The source field always contains the address of the LPR[®] 1D Slave Unit. The destination field contains the address of the measured Group Master Unit. Even if the data set is transferred further on to another unit (e.g. another Group Master Unit), the value of the source and destination field is maintained.

²⁾ The field antenna contains the antenna number of the Slave Unit as well as the antenna number of the measured Group Master Unit. The 4 lower bits represent the antenna number of the Slave Unit (values 1...4) and the higher ones the antenna number of the Group Master Unit (values 1...4).

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

Example of Distance Data

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

Figure 59 - 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 10 03 08 02 11 00 00 10 62 00 00 00 7A E6 00 00 AF C4 7F

- 7E_{hex} START byte
- 00_{hex} TYPE (00: Distance Data)
- 10 03_{hex} = 00010|0000000001|1_{bin} Source LPR[®] 1D address: SID: 2; GID: 1; BBT: 1 (Slave Unit)
- 08 02_{hex} = 00001|0000000001|0_{bin} Destination LPR[®] 1D address: SID: 1; GID: 1; BBT: 0 (Group Master Unit)
- 11_{hex} = 0001|0001_{bin} Antenna port Slave Unit: 1 antenna port Group Master Unit: 1
- 00 00 10 62_{hex} = 4194_{dec} Distance: 4194 mm
- 00 00 00 7A_{hex} = 122_{dec} Velocity: 122 mm/s
- E6_{hex} = 230_{dec} Level: 230 – 256 = -26 dB
- 00_{hex} Error status: 0 means no error; unequal 0 means error (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[®] 1D unit via the serial interface and then transmitted to another LPR[®] 1D unit via the frequency channel. There the user data can be readout.

Direction: LPR[®] 1D → User

Content	Length	Data type	Value
START	1	unsigned integer	0x7E
TYPE	1	unsigned integer	0x01
Source (LPR [®] 1D 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® 1D → 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® 1D unit continuously. It informs the user that the LPR® 1D unit 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® 1D

Content	Length	Data type	Value
START	1	unsigned integer	0x7E
TYPE	1	unsigned integer	0x03
Destination (LPR® 1D address)	2	see chapter 7.4.1	0x####
Relay Selection (Bitmask) (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® 1D units and thus no reception on the destination unit is guaranteed. In case of faulty data frame (e.g. invalid relays chosen or unknown destination address) the LPR® 1D unit will print an error message.

7.3 TCP/IP option: Fixed Frame Protocol

If the LPR® unit 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® unit 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® unit 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® unit, 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.

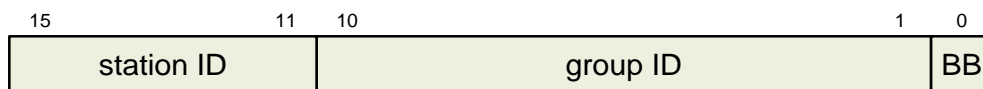
If data is sent to the LPR[®] unit the data has to be packed in a fixed data length (i.e. 15 bytes as for TCP fixed frame option). This data packet is sent as UDP packet to the LPR[®] unit. The port number of the receiver is the same as for the PC.

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

7.4 Remarks

7.4.1 LPR[®] 1D Address

LPR[®] 1D unit addresses are completely defined by a 16 bit value:



BB – Slave Unit Bit: Indicates, if the LPR[®] 1D unit is defined as a Slave Unit or as a Group Master Unit (1=Slave Unit, 0=Group Master Unit)

group ID: group ID of the unit (1..1022)

station ID: station ID of the unit (0..30)

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	Slave Unit	No measurement signal
0x02	peak too low	Slave Unit	Measurement signal is imprecise
0x03	nothing received	Group Master Unit	No measurement data received
0x04	implausible speed	Slave Unit	Velocity is to high
0x05	measurement botched	Slave Unit	Measurement is not feasible.
0x06	no occupying received	Group Master Unit	Measurement channel is not reserved
0x07	no results received	Group Master Unit	No measurement data received
0x08	trigger	Group Master Unit	Unit did not attend the measurement

8 Protocol Description for PROFIBUS Interface

8.1 Profibus data structure

The total length of one data set is 48 bytes. The first 24 bytes presents the data for the slave unit 1 with station ID 2, the second 24 bytes presents the data for the slave unit 2 with station ID 3.

