# **SYMEO LOCAL POSITIONING RADAR**



Product: LPR<sup>®</sup>-1D24

**Product Documentation** 





| CONTENT1 |  |  |  |
|----------|--|--|--|
| TABLE    | TABLE OF FIGURES                                       |  |  |
| LIST C   | OF TABLES7   |  |  |
| SAFE     | TY INSTRUCTIONS  |  |  |
| 1.1      | General10  |  |  |
| 1.2      | Mounting10   |  |  |
| 1.3      | Repairs and Modifications10                            |  |  |
| 1.4      | Transport and Storage10                                |  |  |
| 1.5      | Power Supply11   |  |  |
| 1.6      | Setup and Operation11                                  |  |  |
| 1.7      | System Extensions and Accessories11                    |  |  |
| 1.8      | Additional Instructions12                              |  |  |
| 1.9      | General Requirements for Compliance of Radio Apparatus |  |  |
| 2        | DEVICE OVERVIEW  |  |  |
| 2.1      | Technical Data14                                       |  |  |
| 2.2      | Opening Angle14  |  |  |
| 3        | MOUNTING AND ALIGNMENT15                               |  |  |
| 3.1      | Mounting of Fall Protection16                          |  |  |
| 3.2      | Fresnel Zone17   |  |  |
| 4        | REQUIREMENTS FOR POWER SUPPLY18                        |  |  |
| 5        | SPECIFICATION OF CONNECTORS19                          |  |  |
| 5.1      | Overview of Connections19                              |  |  |
| 5.2      | LED-Display20  |  |  |
| 5.3      | Power Supply21   |  |  |



| 5.3.2  | Plugs<br>Pin Assignment  | 21<br>21   |
|--|--|--|
| <b>5.4</b><br>5.4.1<br>5.4.2<br>5.4.3  | Relay (Optional)<br>Plugs<br>Pin Assignment<br>Contact Specification   | <b>22</b><br>23<br>23  |
| <b>5.5</b><br>5.5.1<br>5.5.2   | Profibus (Optional)<br>Plugs<br>Pin Assignment   | <b>24</b><br>24<br>26  |
| <b>5.6</b><br>5.6.1<br>5.6.2<br>5.6.3  | Ethernet M12<br>Plugs<br>Pin Assignment<br>Connector Cable M12 – RJ45  | 26<br>27<br>27   |
| <b>5.7</b><br>5.7.1  | USB – A Devices<br>Plugs   | <b>27</b><br>27  |
| 6  | LPR <sup>®</sup> -1D24 HOUSING DIMENSIONS  | 28   |
| 7  | WEB USER INTERFACE FOR LPR <sup>®</sup> -1D24  | 29   |
| 7.1  | Establishing a TCP/IP Connection   | 29   |
| 7.2  | Open Web User Interface  | 31   |
| 7.2.1<br>7.2.2<br>7.2.3  | Sign In<br>Initial Operation<br>Change Settings, Review and Save Changes   | 32<br>32<br>35   |
| 7.2.1<br>7.2.2<br>7.2.3<br><b>7.3</b>  | Sign In<br>Initial Operation<br>Change Settings, Review and Save Changes<br>Homepage   | 32<br>32<br>35<br><b>37</b>  |
| 7.2.1<br>7.2.2<br>7.2.3<br>7.3<br>7.4  | Sign In<br>Initial Operation<br>Change Settings, Review and Save Changes<br>Homepage<br>Device   | 32<br>32<br>35<br><b>37</b><br><b>40</b>                             |
| 7.2.1<br>7.2.2<br>7.2.3<br>7.3<br>7.4<br>7.5<br>7.5.1<br>7.5.2<br>7.5.3<br>7.5.4<br>7.5.5<br>7.5.6<br>7.5.7<br>7.5.8 | Sign In<br>Initial Operation<br>Change Settings, Review and Save Changes<br>Homepage<br>Device<br>Device - Settings<br>Device - Settings - Customer Protocol<br>Device - Settings - Filter<br>Device - Settings - Filter<br>Device - Settings - Forwarding<br>Device - Settings - LAN<br>Device - Settings - LAN<br>Device - Settings - Logging<br>Device - Settings - Measurement<br>Device - Settings - Measurement<br>Device - Settings - Measurement<br>Device - Settings - Network Routes | 32<br>35<br>37<br>40<br>40<br>42<br>43<br>45<br>46<br>47<br>51<br>52 |



| 7.6   | Device - Upload Configuration  | 58   |
|---|--|--|
| 7.7   | Device - Downloads   | 58   |
| 7.8   | Device - Firmware Update   | 58   |
| 7.9   | Device - Factory Reset   | 59   |
| 7.10  | Device - Reboot Device   | 60   |
| <b>7.11</b><br>7.11.1<br>7.11.2<br>7.11.3<br>7.11.4<br>7.11.5<br>7.11.6<br>7.11.7<br>7.11.8 | Diagnostics - Operating System Status<br>Diagnostics - Hardware Status<br>Diagnostics - Storage Devices<br>Diagnostics - Relay Status<br>Diagnostics - Range Measurement Statistics<br>Diagnostics - Record Measurement Data<br>Diagnostics - Packet Monitor<br>Diagnostics - Packet Inspector | 60<br>62<br>63<br>64<br>64<br>64<br>66<br>70<br>73<br>74 |
| 7.11.9<br><b>8</b>  | Diagnostics - Station Scan   | 76<br><b>77</b>  |
| 8.1   | Application 1: Distance Measurement  | 77   |
| 8.2   | Application 2: Distance Measurement between two Cranes including Relay<br>Control  | 80   |
| 8.3   | Application 3: Distance Measurement and User Data Transmission   | . 83   |
| 8.4   | Application 4: L-Functionality   | . 84   |
| 9   | DESCRIPTION OF BINARY PROTOCOL XP (1D MESSAGES)  | 86   |
| <b>9.1</b><br>9.1.1<br>9.1.2  | General Description<br>Structure of Data Packet<br>CRC   | <b>86</b><br>86<br>86                                    |
| <b>9.2</b><br>9.2.1<br>9.2.2<br>9.2.3<br>9.2.4<br>9.2.5                                     | Data Types<br>Type 0x01 - User Data<br>Type 0x02 - Send Request<br>Type 0x03 - Relays Switching Command<br>Type 0x16 - Distance Data<br>Type 0x25 - Load Data  | 87<br>88<br>88<br>89<br>90<br>91                         |
| <b>9.3</b>  | Remarks  | 92   |



## **Table of Figures**

|   | 40        |
|---|-----------|
| Figure 1: LPR®-1D24 measurement path  | .13       |
| Figure 2: Beam width of LPR <sup>®</sup> -1D24                                      | .14       |
| Figure 3: LPR <sup>®</sup> -1D24 inclusive mounting bracket                         | .15       |
| Figure 4: Mounting of fall protection   | .16       |
| Figure 5: Calculation and figure of Fresnel zone                                    | .17       |
| Figure 6: LPR®-1D24 Connectors - new Hardware Status - Deliveries from April 2017   | .19       |
| Figure 7: LPR®-1D24 Connectors - old Hardware Status - Deliveries before April 2017 | .19       |
| Figure 8: M12 Connector for power requirement                                       | .21       |
| Figure 9: Scheme of normally open relay contacts                                    | .22       |
| Figure 10: M12 Connector for relay  | .22       |
| Figure 11: M12 Connector Profibus IN  | .25       |
| Figure 12: M12 Connector Profibus OLIT  | 25        |
| Figure 13: M12 Connector Profibus Termination                                       | 25        |
| Figure 14: Ethernet M12   | .20       |
| Figure 15: I DD®_1D24 Housing Dimonsions  | .21       |
| Figure 15. LFT - 1024 Housing Dimensions  | .20       |
| Figure 17. Ding of LDD® 4004  | .30       |
| Figure 17: Ping of LPR <sup>®</sup> -1D24   | .30       |
| Figure 18: Open web User Interface  | .31       |
| Figure 19: WebUI Login  | .32       |
| Figure 20: Initial setup of environment of LPR®-1D24                                | .33       |
| Figure 21: Initial setup of environment - Activate changes                          | .33       |
| Figure 22: Initial setup of environment - Amend invalid settings                    | .33       |
| Figure 23: Settings window for mandatory values                                     | .34       |
| Figure 24: Change of mandatory values   | .35       |
| Figure 25: Save or Discard all changes  | .36       |
| Figure 26: Changes have been saved  | .36       |
| Figure 27: The Home Page of LPR®-1D24   | .37       |
| Figure 28: WebUI - Device Status  | .37       |
| Figure 29: WebUI Information overview   | .38       |
| Figure 30: Set system time  | 38        |
| Figure 31: WebUI - Product properties   | 39        |
| Figure 32: WebLIL - Product features  | 30        |
| Figure 33: Device Menu  | 40        |
| Figure 33: Device - Sattings Manu   | .+0       |
| Figure 34. Device - Settings Menu   | .+1<br>12 |
| Figure 35. Device - Settings - Customer protocor                                    | .42       |
| Figure 30. Device - Settings - Filter   | .43       |
| Figure 37: Device - Settings - Forwarding   | .44       |
| Figure 38: Device - Settings - Forwarding - Parameter setting                       | .45       |
| Figure 39: Device - Settings - LAN Settings   | .46       |
| Figure 40: Device - Settings - Logging  | .46       |
| Figure 41: Device - Settings - Measurement  | .48       |
| Figure 42: Example configuration of one measurement pair Master and Slave unit      | .49       |
| Figure 43: Device - Settings - Measurement - Submit/Review Changes                  | .50       |
| Figure 44: Device - Settings - Measurement - Save all changes                       | .51       |
| Figure 45: Device - Settings - Measurement - Review                                 | .51       |
| Figure 46: Device - Settings - Modem  | .51       |
| Figure 47: Device - Settings - Network Routes                                       | .52       |
| Figure 48: Device - Settings - Network Routes - Add route                           | .52       |
| Figure 49: Device - Settings - Network Routes - Review changes                      | .52       |
|   |           |



| Figure 50: Device - Settings - Profibus   | .53 |
|---|-----|
| Figure 51: Device - Settings - Downloads, Profibus GSD file                             | .53 |
| Figure 52: Device - Settings - Profinet   | .54 |
| Figure 53: Device - Settings - Downloads, Profinet GSDML file                           | .54 |
| Figure 54: Device - Settings - Relay mapping  | .55 |
| Figure 55: Device - Settings - Relay zones  | .56 |
| Figure 56: Device - Settings - Remote Access Settings                                   | .56 |
| Figure 57: Device - Settings - SystemTime Settings                                      | .57 |
| Figure 58: Device - Settings - VPN Remote Access Settings                               | .57 |
| Figure 59: Device - Application Settings  | .58 |
| Figure 60: Device - Downloads   | .58 |
| Figure 61: Device - Firmware update   | .59 |
| Figure 62: Device - Device configuration - Firmware update success message              | .59 |
| Figure 63: Device - Factory Reset   | .59 |
| Figure 64: Device - Reboot Device   | .60 |
| Figure 65: Diagnostics Menu   | .61 |
| Figure 66: Diagnostics - Operating System Status  | .62 |
| Figure 67: Diagnostics - Hardware Status  | .63 |
| Figure 68: Diagnostics - Storage Devices  | .64 |
| Figure 69: Diagnostics - Relay states   | .64 |
| Figure 70: Diagnostics - Control relays - override                                      | .65 |
| Figure 71: Diagnostics - Control relays - Relay states                                  | .65 |
| Figure 72: Diagnostics - Range Measurement Statistics                                   | .66 |
| Figure 73: Diagnostics - Distance over time graph                                       | .67 |
| Figure 74: Diagnostics - RSSI over distance diagram                                     | .68 |
| Figure 75: Diagnostics - Measurement rate over distance diagram                         | .69 |
| Figure 76: Diagnostics - Number of valid measurements over distance diagram             | .70 |
| Figure 77: Diagnostics - Record measurement data - Change logging mode                  | .71 |
| Figure 78: Diagnostics - Record measurement data - Change logging mode - Example        | .71 |
| Figure 79: Diagnostics - Record measurement data  | .72 |
| Figure 80: Diagnostics - Packet monitor   | .73 |
| Figure 81: Diagnostics - Packet inspector   | .75 |
| Figure 82: Diagnostics - Station scan   | .76 |
| Figure 83: Distance measurement between two LPR <sup>®</sup> -1D24                      | .77 |
| Figure 84: Menu Device - Settings - Measurement   | .77 |
| Figure 85: Example Configuration of one measuring pair - Master and Slave unit          | .78 |
| Figure 86: Distance measurement between two cranes with relay control                   | .80 |
| Figure 87: Setting of Zone (usually identical on Master and Slave by crane toward crane |     |
| measurement)  | .80 |
| Figure 88: Relay mapping (usually identical on Master and Slave for crane to crane      |     |
| measurement)  | .81 |
| Figure 89: Settings - Forwarding  | .82 |
| Figure 90: Simple distance measurement between two units and user data transmission     | .83 |
| Figure 91: Forwarding Settings  | .83 |
| Figure 92: L-Functionality  | .84 |
| Figure 93: Forwarding Settings  | 84  |
| Figure 94: Forwarding Settings – Submit/Review changes                                  | 85  |
| Figure 95: Structure of the data packet   | .86 |
| ge. e ee. e. detai e ei ale data paenet initiati initiati initiati initiati initiati    |     |



## List of Tables

| Table 1: LED Display   | 20 |
|--|----|
| Table 2: Pin assignment power supply                             | 21 |
| Table 3: Pin assignment relay                                    | 23 |
| Table 4: Contact specification                                   | 23 |
| Table 5: Pin assignment for Profibus connectors In and Out       | 26 |
| Table 6: Pin assignment for Ethernet M12                         | 27 |
| Table 7: Data Type 0x01 - User Data                              | 38 |
| Table 8: Data Type 0x02 - Send request                           | 38 |
| Table 9: Data Type 0x03 - Relays Switching Command               | 39 |
| Table 10: Data Type 0x16 - Distance Data Output for Group Master | 90 |
| Table 11: Data Type 0x25 - Load Data                             | 91 |
| Table 12: LPR <sup>®</sup> -1D24 address                         | 92 |
| Table 13: Error codes  | 92 |



The documentation for the LPR®-1D24 Local Positioning Radar is published by:

SYMEO GmbH Prof.-Messerschmitt-Str. 3

D-85579 Neubiberg www.symeo.com

If you have any questions or suggestions, please contact:

Email: <u>info@symeo.com</u> phone: +49 89 660 7796 0

Copyright © Symeo GmbH

#### HISTORY

| Version | Date       | Description   |
|---------|------------|---|
| 1.00    | 18.06.2015 | Initial Release: Translation English  |
| 1.01    | 24.07.2015 | Minor corrections,<br>New: the chapters "Web User Interface" and "Mounting of the<br>Fall Protection"   |
| 1.02    | 28.01.2016 | Distance data Type 0x00 changed to Type 0x16, Distance Error<br>Codes table updated.<br>The chapter "WebUI User Interface" updated.<br>New: Ethernet connector cable M12 – RJ45.<br>Added: General Requirements for Compliance of Radio<br>Apparatus, chapter 1.9   |
| 1.03    | 20.04.2016 | New Software version, chapter 7 WebUI updated;<br>Velocity data byte value updated;<br>Chapter "Data Types": added Type 0x01, Type 0x02;<br>FSK channels configuration rules updated  |
| 1.04    | 22.12.2016 | New Software version, chapter 7 WebUI updated;<br>Valid from firmware version/application 5.0.0   |
| 1.05    | 10.11.2017 | WebUI updated: Profinet function added;<br>LPR®-1D24 address for Relays Switching Command matched;<br>The new housing;<br>Application L-Functionality added, chapter 8.4;<br>Serial interface RS422/RS485, Can-Bus and Mini-USB are no<br>longer available;<br>LED Display subchapter 5.2 added;<br>FCC Rules standard corrected: RSS-310;<br>Chapter 9 "Description of Binary Protocol XP" updated;<br>Valid from firmware version/application 6.0.0 |
| 1.06    | 28.03.2018 | Updated Release Version Profinet application note to:<br>DOC.EDO.000258.0002.EN;<br>Profinet updated;<br>WebUI updated to version 7.0.0;<br>New function "Filter" in Settings added;<br>New function "Payload Slave to Master" added under Settings -<br>> Measurement;   |



|      |            | New function "Time delay of network and forwarding hops"<br>added under Settings -> Forwarding;<br>The customer protocol accepts also CRC = 0 for incoming<br>packets;<br>Valid from firmware version/application 7.0.0 |
|------|------------|---|
| 1.07 | 20.06.2018 | Requirements for fall protection updated, see sections 1.1, 3 and 3.1   |
| 1.08 | 12.09.2108 | WebUI updated to version 8.0.1;<br>New BinProtXp message 0x25 (LOAD_DATA);<br>Packet inspector supports incoming messages;<br>Tightening torque for M12 connectors;<br>Valid from firmware version/application 8.0.0    |
| 1.09 | 05.12.2018 | WebUI updated to version 8.1.0  |
| 1.10 | 27.03.2019 | Note added: the simultaneous use of the Profibus module and the relays is not possible  |
| 1.11 | 06.11.2019 | New Firmware version 9.0.0;<br>Added logging mode for logging to volatile memory;<br>Added Russia country settings;<br>Added plot with number of valid measurements, see section<br>7.11.5                              |
| 1.12 | 14.02.2020 | Bug-Notification Note for Firmware Version 9.0.0 and older for Relay Zones Settings added, see section 7.5.12 and 8.2   |
| 1.13 | 18.08.2021 | Pin assignment table for Ethernet corrected, see section 5.6.2;<br>Relay zones description corrected, see section 7.5.12  |
| 1.14 | 20.07.2022 | Note about using of logging mode added, see section 7.5.5   |

#### SYMBOLS USED

The following symbols are used throughout the documentation:



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



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

i Note

This symbol appears before information of particular importance.

All rights reserved, particularly those relating to the translation, reprinting, and reproduction by photocopying or similar processes of all or part of the documentation and for purposes of the award of patents or submission of utility models.

Delivery options and technical changes reserved.

