SYMEO LOCAL POSITIONING RADAR

Product: LPR®-1D24

Product Documentation

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

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HISTORY

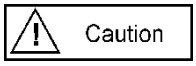
Version	Date	Description
1.00	18.06.2015	Initial Release: Translation English
1.01	24.07.2015	Minor corrections, New: the chapters “Web User Interface” and “Mounting of the Fall Protection”
1.02	28.01.2016	Distance data Type 0x00 changed to Type 0x16, Distance Error Codes table updated. The chapter “WebUI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

		New function “Time delay of network and forwarding hops” added under Settings -> Forwarding; The customer protocol accepts also CRC = 0 for incoming packets; 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; New BinProtXp message 0x25 (LOAD_DATA); Packet inspector supports incoming messages; Tightening torque for M12 connectors; 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; Added logging mode for logging to volatile memory; Added Russia country settings; Added plot with number of valid measurements, see section 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; 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

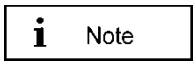
SYMBOLS USED

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.



This symbol appears before information of particular importance.

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

Safety Instructions

1.1 General

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

Warning — The LPR®-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.

Warning — 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.

Caution — Follow the safety instructions in this documentation.

Note — 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

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

Warning — 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

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

1.4 Transport and Storage

Note — Use the original packaging or other suitable packaging for returns and whenever the system is to be transported. This ensures protection from crushing, 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

Caution

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

Caution

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.

Caution

The LPR®-1D24 must not be opened.

1.7 System Extensions and Accessories

Note

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

Caution

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

Note

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®-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® channel. In addition, the relative approach speed of the LPR® sensors is also available.

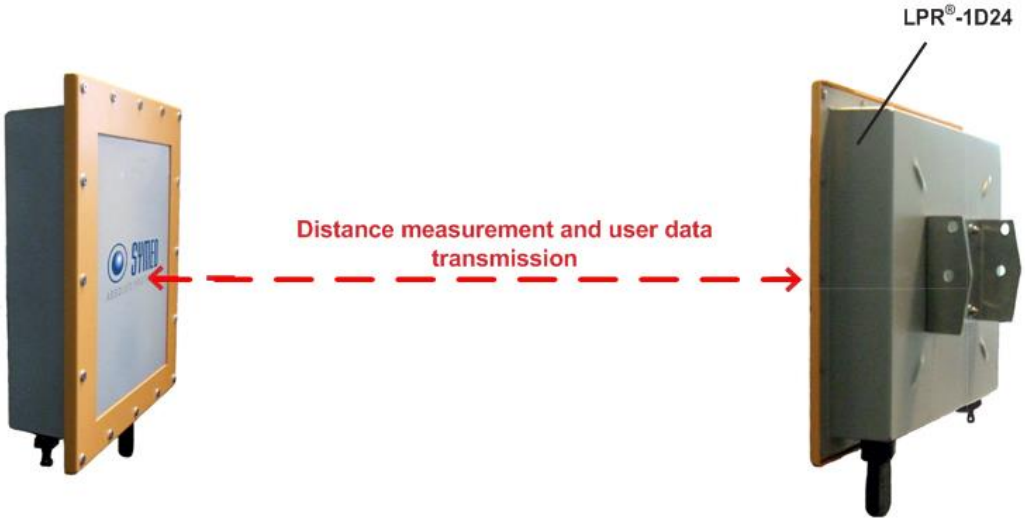


Figure 1: LPR®-1D24 measurement path

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.

Symeo LPR® radio works highly reliable even under adverse environmental conditions. Interference with any WiFi equipment operating in parallel can be excluded at all times. LPR®-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®-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, „*Homepage -> Product properties -> Unit production code*").

Radio Parameters

Frequency range: 24 GHz - 24,25 GHz

Transmission power: max. 100 mW EIRP

2.2 Opening Angle

The LPR®-1D24 has an integrated antenna with +/-9° opening angle horizontal and +/-7° opening angle vertical.

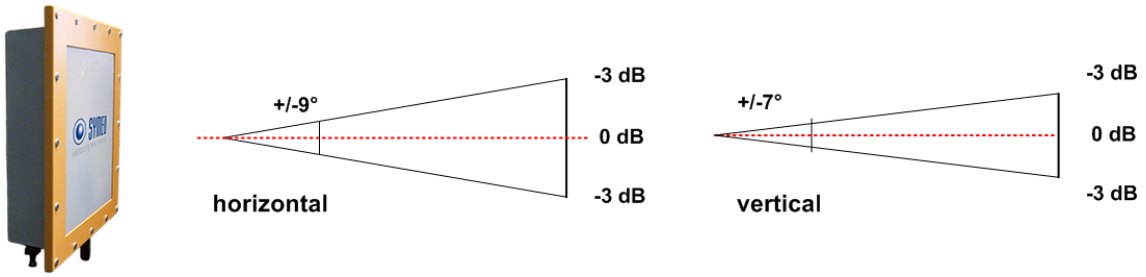


Figure 2: Beam width of LPR®-1D24

Caution

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®-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®-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.

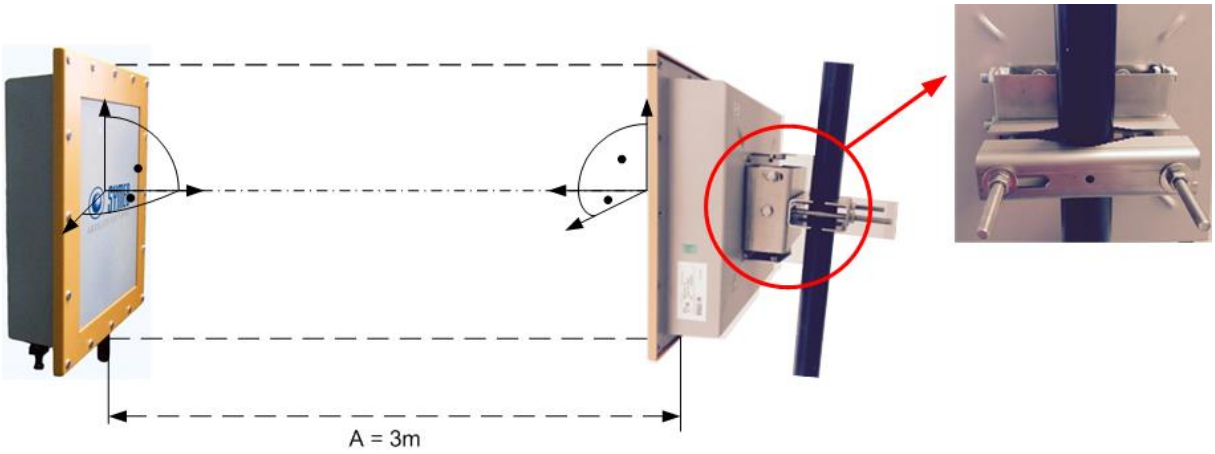


Figure 3: LPR®-1D24 inclusive mounting bracket

3.1 Mounting of Fall Protection

The LPR®-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®-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*).

⚠ Caution

The fall protection should be installed before the assembly of the unit to secure it against falling.

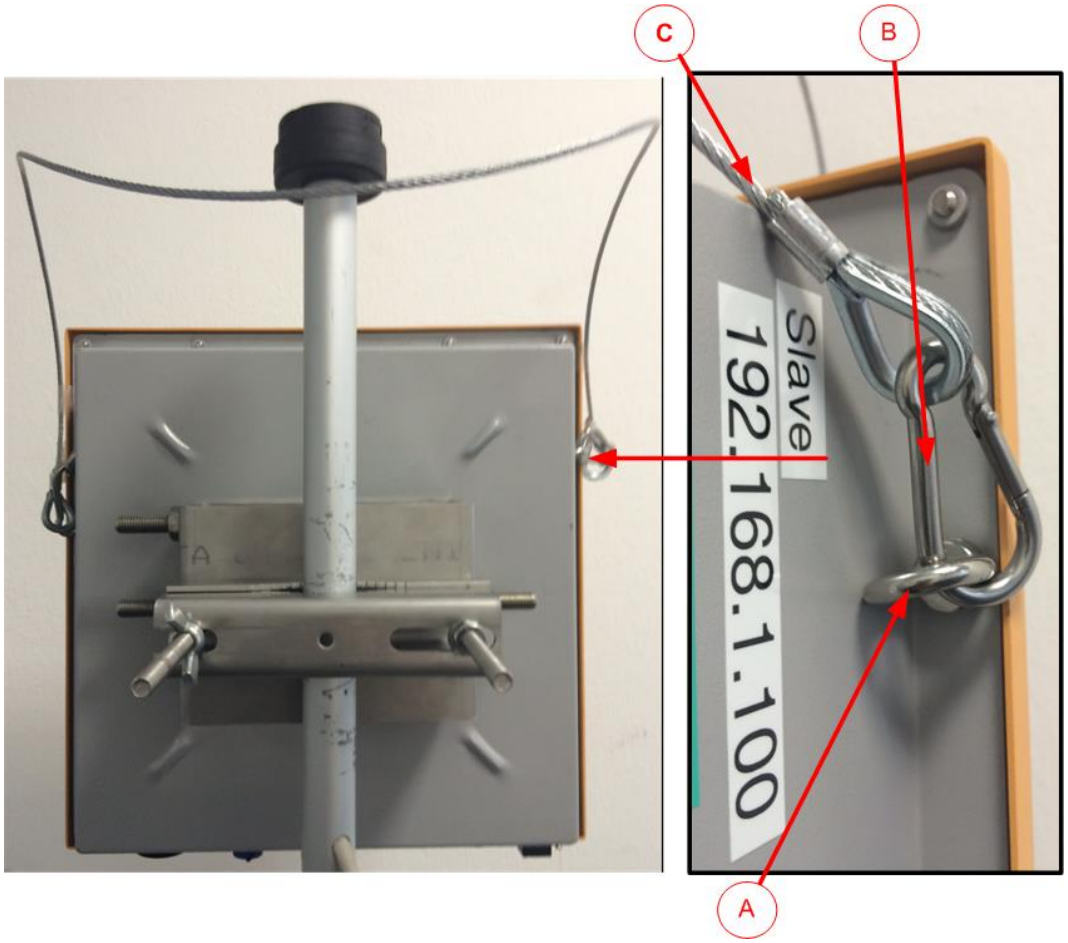


Figure 4: Mounting of fall protection

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.

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:

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

λ is the wave length and d the distance between the two antennas. For a frequency of 24 GHz a wave length λ 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*.

Distance d	Radius b
10 m	0.18 m
50 m	0.40 m
100 m	0.56 m
250 m	0.89 m
500 m	1.25 m
1000 m	1.80 m

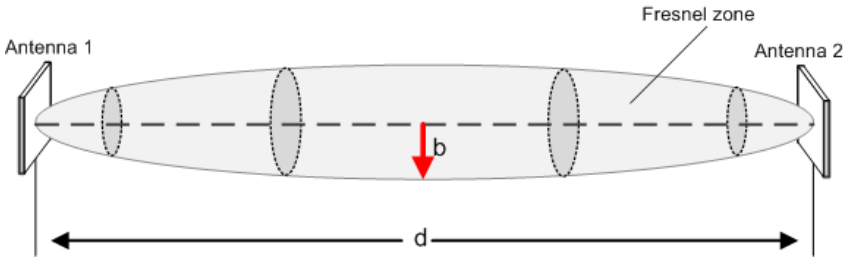


Figure 5: Calculation and figure of Fresnel zone

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

5 Specification of Connectors

5.1 Overview of Connections

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

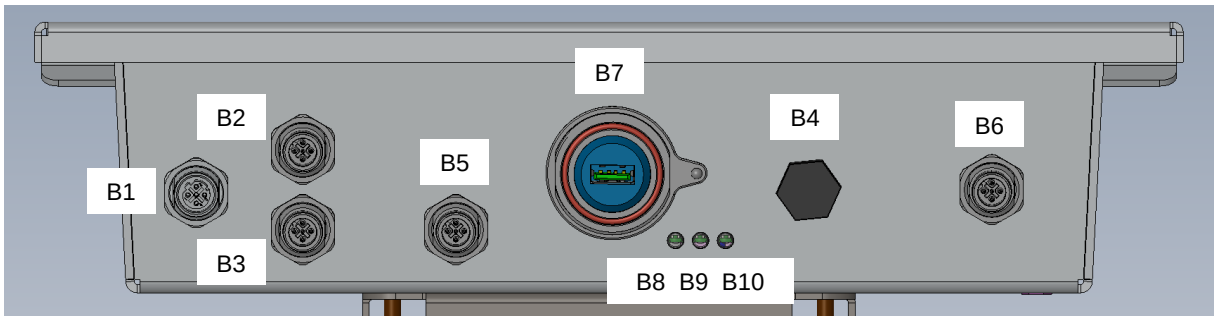


Figure 6: LPR®-1D24 Connectors - new Hardware Status - Deliveries from April 2017

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)

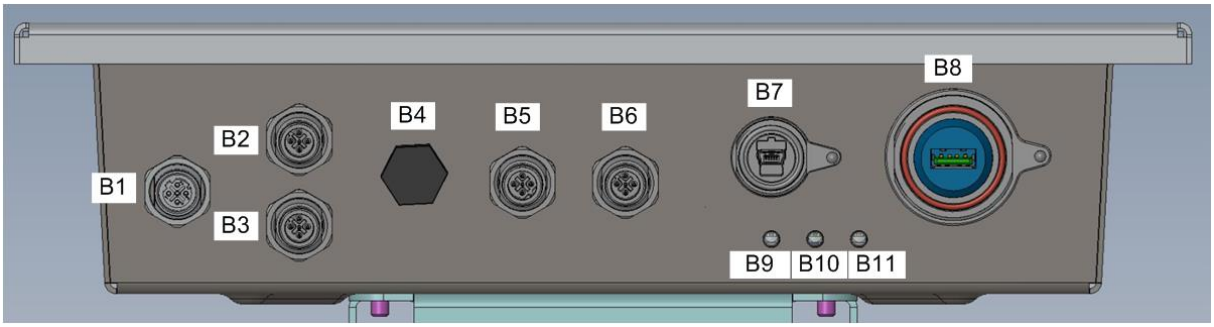


Figure 7: LPR®-1D24 Connectors - old Hardware Status - Deliveries before April 2017

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	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.
Note	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.

LED Display	Status of the Device
LED B8 (Left) **not used**	
LED B9 (Middle) **Ethernet-Status & Profibus:**	
LED OFF	• No Link
Green LED ON	• Link OK
Green LED flashes	• Ethernet activity
LED B10 (Right):	
Blue LED ON	• Startup process / Reboot etc.
Red LED ON	• Measurement not possible
Green LED ON	• Measurement OK

Table 1: LED Display

5.3 Power Supply

The LPR®-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

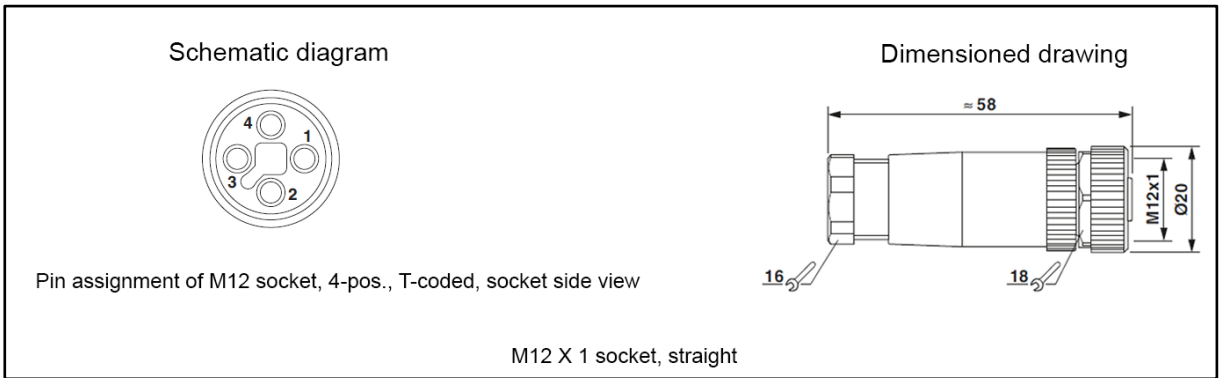


Figure 8: M12 Connector for power requirement

5.3.2 Pin Assignment

Power Supply 10 V DC – 36 V DC	M12 Connector
V_{DC}+	Pin 1
V_{DC}+	Pin 2 (bridged to Pin 1)
V_{DC}-	Pin 3
V_{DC}-	Pin 4 (bridged to Pin 3)

Table 2: Pin assignment power supply

5.4 Relay (Optional)

The LPR®-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*).