Content	Length	Value	Content	Station ID
Distance [mm]	4	0x#####	signed integer	2
Velocity [mm/s] ³⁾	4	0x#####	signed integer	2
Level [dB]	1	0x##	signed integer	2
Error (siehe Kapitel 8.2)	1	0x##	unsigned integer	2
Status	1	0x00	unsigned integer	2
not used	1	0x##	unsigned integer	2
Update counter distance ¹⁾	2	0x#####	unsigned integer	2
Update counter user data ²⁾	2	0x#####	unsigned integer	2
User data	8			2
Distance [mm]	4	0x#####	signed integer	3
Velocity [mm/s] ³⁾	4	0x#####	signed integer	3
Level [dB]	1	0x##	signed integer	3
Error (siehe Kapitel 8.2)	1	0x##	unsigned integer	3
Status	1	0x00	unsigned integer	3
not used	1	0x##	unsigned integer	3
Update counter distance ¹⁾	2	0x#####	unsigned integer	3
Update counter user data ²⁾	2	0x#####	unsigned integer	3
User data	8			3

¹⁾ This counter is incremented when the Profibus-interface receives new data from the LPR[®]-1D unit. In error-free operation this value is not steady.

²⁾ This counter is incremented when the Profibus-interface receives new user data from the LPR[®]-1D unit.

³⁾ The values for velocity are raw data. Velocity data are not smoothed and should only be used with following filtering.

8.2 Error messages

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

Content	Source	Description	Value
no error		Measurement valid	0x00
no peak detected	Slave unit	No Measurement signal	0x01
peak too low	Slave unit	Measurement signal is imprecise	0x02
implausible speed	Slave unit	Velocity is to high	0x04
measurement botched	Slave unit	Measurement is not feasible	0x05
no valid data	Profibus-Interface	Profibus-Interface receives no data from LPR-1DHP unit	0xff

9 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.

9.1 Programs

9.1.1 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.

9.1.2 Command Window (only for LPR unit with TCP/IP interface)

The easiest way to check a connection between a LPR unit 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.

9.1.3 Telnet (only for LPR unit with TCP/IP interface)

A short way to check the functionality of the LPR unit 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 service port of the LPR unit with IP-address 192.168.1.99 and the port 3045.

9.1.4 Browser (only for LPR unit with TCP/IP interface)

A web browser is necessary to make all settings of the LPR unit with TCP/IP interface. You can make network settings as well as settings for the protocol.

9.1.5 Network Scanner (only for LPR unit with TCP/IP interface)

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

9.2 Hardware

The following additional hardware is useful:

- Serial Cable (1:1) less than 2 meters (for a LPR unit without TCP/IP interface)
- LAN-cable (for a LPR unit with TCP/IP interface)
- USB -RS232 converter (if there is no RS232 serial port available at your computer)

9.3 Connection to LPR units with RS232 or Profibus interface

If you have a station without TCP/IP interface connect your PC via the RS232 interface to the LPR 1D unit. For this connection you need a RS232 cable (1:1) which should be less than 2 meters long. A longer cable cannot guarantee a trouble-free transmission of data between the LPR unit and the PC.

For configuration of the LPR-1D unit the service port (C4) or (C5) is provided (RS232).

For connecting to the D-sub socket (C4) please use a standard RS232 cable (1:1) with a maximum length of 2 meters.

Optional the RS232 connection can be established via the terminal block (C5). The pin assignment is shown in Figure 60.

The configuration of the LPR-1D unit is described in chapter 5 Commissioning.

The data port with binary protocol output for units without TCP/IP interface is available on D-sub socket (C8) please use a standard RS232 cable (1:1) with a maximum length of 2 meters or optional the RS232 connection can be established via the terminal block (C7). The pin assignment is shown in Figure 60.

i Note

If you want to use a longer serial cable for the data port you have to reduce the baud rate of the LPR unit, as described in chapter 5.