Application specific documentation can be obtained from the Partner Login under <u>www.symeo.com</u> or from Symeo support.



## **Safety Instructions**

#### 1.1 General



The LPR<sup>®</sup>-1D24 radars are purely tracking and assistance systems. They therefore do not satisfy special requirements for personal safety.

The LPR<sup>®</sup>-1D24 has to be secured with a fall protection. A fall protection is included in the delivery of the mounting bracket set MTM101758 available at Symeo.



Warning

Installed measurement paths need to be inspected and approved by qualified personal according to the instruction manual before putting them in operation.

The radar may be used as an anti-collision warning system but must not interfere directly with the control of equipment, which may cause harm to persons or property.



Follow the safety instructions in this documentation.

Please make sure that you are aware of the latest technical document revision date. You can find it online on the partner/customer website of Symeo GmbH under:

https://www.symeo.com/en/partner-login/index.html

#### 1.2 Mounting



All mounting, installation and maintenance work must be carried out by an electrically qualified or trained person.

Screwed connections, mounting structures and the device itself must be examined at regular intervals, with respect to external damage and loosened connections especially if the radar is mounted exposed or is exposed to high stress.

### 1.3 Repairs and Modifications



Repairs or modifications on the devices should only be performed by Symeo GmbH.

## 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, impact, moisture and electrostatic discharge.

During setup and before operation, refer to the instructions for environmental conditions in this document and in the datasheet. Place the cables in such a way so that they do not build the possible cause of risk and are not damaged.

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



#### 1.5 Power Supply



While installing or using it in open-air, the transient overvoltage cannot be excluded. Here, overvoltage protection is to be used for low voltage in accordance to DIN EN 61643-21 and IEC 61643-21.

While connecting the plug and sockets, please observe the correspondent chapter in this document "Specification of Connectors" and adhere to the specified tightening torques.

Do not use damaged cables (damaged insulation, bare wires). A defective cable may cause a fire hazard.

Be careful that the device can be damaged with reverse polarity despite of strict implementation of polarity reversal protection. In that case, the unit must be sent to the SYMEO service for further testing.

#### 1.6 Setup and Operation



During mounting, make sure that no objects or liquids reach inside the device (risk of short-circuit).

Our units must not be exposed to aggressive vapour or liquids like given in an acid or alkaline environment.

In case of emergency (e.g. damaged housing, control elements or power cables, penetration of liquids or foreign bodies) switch off the device immediately, disconnect from the power line the device and inform your SYMEO service.

Protect the contacts of all sockets and plugs of the device from static electricity. Avoid touching the contacts. If touching the contacts is unavoidable, then one should take the following precautions: Touch a grounded object or wear a ground strap before touching the contacts. This will dissipate static charges.



The LPR®-1D24 must not be opened.

### 1.7 System Extensions and Accessories



Data cables to peripheral devices must be shielded properly.

For LAN cabling, the requirements apply in accordance with EN 50173 and EN 50174-1/2. 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 becomes void in case of any damages caused by replacement of components on the device during installation.



#### 1.8 Additional Instructions



Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### **1.9 General Requirements for Compliance of Radio Apparatus**



The operation of this device requires compliance with regional radio regulations.

This device complies with Part 15 of the FCC Rules and with Industry Canada license-exempt RSS-310. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.



## 2 Device Overview

LPR<sup>®</sup>-1D24 is a highly precise radio sensor for distance measurement. One pair of sensors enables long range measurements with high accuracy. At the same time, further measurement data such as the crane hook height or the load status can be transferred via the wireless LPR<sup>®</sup> channel. In addition, the relative approach speed of the LPR<sup>®</sup> sensors is also available.



Figure 1: LPR<sup>®</sup>-1D24 measurement path

Distance and speed can be used for internal collision avoidance decisions at predetermined distance thresholds. Optional on-board relays will be activated. All data is made available at standard interfaces of each unit in real-time.

The multi-channel radio antenna is integrated into the robust housing. Thus, the devices are easy to install and operate. Rough alignment between the facing units is sufficient for precise measurements, even for very long distances. Via a user-friendly HTML interface, the units can be easily configured and put into operation. Installing special software is not necessary.

**Device Overview** 

Symeo LPR<sup>®</sup> radio works highly reliable even under adverse environmental conditions. Interference with any WiFi equipment operating in parallel can be excluded at all times. LPR<sup>®</sup>-1D24 sensors are maintenance-free.

A unique ID per each unit allows operating multiple pairs in immediate vicinity.



## 2.1 Technical Data

The technical specifications for the LPR<sup>®</sup>-1D24 can be found in our data-sheet under the following link:

https://www.symeo.com/cms/upload/pdf/en/DataSheets/DOC.DBL.000145.LATEST.Symeo\_ Datasheet\_LPR-1D24.pdf

The performance features of the purchased product depend on the version and production code (see chapter 7.3, <u>*Homepage -> Product properties -> Unit production code*</mark>").</u>

#### **Radio Parameters**

| Frequency range:    | 24 GHz - 24,25 GHz |
|---------------------|--------------------|
| Transmission power: | max. 100 mW EIRP   |

### 2.2 Opening Angle

The LPR $^{\mbox{\tiny B}}$ -1D24 has an integrated antenna with +/-9° opening angle horizontal and +/-7° opening angle vertical.



Figure 2: Beam width of LPR<sup>®</sup>-1D24



To achieve maximum performance and range, the two radars must be of the same orientation, preferably with plug connections facing downwards.



## 3 Mounting and Alignment

The LPR<sup>®</sup>-1D24 should be mounted with the separate mounting bracket set **MTM101758** (see *Figure 3*), which has to be ordered separately to the device.

*Figure 3* shows a complete system including the mounting bracket. The bracket must be mounted with a pipe clamp on a pipe. The pipe diameter is best chosen between 40 mm and 75 mm. For mounting, a flat wrench of SW 13 is required.

For mounting the system, please proceed as follows:

- At a suitable place, mount the LPR<sup>®</sup>-1D24 to a suitable pipe with the bracket. To adjust the radar, do not tighten the mounting bracket finally. Specified alignments have to be adhered to if indicated by Symeo.
- A minimum distance of 3 meters between the measuring radars must be maintained to guarantee the specified accuracy. Mounting closer than the minimum distance decreases the accuracy at close proximity.
- ⇒ The radars must have the same orientation for mounting, for example both radars with connectors downwards. For outdoor use, the units have to be mounted with the connectors downwards.
- ⇒ The two radars should be mounted opposite to each other and there should be no offset horizontally and vertically from each other and the radars should not be twisted.
- Now fix the radar by tightening the screws in the mounting bracket and the mounting bracket on the pipe in such a way that no modification is possible anymore. Flat wrench SW 13 is required.



Figure 3: LPR®-1D24 inclusive mounting bracket

Mounting and Alignment



## 3.1 Mounting of Fall Protection

The LPR<sup>®</sup>-1D24 must be protected against fall. The fall protection included in the mounting bracket set MTM101758 consists of the following components (see *Figure 4*):

- A: 2 x ring nuts M5
- B: 2 x snap hooks 5 x 50 mm
- C: 1 x steel cable 3 mm x 1 m

The two ring nuts must be mounted on the back of the LPR<sup>®</sup>-1D24 laterally on the respective second screw from above, which are 4 mm longer than the other screws. Then the snap hook must be attached to the ring nuts. Please put the steel cable around a pipe or a bracket and hang it also into the snap hook (see *Figure 4*).



Figure 4: Mounting of fall protection

Mounting and Alignment



## 3.2 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 radius of the first Fresnel zone can be calculated as follows:

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

 $\lambda$  is the wave length and *d* the distance between the two antennas. For a frequency of 24 GHz a wave length  $\lambda$  of approx. 0.0125 m is calculated. The maximum radius between the two antennas is indicated with *b*. For different distances, the maximum radius is given in the following Table, see *Figure 5*.



Figure 5: Calculation and figure of Fresnel zone

Mounting and Alignment



## 4 **Requirements for Power Supply**

The power supply should have the following characteristics:

- Potential free
- Output power at least 25 W
- Output voltage 10 V DC to 36 V DC
- Short-term maximum current flow (when switched on):
  - At 24 V DC: 2000 mA for 50 ms
  - At 12 V DC: 2500 mA for 50 ms

**Requirements for Power Supply** 



## 5 Specification of Connectors

#### 5.1 **Overview of Connections**

All connectors are fixed externally to the housing. Figure 6 shows the connections in detail.



Figure 6: LPR®-1D24 Connectors - new Hardware Status - Deliveries from April 2017

B1: Ethernet
B2: Profibus IN (optional)
B3: Profibus OUT/ Termination (optional)
B4: Pressure equalization membrane
B5: Relays (optional)
B6: Power supply
B7: USB – A (Logging)
B8 - B10: Status LEDs

#### Previous Hardware State (Deliveries before April 2017)



Figure 7: LPR<sup>®</sup>-1D24 Connectors - old Hardware Status - Deliveries before April 2017

B1: Ethernet

- B2: Can-Bus IN/ Profibus IN (optional)
- B3: Can-Bus OUT/ Profibus OUT/ Termination (optional)
- B4: Pressure equalization membrane
- B5: Serial interface RS422/RS485 / Relays (optional)
- B6: Power supply
- B7: Mini-USB
- B8: USB A (Logging)
- B9 B11: Status LEDs





Note

i

On the following pages, you will find the connector type, the pin assignment, the product code and the Symeo order number. For more information, please see the corresponding Phoenix datasheets.

Mounting instructions in the datasheets must be followed.

## 5.2 LED-Display

The LEDs on the operating display B8, B9 und B10 (see *Figure 6*) indicate different statuses of the device. Refer to the table below for this information.



Table 1: LED Display



### 5.3 **Power Supply**

The LPR<sup>®</sup>-1D24 is powered by a 4-pin M12-Connector (*Figure 6* – Connection B6).

#### 5.3.1 Plugs

Recommended connector:

#### SACC-M12FST-4PECON-PG 9-M - 1418052 (obsolete) SACC-M12FST-4CON-PG 9-M - 1418052 Cable diameter: 6 - 8 mm Tightening torque: 0.4 Nm Symeo order number: MTE101761



Figure 8: M12 Connector for power requirement

#### 5.3.2 Pin Assignment

| Power Supply 10 V DC – 36 V DC | M12 Connector            |
|--------------------------------|--------------------------|
| V <sub>DC</sub> +              | Pin 1                    |
| V <sub>DC</sub> +              | Pin 2 (bridged to Pin 1) |
| V <sub>DC</sub> -              | Pin 3                    |
| V <sub>DC</sub> -              | Pin 4 (bridged to Pin 3) |

Table 2: Pin assignment power supply



## 5.4 Relay (Optional)

The LPR<sup>®</sup>-1D24 has a relay option. The relay contacts are routed via one 8-pin M12-connector outwards (*Figure 6* – Connection B5).

The relay contacts are normally open. Example: If no power is supplied to the device, the relay contacts are open (see *Figure 9*).



Figure 9: Scheme of normally open relay contacts

#### 5.4.1 Plugs

Recommended connector:

SACC-M12FS-8CON-PG9-M - 1513347
 Cable diameter: 6 – 8 mm (PG9)
 Tightening torque: 0.4 Nm
 Symeo order number: MTE101847



Figure 10: M12 Connector for relay



#### 5.4.2 Pin Assignment

Pin assignment for relays is shown in Table 3.

| Relay-Contact | Relay-Contact | M12 Connector |
|---------------|---------------|---------------|
| Relay A       | 13            | Pin 1         |
| Relay A       | 14            | Pin 2         |
| Relay B       | 13            | Pin 3         |
| Relay B       | 14            | Pin 4         |
| Relay C       | 13            | Pin 5         |
| Relay C       | 14            | Pin 6         |
| Relay D       | 13            | Pin 7         |
| Relay D       | 14            | Pin 8         |

Table 3: Pin assignment relay

#### 5.4.3 Contact Specification

| Rated load:                | 1,2 A @ 25 V AC<br>1,2 A @ 30 V DC |
|----------------------------|------------------------------------|
| Maximum switching voltage: | 25 V AC<br>30 V DC                 |
| Maximum switching current: | 8 A @ 25 V AC<br>5 A @ 30 V DC     |

Table 4: Contact specification



## 5.5 **Profibus (Optional)**

The LPR<sup>®</sup>-1D24 with Profibus option can be connected via M12-Connector (*Figure* 6 - connection B2/B3).

#### 5.5.1 Plugs

Recommended connectors:

- Connector Profibus IN
  - SACC-FSB-2SC SH PB SCO 1432868 (obsolete) SACC-M12FSB-2PL SH PB - 1424680
     Cable diameter: 4 - 8 mm
     Tightening torque: 0.4 Nm
     Symeo order number: MTE101762
- Connector Profibus OUT
  - SACC-MSB-2SC SH PB SCO 1432842 (obsolete) SACC-M12MSB-2PL SH PB - 1424678 Cable diameter: 4 - 8 mm Tightening torque: 0.4 Nm Symeo order number: MTE101763
- Connector: Profibus Termination
  - SAC-5P-M12MS PB TR 1507803
     Tightening torque: 0.4 Nm
     Symeo order number: MTE101764











Figure 13: M12 Connector Profibus Termination



#### 5.5.2 Pin Assignment

| Signal         | Pinout<br>LPR <sup>®</sup> -1D24 | Color of Conductor<br>Profibus Standard | M12 Connector |  |  |
|----------------|----------------------------------|---|---------------|--|--|
|                |                                  |   |               |  |  |
| VP + 5V        | Power                            | Brown (BN)                              | Pin 1         |  |  |
| RxD/TxD_N      | A-Conductor                      | White (WH)                              | Pin 2         |  |  |
| DGND           | GND                              | Black (BK)                              | Pin 3         |  |  |
| RxD/TxD_P      | B-Conductor                      | Blue (BU)                               | Pin 4         |  |  |
| Nc             | Nc                               | Gray (GY)                               | Pin 5         |  |  |
| Screen         | Housing                          | Nc                                      | Mass          |  |  |
| Profibus 2-pin |                                  |   |               |  |  |
| RxD/TxD_N      | A-Conductor                      | Green                                   | Pin 2         |  |  |
| RxD/TxD_P      | B-Conductor                      | Red                                     | Pin 4         |  |  |
| Screen         | Housing                          | Screen                                  | Mass          |  |  |

Table 5: Pin assignment for Profibus connectors In and Out

### 5.6 Ethernet M12

The LPR<sup>®</sup>-1D24 can be connected to Ethernet via M12-Connector (*Figure 6* – Connection B1).

#### 5.6.1 Plugs

Recommended connector:

- Connector Ethernet M12
  - SACC-M12MSD-4CON-PG 7-SH 1521258
     Cable diameter: 4 6 mm (PG7)
     Tightening torque: 0.4 Nm
     Symeo order number: MTE101768





Figure 14: Ethernet M12

#### 5.6.2 Pin Assignment

| Signal | Color of Conductor<br>PROFInet <sup>®</sup> | Color of Conductor<br>EIA/TIA 568B | Pin Assignment |
|--------|---|------------------------------------|----------------|
| TD+    | Yellow                                      | White/Orange                       | 1              |
| TD-    | Orange                                      | Orange                             | 3              |
| RD+    | White                                       | White/Green                        | 2              |
| RD-    | Blue  | Green                              | 4              |

Table 6: Pin assignment for Ethernet M12

#### 5.6.3 Connector Cable M12 – RJ45

The connector cable M12 – RJ45 required for connecting via the Ethernet the LPR $^{\mbox{\tiny B}}$ -1D24 (with M12 connector) to a PC (with RJ 45 connector) for initial commissioning and configuration is available from Symeo:

Symeo order number: MTE102007

### 5.7 USB – A Devices

The LPR<sup>®</sup>-1D24 has a USB-Flash Drive Connector, on which the data can be logged (*Figure* 6 – Connection B7).

#### 5.7.1 Plugs

0

Recommended connector:

- USB-Flash Drive
  - o USB-Flash Drive
  - Pin assignment according to USB-Standard
  - End cap flash drive: **DCA-17-03** from Samtec



6 LPR<sup>®</sup>-1D24 Housing Dimensions



Figure 15: LPR<sup>®</sup>-1D24 Housing Dimensions

The minimum pipe diameter is 40 mm, the maximum pipe diameter is 75 mm.



## 7 Web User Interface for LPR<sup>®</sup>-1D24

This chapter describes the LPR®-1D24 Web User Interface (WebUI).



Connection via the Ethernet is required.

For the Ethernet-connection, the connector cable M12 - RJ45 is required for configuration of the LPR<sup>®</sup>-1D24 with M12 and RJ45 connectors. This connector cable can be ordered by Symeo (see chapter 5.6.3).



Please read the Notes on the Firmware Update in "Partner Login" area (Symeo\_Docs -> Firmware -> "Readme\_Firmware\_Update\_LPR-1D24") under <u>https://www.symeo.com/en/partner-login/index.html</u>.

## 7.1 Establishing a TCP/IP Connection

In order for a radar to be successfully commissioned, the following requirements must be met:

- $\Rightarrow$  The unit has been connected to the power supply.
- $\Rightarrow$  Data link has been established over TCP/IP.

Once these prerequisites have been fulfilled, you can connect the unit to the network and commission the LPR<sup>®</sup>-1D24. How to do this is explained in the following chapters.



At delivery the IP-address of the LPR<sup>®</sup>-1D24 is set to **192.168.1.99**, if no IP address is specified on the housing of the LPR<sup>®</sup>-1D24. You can change the IP-address of the LPR<sup>®</sup>-1D24 via the web interface of the LPR<sup>®</sup>-1D24.