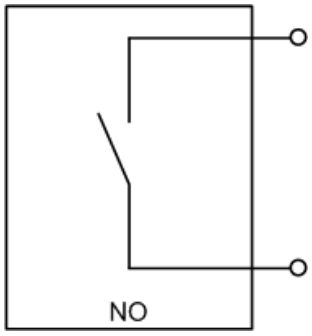


Figure 9: Scheme of normally open relay contacts

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

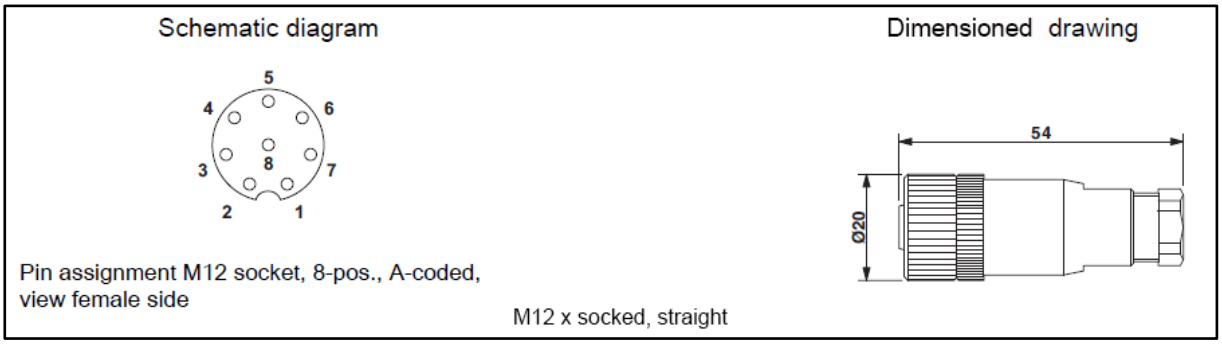


Figure 10: M12 Connector for relay

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 1,2 A @ 30 V DC
Maximum switching voltage:	25 V AC 30 V DC
Maximum switching current:	8 A @ 25 V AC 5 A @ 30 V DC

Table 4: Contact specification

5.5 Profibus (Optional)

The LPR®-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

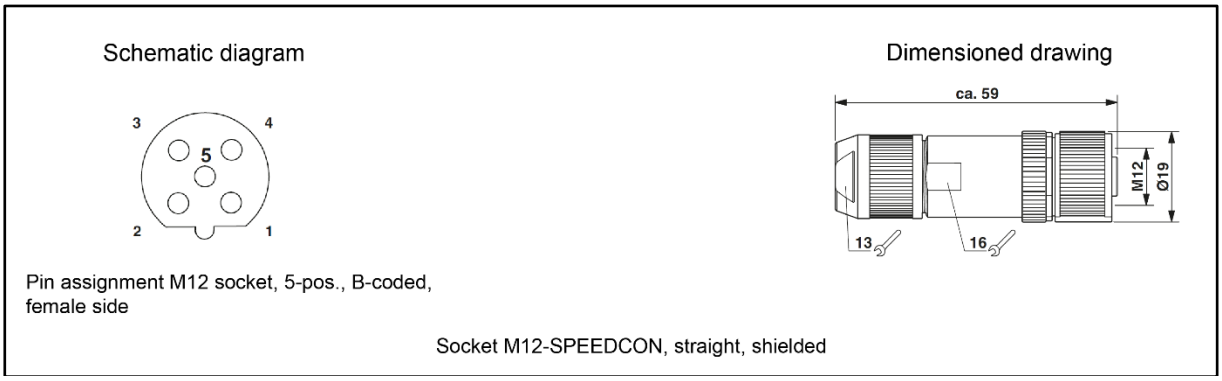


Figure 11: M12 Connector Profibus IN

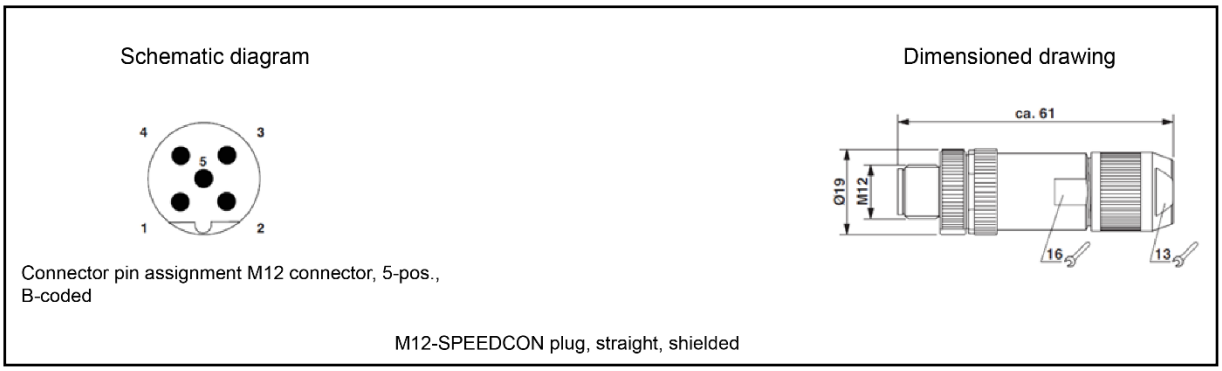


Figure 12: M12 Connector Profibus OUT

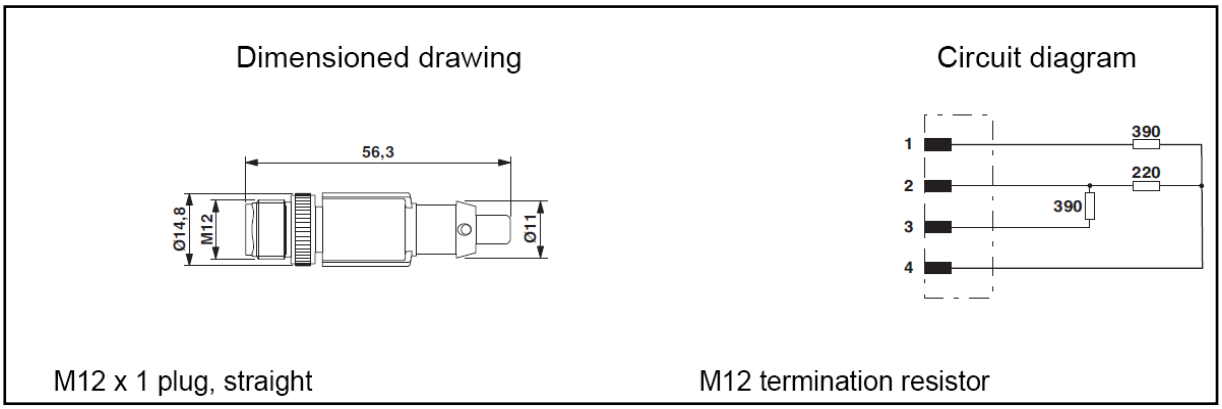


Figure 13: M12 Connector Profibus Termination

5.5.2 Pin Assignment

Signal	Pinout LPR®-1D24	Color of Conductor Profibus Standard	M12 Connector
Profibus 5-pin			
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®-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

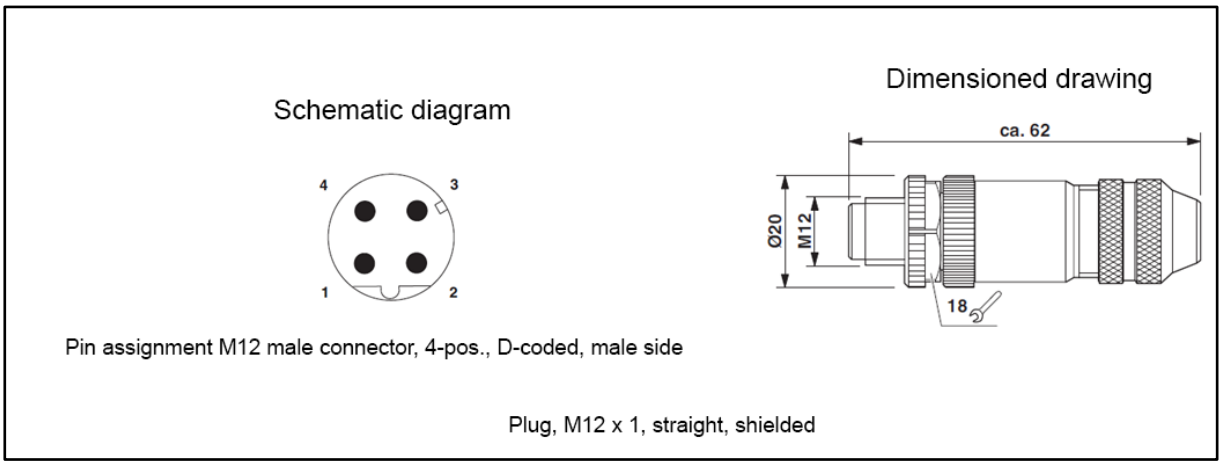


Figure 14: Ethernet M12

5.6.2 Pin Assignment

Signal	Color of Conductor PROFInet®	Color of Conductor 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® -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®-1D24 has a USB-Flash Drive Connector, on which the data can be logged (*Figure 6* – Connection B7).

5.7.1 Plugs

Recommended connector:

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

6 LPR®-1D24 Housing Dimensions

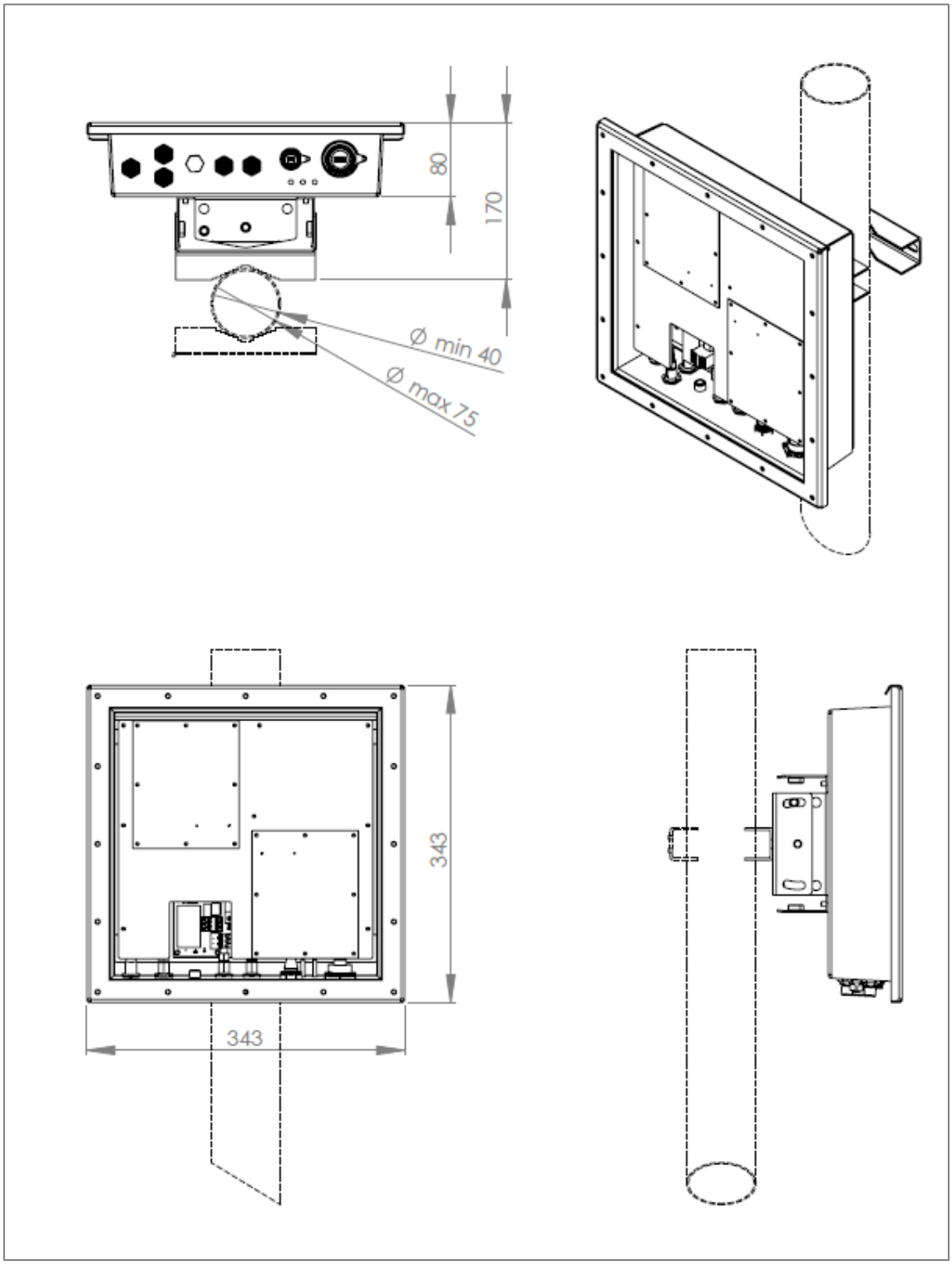


Figure 15: LPR®-1D24 Housing Dimensions

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

7 Web User Interface for LPR®-1D24

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

Caution	Connection via the Ethernet is required.
Note	For the Ethernet-connection, the connector cable M12 – RJ45 is required for configuration of the LPR® -1D24 with M12 and RJ45 connectors. This connector cable can be ordered by Symeo (see chapter 5.6.3).
Note	Please read the Notes on the Firmware Update in “Partner Login” area (Symeo_Docs -> Firmware -> „Readme_Firmware_Update_LPR-1D24“) under https://www.symeo.com/en/partner-login/index.html.

7.1 Establishing a TCP/IP Connection

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

⇨ The unit has been connected to the power supply.

⇨ Data link has been established over TCP/IP.

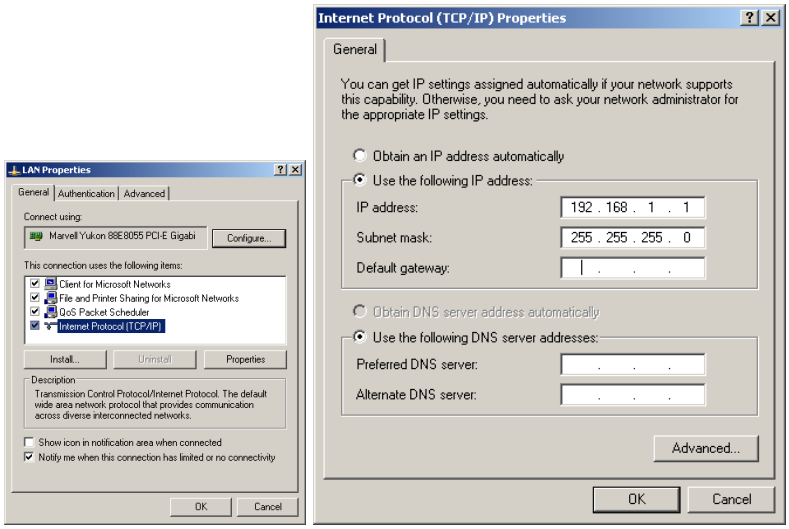
Once these prerequisites have been fulfilled, you can connect the unit to the network and commission the LPR®-1D24. How to do this is explained in the following chapters.

Note	At delivery the IP-address of the LPR®-1D24 is set to **192.168.1.99**, if no IP address is specified on the housing of the LPR®-1D24. You can change the IP-address of the LPR®-1D24 via the web interface of the LPR®-1D24. To get a connection between your PC and the LPR®-1D24 it is maybe necessary to change the network parameters of your computer. The PC and the LPR®-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.

⇨ Connect the LPR®-1D24 and the computer with a network cable.

⇨ Open the network settings of your computer (see *Figure 16*).



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

Figure 16: Network Settings

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

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

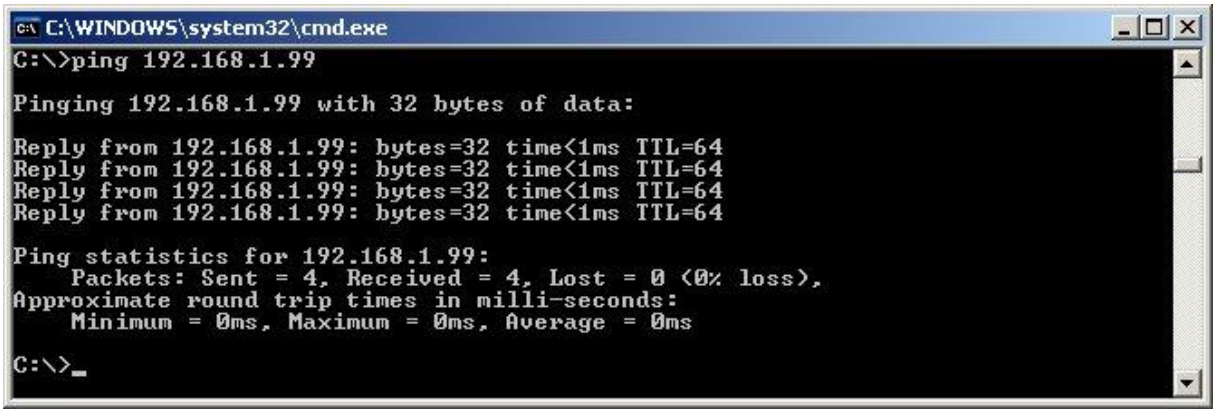


Figure 17: Ping of LPR®-1D24

The LPR®-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®-1D24: http://192.168.1.99. Press **Enter**.

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

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

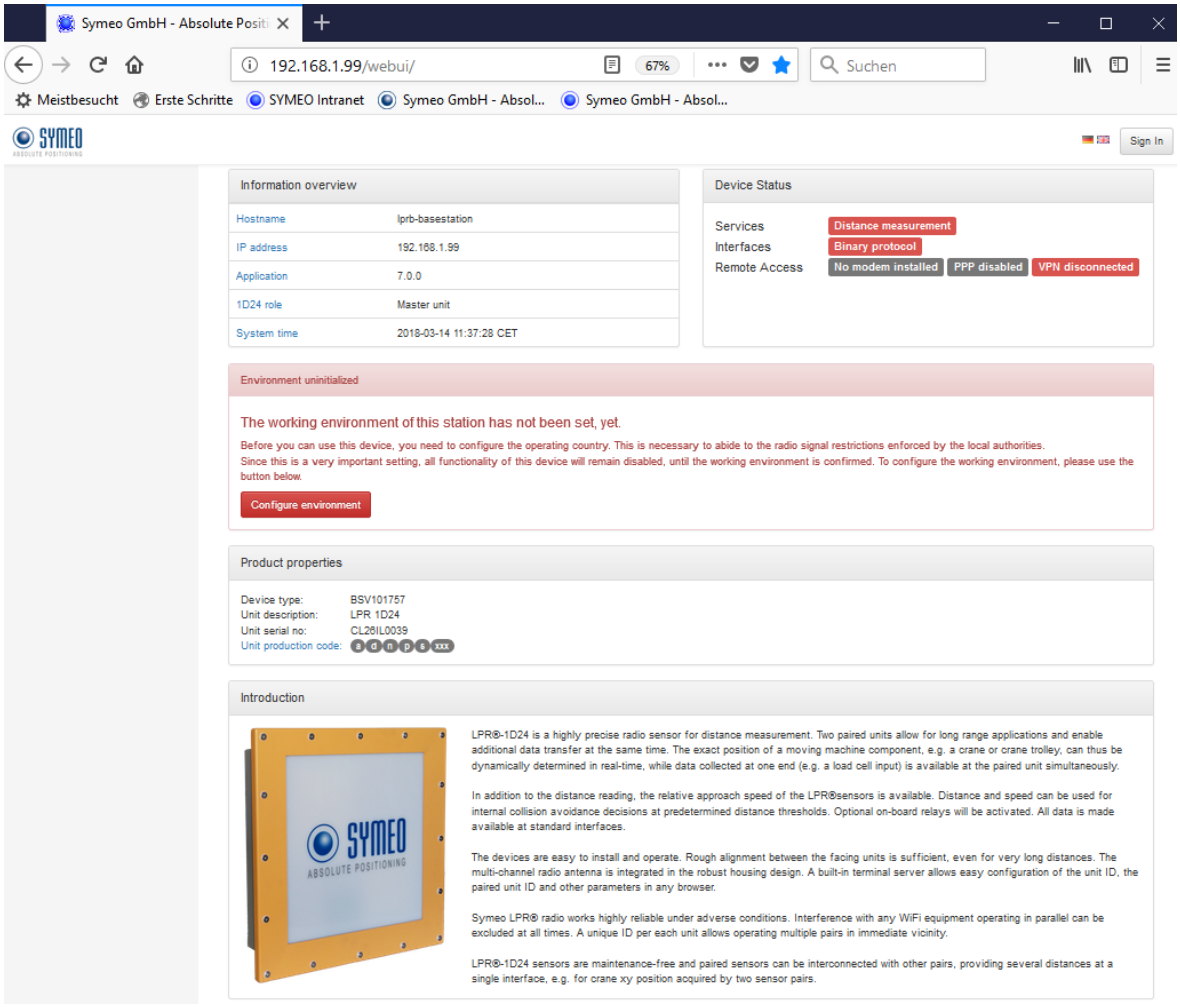


Figure 18: Open Web User Interface

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*).