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

Max. baud rate	Max. Length of RS232 cable
19.200	15 m
57.600	5 m
115.200	<2 m

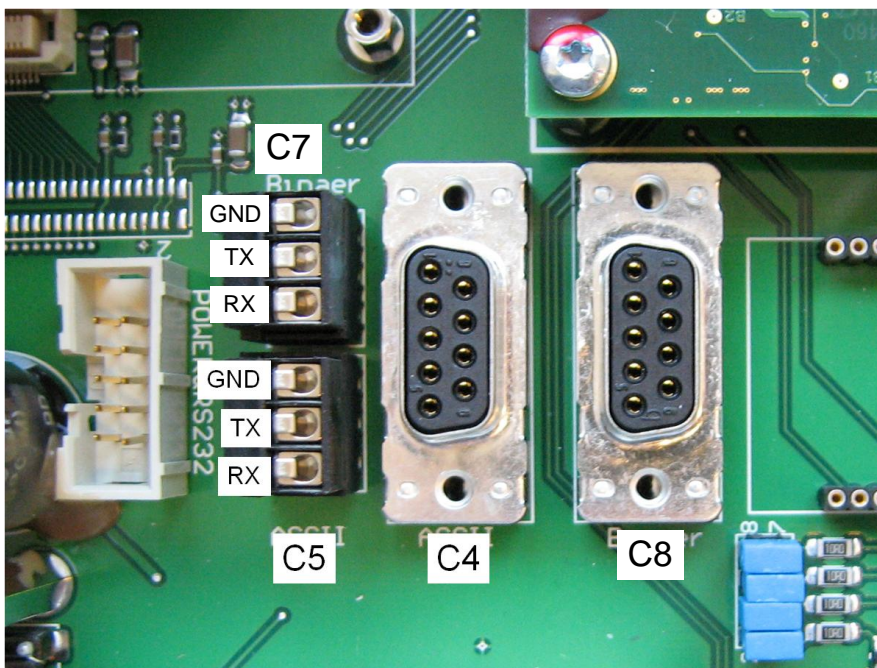


Figure 60 Internal serial service port C4/C5 and data port C8/C7 (RS232)

! Warning

Using the internal serial interface it is important to avoid moisture, dust or any particles into the housing during the process.

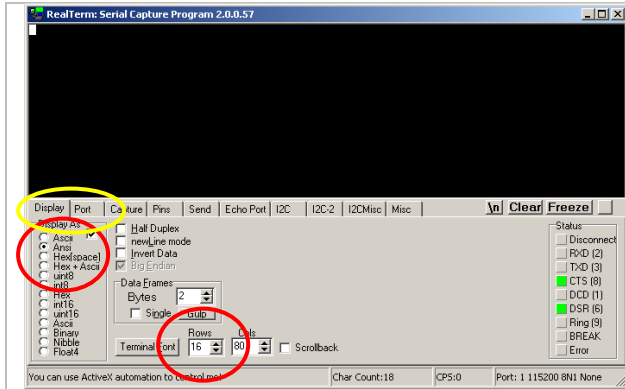
i Note

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

9.3.1 RealTerm (for service port)

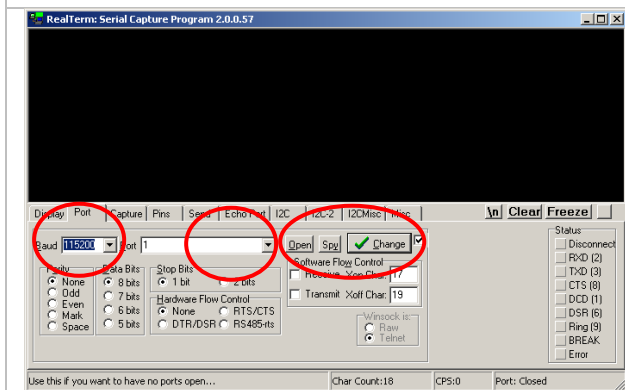
With a terminal program like RealTerm you can perform more detailed analyzing of the system. Restart the LPR-1D unit before using a terminal program (power off-on)

Open now the program RealTerm.

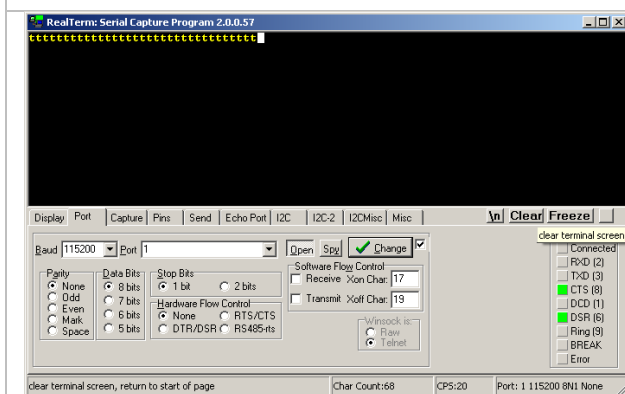


In two tabs you have to change the settings:

- 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 Group Master unit or a Slave unit characters appear in the window.

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

If you are connected to a Slave unit only “m” characters are shown for a working system. In case of a failure nothing is shown when connected to a Slave unit.