To get a connection between your PC and the LPR<sup>®</sup>-1D24 it is maybe necessary to change the network parameters of your computer. The PC and the LPR<sup>®</sup>-1D24 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.
- $\Rightarrow$  Connect the LPR<sup>®</sup>-1D24 and the computer with a network cable.
- $\Rightarrow$  Open the network settings of your computer (see *Figure 16*).



|  | Internet Protocol (TCP/IP) Pro   | operties 🤶 🔀   |
|--|--|--|
|  | General  |  |
|  | You can get IP settings assigne<br>this capability. Otherwise, you n<br>the appropriate IP settings. | ed automatically if your network supports<br>eed to ask your network administrator for |
|  | O Obtain an IP address auto  | omatically   |
| AN Properties  | Use the following IP address   | BSS:   |
| eneral Authentication Advanced   | IP address:  | 192.168.1.1  |
| Marvel Yukon 88E8055 PCI-E Gigabi     Configure  | Subnet mask:   | 255 . 255 . 255 . 0  |
| This connection uses the following items:  | Default gateway:   |  |
| B Clent for Microsoft Networks     B Clent for Microsoft Networks     B Cle and Printer Sharing for Microsoft Networks     B QoS Packet Scheduler     Tritemet Pictocol (TCP/IP) | C Obtain DNS server addre  | ss automatically   |
| Instal Uninstall Properties  | Preferred DNS server:  |  |
| Description<br>Transmission Control Protocol/Internet Protocol. The default<br>wide area network protocol that provides communication<br>across diverse interconnected networks  | Alternate DNS server:  |  |
| Show icon in notification area when connected Notify me when this connection has limited or no connectivity  |  | Advanced   |
| OK Cancel  | ]  | OK Cancel  |

- Enter the following fixed IP-address i.e.
   192.168.1.1. The subnet mask should be set to 255.255.255.0.
- $\Rightarrow$  Click in both windows **OK**.

Figure 16: Network Settings

i Note

If the firewall settings are too restrictive, you may not get access to the LPR<sup>®</sup>-1D24. In this case, deactivate the firewall temporarily.

The LPR<sup>®</sup>-1D24 should be available via your PC now. You can check the connection with a *ping* to the LPR<sup>®</sup>-1D24:

Open the Command-Window:

- 1. Push the Windows Start Button
- 2. Choose **Run**
- 3. Enter **cmd** and click **OK**
- 4. Enter in the cmd.exe window: **ping 192.168.1.99** or the IP-address of LPR<sup>®</sup>-1D24.

| en C:\WINDOWS\system32\cmd.exe   |   |
|--|---|
| C:\>ping 192.168.1.99  |   |
| Pinging 192.168.1.99 with 32 bytes of data:  |   |
| Reply from 192.168.1.99: bytes=32 time<1ms TTL=64<br>Reply from 192.168.1.99: bytes=32 time<1ms TTL=64<br>Reply from 192.168.1.99: bytes=32 time<1ms TTL=64<br>Reply from 192.168.1.99: bytes=32 time<1ms TTL=64 |   |
| Ping statistics for 192.168.1.99:<br>Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),<br>Approximate round trip times in milli-seconds:<br>Minimum = Oms, Maximum = Oms, Average = Oms                       |   |
| C:\>_  | - |

Figure 17: Ping of LPR®-1D24

The LPR<sup>®</sup>-1D24 should answer with a *Reply*.



### 7.2 Open Web User Interface

⇒ Open your web browser. In the address bar of the web browser enter the IP-address of the LPR<sup>®</sup>-1D24: http://192.168.1.99. Press Enter.

A connection is established with your LPR<sup>®</sup>-1D24. The homepage of the LPR<sup>®</sup>-1D24 Web User Interface will appear.

A language selection can be made using the flags in the top right corner of the homepage.



Figure 18: Open Web User Interface



#### 7.2.1 Sign In

In order to be able to change settings a sign in to the WebUI is necessary. Press therefore *"Login"* in the upper right corner of the WebUI. You will be prompted to enter your information for authentication. The dialog box with the username and password field will appear (see *Figure 19*).

| ABSOLUTE POSITIONING   |
|--|
| Please login   |
| Required privilege: DEVICE_CONFIGURE_EDIT<br>We need at least user "symeo" |
| Password   |
| Remember me  |
| Login  |
|  |

Figure 19: WebUI Login

⇒ Enter the user name "**symeo**" and the password "**54all2u**" and press "*Login*". Now your status is displayed as *"Logged in*".

#### 7.2.2 Initial Operation

When the WebUI is opened for the first time or after a software reset, the note "*Environment uninitialized*" will appear (see *Figure 18*).

i Note

During the initial commissioning, you need to configure the operating region, in which you want to use this unit. This is necessary to abide to the radio signal restrictions enforced by the local authorities.

Since this is a mandatory setting, all functionality of this device will remain disabled, until the country setting has been successfully configured.

⇒ Click the *"Configure environment*" button to configure the working environment.



| SYMEO<br>ASSOLUTE POSITIONING |   |  |  | Logged in as symeo   |
|-------------------------------|---|--|--|--|
|                               | Information overview                          | /  | Device Status  |  |
|                               | Hostname                                      | lprb-basestation                           | Services   | Distance measurement   |
|                               | IP address                                    | 192.168.1.99                               | Interfaces   | Binary protocol  |
|                               | Application                                   | 7.0.0                                      | Remote Access  | No modem installed PPP disabled VPN disconnected   |
|                               | 1D24 role                                     | Master unit                                |  |  |
|                               | System time                                   | 2018-03-14 12:27:13 CET                    |  |  |
|                               | Initial setup (<br><sup>Country</sup><br>Save | Of environment<br>United States of America | Please select your oou<br>to the regulations of yo<br>setting has to be the se | ntry to determine the operation environment. This is important to abide<br>our local authorities concerning the radio signal specifications. The<br>ame on all Symeo devices in one setup. |

Figure 20: Initial setup of environment of LPR®-1D24

Select your country to determine the operating environment and confirm it with the "Save" button (see Figure 20).

The setting has to be the same on all Symeo devices used in a specific country.

⇒ Now activate the settings by clicking the *"Activate changes*" button (see *Figure 21*).

| Information over | view                    | Device Statu | S  |
|------------------|-------------------------|--------------|--|
| Hostname         | lprb-basestation        | Services     | Distance measurement                             |
| IP address       | 192.168.1.99            | Interfaces   | Binary protocol                                  |
| Application      | 7.0.0                   | Remote Acce  | No modem installed PPP disabled VPN disconnected |
| 1D24 role        | Master unit             |              |  |
|                  | 2019 02 14 12:21:40 CET |              |  |

Figure 21: Initial setup of environment - Activate changes

#### The following window appears:

| SYMED = Device - Q Di                    | iagnostics +   |   |               | Logged in as symeo                               |
|--|--|---|---------------|--|
| Detected invalid or uninitialized        | Information overview   |   | Device Status |  |
| configuration values, please amend them. | Hostname   | lprb-basestation                                  | Services      | Distance measurement                             |
| Amend Invalid settings                   | IP address   | 192.168.1.99                                      | Interfaces    | Binary protocol                                  |
|  | Application  | 7.0.0   | Remote Access | No modem installed PPP disabled VPN disconnected |
| Changes have been saved.                 | 1D24 role  | Master unit                                       |               |  |
|  | System time  | 2018-03-14 12:35:27 CET                           |               |  |
|  | Product properties   |   |               |  |
|  | Device type: BS<br>Unit description: LP<br>Unit serial no: CL<br>Unit production code: ( | SV101757<br>FR 1024<br>28IL0039<br>ICO (P.C. 000) |               |  |

Figure 22: Initial setup of environment - Amend invalid settings

In the top left corner, the red frame appears which indicates that for a functioning measuring distance, the measurement values, which have not yet been set or invalid, are still to be processed. This is always the case during the initial operation.

⇒ Click the "Amend invalid settings" button.



### **Mandatory Settings**

|   | Information overvie | w                                |   | Device Status   |  |
|---|---------------------|----------------------------------|---|---|--|
| ected invalid or uninitialized<br>Figuration values, please | Hostname            | lorb-basestation                 |   |   |  |
| nd them.  | IP address          | 192 188 1 99                     |   | Services  | Distance measurement   |
| end invalid settings  | Application         | 7.0.0                            |   | Remote Access   | No modem installed PPP disabled VPN disconned  |
|   | 1D24 role           | Master unit                      |   |   |  |
| Settings  | System time         | 2018-03-14 12:39:57 CET          |   |   |  |
| stomer protocol   | oystem time         | 2010/00/11/12:00:07/021          |   |   |  |
| ter   | Measurement Settin  | ngs                              |   |   |  |
| rwarding  |                     |                                  |   |   |  |
| N   |                     | LPR group ID                     | 1   |   |  |
| gging   |                     |                                  | Group identifier of one pair of   | of LPR units associated tog                               | ether. Has to be the same on units measuring with each other.  |
| easurement 🛦  |                     | Measurement mode                 | Master unit   |   |  |
| odem  |                     |                                  | Measuring mode for the LPF  | R-1D24 unit. Any measuring                                | pair of LPR-1D24 stations has to consist of one master and or  |
| twork routes  |                     |                                  | slave unit.   |   |  |
| ofibus  | Numbe               | er of FSK communication channels | 20  |   |  |
| ofinet  |                     |                                  | Number of different FSK co<br>smaller the number of FSK (               | mmunication channels avai<br>channels, the higher the me  | lable. Must be the same value for all stations at the same site.<br>asurement bandwidth.                               |
| mote Access   |                     | FSK communication channel        | -1  |   |  |
| stem Time   |                     |                                  | value violates lower boundar  | V   |  |
| N remote access   |                     |                                  | Integer number in range 1635  |   |  |
|   |                     |                                  | Data communication channe   | I number. Has to be the sar                               | me on all units needing to communicate with each other.  |
|   |                     | Measurement channel              | NA  |   |  |
|   |                     |                                  | value is not a valid selectab   | le option   |  |
|   |                     |                                  | Changes ramp slope of mea<br>changed to separate interfer               | surements. Has to be conf<br>ing pairs when other pairs a | igured identically on master and slave unit of one pair. Can be<br>re close by.  |
|   |                     | Customer specific offset         | 0   |   | m  |
|   |                     |                                  | Number in range -1.01.0 m   |   |  |
|   |                     |                                  | This offset is added to the r<br>production date before Dece<br>0.52 m. | neasured distance and is to<br>mber 2016 (see application | be used only for replacement of LPR1D24 Master units with<br>note DOC.EDO.000241). Offset value which needs to be adde |
|   |                     | Payload Slave to Master          | 50 bytes (up to 33 Hz me  | asurement rate)   |  |
|   |                     |                                  | Concerns only the payload   | from slave to master; for m                               | aster to slave transmissions 200 bytes payload is always pos   |

Figure 23: Settings window for mandatory values

You will be automatically guided to the settings menu sub-item *"Measurement*", where strictly necessary parameters must be set. Further information about these mandatory settings please refer to the chapter 7.5.6.

⇒ If you have entered all these settings, click the "Submit changes" button.



LPR<sup>®</sup>-1D24 – Product Documentation

| SYMEO = Device -                                 | Q Diagnostics -                      |   | Logged in as symeo  |
|--|--------------------------------------|---|---|
| Kesotore Positioning                             | researce synce p                     |   | Services Distance measurement   |
| There are unsaved                                | IP address 192.168.1.99              |   | Interfaces Binary protocol  |
| changes. After you are<br>finished editing, save | Firmware 8.1.0                       |   | Remote No modem installed PPP disabled ACCESS VPN disconnected  |
| your changes.                                    | Mode Master unit                     |   |   |
| Review •   | System time 2019-03-27 10:51:35 CE   | Т   |   |
| Settings   | Measurement                          |   |   |
| Customer protocol                                | LPR group ID                         | 1000  |   |
| Filter   |                                      | Value has changed from "  | ۳.  |
| Forwarding                                       |                                      | Integer number in range 11022<br>Group identifier of one pa<br>measuring with each othe | t<br>ir of LPR units associated together. Has to be the same on units<br>r.   |
| LAN  | Measurement mode                     | Master unit   |   |
| Logging  | measurement mode                     | Measuring mode for the L  | PR-1D24 unit. Any measuring pair of LPR-1D24 stations has to consist  |
| Measurement                                      |                                      | of one master and one sla   | ave unit.   |
| Modem  | Number of FSK communication channels | 20  |   |
| Network routes                                   |                                      | stations at the same site.<br>bandwidth.  | The smaller the number of FSK channels, the higher the measurement  |
| Profibus   | FSK communication channel            | 17  |   |
| Profinet   |                                      | Value has changed from "  | 16"   |
| Relay mapping                                    |                                      | Integer number in range 1635  | ned sumber. Use to be the cases on all units predicts to communicate  |
| Relay zones                                      |                                      | with each other.  | mer number. Has to be the same of all units needing to communicate  |
| Remote access                                    | Measurement channel                  | 9   | ×   |
| Timezone   |                                      | Changes ramp slope of m<br>of one pair. Can be chang                                    | neasurements. Has to be configured identically on master and slave unit<br>ged to separate interfering pairs when other pairs are close by. |
| VPN remote access                                | Customer specific offset             | 0.81  | m   |
|  |                                      | Value has changed from "  | '0.0" m   |
|  |                                      | Number In range -1.01.0 m<br>This offset is added to the                                | e measured distance and is to be used only for replacement of LPR1D24   |
|  |                                      | Master units with producti<br>Offset value which needs                                  | on date before December 2018 (see application note DOC.EDO.000241).<br>s to be added is 0.52 m.   |
|  | Payload Slave to Master              | 50 bytes (up to 33 Hz i   | measurement rate)   |
|  |                                      | Concerns only the payloa<br>payload is always possible                                  | ad from slave to master; for master to slave transmissions 200 bytes<br>le. This settings must be the same on master and slave!             |
|  | Submit changes Review changes        |   |   |

Figure 24: Change of mandatory values

#### 7.2.3 Change Settings, Review and Save Changes

Upon pressing the "*Submit changes*" button in any settings sub item, the WebUI is updated and the choice of valid settings is adapted to your made changes. The settings will however not be applied to the radar until you press the "*Save all changes and perform reboot*" button in the "*Review changes*" page or the "*Save all changes without reviewing*" button in the "*Review…*" dropdown menu in the top left corner of this page.

⇒ You can review your changes by clicking the "*Review…*" button in the top left corner of the homepage (see *Figure 25*) or the "*Review changes*" button at the bottom of the screen (see *Figure 24*).



| ABSOLUTE POSITIONING                             |   |                       |                       |                   |  |              |                     |                         |
|--|---|-----------------------|-----------------------|-------------------|--|--------------|---------------------|-------------------------|
| There are unsaved                                | Information over  | rview                 |                       | Devi              | vice Status  |              |                     |                         |
| changes. After you are<br>finished editing, save | Hostname  | symeo-lpr             |                       | Sen               | rvices   | Distance mea | surement            |                         |
| your changes.                                    | IP address  | 192.168.1.99          |                       | Inte              | Interfaces         Binary protocol           Remote         No modem installed         PPP disab           Access         VPN disconnected |              | ol                  |                         |
|  | Firmware  | 8.1.0                 |                       | Ren               |  |              | stalled PPP disable | PPP disabled            |
|  | Mode  | Master unit           |                       |                   |  |              | cieu                |                         |
|  | System time   | 2018-10-17 15:05:56   | CEST                  |                   |  |              |                     |                         |
|  | Review cha  | nges<br><sub>95</sub> |                       |                   |  |              |                     |                         |
|  | Review cha<br>Changed setting<br>Forwarding Settin  | nges<br><sub>gs</sub> |                       |                   |  |              |                     |                         |
|  | Review cha<br>Changed setting<br>Forwarding Settin<br>Parameter   | nges<br>js<br>gs      | Old value             | New v             | value  |              | Unit                | Actions                 |
|  | Review char<br>Changed setting<br>Forwarding Settin<br>Parameter<br>LAN forwarder                                 | nges<br><sub>gs</sub> | Old value<br>Disabled | New v.<br>Enabled | value  |              | Unit                | Actions                 |
|  | Review cha<br>Changed setting<br>Forwarding Settin<br>Parameter<br>LAN forwarder<br>Measurement Sett              | nges<br>js<br>gs      | Old value<br>Disabled | New vi            | value  |              | Unit                | Actions                 |
|  | Review cha<br>Changed setting<br>Forwarding Settin<br>Parameter<br>LAN forwarder<br>Measurement Sett<br>Parameter | nges<br>JS<br>gs      | Old value<br>Disabled | New v.<br>Enabled | value<br>ed<br>New v   | value        | Unit                | Actions<br>O<br>Actions |

Figure 25: Save or Discard all changes

- ⇒ Confirm the changes by clicking the "Save all changes" button. The dialog box "Changes have been applied" will now appear (see Figure 26).
- ⇒ If you would like to discard all changes made after the last save, press "Discard all changes" in the dropdown menu "Review…" in the top left corner of this page or at the bottom of the screen.

After saving, it takes several seconds until the measurement is restarted with the new settings. Some settings additionally require a reboot of the radar.

| Changes have been saved. | Information overview |                         | Device Status |  |
|--------------------------|----------------------|-------------------------|---------------|--|
|                          | Hostname             | lprb-basestation        | Services      | Distance measurement                             |
|                          | IP address           | 192.168.1.99            | Interfaces    | Binary protocol                                  |
|                          | Application          | 7.0.0                   | Remote Access | No modem installed PPP disabled VPN disconnected |
|                          | 1D24 role            | Master unit             |               |  |
|                          | System time          | 2018-03-14 12:53:07 CET |               |  |
|                          |                      |                         |               |  |
|                          | Review changes       |                         |               |  |
|                          | No changes.          |                         |               |  |

Figure 26: Changes have been saved

You can always come back to the start page if you press on the Symeo symbol <sup>Symen</sup> in the top left hand corner of this page.