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*).

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.

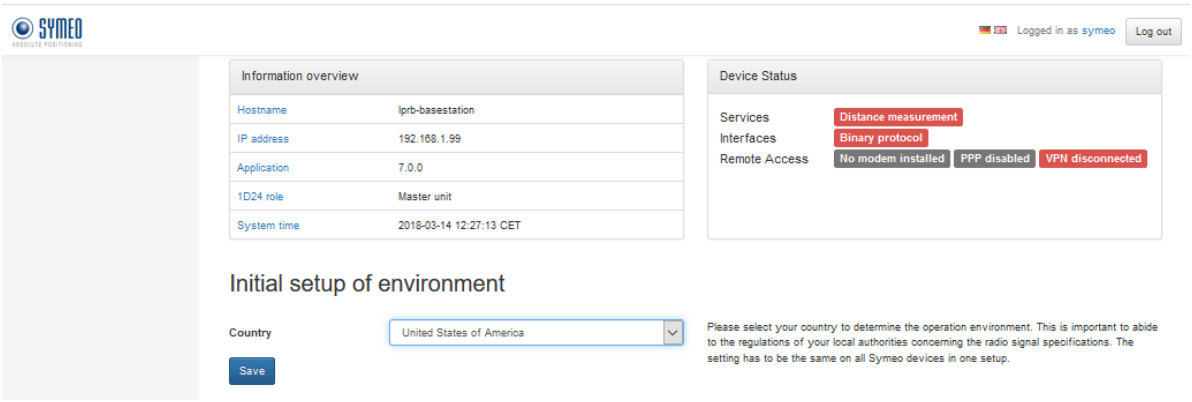


Figure 20: Initial setup of environment of LPR®-1D24

⇨ 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*).

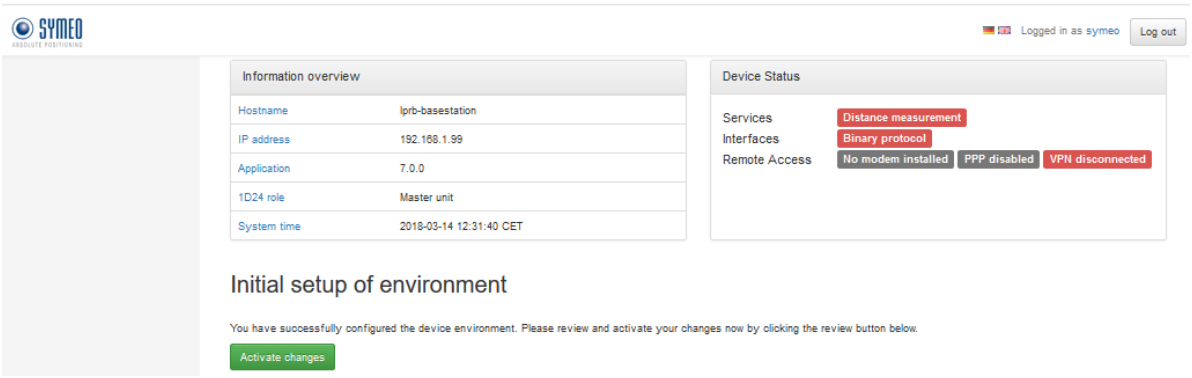


Figure 21: Initial setup of environment - Activate changes

The following window appears:

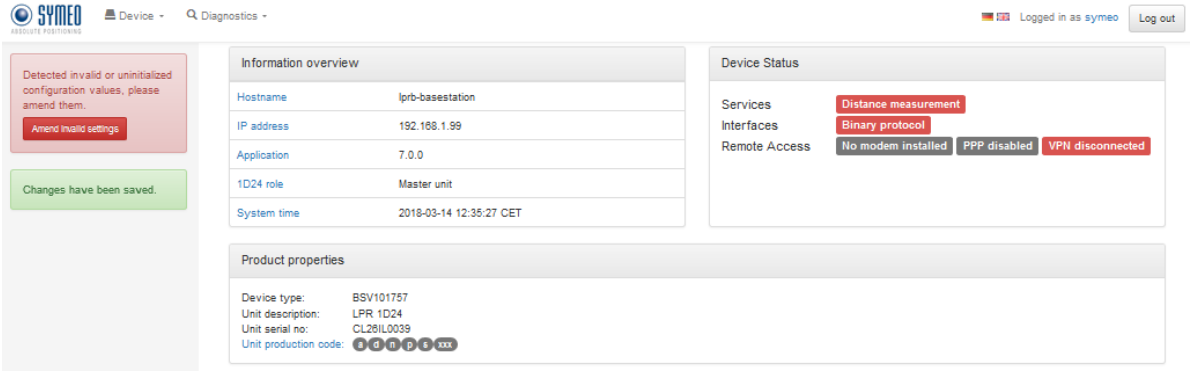


Figure 22: Initial setup of environment - Amend invalid settings

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

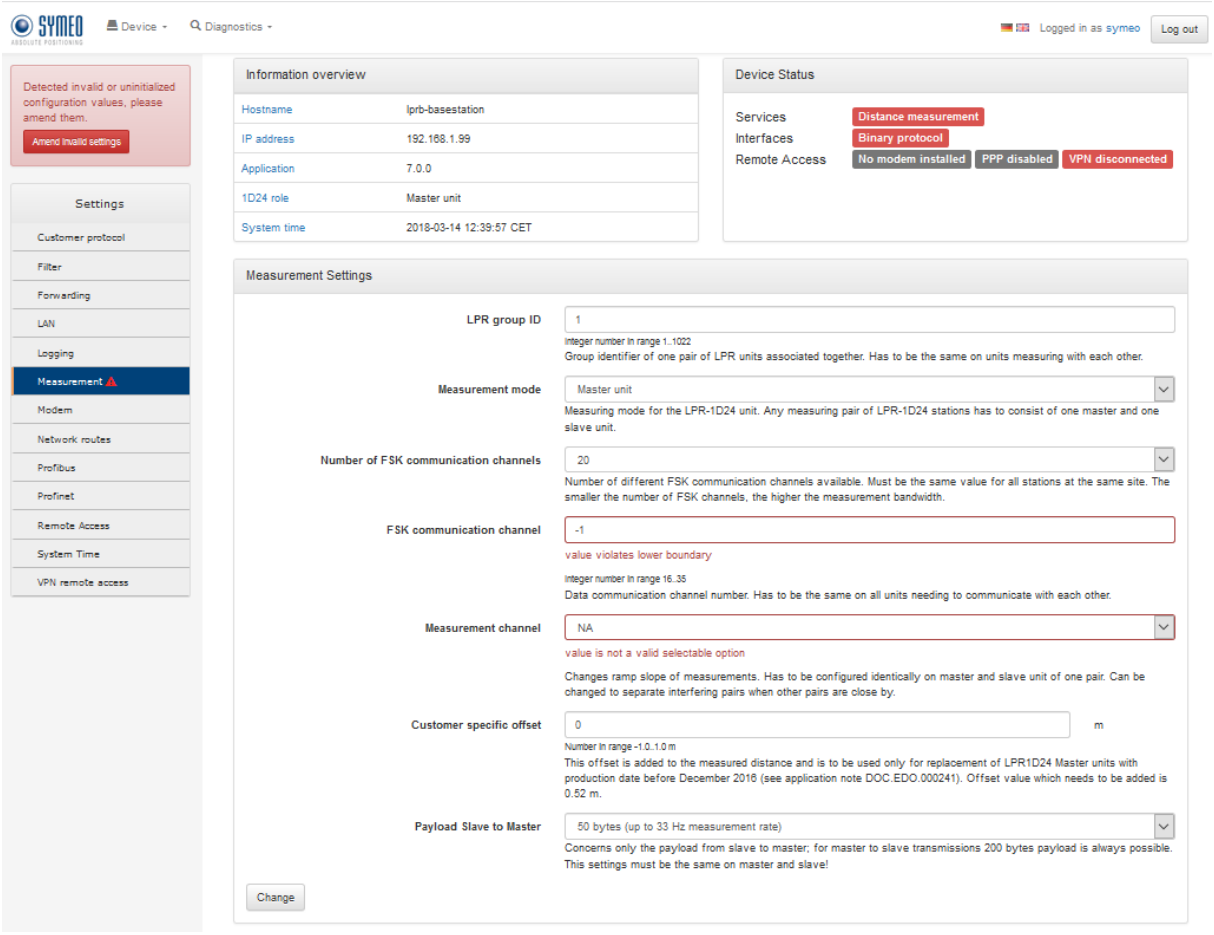


Figure 23: Settings window for mandatory values

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.

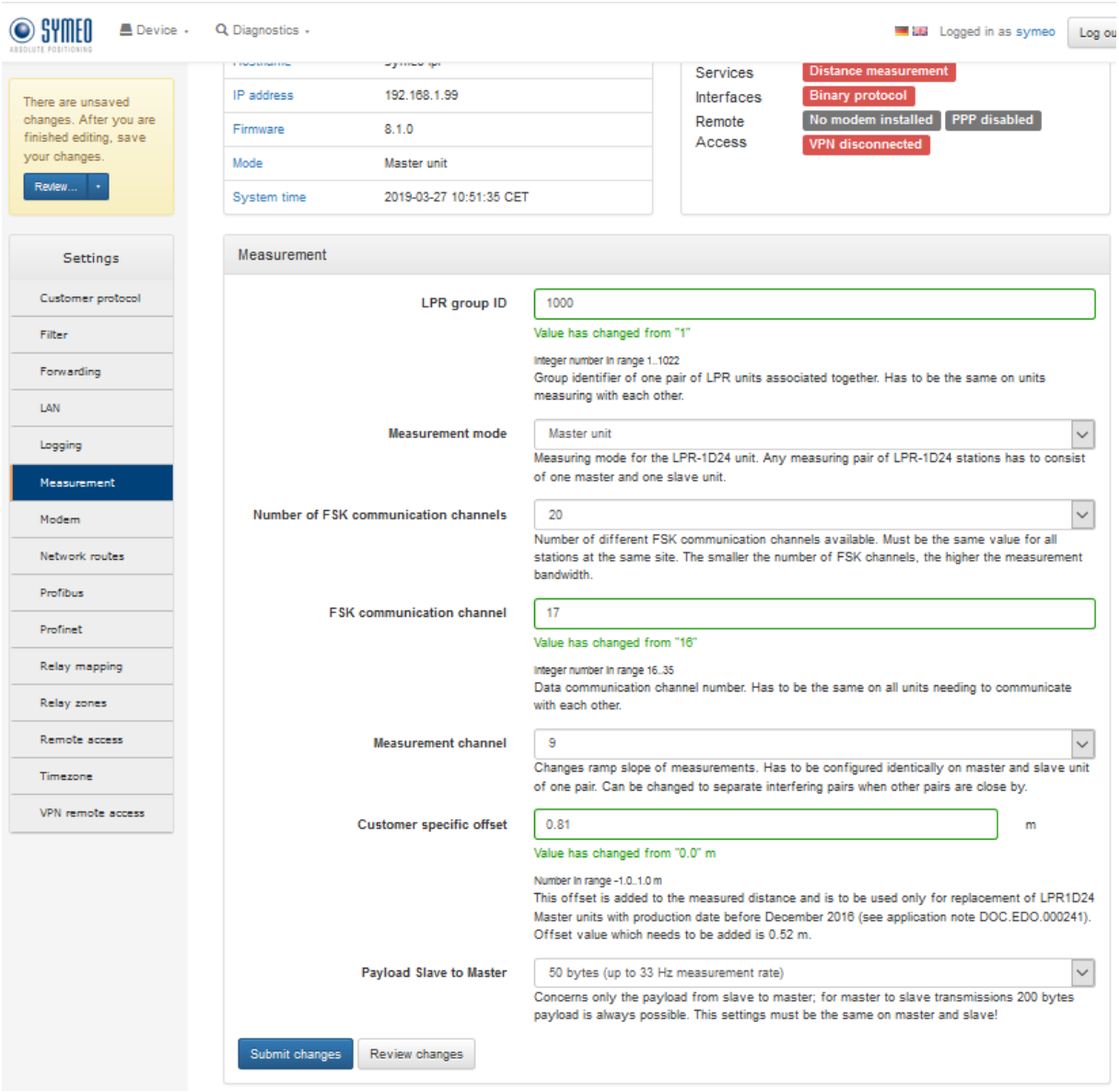


Figure 24: Change of mandatory values

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*).

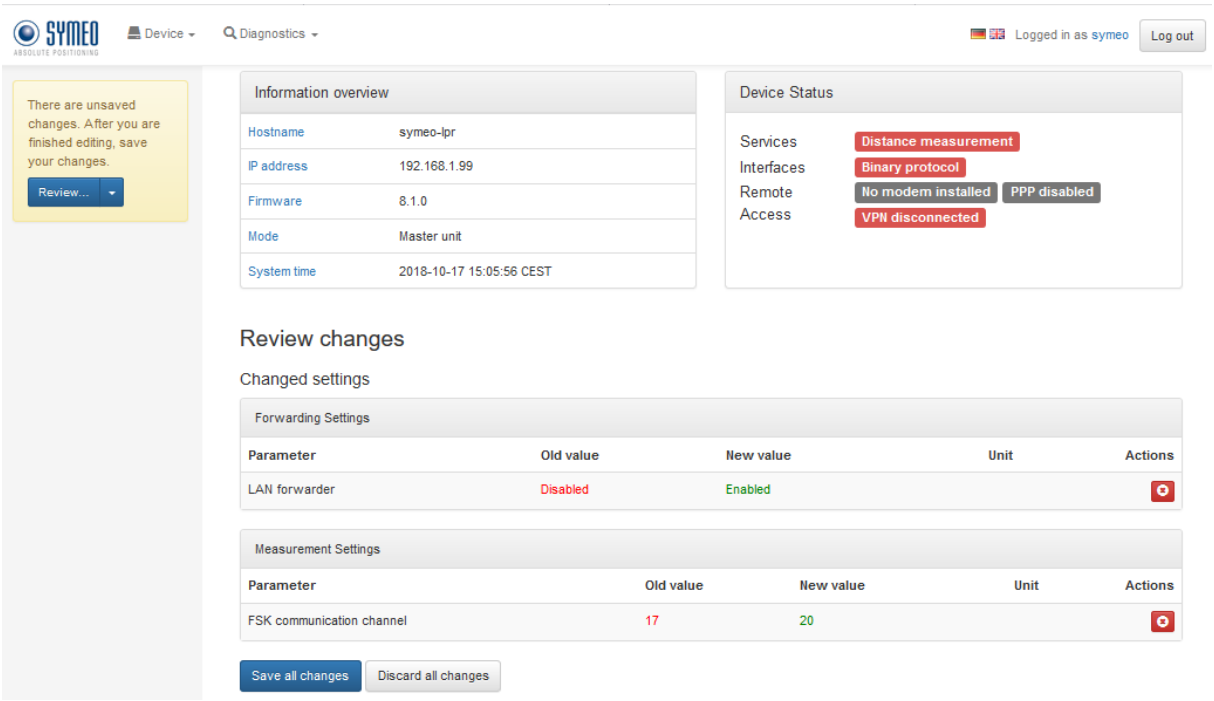


Figure 25: Save or Discard all changes

⇨ 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.

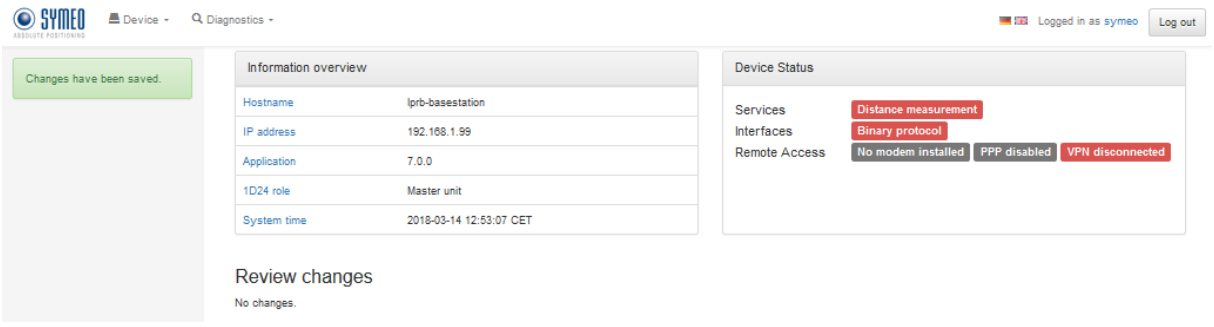


Figure 26: Changes have been saved

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

7.3 Homepage

On the home page (see *Figure 27*), miscellaneous information about the LPR®-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.