9.4 Connection to the LPR unit with TCP/IP interface

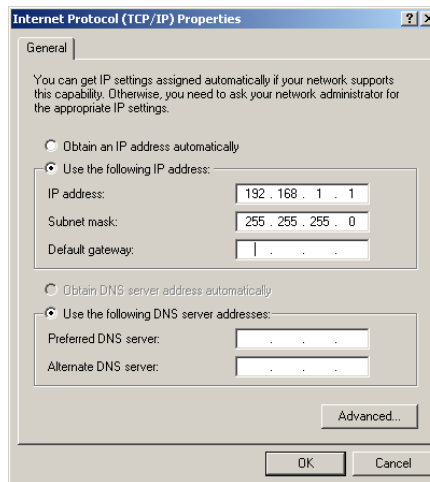
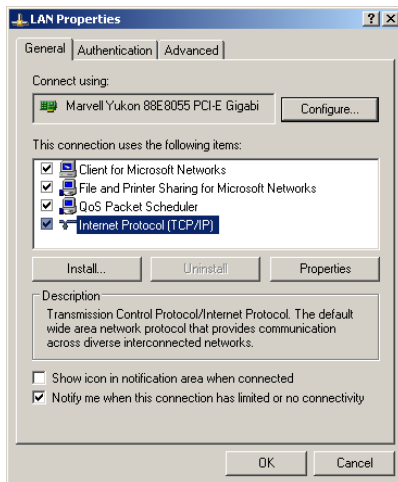
If you have a station with TCP/IP interface you only can connect your PC via the TCP/IP interface to the LPR unit. For the connection you need an Ethernet cable.

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 unit.

9.4.1 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 unit via an Ethernet cable with your PC. If you are not in the same net as the LPR unit you have to change temporary the network settings of your PC. Both IP-addresses 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".

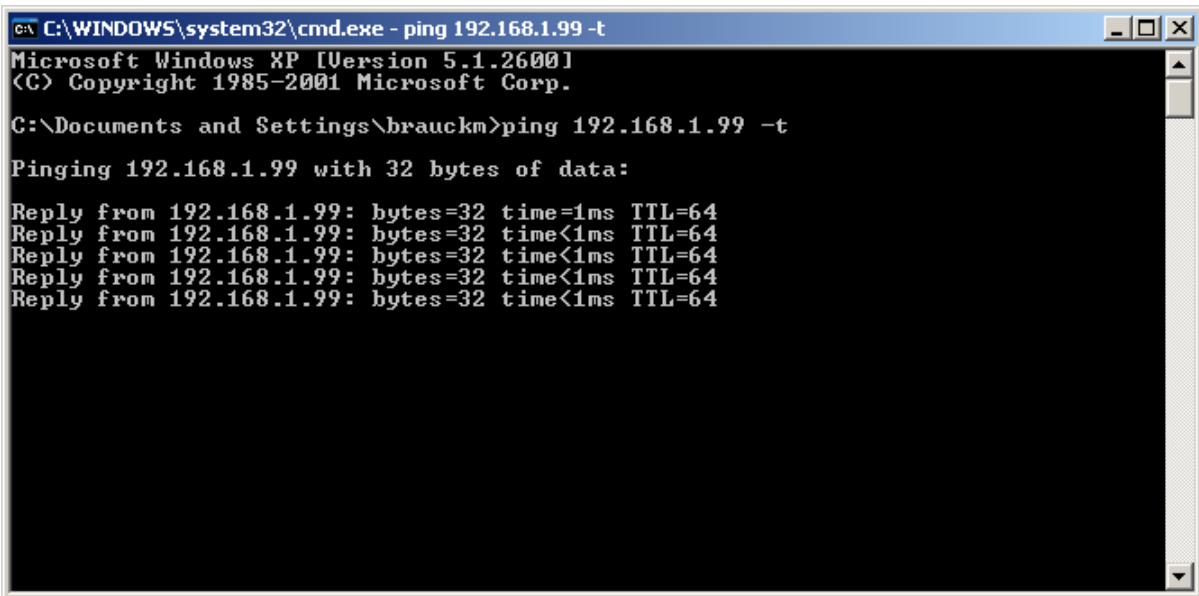
i Note

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

9.4.2 Check TCP/IP connection

The first way to check the IP-connection from your computer to the LPR unit is to "ping" the LPR unit. 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.



```

C:\WINDOWS\system32\cmd.exe - ping 192.168.1.99 -t
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\brauckm>ping 192.168.1.99 -t

Pinging 192.168.1.99 with 32 bytes of data:

Reply from 192.168.1.99: bytes=32 time=1ms TTL=64
Reply from 192.168.1.99: bytes=32 time<1ms TTL=64
Reply from 192.168.1.99: bytes=32 time<1ms TTL=64
Reply from 192.168.1.99: bytes=32 time<1ms TTL=64
Reply from 192.168.1.99: bytes=32 time<1ms TTL=64
  