# 7.3 Homepage

On the home page (see *Figure 27*), miscellaneous information about the LPR<sup>®</sup>-1D24 will be displayed. Beside the *"Information overview"* and the *"Device Status"* which is displayed on each page, you can also see here the *"Product properties"* of the unit. Below is a brief introduction about the sensor.

| SYMEO<br>ABSOLUTE POSITIONING | E Device 🗸 | Q        | Diagnostics 👻  |  |   |  | Logged in as symeo  |
|-------------------------------|------------|----------|--|--|---|--|---|
|                               |            |          | Information overview   |  | Device Status   |  |   |
|                               |            |          | Hostname / IP address  | symeo-lpr / 192.168.1.99   |   | Services   | Distance measurement  |
|                               |            |          | Serial number  | CL26IL0039   |   | Interfaces   | Binary protocol   |
|                               |            | Firmware | 9.0.0  |  | Remote<br>Access  | No modem installed PPP disabled  |   |
|                               |            |          | Mode   | Master unit  |   |  |   |
|                               |            |          | System time  | 2019-07-10 15:54:21 CEST   |   |  |   |
|                               |            |          | Product properties<br>Model number: BSV10175<br>Product name: LPR 1D24<br>Serial number: C126L003<br>Unit production code: C26L003<br>Introduction | 7<br>9<br>P C S SSS<br>LPR®-1D24 is a highly precise radio s<br>applications and enable additional dat<br>e.g. a crane or crane trolley, can thus<br>cell input) is available at the paired uni<br>In addition to the distance reading, the<br>can be used for internal collision avoic<br>will be activated. All data is made ava<br>The devices are easy to install and op<br>distances. The multi-channel radio ant<br>easy configuration of the unit ID, the p<br>Symeo LPR® radio works highly reliat<br>parallel can be excluded at all times. A | senso<br>a trar<br>s be d<br>it sim<br>e relat<br>idance<br>tenna<br>pairec<br>ble ur<br>A unic | r for distance measure<br>isfer at the same time.<br>ynamically determined i<br>ultaneously.<br>tive approach speed of<br>e decisions at predeten<br>at standard interfaces<br>e. Rough alignment betv.<br>is integrated in the rob<br>d unit ID and other param<br>nder adverse conditions<br>up D per each unit alio | ment. Two paired units allow for long range<br>The exact position of a moving machine component,<br>in real-time, while data collected at one end (e.g. a load<br>the LPR®sensors is available. Distance and speed<br>nined distance thresholds. Optional on-board relays<br>ween the facing units is sufficient, even for very long<br>ust housing design. A built-in terminal server allows<br>neters in any browser. |
|                               |            |          |  | LPR®-1D24 sensors are maintenance<br>several distances at a single interface   | e-free<br>e, e.g  | and paired sensors ca<br>for crane xy position   | n be interconnected with other pairs, providing<br>acquired by two sensor pairs.  |

Figure 27: The Home Page of LPR<sup>®</sup>-1D24

On top of every page, the device status is shown (see *Figure 28*):

| Device Status |  |
|---------------|--|
| Services      | Distance measurement                             |
| Interfaces    | Binary protocol                                  |
| Remote Access | No modem installed PPP disabled VPN disconnected |

Figure 28: WebUI - Device Status



- The "*Device Status*" shows the status of the Services, of the interfaces and the Remote Access status.
  - The service status *"Distance measurement"* and the interface status *"Binary protocol"* will be displayed in green, if the measurement path is configured correctly and the customer equipment has been connected to the binary protocol. This also applies to the Remote Access Option if it is available, configured and connected.

It takes some seconds after switching on or after a reboot before the indicator color changes to green. A yellow color could indicate an error in the configuration settings.

• The interface status *"Binary protocol"* button is only green if the customer equipment is connected to the binary port.

The "Information overview" window (see Figure 29) shows:

- Hostname / IP address of the LPR<sup>®</sup>-1D24
- Serial number
- Firmware
- Mode: Master or Slave
- System time

| Information overview  |                          |
|-----------------------|--------------------------|
| Hostname / IP address | symeo-lpr / 192.168.1.99 |
| Serial number         | CL26IL0039               |
| Firmware              | 9.0.0                    |
| Mode                  | Master unit              |
| System time           | 2019-07-10 15:55:43 CEST |

Figure 29: WebUI Information overview

Under the field "System time" (see Figure 29), you can either choose to

- use the system time of your computer or
  - enter the time in the current timezone configured for the unit or as UTC time

#### Set system time

| New system time   |  |  |  |  |
|---|--|--|--|--|
| You can either choose to use the system time of your computer by clicking this button:<br>Set to current time of this system  |  |  |  |  |
| Or you can enter the new date and time for this unit manually. You can choose to enter the time in the current timezone configured for the unit or as UTC time. Please select the appropriate option. |  |  |  |  |
| CEST - 2018-10-10 15:12:58  |  |  |  |  |
| Set time  |  |  |  |  |

Figure 30: Set system time



The "Product properties" window (see Figure 31) displays:

- Model number (Product ID)
- Product name
- Serial number
- Unit production code (gives conclusions regarding the equipment and the performance features of the purchased product)

| Product properties  |                                   |  |  |  |
|---|-----------------------------------|--|--|--|
| Model number:<br>Product name:<br>Serial number:<br>Unit production code: | BSV101757<br>LPR-1D24<br>DACH0001 |  |  |  |

Figure 31: WebUI - Product properties

⇒ Click the "Unit production code" button under the menu item "Product properties" (see Figure 31). The table with the product features will be displayed.

The table below shows a complete list of all features available for this unit (see Figure 32).

| Product features   |                            |        |
|--|----------------------------|--------|
| Please inspect the table below to see a complete list of all features available for this unit.   |                            |        |
| Feature description  | Production code<br>element | Active |
| High accuracy for range measurement +/-2.5 cm (1 $\sigma)$   | a                          | No     |
| Data transmission of user data and relay switch commands via radio signal  | d                          | Yes    |
| Profinet   | 0                          | No     |
| Profibus   | P                          | No     |
| 4 opening relay switches   | 0                          | No     |
| LPR®-1D24 metal housing with integrated multiple antennas (redundant range measurement), 1D controller, interface TCP/IP; range 50 m; accuracy: +/-20 cm (3 $\sigma$ ) | 0                          | Yes    |
| Range option: 0 to 200 m   | ×                          | No     |
| Range option: 0 to 500 m   | xx                         | No     |
| Range option: 0 to 1000 m  | xxx                        | No     |

#### Figure 32: WebUI - Product features



Not all product features can be combined with each other. For example, the simultaneous use of the Profibus module and the relays is not possible.



# 7.4 Device

In this menu (see Figure 33), the following subpages are available:

- Settings
- Upload configuration
- Downloads
- Firmware update
- Factory reset
- Reboot device



Figure 33: Device Menu

# 7.5 Device - Settings

In this menu (see Figure 34), the following subpages are available:

- Customer protocol
- Filter
- Forwarding
- LAN
- Logging
- Measurement
- Modem
- Network Routes
- Profibus
- Profinet
- Relay Mapping
- Relay Zones
- Remote Access
- Timezone
- VPN Remote Access



| Solute Positioning | <b>Q</b> Diagnostics - |   |                          |                            | Logged in as symeo                                  |
|--------------------|------------------------|---|--------------------------|----------------------------|---|
| Settings           | Information ove        | rview   | Dev                      | ice Statu                  | IS  |
| Customer protocol  | Hostname               | 1D24-PMS3   | Ser                      | vices                      | Distance measurement                                |
| Filter             | IP address             | 192.168.97.105                                    | Inte                     | Interfaces Binary protocol | Binary protocol                                     |
| Ecoverding         | Firmware               | 8.0.1   | Ren                      | note                       | No modem installed PPP disabled                     |
|                    | Mode                   | Master unit                                       | Au                       | Access VPN disc            | VPN disabled  |
| Logging            | System time            | 2018-09-13 13:25:06 CEST                          |                          |                            |   |
| Measurement        | Cattingo Over          |   |                          |                            |   |
| Modem              | Settings Overv         | ew  |                          |                            |   |
| Network routes     | This section allow     | vs you to set configuration values regarding this | station. This includes   | configurin                 | g the network interface and the device environment. |
| Profibus           | Please select a to     | pic from the menu on the left to view and chang   | e its related properties | S.                         |   |
| Relay mapping      |                        |   |                          |                            |   |
| Relay zones        |                        |   |                          |                            |   |
| Remote access      |                        |   |                          |                            |   |
| Timezone           |                        |   |                          |                            |   |
| VPN remote access  |                        |   |                          |                            |   |

Figure 34: Device - Settings Menu

This section enables you to adjust configuration settings of this unit. This includes configuring the network interface and the device environment.

Please select a topic from the menu on the left to view and to change the corresponding properties.

i Note

To commission the unit, the entries must be always done under the menu item *"Measurement*".

If you want to change the default settings of the IP addresses and ports, you must also make changes under the menu items *"Customer protocol"* and *"LAN*" (all other settings only when required).

Some settings are only displayed on the screen if the necessary hardware is available (e.g. Profibus, Profinet or Relay).



# 7.5.1 Device - Settings - Customer Protocol

In this menu (see Figure 35), the following settings are available:

- Mode of customer protocol –

   Interface to customer either TCP or UDP
- Port
  - Port of customer protocol binary XP
  - Protocol frame length –
     Frame length of customer protocol binary XP
- TX requests
  - Generates TX requests to inform the customer, that the LPR<sup>®</sup>-1D24 is ready to process a new USER\_DATA message
- Enable custom output interval -
  - Enables a custom output interval of own distance. If disabled, the own measured distance is output with measurement rate. The current measurement rate you can find under *"Diagnostics -> Range measurement statistics*"
- Output interval of own distance -
  - Output interval of own measured distance in milliseconds. Outputs interval of the data record at the customer interface
- Output forwarded relay commands
  - Outputs relay switch messages, forwarded by another LPR<sup>®</sup>-1D24.

| Mode of customer protocol       | TCP server (customer connects to LPR-1D24 unit)  |                            |
|---------------------------------|--|----------------------------|
|                                 | Interface to customer - either TCP or UDP  |                            |
| Port                            | 3046   |                            |
|                                 | Integer number in range 110085535  |                            |
|                                 | Port of customer protocol binary XP  |                            |
| Protocol frame length           | 47   | byte                       |
|                                 | Integer number in range 47100 byte   |                            |
|                                 | Frame length of customer protocol binary XP  |                            |
| TX requests                     | Disabled   |                            |
|                                 | Generate TX request's to inform the customer, that LPR unit is ready to process a new U message  | ISER_DATA                  |
| Enable custom output interval   | Enabled  |                            |
|                                 | Enable a custom output interval of own distance. If disabled, the own measured distanc<br>measurement rate. If disabled and the device is in slave mode, no error messages are g | e is output w<br>enerated. |
| Output interval of own distance | 100  | ms                         |
|                                 | Integer number in range 2560000 ms   |                            |
|                                 | Output interval of own measured distance in milliseconds   |                            |
| Output forwarded relay commands | Disabled   |                            |
|                                 | Output relay switch messages, forwarded by another LPR1D24 unit  |                            |
|                                 |  |                            |

Figure 35: Device - Settings - Customer protocol



## 7.5.2 Device - Settings - Filter

In this menu (see Figure 36), the following settings are available:

- Enable advanced filtering
  - Enables speed dependent filtering method
  - o Decreases filter lag time and measurement noise

| i | Note |  |
|---|------|--|
|   |      |  |
| i | Note |  |

The filter should only be enabled under good measuring conditions.

This function must be set on the Master unit.

| Filter         |  |   |
|----------------|--|---|
| Enable advar   | nced filtering Disabled<br>Enable speed dependent filtering method | ~ |
| Submit changes |  |   |

Figure 36: Device - Settings - Filter

# 7.5.3 Device - Settings - Forwarding

The LPR<sup>®</sup>-1D24 can forward the following data from one radar to another:

- The measured distance
- USER- and RELAY-data received by customer protocol (can only be forwarded via radio transmission)
- Data already forwarded by another LPR®-1D24

In this menu (see *Figure 37*), the following settings are available:

- Radio channel forwarder (is activated by default) -
  - Forwards all possible data via radio channel to partner LPR<sup>®</sup>-1D24. The maximum data amount, which can be transmitted, is 200 bytes. If more than 50 bytes shall be transferred from Slave to Master via radio transmission, please adjust setting *"Measurement -> Payload Slave to Master"*

See Application example in the chapter 8.3.

- LAN forwarder (must be first activated by the user) -
  - Forwards all possible data (USER- and RELAY-data is only forwarded via LAN if it was forwarded via radio channel beforehand) via LAN to connected LPR<sup>®</sup>-1D24 units. A destination IP address must be set (see *Figure 38*)
  - The forwarding takes place via UDP therefore a UDP broadcast address can also be set as the destination IP address to forward the data to more than one LPR<sup>®</sup>-1D24. The customer can enter USER- and RELAY- data records. These are forwarded with the injection rate, **but not faster** than the LPR<sup>®</sup>-1D24 measurement rate (about 30 Hz)
- Enable custom forward interval -



- Enables a custom forward interval of the unit's distance data (see *Figure 38*). This can be necessary if a slow processing device is at the end of the forwarding chain. If disabled, the own measured distance is forwarded with the measurement rate
- Time delay of network and forwarding hops -
  - Compensates the time delay caused by network and forwarding hops. The forwarded distance is recalculated, based on the current velocity and the set time delay.

| i | Note |  |
|---|------|--|
| i | Note |  |

No configuration is required on the respective LPR<sup>®</sup>-1D24 receiving radar.

The amount of forwarded data via radio transmission influences the measurement rate of the device.

| Forwarding                                |   |                  |
|---|---|------------------|
| Radio channel forwarder                   | Enabled   | ~                |
|   | Forward packages via radio channel to partner LPR1D24 unit  |                  |
| LAN forwarder                             | Disabled  | ~                |
|   | Forward packages via LAN to connected LPR1D24 unit  |                  |
| Enable custom forward interval            | Disabled  | $\sim$           |
|   | Enable a custom forward interval of own distance. If disabled, the own measured distan<br>with measurement rate.  | nce is forwarded |
| Time delay of network and forwarding hops | 0   | ms               |
|   | Integer number in range 0500 ms<br>Compensate the time delay caused by network and forwarding hops. The forwarded dis<br>recalculated, based on the current velocity. | stance is        |
| Submit changes                            |   |                  |

Figure 37: Device - Settings - Forwarding

**i** Note

If you want to enable *"LAN forwarder*" to forward distance data and user data to the LPR<sup>®</sup>-1D24 that is connected via LAN, or if you want to activate the own forwarding interval, you must confirm this by pressing the *"Submit changes*" button to enter the Destination IP address or the Output interval.



| Forwarding                                |   |                      |
|---|---|----------------------|
| Radio channel forwarder                   | Enabled   | ~                    |
| LAN forwarder                             | Forward packages via radio channel to partner LPR1D24 unit  | ~                    |
|   | Value has changed from "Disabled"   |                      |
|   | Forward packages via LAN to connected LPR1D24 unit  |                      |
| Destination IP address                    | 0.0.0.0<br>Destination IP address of connected LPR1D24 unit   |                      |
| Enable custom forward interval            | Enabled   | ~                    |
|   | Value has changed from "Disabled"   |                      |
|   | Enable a custom forward interval of own distance. If disabled, the own measured distance is forward measurement rate.                                     | arded with           |
| Output interval of own distance           | 100   | ms                   |
|   | Integer number in range 2560000 ms  |                      |
|   | Output interval of own measured distance to be forwarded over LAN.  |                      |
| Time delay of network and forwarding hops | 0   | ms                   |
|   | Integer number in range 0500 ms<br>Compensate the time delay caused by network and forwarding hops. The forwarded distance is re<br>the current velocity. | calculated, based on |
| Submit changes Review changes             |   |                      |

Figure 38: Device - Settings - Forwarding - Parameter setting

# 7.5.4 Device - Settings - LAN

In this menu, (see Figure 39), the following settings are available:

- Link type
- Address Mode
- IP-Address
- Netmask
- Gateway
- Hostname (Local hostname, this name will also be offered to the DHCP server in DHCP mode)
- DNS (IP of name server domain name system
- Syslog (IP of server for syslog messages)
- NTP Server (IP or hostname of time server network time protocol)



| LAN            |  |        |
|----------------|--|--------|
| Link type      | Autonegotiation  | $\sim$ |
| Address Mode   | Static IP  | $\sim$ |
| IP-Address     | 192.168.1.99   |        |
| Netmask        | 255.255.255.0  |        |
| Gateway        | 0.0.0.0  |        |
| Hostname       | symeo-lpr  |        |
|                | Local hostname, this name will also be offered to the DHCP server in DHCP mode |        |
| DNS            | 0.0.0.0  |        |
| Syslog         | 0.0.0.0  |        |
|                | IP of server for syslog messages   |        |
| NTP Server     |  |        |
| Submit changes | er nostname of time server (network time protocol)                             |        |

Figure 39: Device - Settings - LAN Settings

# 7.5.5 Device - Settings - Logging

In this menu (see *Figure 40*), you can choose the logging mode:

- Disabeled
- Log to SD card if available
- Log to USB stick if available (recommended)
- Log to USB stick if available, use SD card as fallback
- Log to volatile memory only

| Logging        |              |   |        |
|----------------|--------------|---|--------|
|                | Logging mode | Log to USB stick if available (recommended)                                   | $\sim$ |
| Submit changes |              | Defines whether unit logs system events and measurements to a storage device. |        |

Figure 40: Device - Settings - Logging



The logging function is only to be activated temporarily in case of trouble shooting. The Symeo Support Team must be informed under <a href="mailto:support@symeo.com">support@symeo.com</a> prior to the activation.





### 7.5.6 Device - Settings - Measurement

In this menu (see Figure 41), the following settings are available:

- LPR<sup>®</sup>-1D24 group ID
  - Group identifier of one pair of LPR<sup>®</sup>-1D24, associated together. Has to be the same on units measuring with each other. Diverse measurement paths must also be adjusted to different group IDs
- Measurement mode
  - Measuring mode for the LPR<sup>®</sup>-1D24. Any measuring pair of LPR<sup>®</sup>-1D24 has to consist of one Master and one Slave unit
- Number of FSK communication channels -
  - Number of different FSK communication channels available. Must be the same value for all radars at the same site. The smaller the number of FSK channels, the higher the measurement bandwidth
- FSK communication channel -
  - Data communication channel number. Has to be the same on all units that need to communicate with each other
- Measurement channel
  - Changes ramp slope of measurements. Has to be configured identically on Master and Slave unit of one pair. Can be adapted to separate interfering pairs close to each other
- Customer specific offset -

# Caution

- This offset will be added to the measured distance and may only be used for the replacement of LPR®-1D24 Master units with a production date before December 2016 (please observe the Application Note "DOC.EDO.000241.0001.EN\_Replacement\_procedure\_for\_LPR-1D24\_Master-Units\_delivered\_before\_12.2016.pdf".).
   The Offset value that must be entered is 0.52 m
- Payload Slave to Master
  - o Adjusts the internal delay time reserved for radio transmission data
  - If less than 50 bytes need to be forwarded via radio transmission the setting "50 bytes" should be used
  - If more than 50 bytes (maximum 200 bytes) need to be forwarded via radio transmission, the setting "200 bytes" should be used.