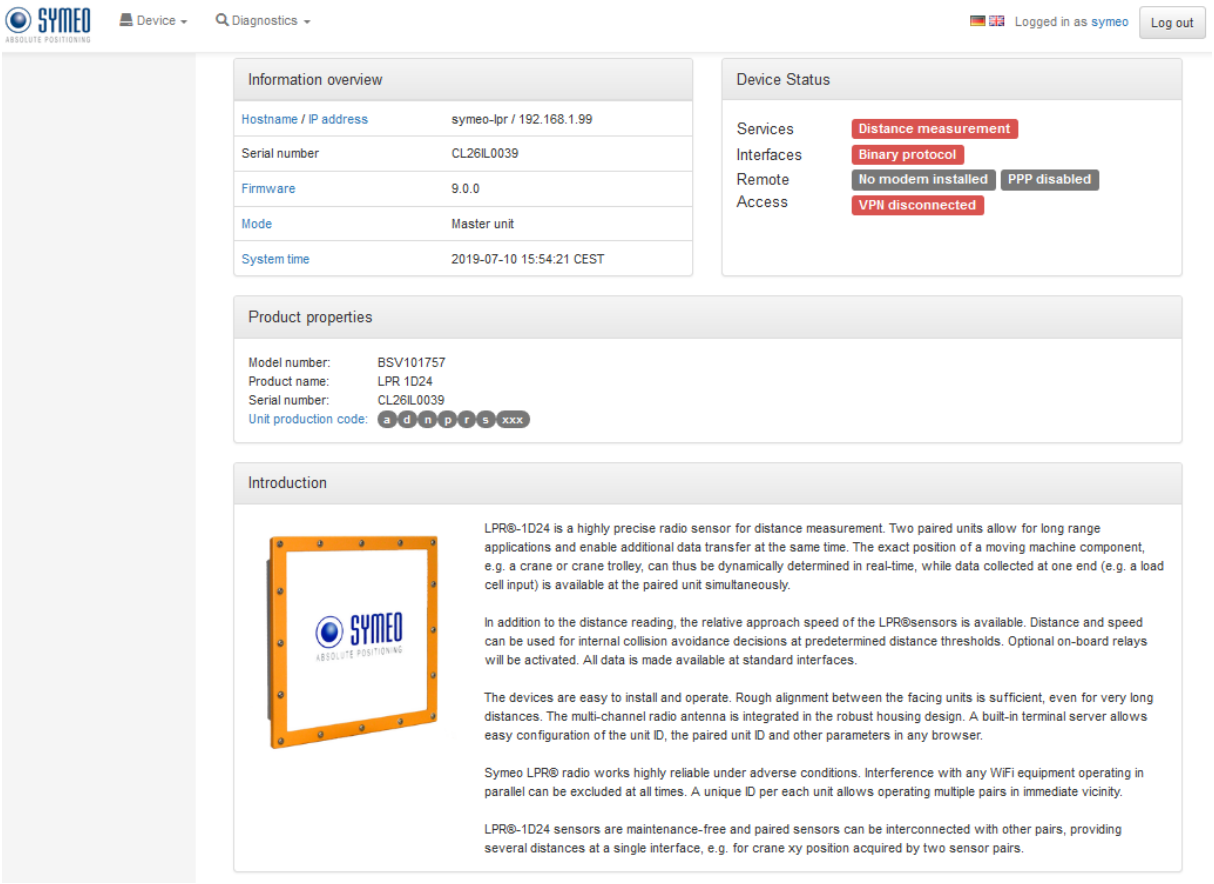


Figure 27: The Home Page of LPR®-1D24

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

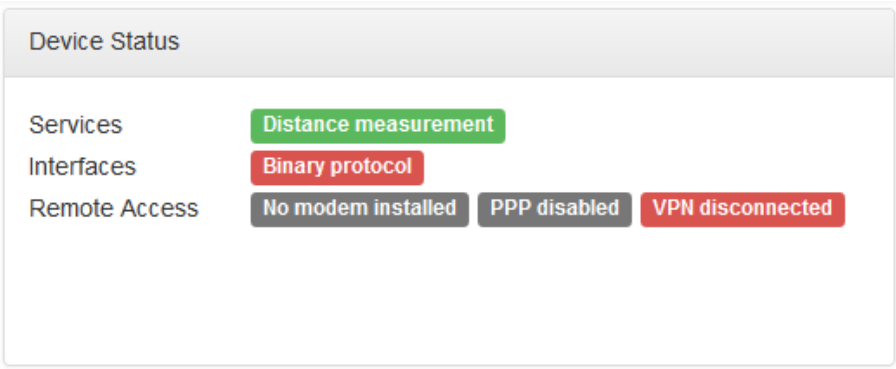


Figure 28: WebUI - Device Status

- 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.

Note

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®-1D24
- Serial number
- Firmware
- Mode: Master or Slave
- System time

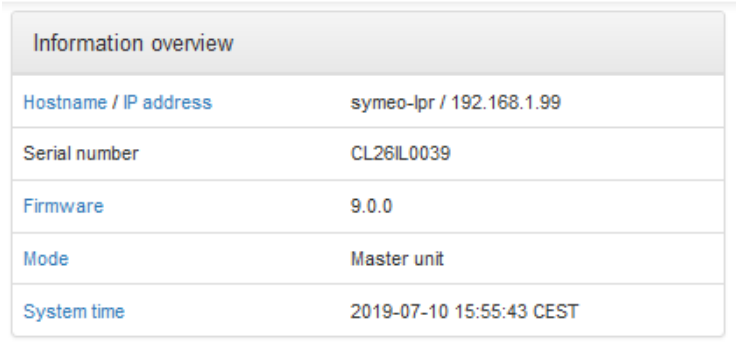


Figure 29: WebUI Information overview

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

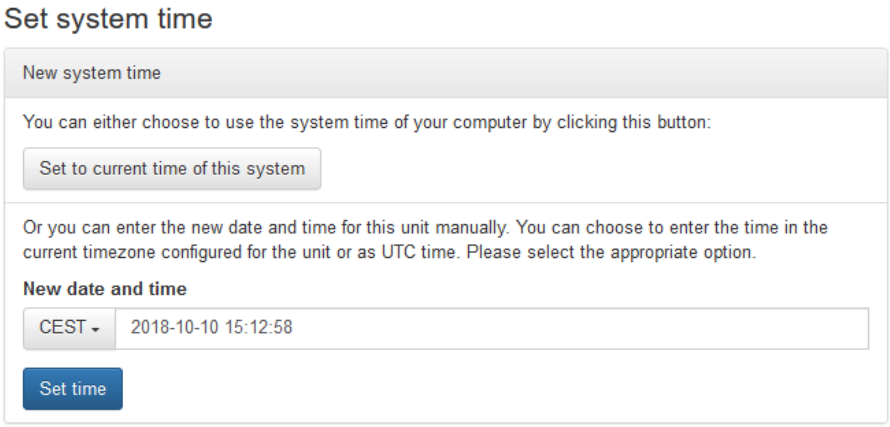


Figure 30: Set system time

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)

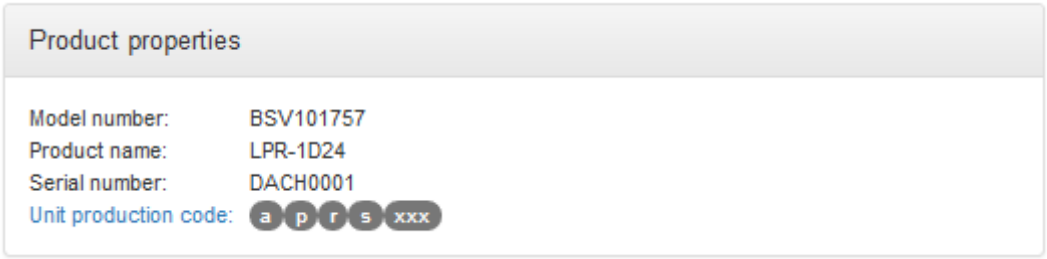


Figure 31: WebUI - Product properties

⇨ 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 element	Active
High accuracy for range measurement +/-2.5 cm (1 σ)	a	No
Data transmission of user data and relay switch commands via radio signal	d	Yes
Profinet	n	No
Profibus	p	No
4 opening relay switches	r	No
LPR®-1D24 metal housing with integrated multiple antennas (redundant range measurement), 1D controller, interface TCP/IP; range 50 m; accuracy: +/-20 cm (3 σ)	s	Yes
Range option: 0 to 200 m	x	No
Range option: 0 to 500 m	xx	No
Range option: 0 to 1000 m	xxx	No

Figure 32: WebUI - Product features

i Note

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

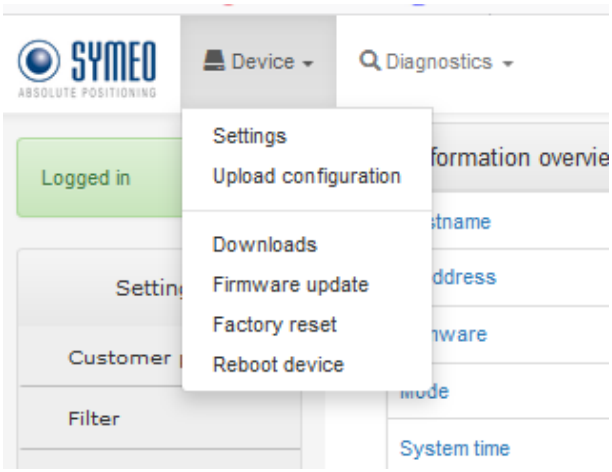


Figure 33: Device Menu

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

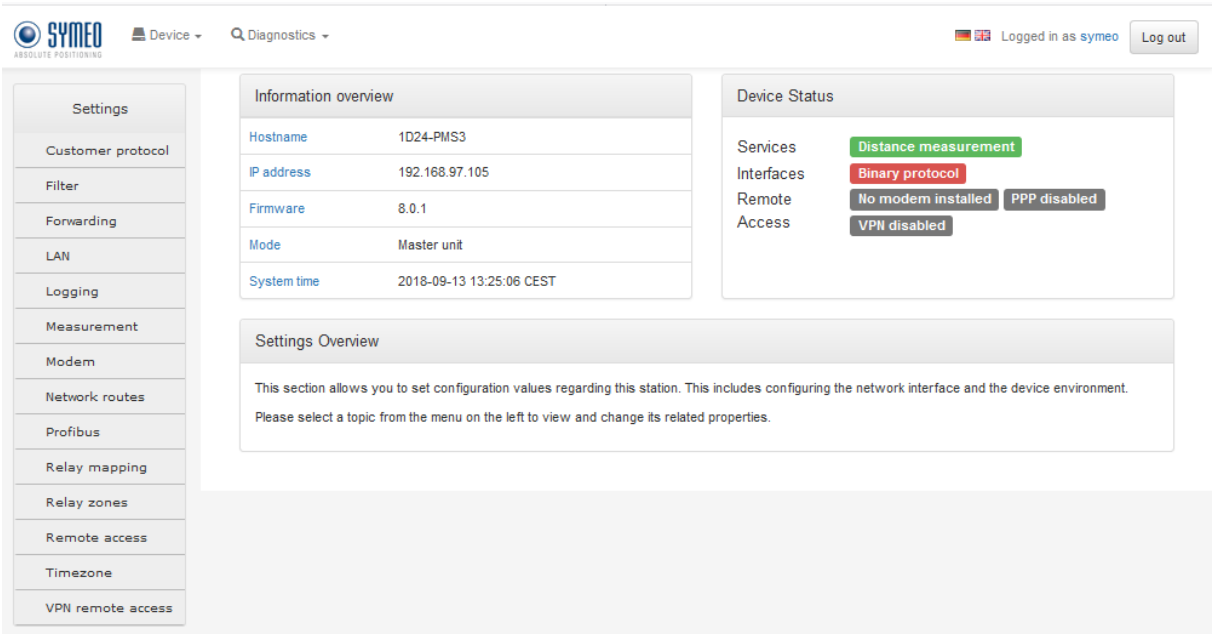


Figure 34: Device - Settings Menu

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.

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®-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®-1D24.

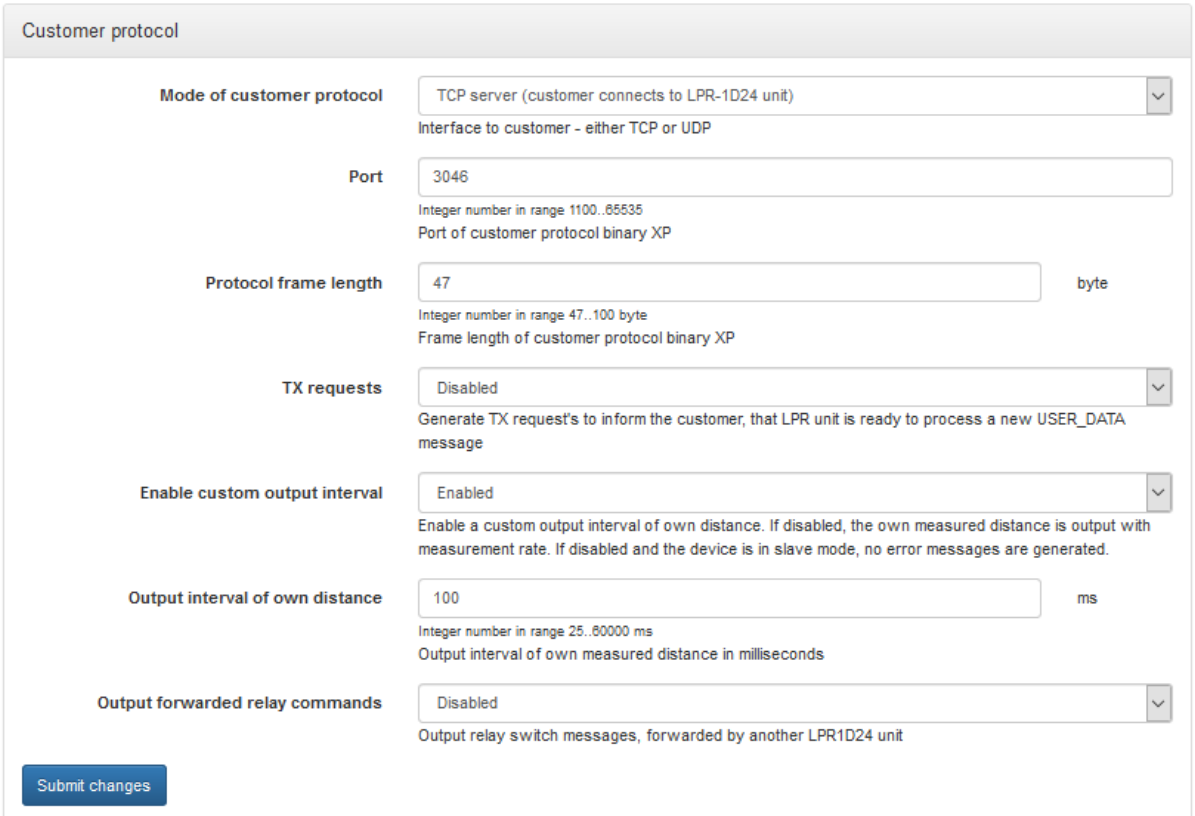


Figure 35: Device - Settings - Customer protocol

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
  - Decreases filter lag time and measurement noise

Note — The filter should only be enabled under good measuring conditions.

Note — This function must be set on the Master unit.

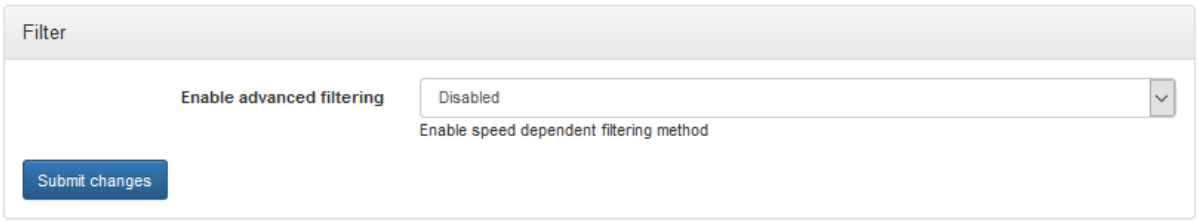


Figure 36: Device - Settings - Filter

7.5.3 Device - Settings - Forwarding

The LPR®-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®-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®-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®-1D24. The customer can enter USER- and RELAY- data records. These are forwarded with the injection rate, **but not faster** than the LPR®-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.

Note No configuration is required on the respective LPR®-1D24 receiving radar.

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

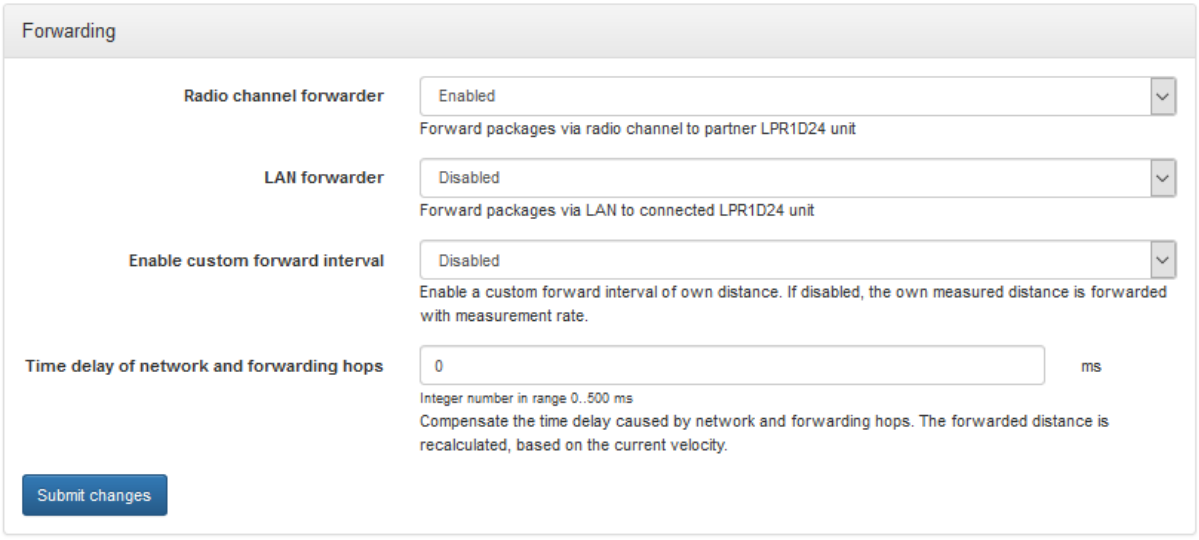


Figure 37: Device - Settings - Forwarding

Note If you want to enable „*LAN forwarder*" to forward distance data and user data to the LPR®-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.