```

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

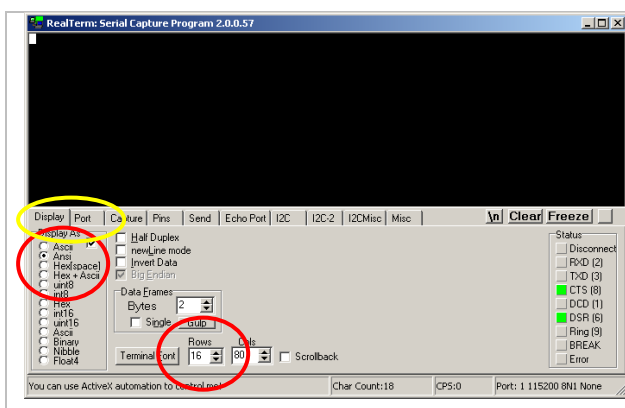
If the connection failed probably your firewall settings of your PC are set to restrictive or the IP-address of the LPR unit is probably not 192.168.1.99. Please check the settings. Compare also the hint in chapter 9.4.1.

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

9.4.3 RealTerm (for service port)

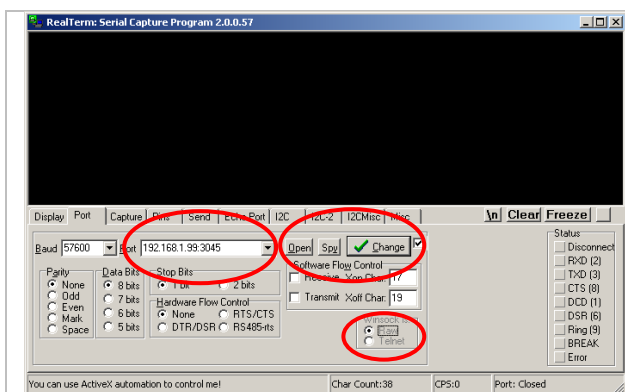
With a terminal program like RealTerm you can perform more detailed analyzing of the system. Restart the LPR-1D unit before using a terminal program (power off-on)

Open now the program RealTerm.

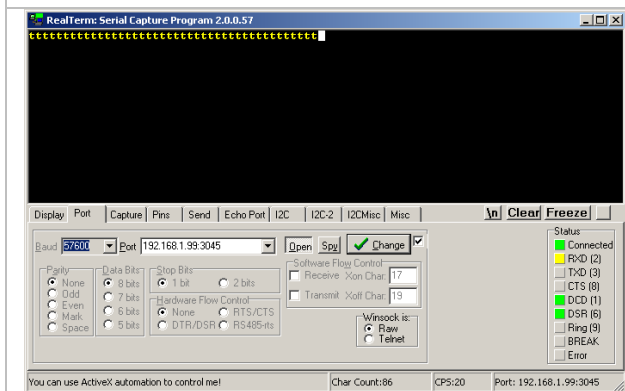


In two tabs you have to change the settings:

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



- Tab Port:
 - Enter the IP-address of the LPR unit and the port: IP-address:port
 - I.e.: 192.168.1.99:3045
 - Click on WinSock is RAW
 - Open the connection



Depending if you are connected to a Group Master unit or a Slave unit characters appear in the window.

If you are connected to a Group Master unit a lot of "t" characters appear in case of a failure. This happens because the Group Master unit 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.

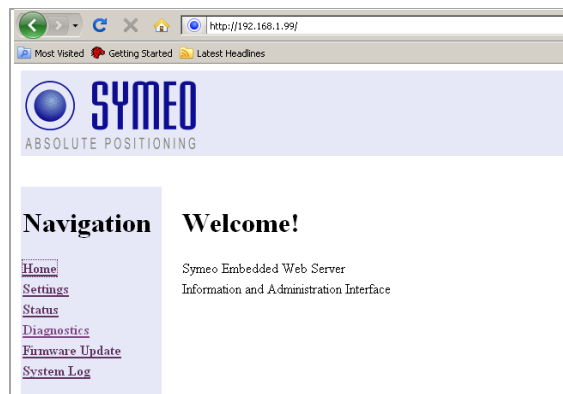
If you are connected to a Slave unit only "m" characters are shown for a working system. In case of a failure nothing is shown when connected to a Slave unit.

If you do not get access to the LPR unit check if the port is open. The port for the service port is 3045 per default. But it might be possible that you have changed it or did not open it (see chapter 9.4.4).