Concerns only the payload from slave to master; for master to slave transmissions 200 bytes payload is always possible.



These settings must be the same on Master and Slave.



| Measurement                          |  |
|--------------------------------------|--|
| LPR group ID                         | 1000         Integer number in range 11022         Group identifier of one pair of LPR units associated together. Has to be the same on units measuring  |
| Measurement mode                     | With each other.  Master unit Measuring mode for the LPR-1D24 unit. Any measuring pair of LPR-1D24 stations has to consist of one master and one slave unit.   |
| Number of FSK communication channels | 20   |
| FSK communication channel            | the same site. The smaller the number of FSK channels, the higher the measurement bandwidth.          17         Integer number in range 1835         Data communication channel number. Has to be the same on all units needing to communicate with each                      |
| Measurement channel                  | other. 9 Changes ramp slope of measurements. Has to be configured identically on master and slave unit of one pair. Can be changed to separate interfering pairs when other pairs are close by.  |
| Customer specific offset             | 0.81 m Number in range -1.01.0 m This offset is added to the measured distance and is to be used only for replacement of LPR1D24 Master units with production date before December 2016 (see application note DOC.ED0.000241). Offset value which needs to be added is 0.52 m. |
| Payload Slave to Master              | 50 bytes (up to 33 Hz measurement rate)  |
| Submit changes                       |  |

Figure 41: Device - Settings - Measurement

When the General settings function (*Device ->Settings -> Measurement*) is opened the first time, FSK communication channel and Measurement channel must be configured. The values for the FSK communication channel must be in the range given for the specific country, here between 16...35 (see *Figure 41*).



# Example Configuration of One Pair of LPR<sup>®</sup>-1D24:

| Measurement                          |  |                 |
|--------------------------------------|--|-----------------|
| LPR group ID                         | 1000   |                 |
|                                      | L<br>Integer number in range 11022<br>Group identifier of one pair of LPR units associated together. Has to be the same on units mea<br>with each other.   | suring          |
| Measurement mode                     | Master unit  | ~               |
|                                      | Measuring mode for the LPR-1D24 unit. Any measuring pair of LPR-1D24 stations has to consi<br>master and one slave unit.   | st of one       |
| Number of FSK communication channels | 20   | ~               |
|                                      | Number of different FSK communication channels available. Must be the same value for all stat<br>the same site. The smaller the number of FSK channels, the higher the measurement bandwidt  | tions at<br>th. |
| FSK communication channel            | 17   |                 |
|                                      | Integer number in range 1835<br>Data communication channel number. Has to be the same on all units needing to communicate to<br>other.   | with each       |
| Measurement channel                  | 9  | $\sim$          |
|                                      | Changes ramp slope of measurements. Has to be configured identically on master and slave u<br>pair. Can be changed to separate interfering pairs when other pairs are close by.  | init of one     |
| Customer specific offset             | 0.81 m   |                 |
|                                      | Number in range -1.01.0 m<br>This offset is added to the measured distance and is to be used only for replacement of LPR1I<br>Master units with production date before December 2016 (see application note DOC.EDO.0002<br>Offset value which needs to be added is 0.52 m. | D24<br>241).    |
| Payload Slave to Master              | 50 bytes (up to 33 Hz measurement rate)  | ~               |
| Submit changes                       | Concerns only the payload from slave to master; for master to slave transmissions 200 bytes<br>always possible. This settings must be the same on master and slave!  | payload is      |

| Measurement                          |   |          |
|--------------------------------------|---|----------|
| LPR group ID                         | 1000  |          |
|                                      | Integer number in range 11022<br>Group identifier of one pair of LPR units associated together. Has to be the same on units measuri<br>each other.  | ing with |
| Measurement mode                     | Slave unit  | ~        |
|                                      | Measuring mode for the LPR-1D24 unit. Any measuring pair of LPR-1D24 stations has to consist o<br>master and one slave unit.  | fone     |
| Number of FSK communication channels | 20  | $\sim$   |
|                                      | Number of different FSK communication channels available. Must be the same value for all station:<br>same site. The smaller the number of FSK channels, the higher the measurement bandwidth. | s at the |
| FSK communication channel            | 17  |          |
|                                      | Integer number in range 1835<br>Data communication channel number. Has to be the same on all units needing to communicate with<br>other.  | ı each   |
| Measurement channel                  | 9   | $\sim$   |
|                                      | Changes ramp slope of measurements. Has to be configured identically on master and slave unit of<br>pair. Can be changed to separate interfering pairs when other pairs are close by.         | ofone    |
| Payload Slave to Master              | 50 bytes (up to 33 Hz measurement rate)   | $\sim$   |
|                                      | Concerns only the payload from slave to master; for master to slave transmissions 200 bytes pay<br>always possible. This settings must be the same on master and slave!                       | load is  |
| Submit changes                       |   |          |

Figure 42: Example configuration of one measurement pair Master and Slave unit





Configuration rules:

- To prevent mutual disturbance of multiple LPR<sup>®</sup>-1D24, multiple use of the same FSK channel in the radio coverage of the devices must be avoided (e.g. do not use two routes with the same FSK = 1).
- If pairs of the LPR<sup>®</sup>-1D24 are mounted within radio coverage, the FSK channels should be at least two channels apart from each other, e.g. 16, 18.
- Furthermore, these LPR<sup>®</sup>-1D24 pairs should also get different measurement channels, e.g. 0 or 1.

#### Example Configuration:

FSK: 16 Measurement channel: 0

FSK: 18 Measurement channel: 1

Your settings changes (e.g. FSK communication channel value) will be shown in green (see *Figure 43*).

| Measurement                          |  |                    |
|--------------------------------------|--|--------------------|
| LPR group ID                         | 1000   |                    |
|                                      | Integer number in range 11022<br>Group identifier of one pair of LPR units associated together. Has to be the same on units measur<br>with each other.   | ring               |
| Measurement mode                     | Master unit  | $\sim$             |
|                                      | Measuring mode for the LPR-1D24 unit. Any measuring pair of LPR-1D24 stations has to consist<br>master and one slave unit.   | ofone              |
| Number of FSK communication channels | 20   | $\sim$             |
|                                      | Number of different FSK communication channels available. Must be the same value for all station the same site. The smaller the number of FSK channels, the higher the measurement bandwidth.  | is at              |
| FSK communication channel            | 16   |                    |
|                                      | Value has changed from "17"  |                    |
|                                      | Integer number in range 1035<br>Data communication channel number. Has to be the same on all units needing to communicate wit<br>other.  | h each             |
| Measurement channel                  | 9  | $\sim$             |
|                                      | Changes ramp slope of measurements. Has to be configured identically on master and slave unit<br>pair. Can be changed to separate interfering pairs when other pairs are close by.   | ofone              |
| Customer specific offset             | 0.81 m   |                    |
|                                      | Number in range -1.01.0 m<br>This offset is added to the measured distance and is to be used only for replacement of LPR1D24<br>Master units with production date before December 2016 (see application note DOC.EDO.000241<br>Offset value which needs to be added is 0.52 m. | <del>1</del><br>). |
| Payload Slave to Master              | 50 bytes (up to 33 Hz measurement rate)  | $\sim$             |
|                                      | Concerns only the payload from slave to master; for master to slave transmissions 200 bytes pay<br>always possible. This settings must be the same on master and slave!  | yload is           |
| Submit changes Review changes        |  |                    |

Figure 43: Device - Settings - Measurement - Submit/Review Changes

⇒ Click "Submit changes" button to save your changes or the "Review changes" button to check your changes.

The "*Review changes*" window will be shown. Here you can check all parameters that you have changed.



Review changes

| Changed setting    | S                   |           |           |        |         |
|--------------------|---------------------|-----------|-----------|--------|---------|
| Measurement Settin | ngs                 |           |           |        |         |
| Parameter          |                     | Old value | New value | Unit / | Actions |
| FSK communication  | channel             | 34        | 16        |        | 0       |
| Save all changes   | Discard all changes |           |           |        |         |



⇒ Press the "Save all changes" button to save your changes or the "Discard all changes" button to discard your changes. You can also save or review all changes in the "Review…" button at the left upper corner of this page (see Figure 45).

| ASSOLUTE POSITIONING Device - Q D  | iagnostics 👻         |                          |  |
|--|----------------------|--------------------------|--|
| Saved successfully!  | Information overview |                          |  |
|  | Hostname             | symeo-lpr                |  |
| There are unsaved<br>changes. After you are<br>finished editing, save your<br>changes. | IP address           | 192.168.1.99             |  |
|  | Firmware             | 8.1.0                    |  |
|  | Mode                 | Master unit              |  |
| Review   | System time          | 2018-10-10 14:38:55 CEST |  |
| Save all changes without reviewing   | 1                    |                          |  |
| Discard all changes  | Forwarding           |                          |  |
|  |                      |                          |  |

Figure 45: Device - Settings - Measurement - Review

# 7.5.7 Device - Settings - Modem

In this menu (see Figure 46), the following settings are available:

- PPP Point to Point protocol connection
- APN address
- APN username
- APN password

| Modem          |          |
|----------------|----------|
| РРР            | Disabled |
| APN address    |          |
| APN username   |          |
| APN password   |          |
| Submit changes |          |

Figure 46: Device - Settings - Modem



## 7.5.8 Device - Settings - Network Routes

In this menu (see Figure 47), you can adapt the network routes.

⇒ Click the "+ add route" button.

| Network routes        |
|-----------------------|
| Adapt network routes  |
| No routes defined yet |
| + add route           |

Figure 47: Device - Settings - Network Routes

The dialog box "*Add route*" will appear.

 $\Rightarrow$  Press the "*Add route*" button.

| Add route         |               |  |
|-------------------|---------------|--|
| Туре              | Network       |  |
| Target IP address | 192.168.98.1  |  |
| Netmask           | 255.255.255.0 |  |
| Gateway           | 192.168.97.1  |  |
| Add route Cancel  |               |  |

Figure 48: Device - Settings - Network Routes - Add route

Here you can check the made changes and add the new route (see Figure 49).

| Network routes             |         |                   |                 |              |  |  |
|----------------------------|---------|-------------------|-----------------|--------------|--|--|
| Adapt network routes       |         |                   |                 |              |  |  |
| Route                      | Туре    | Target IP address | Network Netmask | Gateway      |  |  |
| 1                          | Network | 192.168.98.1      | 255.255.255.0   | 192.168.97.1 |  |  |
| + add route Review changes |         |                   |                 |              |  |  |

Figure 49: Device - Settings - Network Routes - Review changes



### 7.5.9 Device - Settings - Profibus

This function is only available under the menu "*Device* -> *Settings*" if the device is equipped with a Profibus Interface.

In this menu (see *Figure 50*), you can set the Profibus slave address:

| Profibus       |                        |  |
|----------------|------------------------|--|
|                | Profibus slave address | 65   |
|                |                        | Integer number in range 1125<br>Profibus slave address for this device on the bus. |
| Submit changes |                        |  |

Figure 50: Device - Settings - Profibus

For information how to connect the Profibus interface to your system, please refer to our application note "DOC.EDO.000060.0002.EN\_app\_note\_LPR-1D24\_Profibus.pdf". This could be found in the "Partner/Customer Login" area of our website under "Symeo\_Docs". There you will also find a GSD file. You can also download this GSD file directly from the device under "*Device -> Downloads*" (see *Figure 51*).

| Downloads   |                                |  |  |  |
|---|--------------------------------|--|--|--|
| In this section you can download several files from the unit. |                                |  |  |  |
| Settings  | Download settings of this unit |  |  |  |
| Profibus GSD file   | Download Profibus GSD file     |  |  |  |
| Profinet GSDML file   | Download Profinet GSDML file   |  |  |  |
|   |                                |  |  |  |

Figure 51: Device - Settings - Downloads, Profibus GSD file

# 7.5.10 Device - Settings - Profinet

i Note

This function is only available under the menu *"Device -> Settings*" if the device is equipped with a Profinet interface.

In this menu, you can view the settings of the Profinet interface.

⇒ Click the "*Refresh*" button to reload the view or press "*Clear Profinet settings*" to delete the current settings (see *Figure 52*).

i Note



| Profinet settings  |                   |  |  |  |
|--|-------------------|--|--|--|
| The following settings are obtained from the profinet controller. You cannot change it here. |                   |  |  |  |
| Parameter  | Value             |  |  |  |
| MAC address  | 00:04:a3:db:b7:cb |  |  |  |
| Device name  | lpr1d24-82-left   |  |  |  |
| IP address   | 0.0.0.0           |  |  |  |
| Netmask  | 0.0.0.0           |  |  |  |
| Gateway  | 0.0.0.0           |  |  |  |
| Refresh Clear Profine  | et settings       |  |  |  |

Figure 52: Device - Settings - Profinet



This device complies with Profinet Conformance Class A.

It has one Ethernet interface (M12-Connector), one MAC address and up to two IP addresses:

# an IPv4 IP address (default 192.168.1.99) and a Profinet IP address (optional).

IPv4 address and Profinet IP address of a device must not be the same, i.e. all IP addresses in the network segment must be unique.

For example if two devices are connected via a network switch, up to 4 (four) different IP addresses must be assigned.

For information how to connect the Profinet interface to your system, please refer to our application note "DOC.EDO.000258.0002.EN\_app\_note\_LPR-1D24\_Profinet.pdf", which can be found in the "Partner/Customer Login" area of our website under "Symeo\_Docs". There you will also find the GSDML file. You can also download the GSDML file directly from the device under *"Device -> Downloads"* (see *Figure 53*).

| Downloads               |                                       |
|-------------------------|---------------------------------------|
| In this section you can | download several files from the unit. |
| Settings                | Download settings of this unit        |
| Profibus GSD file       | Download Profibus GSD file            |
| Profinet GSDML file     | Download Profinet GSDML file          |
|                         |                                       |

Figure 53: Device - Settings - Downloads, Profinet GSDML file



# 7.5.11 Device - Settings - Relay Mapping

In this menu (see Figure 54), the following settings are available:

- Relay 1
- Timeout Relay 1 (only applicable if relay is remote controlled)
- Relay 2
- Timeout Relay 2 (only applicable if relay is remote controlled)
- Relay 3
- Timeout Relay 3 (only applicable if relay is remote controlled)
- Relay 4
- Timeout Relay 4 (only applicable if relay is remote controlled)

Under the items Relay (1, 2, 3, 4) you can choose the following settings:

- System Health -> Relay will open if there is no longer a valid distance measurement
- Controlled by Zone 1 state -> Relay will open when measured distance is below this value
- Controlled by Zone 2 state -> Relay will open when measured distance is below this value
- Remote controlled by Customer Interface -> Relay will be operated by the externally relay switching command (see chapter 9.2.3)
- Remote controlled by Profinet -> Relay is switched by a relay switching command via Profinet
- Remote controlled by other LPR<sup>®</sup>-1D24 -> Relay is switched by a relay switching command via the air interface (see chapter 9.2.3).

| Relay mapping   |   |    |
|-----------------|---|----|
| Relay 1         | Remote controlled by Customer Interface (Network)   | ~  |
| Timeout Relay 1 | 1000  | ms |
|                 | Integer number in range 030000 ms<br>Timeout of relay 1 (only applicable if relay is remote controlled) |    |
| Relay 2         | Remote controlled by Customer Interface (Network)   | ~  |
| Timeout Relay 2 | 1000  | ms |
|                 | Integer number in range 030000 ms<br>Timeout of relay 2 (only applicable if relay is remote controlled) |    |
| Relay 3         | Remote controlled by Customer Interface (Network)   | ~  |
| Timeout Relay 3 | 1000  | ms |
|                 | Integer number in range 030000 ms<br>Timeout of relay 3 (only applicable if relay is remote controlled) |    |
| Relay 4         | Remote controlled by Customer Interface (Network)   | ~  |
| Timeout Relay 4 | 1000  | ms |
|                 | Integer number in range 030000 ms<br>Timeout of relay 4 (only applicable if relay is remote controlled) |    |
| Submit changes  |   |    |

Figure 54: Device - Settings - Relay mapping

Web User Interface for LPR®-1D24



The relays, which receive Relay Switching Command externally or via radio, will be opened if one or more Relay Switching Command are not received in time. To prevent this problem, you can set a timeout for each relay.

Only when the set timeout is exceeded without receiving a Relay Switching Command, the relays open.

### 7.5.12 Device - Settings - Relay Zones

This function is only available if the device is equipped with relays.

In this menu (see *Figure 55*), the following settings are available:

- Zone 1 distance
  - Relay assigned to zone 1 will open if measured distance is below this value, e.g. the distance when the stopping zone is reached
- Zone 2 distance
  - Relay assigned to zone 2 will open if measured distance is below this value, e.g. the distance when the warning zone is reached.



Please take note of the following information regarding the *Relay Zones Settings* for Firmware Version **9.0.0 and older**:

The value for *Zone 2 distance* must **always be greater** than the value for *Zone 1 distance*.

| Relay zones     |   |   |
|-----------------|---|---|
| Zone 1 distance | 5.0   | m |
|                 | Number in range 0.040.0 m   |   |
|                 | Relay assigned to zone 1 will open when measured distance below this value. |   |
| Zone 2 distance | 10.0  | m |
|                 | Number in range 0.040.0 m   |   |
|                 | Relay assigned to zone 2 will open when measured distance below this value. |   |
| Submit changes  |   |   |

Figure 55: Device - Settings - Relay zones

Please see the example for the Relay Zones Settings in the chapter 8.2.