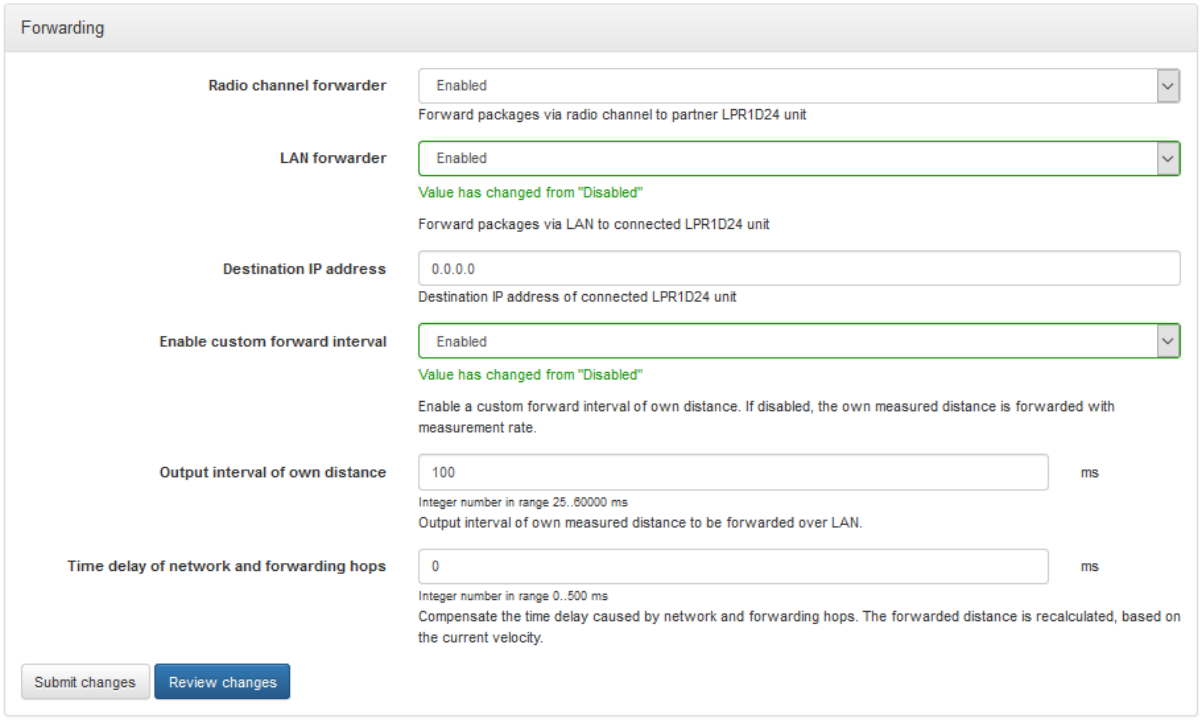


Figure 38: *Device - Settings - Forwarding - Parameter setting*

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)

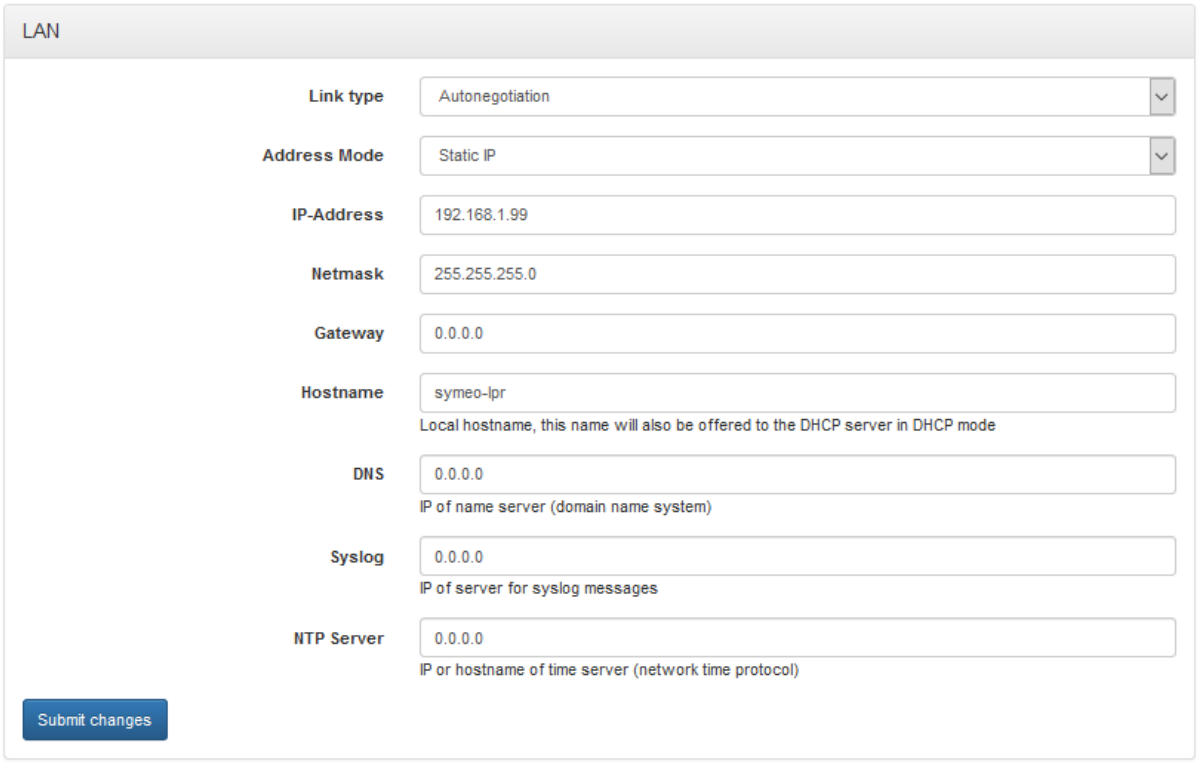


Figure 39: Device - Settings - LAN Settings

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

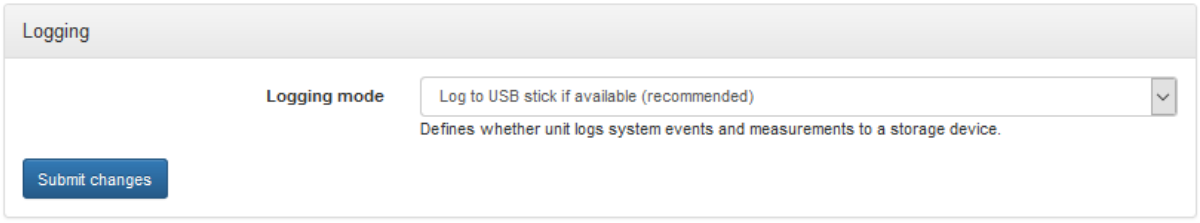


Figure 40: Device - Settings - Logging

i Note

The logging function is only to be activated temporarily in case of trouble shooting. The Symeo Support Team must be informed under support@symeo.com prior to the activation.

7.5.6 Device - Settings - Measurement

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

- LPR®-1D24 group ID –
  - Group identifier of one pair of LPR®-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®-1D24. Any measuring pair of LPR®-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 –
  - 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.

Note

These settings must be the same on Master and Slave.

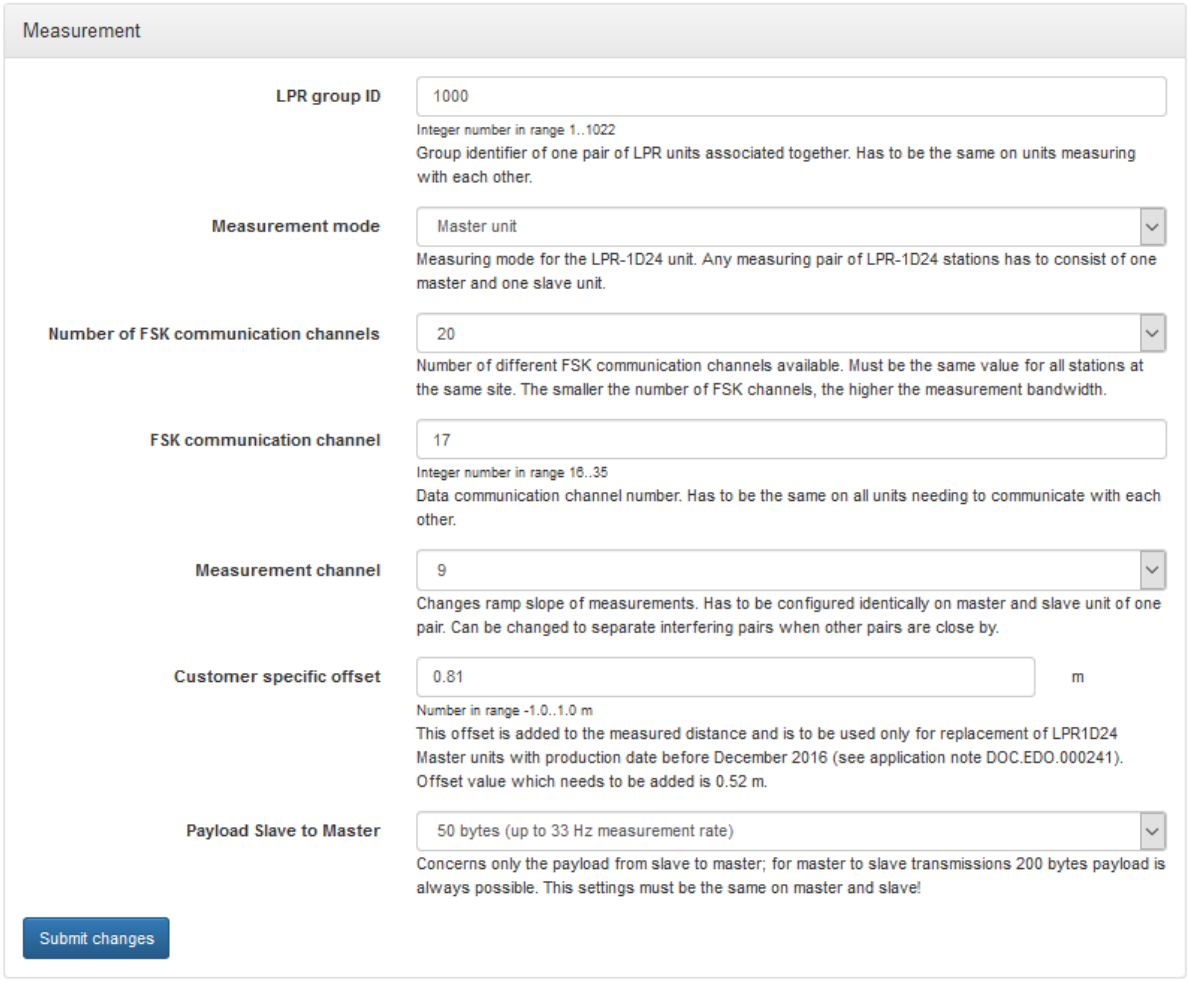


Figure 41: Device - Settings - Measurement

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®-1D24:

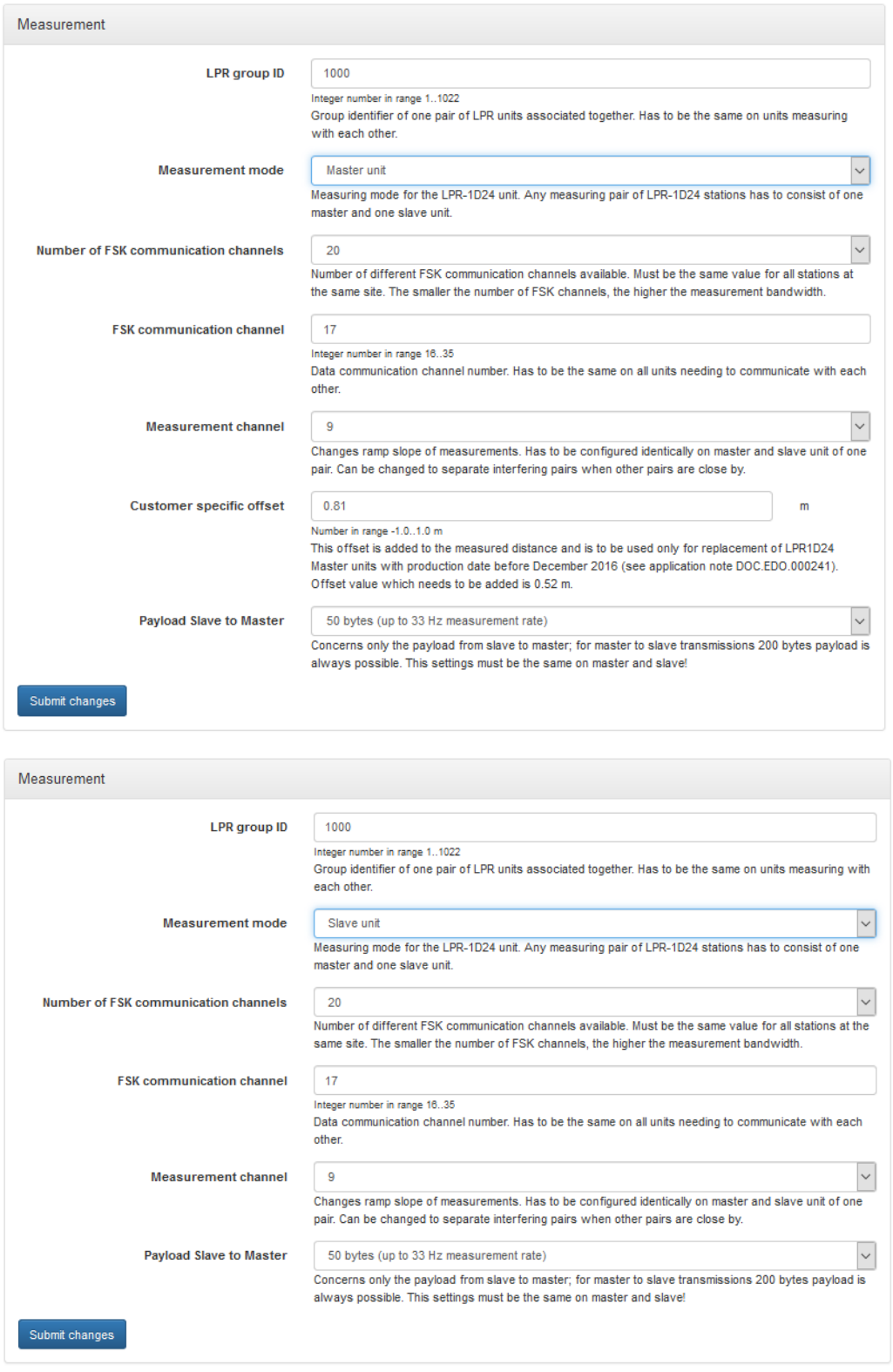


Figure 42: Example configuration of one measurement pair Master and Slave unit

Note

Configuration rules:

- To prevent mutual disturbance of multiple LPR®-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®-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®-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*).

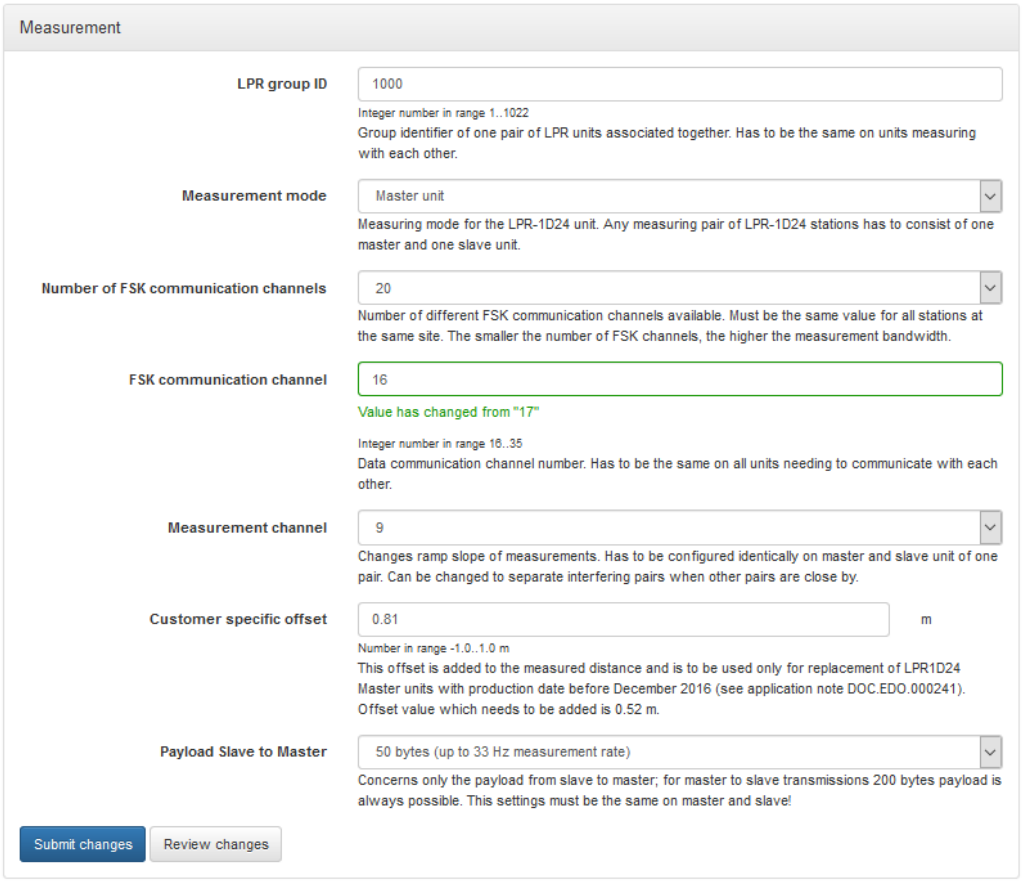


Figure 43: Device - Settings - Measurement - Submit/Review Changes

⇨ 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.

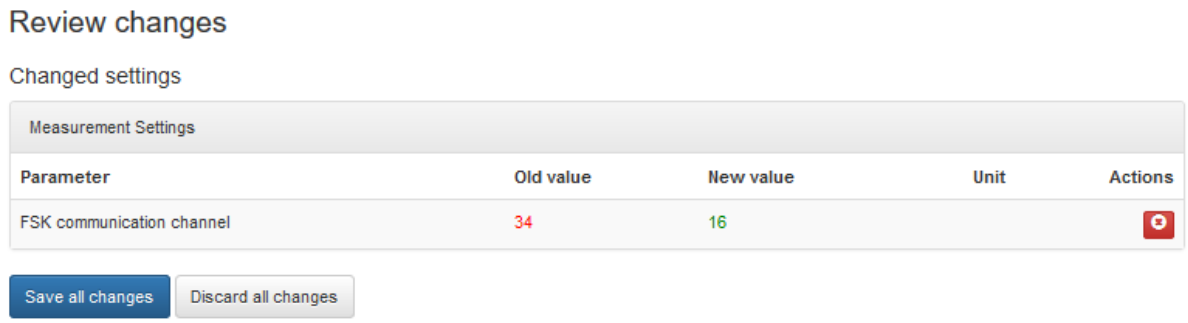


Figure 44: Device - Settings - Measurement - Save all changes

⇨ 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*).