9.4.4 Web Interface

If you can "ping" the IP-address of the LPR unit but do not get data (either via the service port or the data port or both ports) you have to check the settings on the web page of the LPR unit.

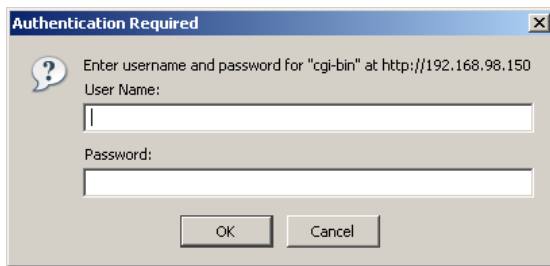
Open a web browser and enter the IP-address of the LPR unit (i.e. http://192.168.1.99).



You get access to the LPR unit. 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 unit.

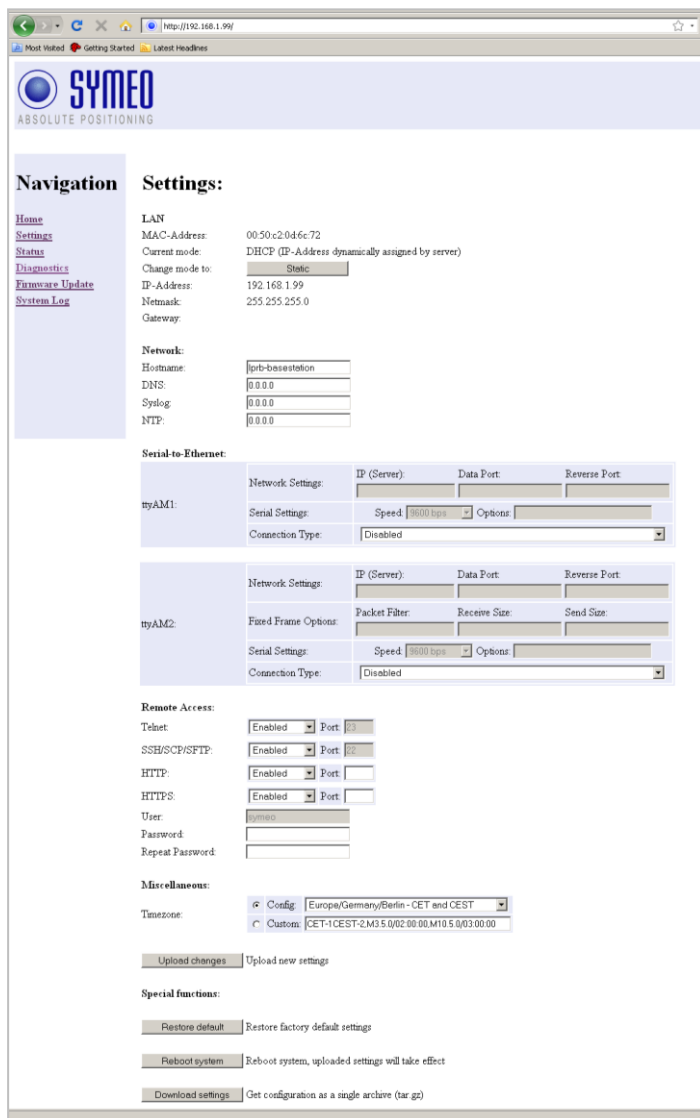
→ Click on Settings.



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 unit looks like the following.



Scroll down to the section:

Serial-to-Ethernet:

Here you enter the connection type for the service port (ttyAM1) and the data 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 service port and 3046 for the data 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 unit as described in chapter 9.4.3.

9.5 No Measurements

With the configuration tool *Symeo Wizard* you can check the functionality of your system when connected to the service port as described in chapter 5.

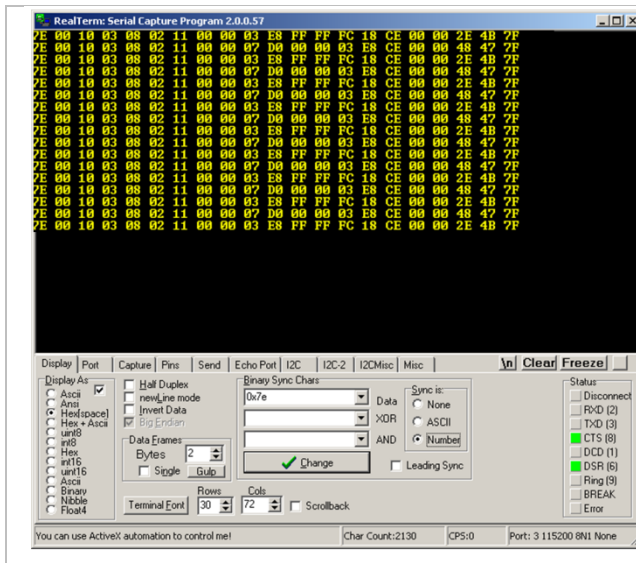
If this is working you also can check the data port output for LPR-1D units with TCP/IP or RS232 interface using RealTerm to display. For LPR-1D units with TCP/IP or RS232 interface the data port provides the binary protocol as described in chapter 7.