### 7.5.13 Device - Settings - Remote Access

This function allows to configure a VPN-access if required:

| Remote access  |         |        |
|----------------|---------|--------|
| нттр           | Enabled | $\sim$ |
| OpenVPN Client | Enabled | $\sim$ |
| Submit changes |         |        |

Figure 56: Device - Settings - Remote Access Settings



# Warning

If you disable http, the access to the WebUI of this unit will be disabled. An access to the WebUI is then only possible via HTTPS.

For configuration of the VPN remote access, please refer to the chapter 7.5.15.

### 7.5.14 Device - Settings - Timezone

In this menu (see Figure 57), the following settings are available:

- Timezone
  - Must be set to custom timezone if needed timezone is not in the dropdown menu
- Custom timezone
  - Needs to be filled if customer specific timezone is used.

| Timezone        |  |  |
|-----------------|--|--|
| Timezone        | Europe/Germany/Berlin - CET and CEST         |  |
| Custom timezone | CET-1CEST-2,M3.5.0/02:00:00,M10.5.0/03:00:00 |  |
| Submit changes  |  |  |

Figure 57: Device - Settings - SystemTime Settings

#### 7.5.15 Device - Settings - VPN Remote Access

In this menu (see Figure 58), you can choose the following VPN remote access settings:

- OpenVPN Client (activate / deactivate)
- PPP (activate / deactivate)
- APN address
- APN username
- APN password
- Current VPN certificate name
- Change VPN certificate Choose new certificate
  - The certificate must be an All-In-One certificate. All keys and certificates must be contained in the same file.

#### VPN remote access

| Settings       |            | Current VPN certificate |
|----------------|------------|-------------------------|
| OpenVPN Client | Disabled V | Certificate name:       |
| РРР            | Disabled   | <none></none>           |
| APN address    |            | Change VPN certificate  |
| APN username   |            | Choose new certificate  |
| APN password   |            | Browse                  |
| Submit changes |            | Submit new certificate  |

Figure 58: Device - Settings - VPN Remote Access Settings



# 7.6 Device - Upload Configuration

In this menu (see Figure 59), you can upload a local configuration file.





- $\Rightarrow$  Click the *"Browse"* button to choose a local configuration file for upload.
- ⇒ Click the *"Upload configuration*" button to upload your configuration.

# 7.7 Device - Downloads

In this menu (see Figure 60), you can download several files from the unit.

- Download settings of this unit (all configuration parameters)
- Download Profibus GSD file
- Download Profinet GSDML file

| )ownloads              |                                       |
|------------------------|---------------------------------------|
| n this section you can | download several files from the unit. |
| Settings               | Download settings of this unit        |
| Profibus GSD file      | Download Profibus GSD file            |
| Profinet GSDML file    | Download Profinet GSDML file          |
|                        |                                       |

Figure 60: Device - Downloads

# 7.8 Device - Firmware Update

In this menu (see Figure 61), the following settings are available:

• Update the firmware

Use the *"Browse*" button to find the firmware file provided by Symeo and press *"Upload firmware*".



Please use **the latest firmware version**.**tar.gz file**. You can download it online on the partner/customer website of Symeo GmbH under:

https://www.symeo.com/en/partner-login/index.html

Web User Interface for LPR®-1D24



| ïrmware update                            |   |
|---|---|
| lease choose a local file for the update: |   |
| Browse lpr_1d24_8.1.0.tar.gz              | J |
| Upload firmware                           |   |

#### Figure 61: Device - Firmware update

A successful firmware upload will be indicated. To activate the new firmware it is necessary to flash the firmware and reboot the unit (see *Figure 62*). Therefore, you have to click on the *"Flash firmware*" button.

| Firmware update       |  |  |
|-----------------------|--|--|
| Upload complete       |  |  |
|                       | Please do not turn off or reset the device after starting Flashing!<br>The device is rebooted automatically after Firmware update. |  |
| Flash firmware Cancel |  |  |

Figure 62: Device - Device configuration - Firmware update success message



All radars that measure or forward together should have the same firmware version. Therefore, both units (Master and Slave) have to be upgraded.

The previous setting "*Device -> Settings -> Customer protocol -> Mode of customer protocol*" is lost after the upgrade to the new Firmware version in case that it had been changed under the previous Firmware version from default value (TCP server).



Please read the Notes on the Firmware Update in "Partner Login" area (Firmware -> "Readme\_Firmware\_Update\_LPR-1D24") under <u>https://www.symeo.com/en/partner-login/index.html</u>.

# 7.9 Device - Factory Reset

In this menu (see Figure 63), you can restore factory settings:

| Confirm Factory Res   | et   |  |
|-----------------------|--|--|
|                       | Attention! All settings are lost after restoring factory settings! |  |
| Really restore factor | ory settings and reboot device?                                    |  |
| NO, do not restore fa | Actory settings YES, do factory reset                              |  |

Figure 63: Device - Factory Reset



Please press "YES, do factory reset" if you want to perform a reboot.



Attention! All settings are lost after restoring factory settings!



Note that factory reset will also reset passwords.

# 7.10 Device - Reboot Device

In this menu (see Figure 64), the following settings are available:

• Reboot the device

| Really reboot device | ce?                |
|----------------------|--------------------|
| NO, do not reboot    | YES, reboot device |

The page will automatically reload once the reboot is finished. Please wait a moment.

Estimated reboot progress

Figure 64: Device - Reboot Device

Please press "YES, reboot device" if you want to perform a reboot.

The homepage will automatically reload once the reboot is finished.

# 7.11 Diagnostics

In this menu (see *Figure 65*), the following subpages are available:

- Operating System Status
- Hardware Status
- Storage device
- Relay status
- Range measurement statistics
- Record measurement data
- Packet monitor
- Packet inspector
- Station scan



| SYMED ABSOLUTE POSITIONING | 📕 Device 👻 | <b>Q</b> Diagnost  | ics 👻  |  |  |  |  |
|----------------------------|------------|--|--|--|--|--|--|
|                            |            | Operating<br>Hardware  | System Status<br>Status  | iew  |  |  |  |
|                            |            | Storage devices<br>Relay status<br>Range measurement statistics<br>Record measurement data |  | D24-PMS3   |  |  |  |
|                            |            |  |  | 92.168.97.105                                      |  |  |  |
|                            |            |  |  | .0.1<br>aster unit                                 |  |  |  |
|                            |            |  |  |  |  |  |  |
|                            |            | Packet mor<br>Packet insp  | nitor<br>pector  | 018-09-13 11:35:59 CEST                            |  |  |  |
|                            |            | Station sca  | in   | 25   |  |  |  |
|                            |            |  | Model number:<br>Product name:<br>Serial number:<br>Unit production co | BSV101757<br>LPR-1D24<br>DACH0001<br>de: a prs xxx |  |  |  |

Figure 65: Diagnostics Menu



# 7.11.1 Diagnostics - Operating System Status

In this menu (see *Figure 66*), the operating system status can be displayed.

In case of problems, this information may be requested by Symeo support.

| Operating System 8         | Status  |  |                        |                           |                     |                 |             |                     |                        |
|----------------------------|---------|--|------------------------|---------------------------|---------------------|-----------------|-------------|---------------------|------------------------|
| Device information         |         |  |                        |                           |                     |                 |             |                     |                        |
| Serial number              |         | DACH0001                               |                        |                           |                     |                 |             |                     |                        |
| Services                   |         | FusionEngine system                    |                        |                           |                     |                 |             |                     |                        |
| Environment settin         | ngs     | Germany (ETSI)                         |                        |                           |                     |                 |             |                     |                        |
| Uptime                     |         |  |                        |                           |                     |                 |             |                     |                        |
| 6 days                     |         |  |                        |                           |                     |                 |             |                     |                        |
| Memory                     |         |  |                        |                           |                     |                 |             |                     |                        |
| MemTotal                   |         | 1031052 kB                             |                        |                           |                     |                 |             |                     |                        |
| MemFree                    |         | 49976 kB                               |                        |                           |                     |                 |             |                     |                        |
| Networking                 | inform  | ation                                  |                        |                           |                     |                 |             |                     |                        |
| Proto                      | Reov-Q  | Send-Q                                 | Local Addre            | 955                       |                     | Foreign Addres  | 55          |                     | State                  |
| top                        | 0       | 0                                      | 22                     |                           |                     |                 |             |                     | LISTEN                 |
| top                        | 0       | 0                                      | 0.0.0.0:22             |                           |                     | 0.0.0.0.*       |             |                     | LISTEN                 |
| top                        | 0       | 0                                      | 0.0.0.0:80             |                           |                     | 0.0.0.0.*       |             |                     | LISTEN                 |
| top                        | 0       | 0                                      | 0.0.0.0:443            |                           |                     | 0.0.0.0.*       |             |                     | LISTEN                 |
| top                        | 0       | 0                                      | 0.0.0.0:1000           | •                         |                     | 0.0.0.0.*       |             |                     | LISTEN                 |
| top                        | 0       | 0                                      | 0.0.0.0:1001           | 1                         |                     | 0.0.0.0:*       |             |                     | LISTEN                 |
| top                        | 0       | 0                                      | 0.0.0.0:1003           | 0.0.0.0:1002              |                     | 0.0.0.0.*       |             |                     | LISTEN                 |
| top                        | 0       | 0                                      | 0.0.0.0:1003           | 0.0.0.0:1003              |                     | 0.0.0.0.*       |             |                     | LISTEN                 |
| top                        | 0       | 0                                      | 0.0.0.0:3046           | 0.0.0.0:3046              |                     | 0.0.0.0.+       |             |                     | LISTEN                 |
| top                        | 0       | 0                                      | 0.0.0.0:7777           | 0.0.0.0:7777              |                     | 0.0.0.0.*       |             |                     | LISTEN                 |
| top                        | 0       | 0                                      | 0.0.0.0.8000           | 0                         |                     | 0.0.0.0.*       |             |                     | LISTEN                 |
| top                        | 0       | 0                                      | 192.168.97.            | 105:80                    |                     | 10.8.0.34:5165  | 1           |                     | ESTABLISHED            |
| Filesystem                 |         |  |                        |                           |                     |                 |             |                     |                        |
| Filesystem                 |         | Size                                   | Used                   | Available                 | Use                 | %               |             | Mounted             |                        |
| /dev/root                  |         | 47.0M                                  | 39.9M                  | 4.7M                      |                     | 8               | 9%          | 1                   |                        |
| devtmpfs                   |         | 495.5M                                 | 0                      | 495.5M                    |                     | 0               | 96          | /dev                |                        |
| tmpfs                      |         | 503.4M                                 | 24.0K                  | 503.4M                    |                     | 0               | 96          | /dev/shm            |                        |
| tmpfs                      |         | 503.4M                                 | 19.1M                  | 484.3M                    | 1                   | 4               | 96          | /tmp                |                        |
| /dev/mmcbik1p1             |         | 124.0M                                 | 42.1M                  | 75.4M                     |                     | 3               | 6%          | /mnt/system         |                        |
| /dev/mmcbik1p2             |         | 124.0M                                 | 1.5M                   | 116.0M                    |                     | 1               | 96          | /mnt/system_backu   | p                      |
| /dev/mmcbik1p5             |         | 3.9M                                   | 32.0K                  | 3.6M                      |                     | 1               | 96          | /mnt/config         |                        |
| /dev/mmcbik1p6             |         | 3.9M                                   | 29.0K                  | 3.6M                      |                     | 1               | 96          | /mnt/config_backup  | 0                      |
| /dev/mmcbik1p9             |         | 2.90                                   | 5.6M                   | 2.89                      | -                   | 0               | 96          | /mnt/storage        |                        |
| /dev/mmcbik1p7             |         | 124.0M                                 | 18.2M                  | 99.3M                     | -                   | 1               | 6%          | /mnt/application    |                        |
| /dev/mmcoik1ps             |         | 124.00                                 | 18.20                  | 99.30                     | _                   | 1               | 576         | /mnt/application_or | sckup                  |
| Software Ve                | reione  | 3.63                                   | 3.23                   | 106.4//                   |                     | 9               | 270         | Annyexi30           |                        |
| Sonware ve                 | 1310113 |  |                        |                           |                     |                 |             |                     |                        |
| Name<br>Restlander Verster | · · ·   |  |                        |                           |                     |                 |             |                     |                        |
| Kamal Varian               |         | -2007 2013.04-0002991676701 ().        | 1494574 (manuficacity) | ultimbabl) (see used as i | 0.0 /Bulldreat CO.d | 3.05-02000740-1 | 964) #4 GVD | DEENET The Area     | 77 16-57-36 05 57 0017 |
| Reniel Version             |         | ************************************** | uruenni (nammizschig   | www.arveniy.gcc.version.4 | Kalo (Banaroot 201  | ana Angeora an  |             | - NEEWEY THU APPS   | ar 10.5r.30 CEST 2017  |

Figure 66: Diagnostics - Operating System Status



# 7.11.2 Diagnostics - Hardware Status

In this menu (see *Figure 67*), system values and system voltages are displayed. In case of problems, this information may be requested by Symeo support.



Figure 67: Diagnostics - Hardware Status

This display is automatically refreshed every 5 seconds.



### 7.11.3 Diagnostics - Storage Devices

In this menu (see *Figure 68*), you can select the storage devices to format them if necessary. Under the *"Format*" button, you can select the filesystem for the device:

- ext2
- ext3
- ext4 (recommended)
- vfat.

| Storage Devices  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|
| The following storage devices were found in your device:                               |  |  |  |  |  |  |
| SD card •     Free space: 2.3 GB       Total size:     3.7 GB       Format     m: vfat |  |  |  |  |  |  |

Figure 68: Diagnostics - Storage Devices

### 7.11.4 Diagnostics - Relay Status

In this menu (see Figure 69), the current relay output of this unit is displayed.

| Relay states         |           |  |  |  |  |
|----------------------|-----------|--|--|--|--|
| Current relay output | this unit |  |  |  |  |
| Relay                | State     |  |  |  |  |
| relay 1              | closed    |  |  |  |  |
| relay 2              | opened    |  |  |  |  |
| relay 3              | opened    |  |  |  |  |
| relay 4              | opened    |  |  |  |  |
| Control relays       |           |  |  |  |  |

Figure 69: Diagnostics - Relay states

By pressing the *"Control relays*" button, you can bridge the normal relay control and test the opening and closing of the relays one by one or altogether (see *Figure 70* and *Figure 71*).







| Relay states          |  |  |
|-----------------------|--|--|
|                       | Warning! Automatic relay control interrupted!  |  |
| Click the colored rel | y buttons to toggle the relay state.<br>ode is changed back to automatic mode in 54 seconds. |  |
| Relay                 | State  |  |
| relay 1               | opened   |  |
| relay 2               | opened   |  |
| relay 3               | opened   |  |
| relay 4               | opened   |  |
| close all relays      | open all relays quit override mode Renew override duration                                   |  |

Figure 71: Diagnostics - Control relays - Relay states



This should never be done in live-operation, but at best during commissioning or maintenance operation.



## 7.11.5 Diagnostics - Range Measurement Statistics

This section allows you to view raw measurements and range statistics (see *Figure 72*). Please select a topic from the menu on the left (see *Figure 72*) to view the corresponding information.

- Live range measurement
- Signal strength statistics
- Measurement rate statistics
- Number valid measurements statistics

| SYNED Device - Q Diagnostics -   |                           |                          |  |  |
|--|---------------------------|--------------------------|--|--|
| Range measurement statistics   | Information overview      |                          |  |  |
| Live more more warmant   | Hostname / IP address     | symeo-lpr / 192.168.1.99 |  |  |
|  | Serial number             | CL26IL0039               |  |  |
| Signal strength statistics   | Firmware                  | 9.0.0                    |  |  |
| Measurement rate statistics  | Mode                      | Master unit              |  |  |
| Number valid measurements<br>statistics  | System time               | 2019-07-10 16:00:33 CEST |  |  |
|  | Range Statistics Overview |                          |  |  |
| This section allows you to view raw measurements and range statistics.<br>Please select a topic from the menu on the left to view the corresponding information. |                           |                          |  |  |

Figure 72: Diagnostics - Range Measurement Statistics



## Live Range Measurement

In this menu (see *Figure 73*), the current distance and the current RSSI value (Signal strength) will be displayed, furthermore, the distance over time graph.



Figure 73: Diagnostics - Distance over time graph

By pointing the mouse in the graph and using the scroll wheel, you can downsize or enlarge the timeline.



# **Signal Strength Statistics**



Figure 74: Diagnostics - RSSI over distance diagram

This diagram shows the recorded distance-signal strength pairs since the last power-on. You can use it to detect abnormal signal propagation routes at certain constellations of the two LPR<sup>®</sup>-1D24, as the signal strength should decrease with increasing distance.

The diagram is automatically refreshed every 10 seconds.

The distance axis displays the distance between the two LPR<sup>®</sup>-1D24, and the RSSI axis the received signal strength in dB. As the signal strength at specific distances may vary, the statistical distribution of the signal strength is also recorded. Displayed are the mean received signal strength, the 10 % quantile and the 90 % quantile. The Quantiles give you information about how many recorded signal strength values were lower than the corresponding line. 10 % of the recorded signal strengths were lower than the 10 % quantile line and 90 % were lower than the 90 % quantile line, leaving 80 % in between those two lines. This way you get an idea of the signal strength distribution per distance without including extreme outliers. This helps identifying distances with increased signal distortions (e.g. due to multipath signal propagation), as the variance of the signal strength there usually increases.



# **Measurement Rate Statistics**



Figure 75: Diagnostics - Measurement rate over distance diagram

This diagram shows the recorded distance-measurement rate pairs since the last power-on. You can use it to detect systematical measurement errors at certain constellations of the two LPR<sup>®</sup>-1D24, as the measurement rate decreases in this case.

The diagram is automatically refreshed every 10 seconds.

The distance axis displays the distance between the two LPR<sup>®</sup>-1D24, and the measurement rate axis the current rate of range measurements in Hertz. As the measurement rate at specific distances may vary, the statistical distribution of the measurement rate is also recorded. Displayed are the mean measurement rate, the 10 % quantile and the 90 % quantile. The Quantiles give you information about how many recorded measurement rate values were lower than the corresponding line. 10 % of the recorded measurement rates were lower than the 10 % quantile line and 90 % were lower than the 90 % quantile line, leaving 80 % in between those two lines. This way you get an idea of the measurement rate distribution per distance without including extreme outliers. This helps identifying distances with increased errors in range measurement (e.g., due to multipath signal propagation), as the measurement rate decreases as errors are encountered.