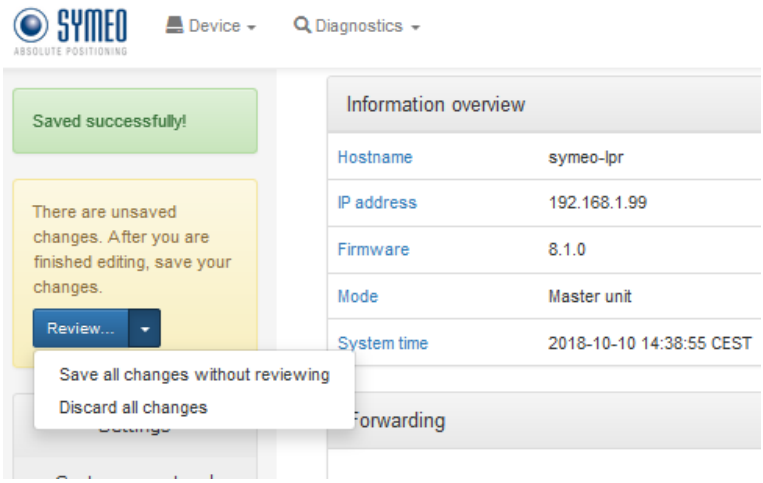


Figure 45: Device - Settings - Measurement - Review

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

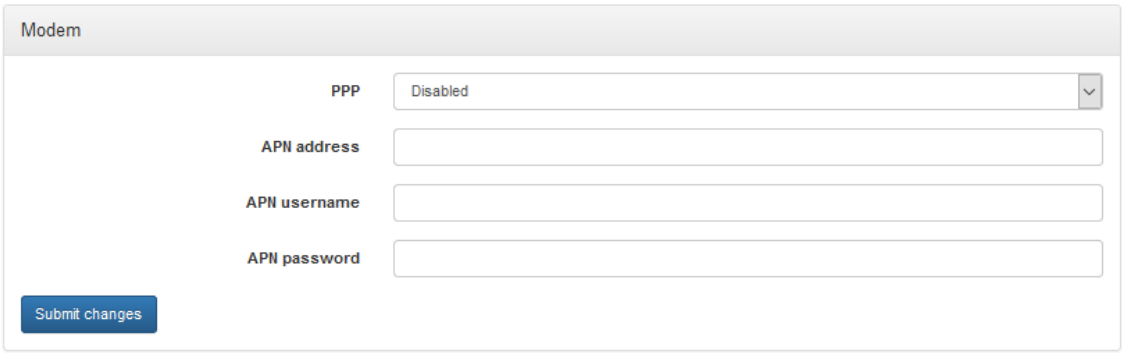


Figure 46: Device - Settings - Modem

7.5.8 Device - Settings - Network Routes

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

⇨ Click the „+ *add route*" button.

Figure 47: Device - Settings - Network Routes

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

⇨ Press the „*Add route"* button.

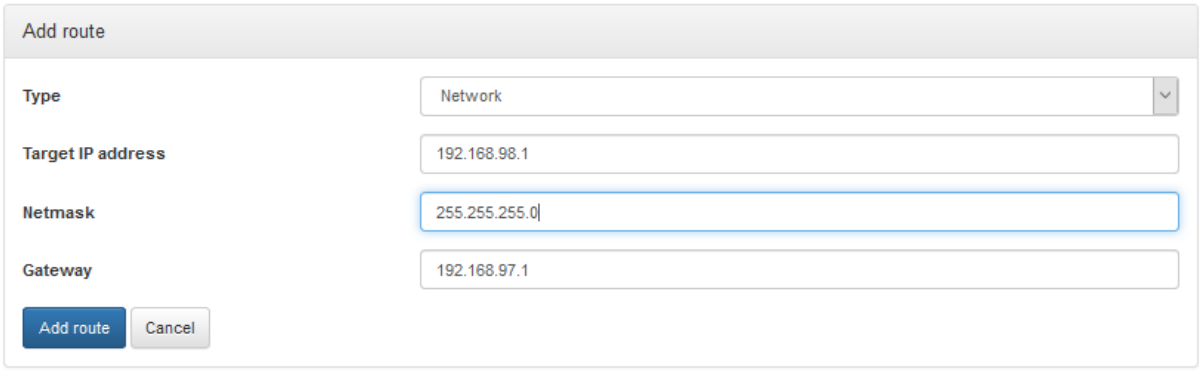


Figure 48: Device - Settings - Network Routes - Add route

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

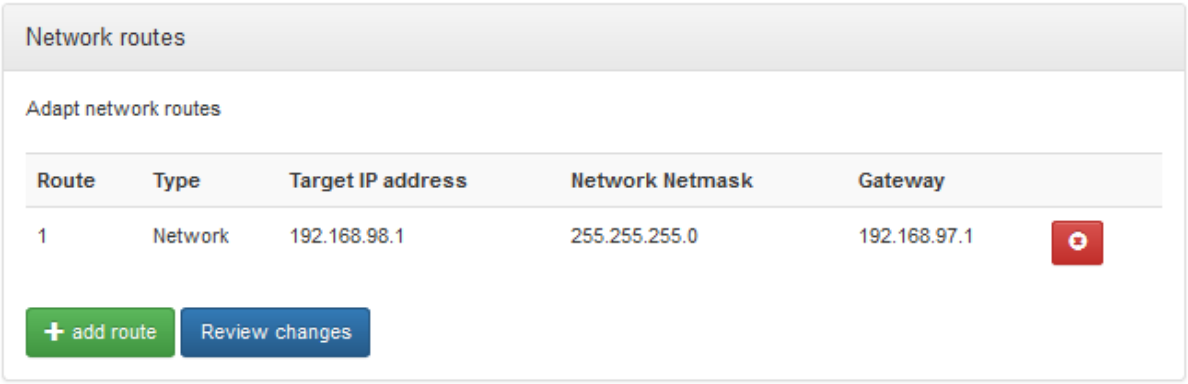


Figure 49: Device - Settings - Network Routes - Review changes

7.5.9 Device - Settings - Profibus

Note	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:

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*).

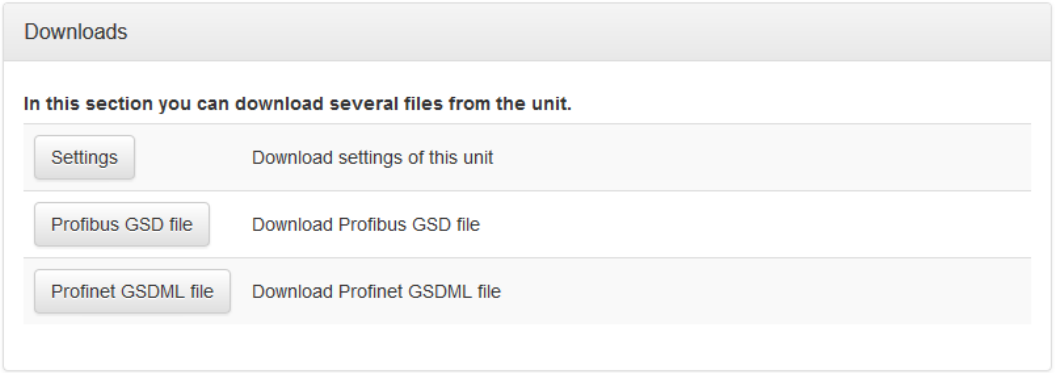


Figure 51: Device - Settings - Downloads, Profibus GSD file

7.5.10 Device - Settings - Profinet

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*).

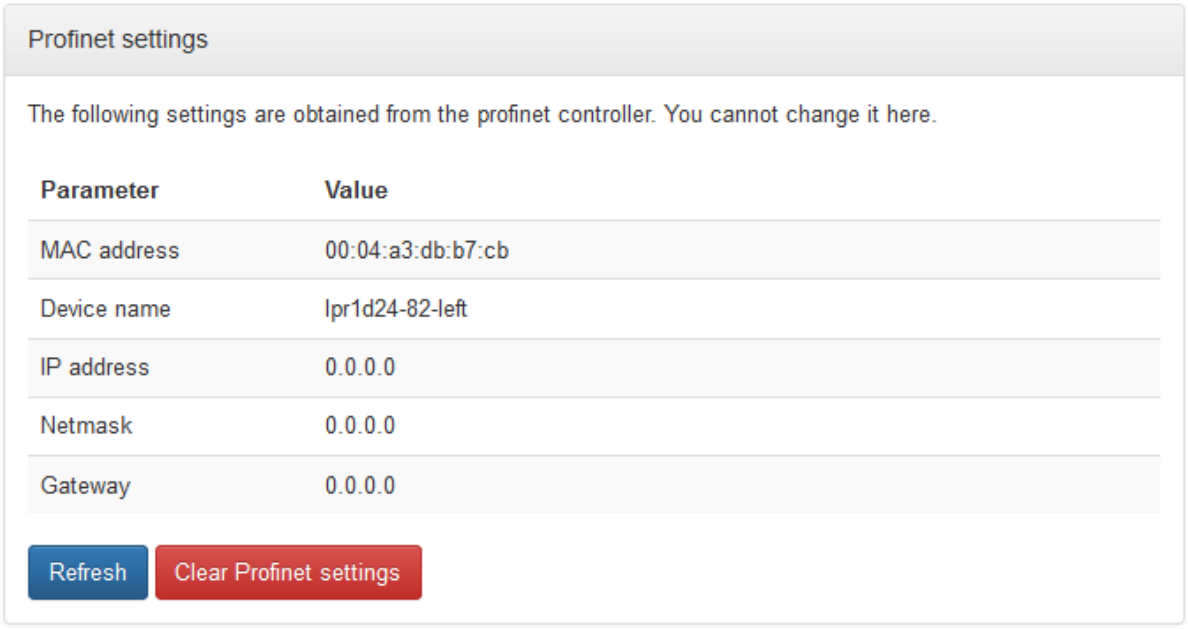


Figure 52: Device - Settings - Profinet

Caution

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*).

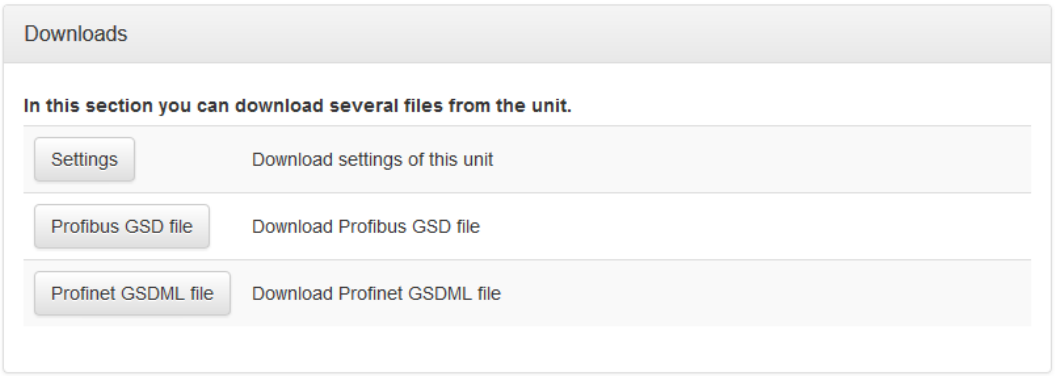


Figure 53: Device - Settings - Downloads, Profinet GSDML file

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®-1D24 -> Relay is switched by a relay switching command via the air interface (see chapter 9.2.3).

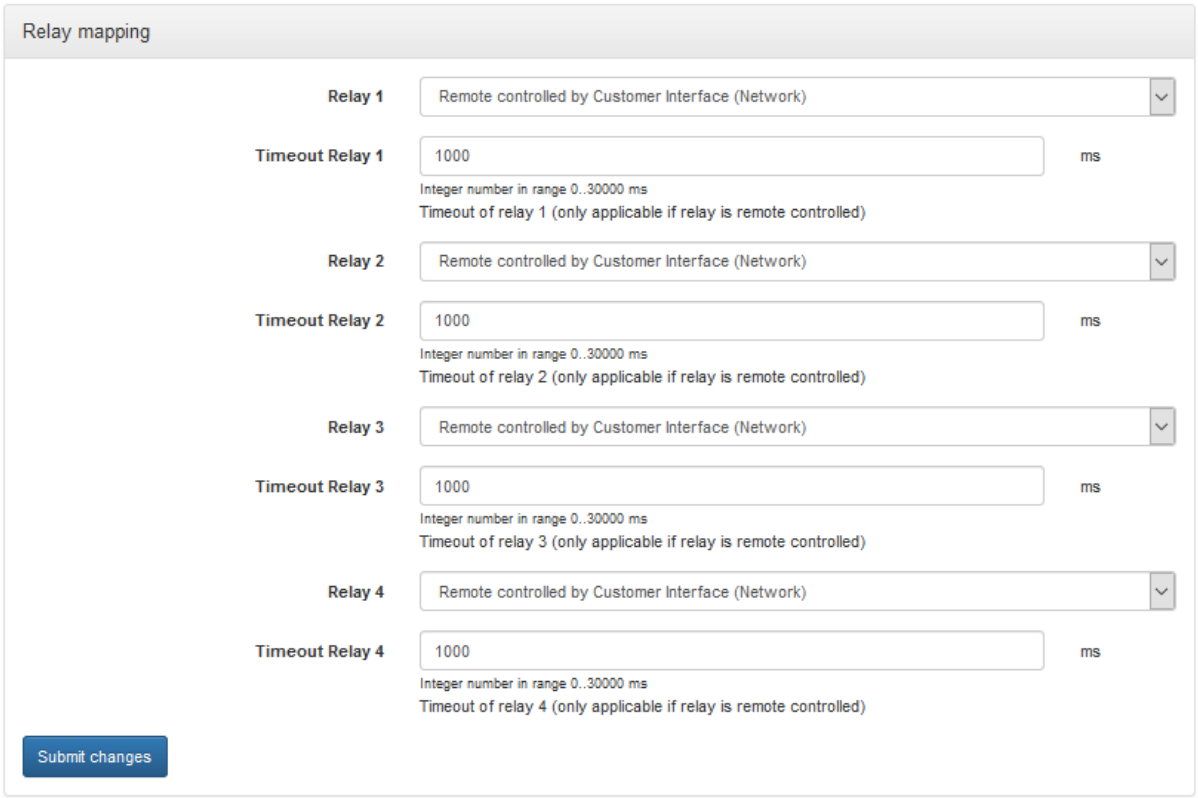


Figure 54: Device - Settings - Relay mapping

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.

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*.

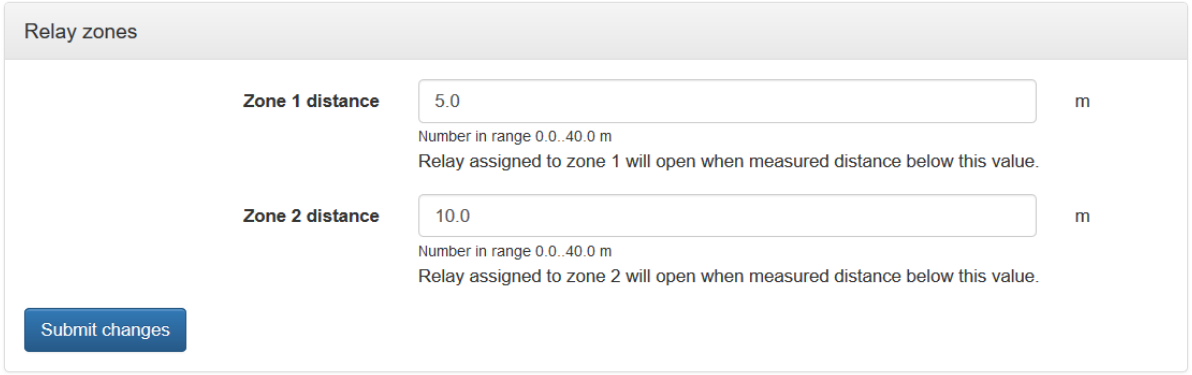


Figure 55: *Device - Settings - Relay zones*

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:

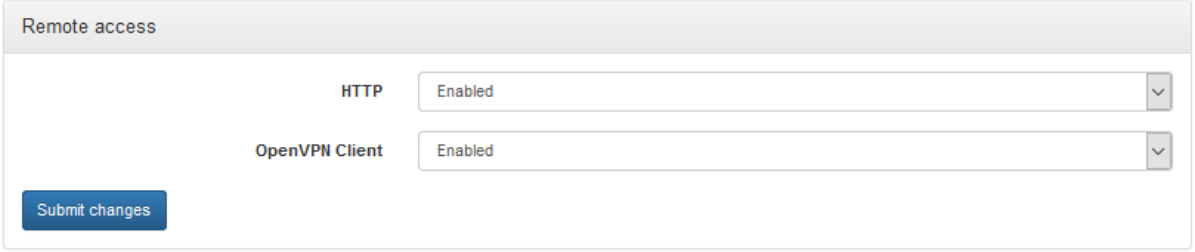


Figure 56: Device - Settings - Remote Access Settings

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.

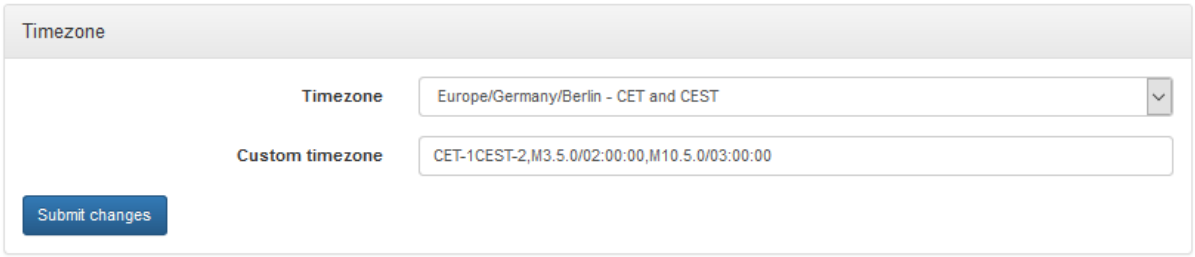


Figure 57: Device - Settings - SystemTime Settings

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.