Check List:

- 1) The antennas are connected to the right port of the LPR 1D unit.

	Group Master unit	Slave unit 1	Slave unit 2
measurement 1	Antenna at Port 1	Antenna at Port 1	x
measurement 2 (optional)	Antenna at Port 2	x	Antenna at Port 1

- 2) 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.
- 3) For a distance measurement always two stations are involved. It has to be a Group Master unit and a Slave unit. Make sure that never two Slave units or two Group Master units are measuring with each other.
- 4) Units are powered with correct voltage and the LEDs on the front of the units lighting as described in chapter 3
- 5) Check if the rotary switch S2 is set correctly:
 position „0“: RS232
 position „3“: TCP/IP
 position „6“: Profibus
- 6) For LPR-1D units with TCP/IP interface all settings have been made in the WEB server according to chapter 6.2.
- 7) Units are properly configured with Symeo Wizard as described in chapter 5.
- 8) Distance data are displayed in Symeo Wizard, see chapter 5.4.2. If not try to overwrite the configuration with the program LPR 1D wizard for all stations again.
- 9) Check the data port is working. Open the program RealTerm. If connected to a LPR unit with TCP/IP interface open the data port 3046: Enter 192.168.1.99:3046. The display in RealTerm should be set to Hex[space] to “see” binary data. If you use a LPR unit with RS232 interface connect the serial cable to the data port C8, see Figure 60. An example of the binary protocol output at the data port is shown below.



Example for a binary protocol output at the data port

10 Appendix A: Agency certifications

i Note

For FCC versions only!

United States (FCC) and Canada (Industry Canada)

Radiofrequency radiation exposure Information:

This equipment complies with FCC/IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

i Note

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

i Note

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

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

i Note

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.

i Note

Installation:

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

Repairs:

Repairs to the device must be carried out by authorized technicians.

Unauthorized opening and incorrect repairs could result in severe danger to the user (danger of electric shock, radiated energy, fire hazard).

United States (FCC)

i Note

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

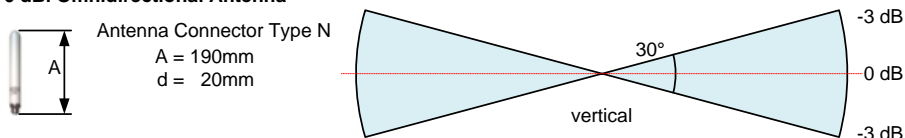
However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

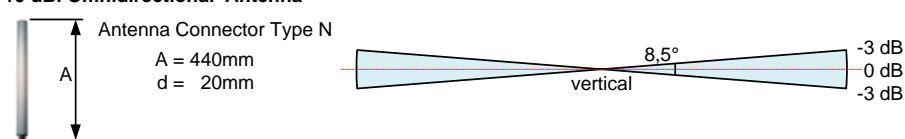
i Note

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.