# Number Valid Measurements Statistics

Number of valid measurements over distance diagram.



Figure 76: Diagnostics - Number of valid measurements over distance diagram

This diagram shows the recorded number of valid measurements pairs since the last poweron. You can use it to detect abnormal signal propagation routes at certain constellations of the two LPR<sup>®</sup> stations.

The diagram is automatically refreshed every 10 seconds.

The distance axis X displays the distance between the two LPR<sup>®</sup> stations, and the Y axis the number of valid measurements. This helps identifying distances with increased signal distortions (e.g. due to multipath signal propagation).

# 7.11.6 Diagnostics - Record Measurement Data

In this menu (see *Figure 79*), you can record the measurement data.

Under "Control" you can change logging mode. The following options are available:

- Disabled
- Log to SD card if available
- Log to USB stick if available (recommended)
- Log to USB stick if available, use SD card as fallback
- Log to volatile memory only
- ⇒ Click the drop-down menu window "Change logging mode" (see Figure 77) to choose the logging mode.



# Control

| Current logging mode: Log to SD card if available      |     |
|--|-----|
| Currently logging to device: SD card                   |     |
| Change logging mode 👻                                  |     |
| Disabled   |     |
| Log to SD card if available                            |     |
| Log to USB stick if available (recommended)            |     |
| Log to USB stick if available, use SD card as fallback | ur  |
| Log to volatile memory only                            | Iro |

Figure 77: Diagnostics - Record measurement data - Change logging mode

⇒ Choose one of the settings (recommended log to USB stick if available) and refresh the page using the F5 key.

Log to USB stick if available (recommended):



#### Log to SD card if available:



Figure 78: Diagnostics - Record measurement data - Change logging mode - Example



Under "Measurements" you can view record measurement data (see Figure 79):

- Measurements from all logging devices Measurements from volatile memory •
- Measurements from SD card •

| Co<br>Currer | nt<br>nt lo   | rol<br>Iging mode: Log to USB stick if available (recommended)                        |           |                |         |  |  |  |
|--------------|---|---|-----------|----------------|---------|--|--|--|
| Ø            | There are currently no devices to log to, thus logging is inactive. |   |           |                |         |  |  |  |
| Cha          | inge  | logging mode -  |           |                |         |  |  |  |
|              |   |   |           |                |         |  |  |  |
| Me           | a   | surements   |           |                |         |  |  |  |
| Mea<br>all I | asun<br>loggi   | ements from Measurements from Measurements from<br>ng devices volatile memory SD card |           |                | C       |  |  |  |
|              |   | Name  | Size      | Viewable files | Actions |  |  |  |
|              | -   | syslog.tar.xz   | 29.1 KiB  |                | ± 0     |  |  |  |
|              | î   | meas_2018-03-03_120001  | 1.2 MiB   |                | ± 0     |  |  |  |
|              | î   | meas_2018-03-03_060001  | 1.2 MiB   |                | ± 0     |  |  |  |
|              | 6   | meas_2018-03-03_000001.tar.xz   | 464.3 KiB |                | ± 0     |  |  |  |
|              | -   | meas_2018-03-02_180001.tar.xz   | 464.3 KiB |                | ± 0     |  |  |  |
|              | 6   | meas_2018-03-02_120001.tar.xz   | 464.3 KiB |                | ± 0     |  |  |  |
|              | Ŀ   | meas_2018-03-02_060001.tar.xz   | 464.3 KiB |                | ± 0     |  |  |  |
|              | 6   | meas_2018-03-02_000001.tar.xz   | 464.2 KiB |                | ± 0     |  |  |  |
|              | Ŀ   | meas_2018-03-01_180001.tar.xz   | 464.3 KiB |                | ± 0     |  |  |  |
|              | 6   | meas_2018-03-01_151549.tar.xz   | 466.4 KiB |                | ± 0     |  |  |  |
|              | -   | meas_2018-03-01_120001.tar.xz   | 464.1 KiB |                | ± 0     |  |  |  |
|              | 6   | meas_2018-03-01_105007.tar.xz   | 466.4 KiB |                | ± 0     |  |  |  |
|              | 6   | meas_2018-03-01_060001.tar.xz   | 464.1 KiB |                | ± 0     |  |  |  |
|              | 6   | meas_2018-03-01_000001.tar.xz   | 464.2 KiB |                | ± 0     |  |  |  |
|              | -   | meas_2018-02-28_180001.tar.xz   | 464.3 KiB |                | ± 0     |  |  |  |
|              | 6   | meas_2018-02-28_174453.tar.xz   | 466.4 KiB |                | ± 0     |  |  |  |
|              | -   | meas_2018-02-19_085956.tar.xz   | 1.9 MiB   |                | ± 0     |  |  |  |
|              | 6   | meas_2018-02-16_155909.tar.xz   | 8.5 MiB   |                | ± 0     |  |  |  |
|              | -   | meas_2018-02-16_141538.tar.xz   | 5.5 MiB   |                | ± 0     |  |  |  |
|              | 6   | meas_2018-02-16_120001.tar.xz   | 12.9 MiB  |                | ± 0     |  |  |  |
|              | -   | meas_2018-02-16_115520.tar.xz   | 1.4 MiB   |                | ± 0     |  |  |  |
|              | 6   | meas_2018-02-16_102129.tar.xz   | 11.4 MiB  |                | ± 0     |  |  |  |
|              | 6   | meas_2018-02-16_090648.tar.xz   | 8.0 MiB   |                | ± 0     |  |  |  |

Figure 79: Diagnostics - Record measurement data


#### 7.11.7 Diagnostics - Packet Monitor

In this menu (see *Figure 80*), you can view the quantity of transmitted and received packets from the various data packages.

| Packet monitor          |                            |                        |
|-------------------------|----------------------------|------------------------|
| Packet type             | Number of received packets | Number of send packets |
| Customer Interface      |                            |                        |
| Own distance            | N/A                        | 950302                 |
| Other distance          | N/A                        | 0                      |
| TX request              | N/A                        | 0                      |
| Userdata                | feature locked             | feature locked         |
| Relay switch            | feature locked             | N/A                    |
| Radio channel Forwarder |                            |                        |
| Other distance          | 0                          | 0                      |
| Userdata                | 0                          | 0                      |
| Relay switch            | 0                          | 0                      |
| LAN Forwarder           |                            |                        |
| Own distance            | N/A                        | 0                      |
| Other distance          | 0                          | 0                      |
| Userdata                | 0                          | 0                      |
| Relay switch            | 0                          | 0                      |
| Refresh                 |                            |                        |

#### Figure 80: Diagnostics - Packet monitor

If problems occur, this information can be requested by Symeo support.



#### 7.11.8 Diagnostics - Packet Inspector

With this window, you can see the output of the binary port (see Figure 81).

For it, you must press the *"Get new data*" button to get at first the last 10 records. Then you must select one record by driving over with the mouse and pressing the left mouse button.

By expanding of *"Hexadecimal view"* and/or *"Detailed view"*, you can view this data in the appropriate format.

Under the "*Outgoing packets/Incoming packets*" button, the outgoing and incoming data packets will be shown.



|      |      |       |      | _  |
|------|------|-------|------|----|
| Pac  | KOT. | Inci  | noct | or |
| 1 00 | NOL. | 111-0 |      |    |

Clear view Get new data Outgoing packets -

#### Overview

| Time stamp   | Туре | Description  | Age (seconds) |
|--------------|------|--|---------------|
| 16:12:10.542 | 16   | Distance Data (GID: 1000, SID: 2, Distance: 126.0m, Error code: 0)   | 0.093         |
| 16:12:10.443 | 16   | Distance Data (GID: 1000, SID: 2, Distance: 126.001m, Error code: 0) | 0.193         |
| 16:12:10.343 | 16   | Distance Data (GID: 1000, SID: 2, Distance: 126.002m, Error code: 0) | 0.293         |
| 16:12:10.243 | 16   | Distance Data (GID: 1000, SID: 2, Distance: 126.002m, Error code: 0) | 0.392         |
| 16:12:10.145 | 16   | Distance Data (GID: 1000, SID: 2, Distance: 126.0m, Error code: 0)   | 0.491         |
| 16:12:10.043 | 16   | Distance Data (GID: 1000, SID: 2, Distance: 126.001m, Error code: 0) | 0.593         |
| 16:12:09.944 | 16   | Distance Data (GID: 1000, SID: 2, Distance: 125.999m, Error code: 0) | 0.692         |
| 16:12:09.843 | 16   | Distance Data (GID: 1000, SID: 2, Distance: 125.999m, Error code: 0) | 0.793         |
| 16:12:09.742 | 16   | Distance Data (GID: 1000, SID: 2, Distance: 126.002m, Error code: 0) | 0.893         |
| 16:12:09.643 | 16   | Distance Data (GID: 1000, SID: 2, Distance: 126.005m, Error code: 0) | 0.993         |

#### Hexadecimal view

#### Detailed view

| Identifier       | Value                                    | Length | Data type        |
|------------------|--|--------|------------------|
| Start identifier | 0x7e                                     | 1      |                  |
| Туре             | 0x16                                     | 1      |                  |
| Source address   | 0x 17 d0                                 | 2      |                  |
| Distance [mm]    | 126000                                   | 4      | signed integer   |
| Velocity [mm/s]  | -1                                       | 4      | signed integer   |
| Level [dB/10]    | -866                                     | 2      | signed integer   |
| Reserved         | 0x 15 ae 00 44 d3 df 00 00               | 8      |                  |
| Error            | 0  | 2      | unsigned integer |
| Reserved         | 0x 00 00 00 00 00 00 00 00 00 00 00 00 0 | 20     |                  |
| CRC              | 0x 6e f2                                 | 2      |                  |
| End identifier   | 0x7f                                     | 1      |                  |

Figure 81: Diagnostics - Packet inspector



#### 7.11.9 Diagnostics - Station Scan

In this menu (see *Figure 82*), the following Symeo units found in your current local area network (LAN) would be displayed.

| Station scan                   |   |                |                      |        |  |  |
|--------------------------------|---|----------------|----------------------|--------|--|--|
| The following Symeo stations v | The following Symeo stations were found in your current local area network (LAN). |                |                      |        |  |  |
| Serial number                  | MAC address   | IP address     | Temporary IP address |        |  |  |
|                                | 54:35:df:00:0b:b1   | 192.168.97.101 | 0.0.0.0              | Change |  |  |
|                                | 54:35:df:00:09:c8   | 192.168.97.102 | 0.0.0.0              | Change |  |  |
| DACH0001                       | 00:04:a3:db:e4:1d   | 192.168.97.105 | 0.0.0.0              | Change |  |  |
|                                | 00:50:c2:0d:6b:b5   | 192.168.97.111 | 0.0.0.0              | Change |  |  |
|                                | 54:35:df:00:03:27   | 192.168.97.201 | 0.0.0.0              | Change |  |  |
|                                | 54:35:df:00:02:9d   | 192.168.97.202 | 0.0.0.0              | Change |  |  |
| DACH0002                       | 00:04:a3:db:b4:e9   | 192.168.97.205 | 0.0.0.0              | Change |  |  |
|                                | 54:35:df:00:11:24   | 192.168.97.210 | 0.0.0.0              | Change |  |  |
|                                | 00:50:c2:0d:6c:72   | 192.168.97.211 | 0.0.0.0              | Change |  |  |
|                                | 54:35:df:00:05:d9   | 192.168.97.217 | 0.0.0.0              | Change |  |  |
| Rescan                         |   |                |                      |        |  |  |

Figure 82: Diagnostics - Station scan



# 8 Application

In this chapter, you will find the necessary settings for some of the most common applications.

## 8.1 Application 1: Distance Measurement

The basic application is the distance measurement between two LPR®-1D24.



Figure 83: Distance measurement between two LPR®-1D24

The necessary settings for this must be made under "Device -> Settings -> Measurement":

| SYMED      | 📕 Device 🗸                  | <b>Q</b> Diag | inostics + |                         |
|------------|-----------------------------|---------------|------------|-------------------------|
| Settings   | Settings<br>Upload configur | ration        | mation o   | verview                 |
| Customer   | Downloads                   |               | ime        | lprb-basestation        |
| Ciltar.    | Firmware updat              | te            | ess        | 192.168.1.99            |
| Filter     | Factory reset               |               | ation      | 7.0.0                   |
| Forwarding | Reboot device               |               |            | 1.0.0                   |
| LAN        |                             | 1024          | ole        | Master unit             |
| Logging    |                             | Syste         | m time     | 2018-03-14 16:12:05 CET |
| Measureme  | nt                          |               |            |                         |

Figure 84: Menu Device - Settings - Measurement



#### Example Configuration of One Pair of LPR<sup>®</sup>-1D24:

| Measurement                          |  |                 |
|--------------------------------------|--|-----------------|
| LPR group ID                         | 1000   |                 |
|                                      | L<br>Integer number in range 11022<br>Group identifier of one pair of LPR units associated together. Has to be the same on units mea<br>with each other.   | suring          |
| Measurement mode                     | Master unit  | ~               |
|                                      | Measuring mode for the LPR-1D24 unit. Any measuring pair of LPR-1D24 stations has to consi<br>master and one slave unit.   | st of one       |
| Number of FSK communication channels | 20   | ~               |
|                                      | Number of different FSK communication channels available. Must be the same value for all stat<br>the same site. The smaller the number of FSK channels, the higher the measurement bandwidt  | tions at<br>th. |
| FSK communication channel            | 17   |                 |
|                                      | Integer number in range 1835<br>Data communication channel number. Has to be the same on all units needing to communicate to<br>other.   | with each       |
| Measurement channel                  | 9  | $\sim$          |
|                                      | Changes ramp slope of measurements. Has to be configured identically on master and slave u<br>pair. Can be changed to separate interfering pairs when other pairs are close by.  | init of one     |
| Customer specific offset             | 0.81 m   |                 |
|                                      | Number in range -1.01.0 m<br>This offset is added to the measured distance and is to be used only for replacement of LPR1I<br>Master units with production date before December 2016 (see application note DOC.EDO.0002<br>Offset value which needs to be added is 0.52 m. | D24<br>241).    |
| Payload Slave to Master              | 50 bytes (up to 33 Hz measurement rate)  | ~               |
| Submit changes                       | Concerns only the payload from slave to master; for master to slave transmissions 200 bytes<br>always possible. This settings must be the same on master and slave!  | payload is      |

| Measurement                          |   |          |
|--------------------------------------|---|----------|
| LPR group ID                         | 1000  |          |
|                                      | Integer number in range 11022<br>Group identifier of one pair of LPR units associated together. Has to be the same on units measuri<br>each other.  | ing with |
| Measurement mode                     | Slave unit  | ~        |
|                                      | Measuring mode for the LPR-1D24 unit. Any measuring pair of LPR-1D24 stations has to consist o<br>master and one slave unit.  | fone     |
| Number of FSK communication channels | 20  | $\sim$   |
|                                      | Number of different FSK communication channels available. Must be the same value for all station:<br>same site. The smaller the number of FSK channels, the higher the measurement bandwidth. | s at the |
| FSK communication channel            | 17  |          |
|                                      | Integer number in range 1835<br>Data communication channel number. Has to be the same on all units needing to communicate with<br>other.  | ı each   |
| Measurement channel                  | 9   | $\sim$   |
|                                      | Changes ramp slope of measurements. Has to be configured identically on master and slave unit of<br>pair. Can be changed to separate interfering pairs when other pairs are close by.         | ofone    |
| Payload Slave to Master              | 50 bytes (up to 33 Hz measurement rate)   | $\sim$   |
|                                      | Concerns only the payload from slave to master; for master to slave transmissions 200 bytes pay<br>always possible. This settings must be the same on master and slave!                       | load is  |
| Submit changes                       |   |          |

Figure 85: Example Configuration of one measuring pair - Master and Slave unit



i Note

Configuration rules:

- To prevent mutual disturbance of multiple LPR<sup>®</sup>-1D24, multiple use of the same FSK channel in the radio coverage of the devices must be avoided (e.g. do not use two routes with the same FSK = 1).
- If pairs of the LPR<sup>®</sup>-1D24 are mounted within radio coverage, the FSK channels should be at least two channels apart from each other, e.g. 16, 18.

Furthermore, these LPR<sup>®</sup>-1D24 pairs should also get different measurement channels, e.g. 0 or 1.

If on one site more than 10 measurement paths are built close together, the number of FSK communication channels should be increased to prevent disturbance by the double use of FSK channels. If not, the default value should always be maintained.

Once these settings were made, the radar measures and outputs on the default IP address 192.168.1.99 the data with an output interval of 10 Hz on port 3046.

Changes of these default values can be made under *"Device-> Settings -> LAN"* and *"Device -> Settings -> Customer protocol"* (see chapter 7.5.1 and 7.5.4).



The customer specific offset may only be used for exchanging of the LPR<sup>®</sup>-1D24 Master units with a production date before December 2016. For further information, please refer to the Application Note "DOC.EDO.000241.0001.EN\_Replacement\_procedure\_for\_LPR-1D24\_Master-Units\_delivered\_before\_12.2016.pdf".



# 8.2 Application 2: Distance Measurement between two Cranes including Relay Control



This application is only available if the LPR<sup>®</sup>-1D24 is ordered with the corresponding production code ("r") (see *Figure 31* and *Figure 32*).

This application measures the distance between two bridges and triggers a relay if it is below the zone distance (anti-collision warning system).