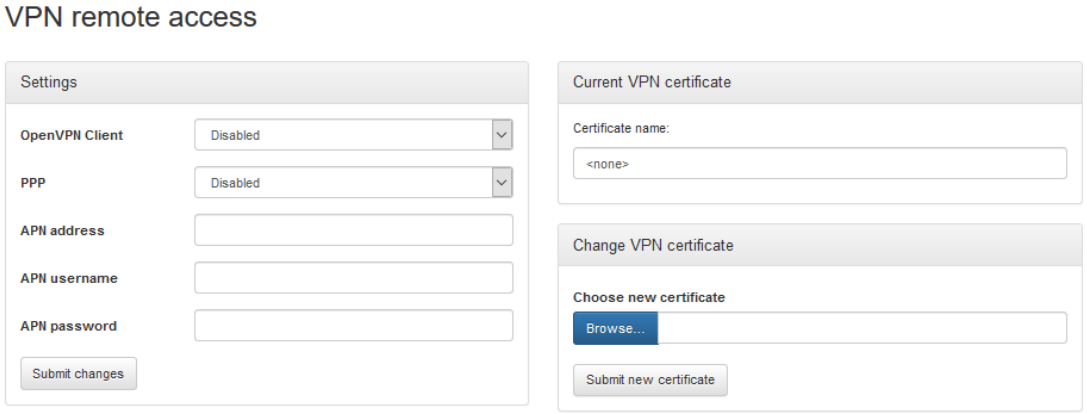


Figure 58: Device - Settings - VPN Remote Access Settings

7.6 Device - Upload Configuration

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

Figure 59: Device - Application Settings

⇨ 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

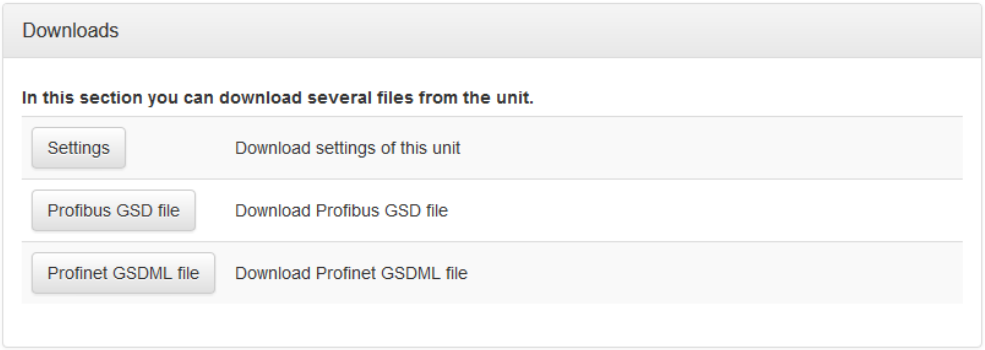


Figure 60: Device - Downloads

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*".

Note	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

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.

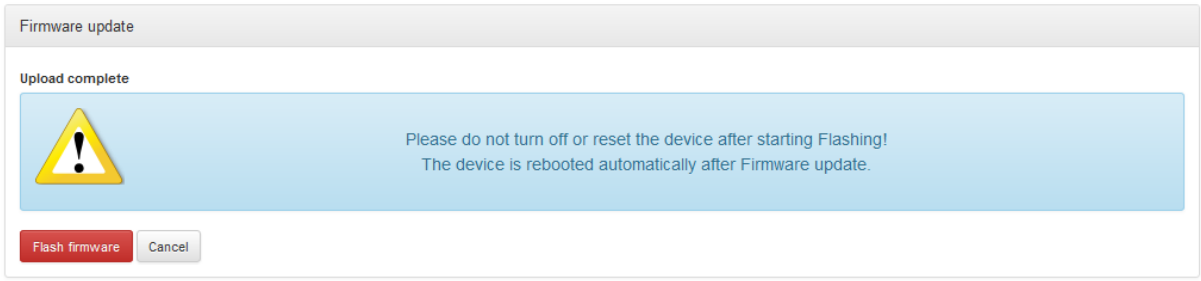


Figure 62: Device - Device configuration - Firmware update success message

i Note	All radars that measure or forward together should have the same firmware version. Therefore, both units (Master and Slave) have to be upgraded.
i Note	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).
i Note	Please read the Notes on the Firmware Update in "Partner Login" area (Firmware -> „Readme_Firmware_Update_LPR-1D24") under https://www.symeo.com/en/partner-login/index.html.

7.9 Device - Factory Reset

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

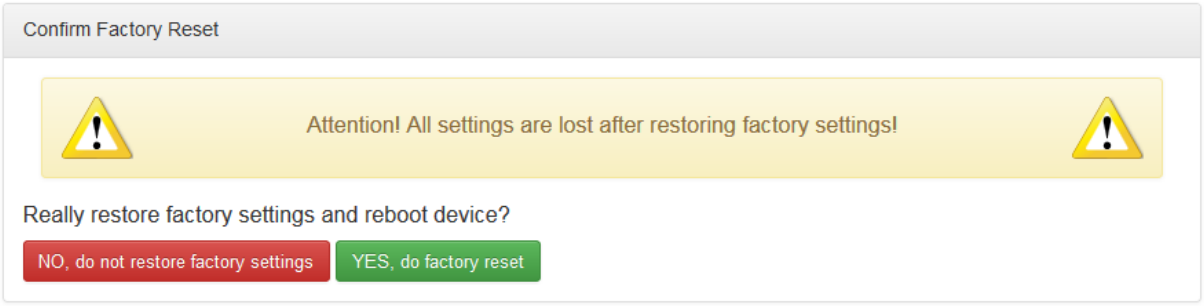


Figure 63: Device - Factory Reset

Please press „*YES, do factory reset*“ if you want to perform a reboot.

Caution	Attention! All settings are lost after restoring factory settings!

Note	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

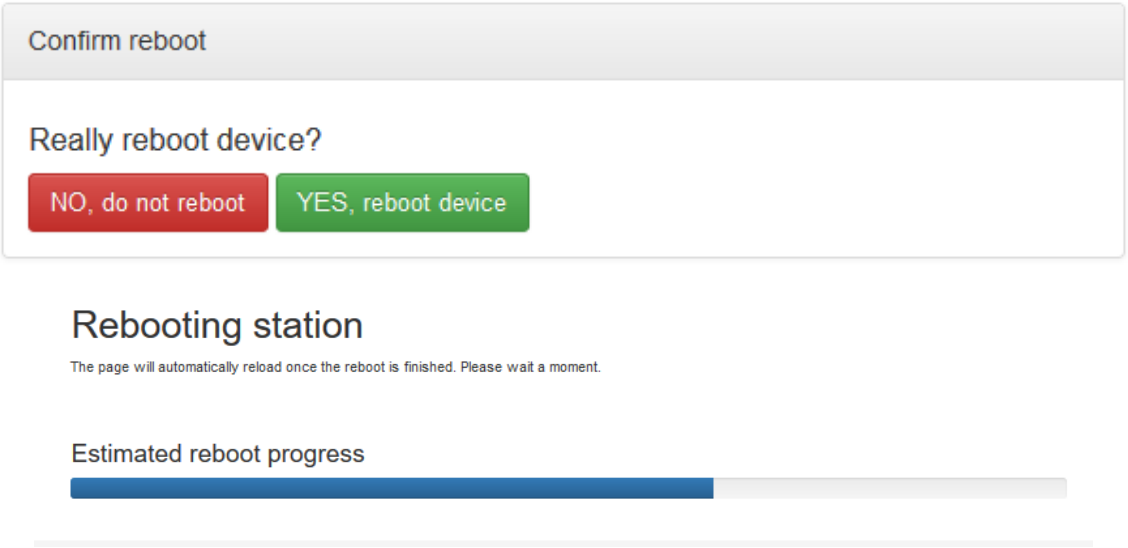


Figure 64: Device - Reboot Device

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

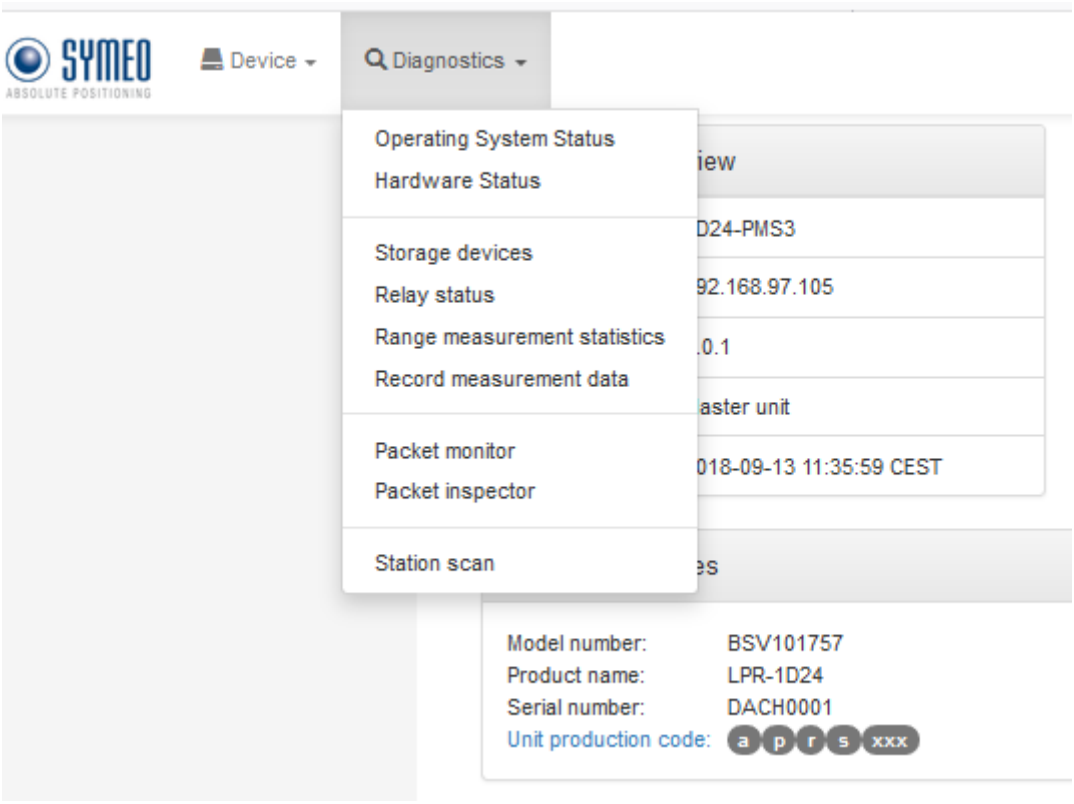


Figure 65: Diagnostics Menu

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.

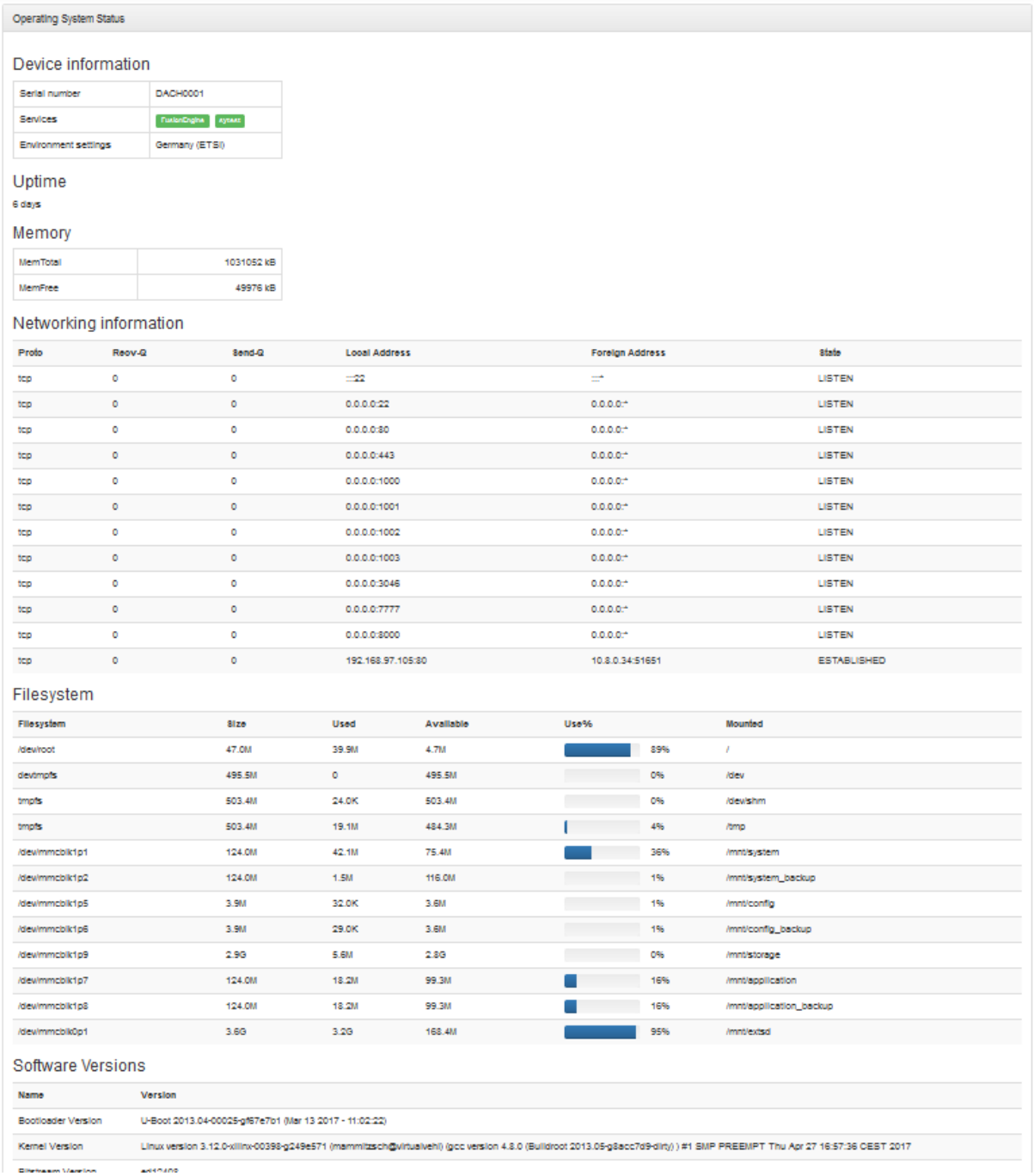


Figure 66: Diagnostics - Operating System Status

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.

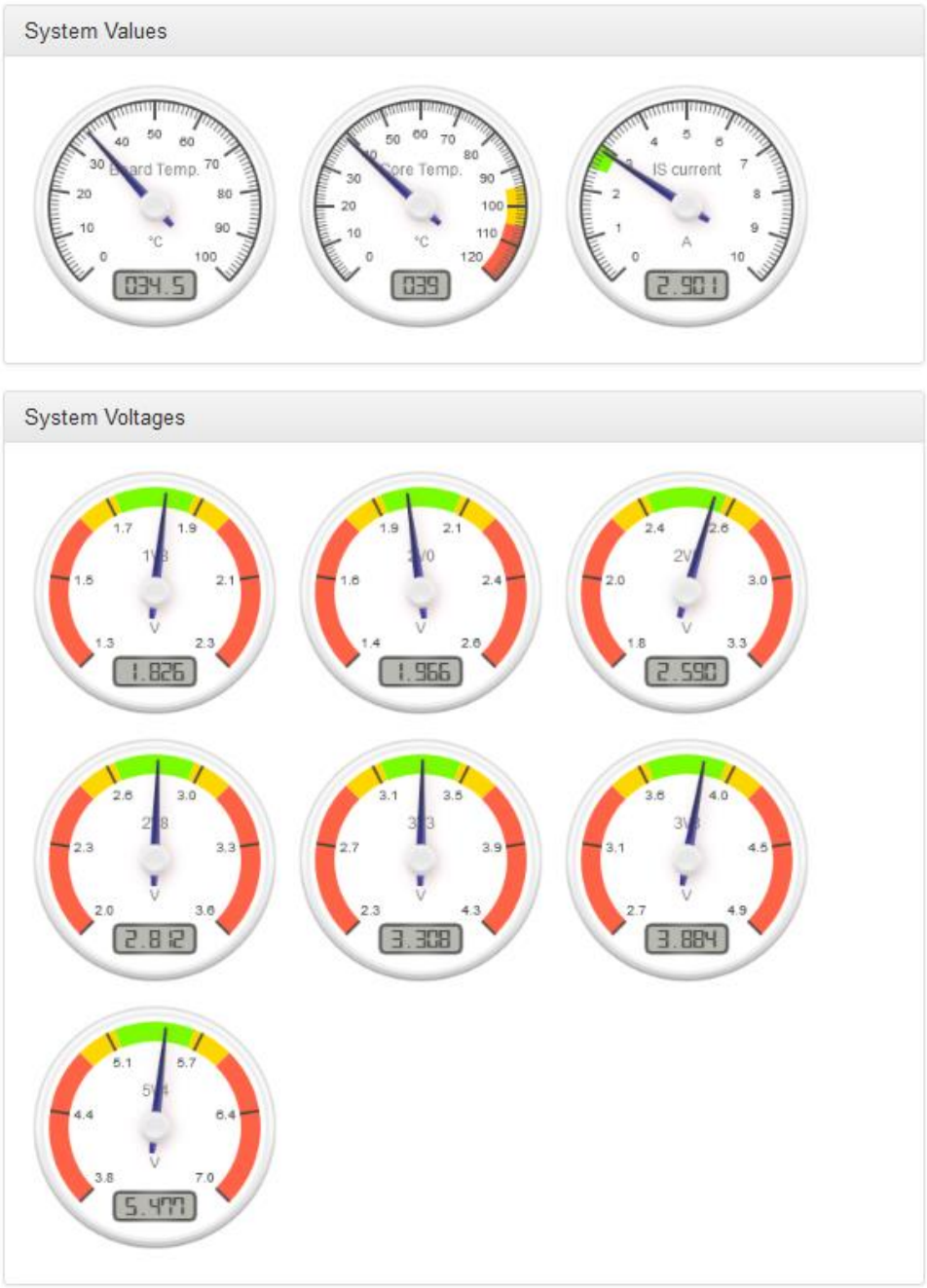


Figure 67: Diagnostics - Hardware Status

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.