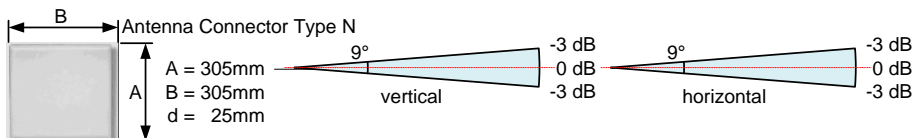
6 dBi Omnidirectional Antenna



10 dBi Omnidirectional Antenna



23 dBi Planar Antenna



13 dBi Sector Antenna

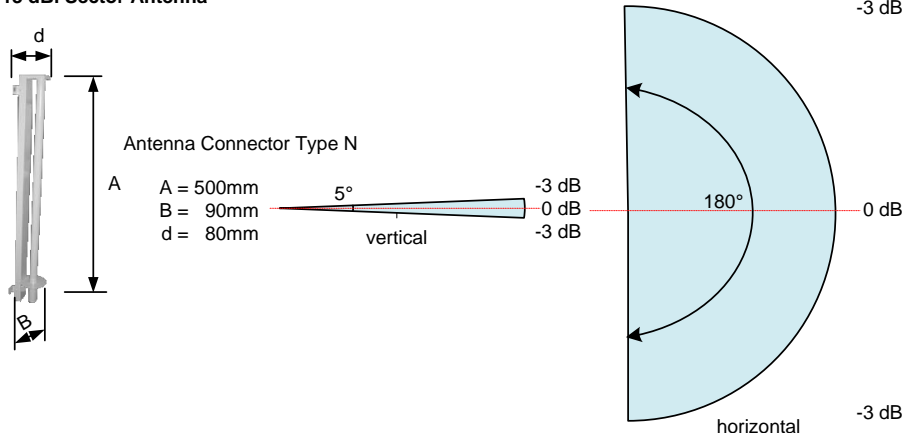


Figure 61: LPR® 1D antenna

Canada (Industry Canada)

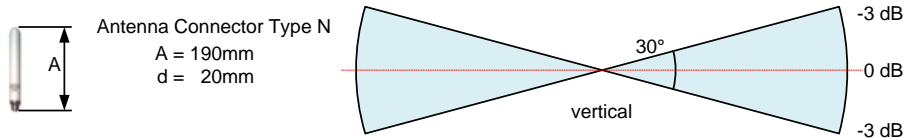
i Note

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

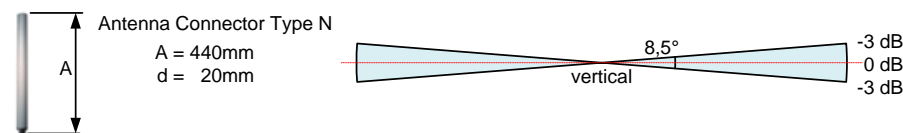
i Note

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.

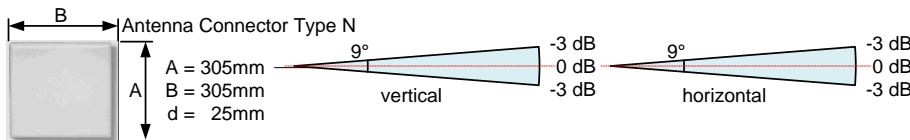
6 dBi Omnidirectional Antenna



10 dBi Omnidirectional Antenna



23 dBi Planar Antenna



13 dBi Sector Antenna

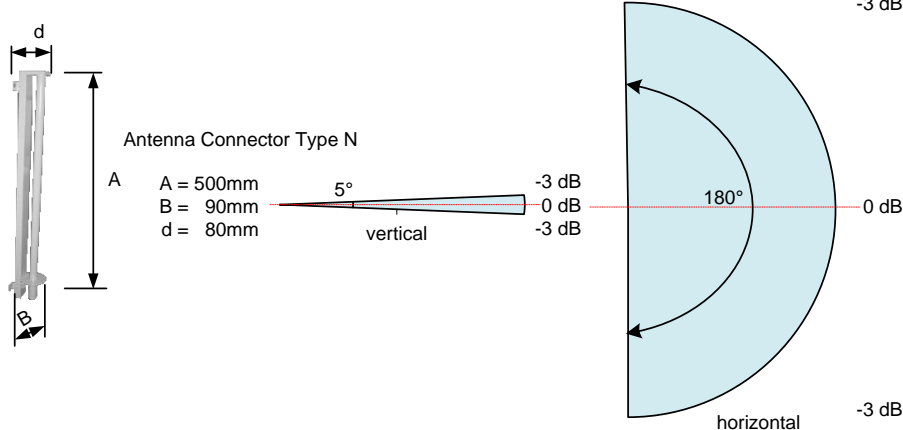


Figure 62: LPR® 1D antenna

11 Appendix B: Table of countries and regulations

Country	Regulation setting in Wizard
Australia/New Zealand	ETSI EN
Brazil	FCC
Canada	FCC
China	Setting for China ^(*)
Europe	ETSI EN
India	ETSI EN
Malaysia	ETSI EN
Republic of South Africa	ETSI EN
Russia	ETSI EN
Singapore	ETSI EN
Taiwan	ETSI EN
Turkey	ETSI EN
USA	FCC

^(*) not yet implemented, will follow in next update of Symeo Wizard

i Note

For countries not listed above please contact *Symeo* for further information.

i Note

Observe the regional-specific regulations and mandatory permissions to operate LPR-1D systems in the respective countries. Please contact *Symeo* for further clarification.