Figure 86: Distance measurement between two cranes with relay control

The setting for the distance measurement works as described under Application1. To define the relay zone distance, settings under *"Device -> Settings -> Relay zones*" are necessary.

| Relay zones Settings |   |   |
|----------------------|---|---|
| Zone 1 distanc       | e 10  | m |
|                      | Type: floating point number, Range: 0.040.0 m                               |   |
|                      | Relay assigned to zone 1 will open when measured distance below this value. |   |
| Zone 2 distanc       | e 20  | m |
|                      | Type: floating point number, Range: 0.040.0 m                               |   |
|                      | Relay assigned to zone 2 will open when measured distance below this value. |   |
| Change               |   |   |

Figure 87: Setting of Zone (usually identical on Master and Slave by crane toward crane measurement)



## i Note

Please take note of the following information regarding the Relay Zones Settings for Firmware Version **9.0.0 and older**: The value for *Zone 2 distance* must **always be greater** than the value for *Zone 1 distance*.

Usually, in the case of an anti-collision warning system between two cranes, the stop areas (Xs) and the warning areas (Xw) are the same for both cranes.

In *Figure 86*, the distance XS1 corresponds to the distance to Zone 1 and the XW1 to the distance to Zone 2 on the Master as well as the XS2 the distance to Zone 1 and the XW2 the distance to Zone 2 on the Slave.

Relays assigned to these zones will open when measured distances are below these values. These settings can be made under *"Device -> Settings -> Relay zones*".

| Relay mapping   |   |    |        |
|-----------------|---|----|--------|
| Relay 1         | Remote controlled by Customer Interface (Network)   |    | $\sim$ |
| Timeout Relay 1 | 1000  | ms |        |
|                 | Integer number in range 030000 ms<br>Timeout of relay 1 (only applicable if relay is remote controlled) |    |        |
| Relay 2         | Remote controlled by Customer Interface (Network)   |    | $\sim$ |
| Timeout Relay 2 | 1000  | ms |        |
|                 | Integer number in range 030000 ms<br>Timeout of relay 2 (only applicable if relay is remote controlled) |    |        |
| Relay 3         | Remote controlled by Customer Interface (Network)   |    | $\sim$ |
| Timeout Relay 3 | 1000  | ms |        |
|                 | Integer number in range 030000 ms<br>Timeout of relay 3 (only applicable if relay is remote controlled) |    |        |
| Relay 4         | Remote controlled by Customer Interface (Network)   |    | $\sim$ |
| Timeout Relay 4 | 1000  | ms |        |
|                 | Integer number in range 030000 ms<br>Timeout of relay 4 (only applicable if relay is remote controlled) |    |        |
| Submit changes  |   |    |        |

Figure 88: Relay mapping (usually identical on Master and Slave for crane to crane measurement)

In the example in *Figure 88*, Relay 1 is assigned to Zone 1 and Relay 2 to Zone 2. This means, when the distance between the cranes is below the range value of Zone 2 (20m) Relay 2 will be triggered (opened). If it is also below the range value of Zone 1 (10m), the Relay 1 will be additionally triggered.

If the distance values are exceeded again, the relays return to their original state (closed).

If the measurement fails or when a device is switched off, all relays will be opened for safety reasons.

It is also possible to switch the relays from an external customer device (e.g. a PLC) through a Relay Switching Command (described in section 9.2.3). In this case, the customer has to determine which relay switching data has to be sent and when it has to be sent.



For this, the device must have the optional feature "Data transmission of user data and relay switch commands via radio signal".

If the relay data should be transmitted via the air interface, you have to enable the option forwarding under "*Device -> Settings -> Forwarding*".

| Forwarding                                |  |        |
|---|--|--------|
| Radio channel forwarder                   | Enabled  | $\sim$ |
|   | Forward packages via radio channel to partner LPR1D24 unit   |        |
| LAN forwarder                             | Disabled   | $\sim$ |
|   | Forward packages via LAN to connected LPR1D24 unit   |        |
| Enable custom forward interval            | Disabled   | $\sim$ |
|   | Enable a custom forward interval of own distance. If disabled, the own measured distance is forw<br>with measurement rate. | warded |
| Time delay of network and forwarding hops | 0 ms   |        |
|   | Integer number in range 0500 ms  |        |
|   | Compensate the time delay caused by network and forwarding hops. The forwarded distance is                                 |        |
|   | recalculated, based on the current velocity.   |        |
| Submit changes                            |  |        |

Figure 89: Settings - Forwarding

The setting "Radio channel forwarder" must be enabled.

Furthermore, this Relays Switching Command must then be assigned to one or more relays (see *Figure 54*).

The relays, which receive Relay Switching Command externally or via radio, will be opened if one or more Relay Switching Command are not received in time. To prevent this problem, you can set a timeout for each relay.

Only when the set timeout is exceeded without receiving a Relay Switching Command, the relays open.

The time limit can be set under "Device -> Settings -> Relay mapping" (see Figure 54).



# 8.3 Application 3: Distance Measurement and User Data Transmission

In this application additional user data is transmitted via the air interface, e.g. user data from PLC 1 should be transmitted to PLC 2 via air interface (or vice versa), see *Figure 90*.



Figure 90: Simple distance measurement between two units and user data transmission

In addition to the settings described in Application 1, you only have to activate the forwarding of these user data via *"Radio channel forwarder -> Enable"* by selecting *"Enabled*" option.

See "Device -> Settings -> Forwarding", Figure 91.

| Forwarding                                |  |                 |
|---|--|-----------------|
| Radio channel forwarder                   | Enabled  | ~               |
|   | Forward packages via radio channel to partner LPR1D24 unit   |                 |
| LAN forwarder                             | Disabled   | ~               |
|   | Forward packages via LAN to connected LPR1D24 unit   |                 |
| Enable custom forward interval            | Disabled   | ~               |
|   | Enable a custom forward interval of own distance. If disabled, the own measured distant with measurement rate.   | ce is forwarded |
| Time delay of network and forwarding hops | 0  | ms              |
|   | Integer number in range 0500 ms<br>Compensate the time delay caused by network and forwarding hops. The forwarded dist<br>recalculated, based on the current velocity. | tance is        |
| Submit changes                            |  |                 |

Figure 91: Forwarding Settings



## 8.4 Application 4: L-Functionality

In this application, the binary data from both measurement paths can be retrieved from all LPR<sup>®</sup>-1D24 (e.g. the distance data of the trolley and the bridge measurement can be read on the crane trolley).



Figure 92: L-Functionality

In addition to the settings described in Application 1, you have to activate the forwarding of the distance data via *"Radio channel forwarder -> Enabled*".

See "Device -> Settings -> Forwarding", Figure 93.

| Radio channel forwarder                  | Enabled   |                |
|--|---|----------------|
|  | Forward packages via radio channel to partner LPR1D24 unit  |                |
| LAN forwarder                            | Disabled  |                |
|  | Forward packages via LAN to connected LPR1D24 unit  |                |
| Enable custom forward interval           | Disabled  |                |
|  | Enable a custom forward interval of own distance. If disabled, the own measured dista<br>with measurement rate. | nce is forward |
| ime delay of network and forwarding hops | 0   | ms             |
|  | Integer number in range 0500 ms   |                |
|  |   |                |
| ime delay of network and forwarding hops | 0<br>Integer number in range 0500 ms  | ms             |

Figure 93: Forwarding Settings



By pressing the *"Submit changes*" button in the *"Forwarding Settings"* window an additional field *"Destination IP address"* appears, where you have to enter the IP address of the destination unit, which can be connected either directly or via a network cable (see *Figure 94*).

It does not matter whether two Masters, two Slaves or one Master and one Slave are connected for example on the bridge.

| Forwarding                           |   |                |
|--------------------------------------|---|----------------|
| Radio channel forwarder              | Enabled<br>Forward packages via radio channel to partner LPR1D24 unit   | ~              |
| LAN forwarder                        | Enabled   | ~              |
|                                      | Value has changed from "Disabled"<br>Forward packages via LAN to connected LPR1D24 unit   |                |
| Destination IP address               | 192.168.1.100 <br>Destination IP address of connected LPR1D24 unit  |                |
| Enable custom forward interval       | Disabled  | ~              |
|                                      | Enable a custom forward interval of own distance. If disabled, the own measured of<br>forwarded with measurement rate.  | listance is    |
| Output interval of own distance      | 100   | ms             |
|                                      | Integer number in range 2560000 ms<br>Output interval of own measured distance to be forwarded over LAN.  |                |
| Time delay of network and forwarding | 0   | ms             |
| nops                                 | Integer number in range 0500 ms<br>Compensate the time delay caused by network and forwarding hops. The forward<br>recalculated, based on the current velocity. | ed distance is |
| Submit changes Review changes        |   |                |

Figure 94: Forwarding Settings – Submit/Review changes

If you want to have all data, e.g. only on the trolley unit, a transfer from Master 1 to Master 2 is sufficient (see *Figure 92*), thus the forwarding settings on Master 1 with the destination address of Master 2 must be set.

If the data should be available on all units, you must also set the forwarding settings on Master 2 with the destination IP address of Master 1.



Please make sure that the both devices connected via Ethernet must have different IP addresses.



## 9 Description of Binary Protocol XP (1D Messages)

## 9.1 General Description

This protocol describes the interface between the LPR<sup>®</sup>-1D24 and the user. The binary protocol XP provides information in high density. Its structure ensures a simple implementation. The transfer is done in single data frames.

#### 9.1.1 Structure of Data Packet

Each data packet has the same fixed length and begins with the START symbol (0x7e).

Figure 95 shows the general structure of a data packet.



The START- and STOP-field in each data packet are the symbols 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 by 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 (TYPE + DATA) except the START and END data field.

All multi byte integers (e.g. CRC field) are encoded in Network-Byte-Order (Big-Endian). All signed integer are represented in two's complement.

#### 9.1.2 CRC

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

The customer protocol accepts also CRC = 0 for incoming packets.



## 9.2 Data Types

All data packets use the fixed frame protocol. The protocol length can be set under the menu *"Device -> Settings -> Customer protocol -> Protocol frame length"*. The default setting is 47 bytes.

To get a connection to the customer device, a TCP/IP or a UDP connection between the LPR<sup>®</sup>-1D24 and the customer device must be established. When using the TCP/IP protocol (default setting), the customer device must initiate the connection to port 3046 on the LPR<sup>®</sup>-1D24.



The TCP-Port can be set by the user in the WebUI under the menu "Device -> Settings -> Customer protocol -> Mode of customer protocol". The default value is 3046.

When using the UDP variant of the fixed frame protocol, the IP address and the UDP port of the receiving computer must be configured in the LPR<sup>®</sup>-1D24 WebUI. The protocol mode can be changed to *"UDP*" under the menu *"Device -> Customer protocol -> Mode of customer protocol*". 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.



The UDP-Port can be chosen by the user in the WebUI under the menu "Device -> Settings -> Customer protocol -> Mode of customer protocol". The default value is 3046.

If the connection is established, the PC has to read the data from the LPR<sup>®</sup>-1D24 in fixed blocks (e.g. 47 bytes). The first byte is always the START-byte and the second byte is always the TYPE-byte. The relevance of the following data depends on the data type, however, the position of all information (e.g. distance, velocity level etc.) remains always the same in the data packet. For example, for the data packet type 0x16 (distance data) the measured velocity is *always* written in data bytes 9.-12.



If data is sent to the LPR<sup>®</sup>-1D24, it has to be filled up to the same fixed protocol length (i.e. to 47 bytes for the default settings). It is not important, what data is used to fill up the data packets, however, the use of zero bytes could facilitate a possible troubleshooting.



#### 9.2.1 Type 0x01 - User Data

User Data can be integrated at the LPR<sup>®</sup>-1D24 and then transmitted to another LPR<sup>®</sup>-1D24 via the frequency channel. There the user data can be readout.

Direction: LPR<sup>®</sup>-1D24  $\leftrightarrow$  User

| Content                    | Length | Data type              | Value            |
|----------------------------|--------|------------------------|------------------|
|                            | (byte) |                        |                  |
| START                      | 1      | unsigned integer       | 0x7E             |
| TYPE                       | 1      | unsigned integer       | 0x01             |
| Source (LPR®-1D24 address) | 2      | see chapter 9.3.1.     | 0x####           |
| Liser Data                 | 8      | depends on application | 0x#### #### #### |
| ooor Dulu                  | 0      |                        | ####             |
| CRC                        | 2      | unsigned integer       | 0x####           |
| END                        | 1      | unsigned integer       | 0x7F             |

#### Table 7: Data Type 0x01 - User Data

Total length: 15 byte

#### 9.2.2 Type 0x02 - Send Request

#### Direction: LPR<sup>®</sup>-1D24 $\rightarrow$ User

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

Table 8: Data Type 0x02 - Send request

Total length: 5 byte

This packet is sent from the LPR<sup>®</sup>-1D24 continuously. It informs the user that the LPR<sup>®</sup>-1D24 is able to receive data from the user. The user may only send one single data frame after receiving a send request.



A Send Request is only sent if the *"TX requests*" field is activated in the WebUI under *"Device -> Settings -> Customer protocol".* 



## 9.2.3 Type 0x03 - Relays Switching Command

#### Direction: User $\rightarrow LPR^{\text{®}}$ -1D24

| Content  | Length<br>(byte) | Data Type         | Value  |
|--|------------------|-------------------|--------|
| START  | 1                | unsigned integer  | 0x7E   |
| TYPE   | 1                | unsigned integer  | 0x03   |
| Destination (LPR <sup>®</sup> -1D24 address)   | 2                | See chapter 9.3.1 | 0x#### |
| Relay Selection (Bitmask) (Bit 14 $\rightarrow$<br>Relay 14)<br>Bit significance 0-7 starting with 0 as<br>the lowest (set) Bit value. | 1                | unsigned integer  | 0x##   |
| Relay Switch (Bitmask)   | 1                | unsigned integer  | 0x##   |
| CRC  | 2                | unsigned integer  | 0x#### |
| END  | 1                | unsigned integer  | 0x7F   |

Table 9: Data Type 0x03 - Relays Switching Command

Total length: 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 =  $0xFF_{hex} = 1111111_{bin}$  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<sup>®</sup>-1D24 and thus no reception on the destination unit is guaranteed.



### 9.2.4 Type 0x16 - Distance Data

Direction: LPR<sup>®</sup>-1D24  $\rightarrow$  User

| Content                           | Length<br>(byte) | Data Type         | Value       |
|-----------------------------------|------------------|-------------------|-------------|
| START                             | 1                | unsigned integer  | 0x7E        |
| TYPE                              | 1                | unsigned integer  | 0x16        |
| Source (LPR <sup>®</sup> address) | 2                | see chapter 9.3.1 | 0x####      |
| Distance [mm]                     | 4                | signed integer    | 0x#### #### |
| Velocity [mm/s]                   | 4                | signed integer    | 0x#### #### |
| Level [dB/10]                     | 2                | signed integer    | 0x####      |
| Reserved                          | 8                |                   |             |
| Error                             | 2                | unsigned integer  | 0x####      |
| Reserved                          | 20               |                   |             |
| CRC                               | 2                | unsigned integer  | 0x####      |
| END                               | 1                | unsigned integer  | 0x7F        |

Table 10: Data Type 0x16 - Distance Data Output for Group Master

Total length: 47 byte



#### 9.2.5 Type 0x25 - Load Data

Load data contains information about the active load shapes and a height information.

They can be fed into the LPR $^{\mbox{\tiny B}}$ -1D24 via the customer port and then transmitted to another LPR $^{\mbox{\tiny B}}$ -1D24 via the frequency channel.

Direction: User  $\rightarrow LPR^{\mathbb{R}}$ -1D24

| Content                                 | Length<br>(byte) | Data type         | Value  |
|---|------------------|-------------------|--------|
| START                                   | 1                | unsigned integer  | 0x7E   |
| ТҮРЕ                                    | 1                | unsigned integer  | 0x25   |
| Source address                          | 2                | see chapter 9.3.1 | 0x#### |
| Flags (Bitmask) <sup>1)</sup>           | 1                | unsigned integer  | 0x##   |
| Inactive Shapes (Bitmask) <sup>2)</sup> | 1                | unsigned integer  | 0x##   |
| Height [cm] 3)                          | 2                | unsigned integer  | 0x##   |
| CRC                                     | 2                | unsigned integer  | 0x#### |
| END                                     | 1                | unsigned integer  | 0x7F   |

Table 11: Data Type 0x25 - Load Data

Total length: 11 Bytes

<sup>1)</sup> Flags:

Bit 0: Has up state flag / has hoist limit switch Bit 1: Up state flag / Hoist limit switch Bit 2: Has inactive shapes bitmask flag Bit 3: Has height information flag Bit 4 – 7: reserved

<sup>2)</sup> Inactive Shapes bitmask: Contains information about the current state of the hoist and load

shapes (bit=0: shape active, bit=1: shape inactive)

Bit 0: hoist shape Bit 1 – 3: load shapes Bit 4 – 7: reserved

<sup>3)</sup> The current value of the height sensor in cm, where 0 means the hoist/load is at the top position.



### 9.3 Remarks

#### 9.3.1 LPR<sup>®</sup>-1D24 Address

LPR<sup>®</sup>-1D24 addresses are completely defined by a 16 bit value:

| 15 | 11         | 10 | 1        | 0 | _ |
|----|------------|----|----------|---|---|
|    | Station-ID |    | Group-ID | 0 |   |

| 0                             | Reserved  |
|-------------------------------|---|
| Group-ID:                     | The Group-ID of the unit (11022)                  |
| Station-ID:                   | The Station-ID of the unit (SID)                  |
| for Distance Data:            | Master and Slave SID is <i>always</i> 2 (SID = 2) |
| for Relays Switching Command: | SID = 1 for Master und SID = 2 for Slave          |

Table 12: LPR<sup>®</sup>-1D24 address

#### 9.3.2 Distance Error Codes

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

| Value | Description   |
|-------|---|
| 0x00  | No error $\rightarrow$ measurement valid                  |
| 0x01  | No measurement signal                                     |
| 0x02  | Peak to low $\rightarrow$ measurement signal is imprecise |
| 0x04  | Implausible speed   |
| 0x05  | Measurement failed  |
| 0x14  | Measured distance is larger than the theoretical limit    |
| 0x15  | Synchronization error                                     |
| 0x16  | Synchronization error                                     |
| 0x19  | Synchronization error                                     |
| 0x20  | Synchronization error                                     |
| 0xfe  | Outlier detected (only diversity)                         |
| Oxff  | No data received  |

Table 13: Error codes