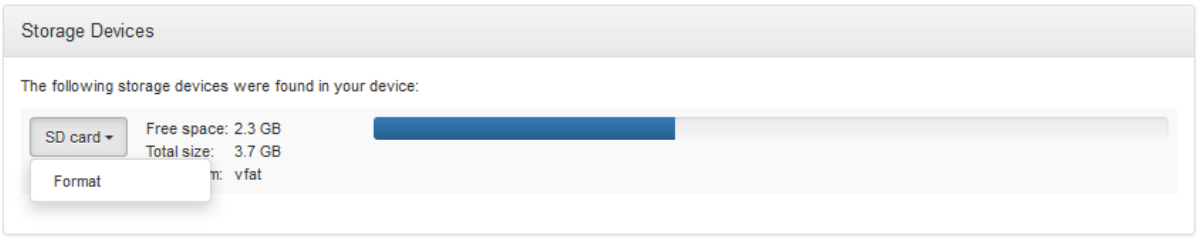


Figure 68: Diagnostics - Storage Devices

7.11.4 Diagnostics - Relay Status

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

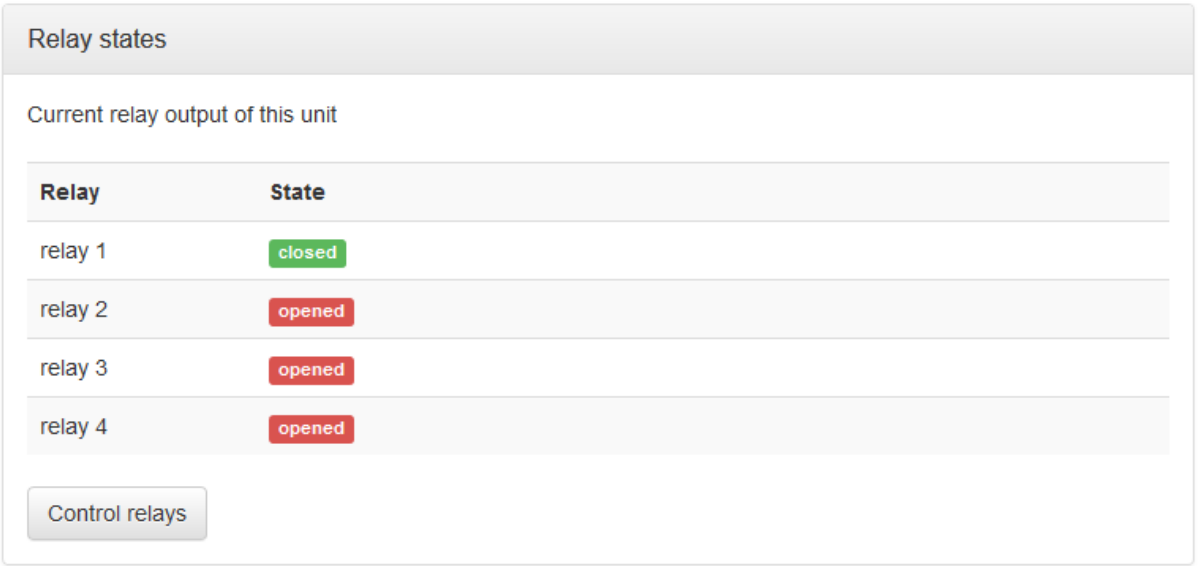


Figure 69: Diagnostics - Relay states

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*).

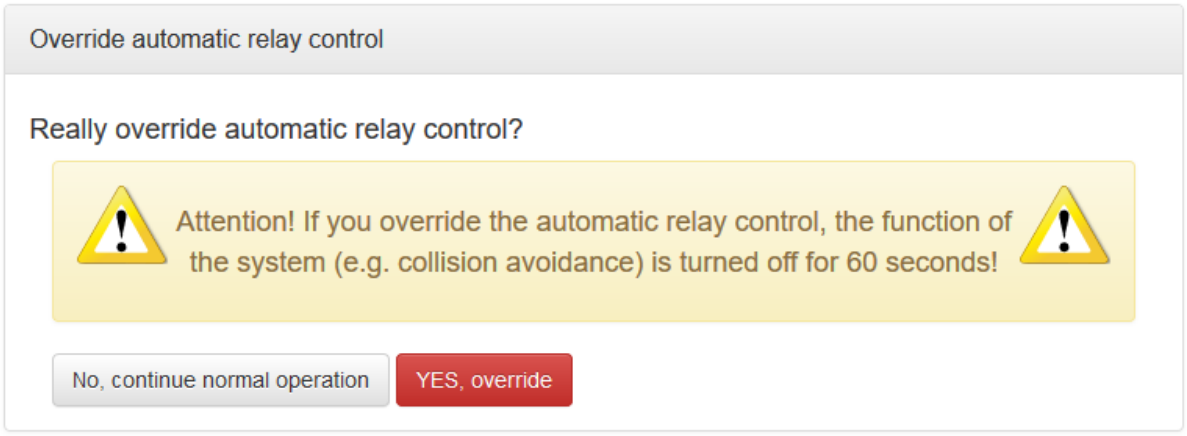


Figure 70: Diagnostics - Control relays - override

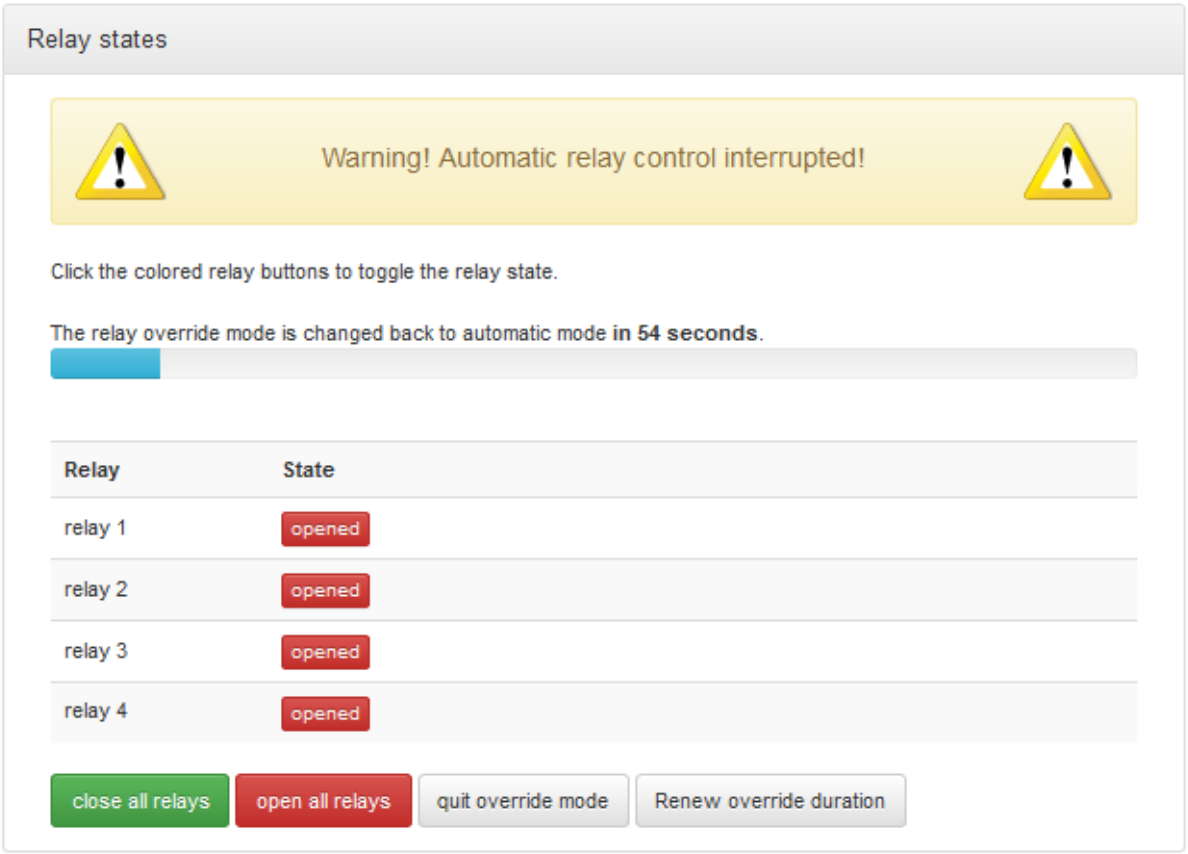


Figure 71: Diagnostics - Control relays - Relay states

Warning 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

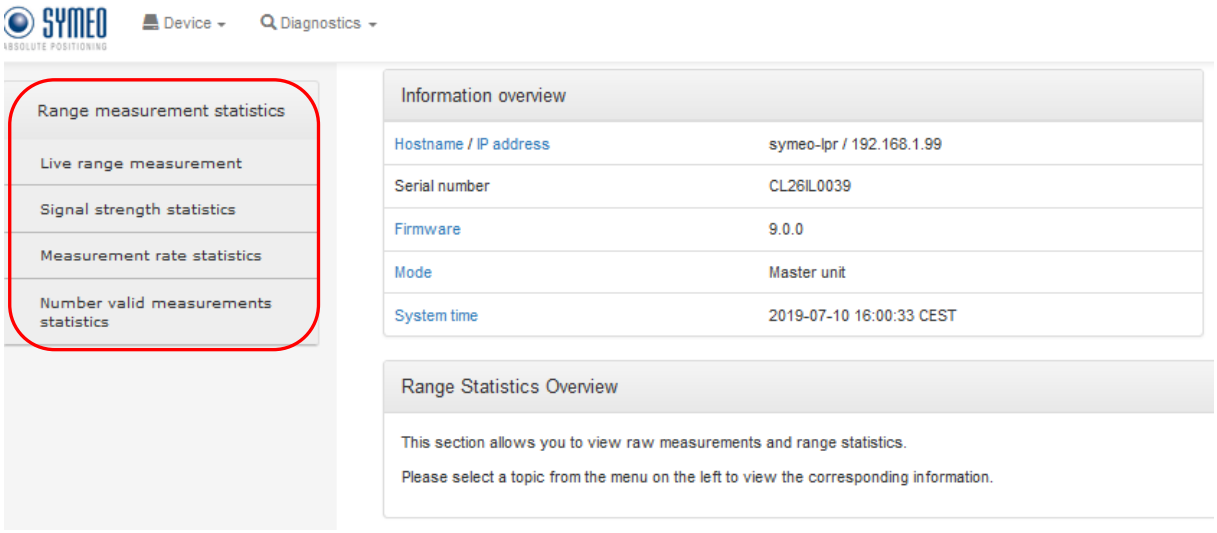


Figure 72: Diagnostics - Range Measurement Statistics

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.

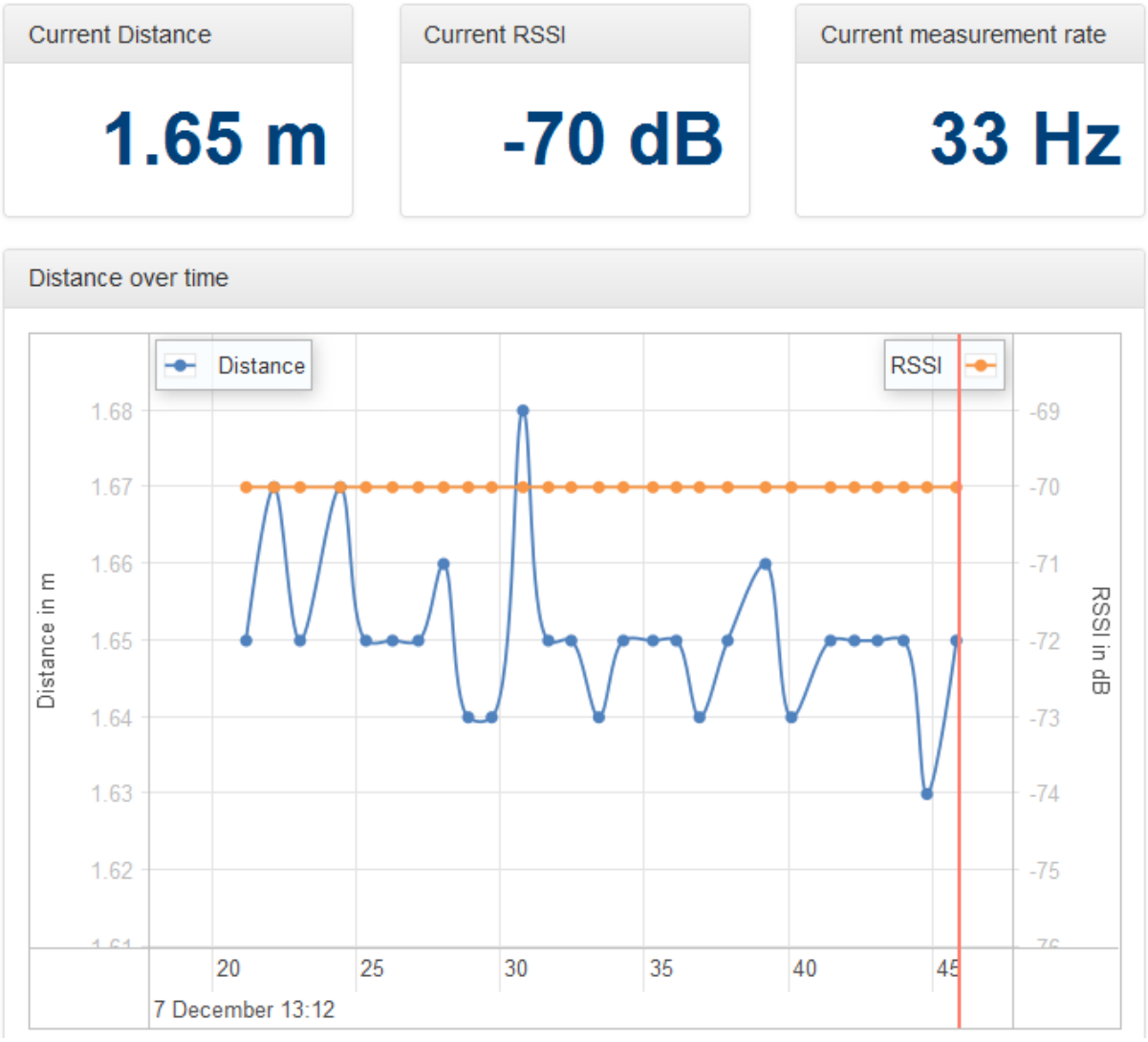


Figure 73: Diagnostics - Distance over time graph

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®-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®-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

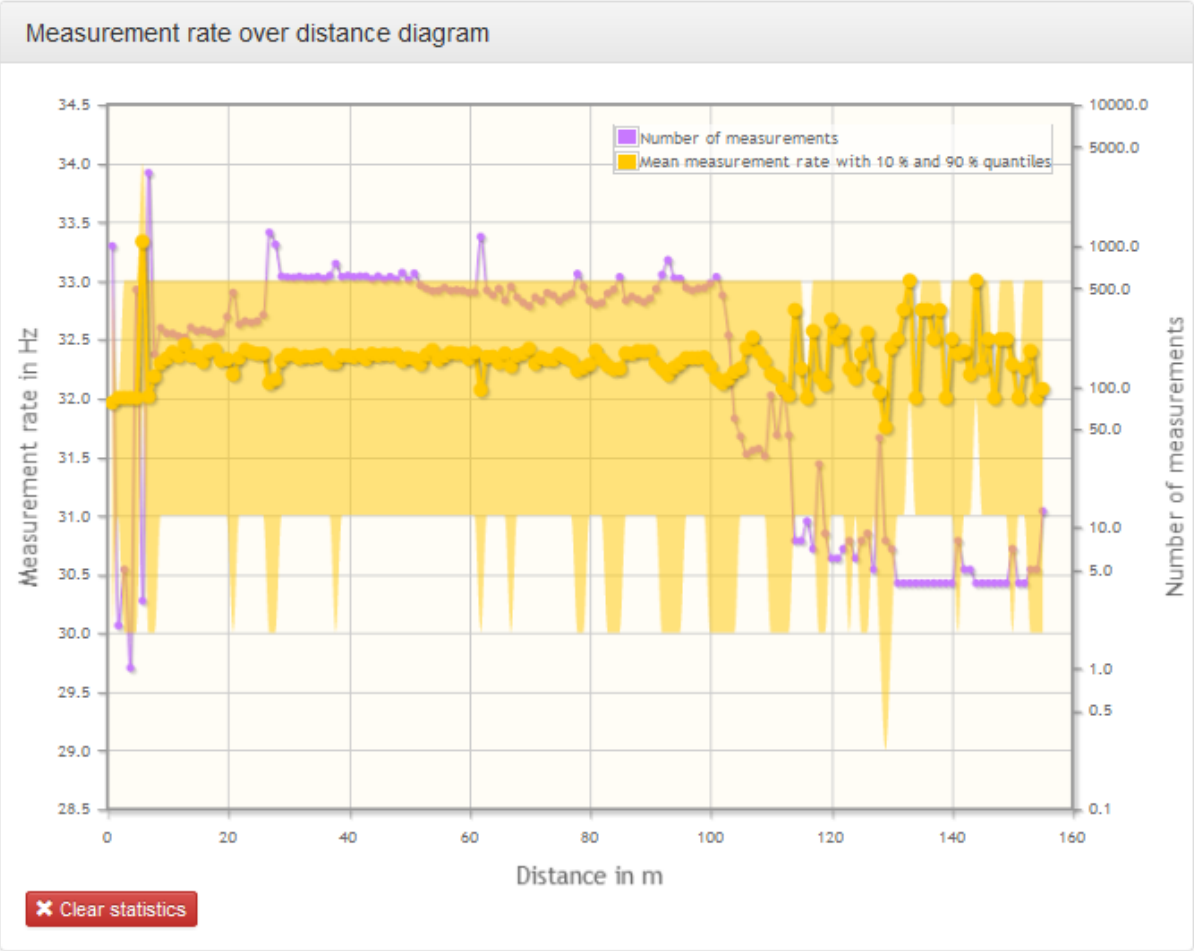


Figure 75: Diagnostics - Measurement rate over distance diagram

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®-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®-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 power-on. You can use it to detect abnormal signal propagation routes at certain constellations of the two LPR® stations.

The diagram is automatically refreshed every 10 seconds.

The distance axis X displays the distance between the two LPR® 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.

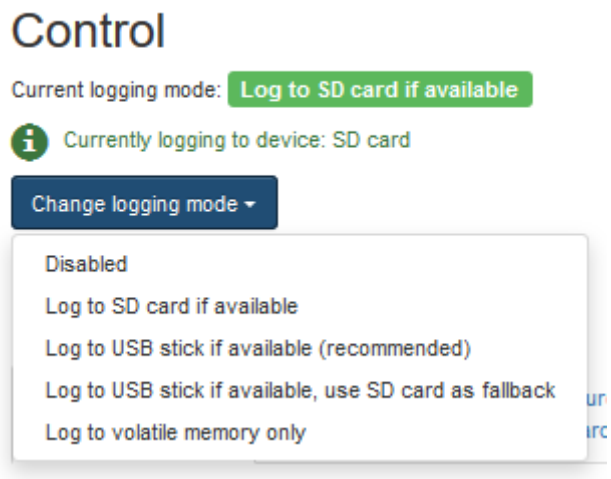
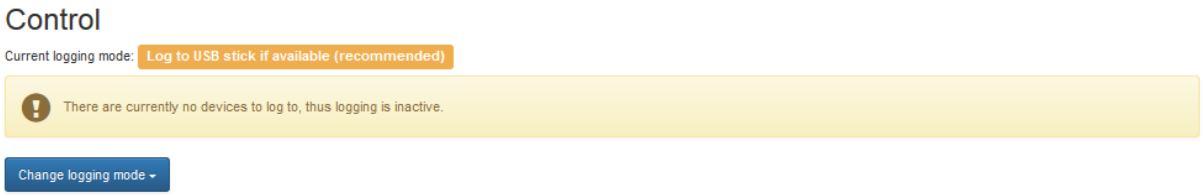


Figure 77: Diagnostics - Record measurement data - Change logging mode

⇨ 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:

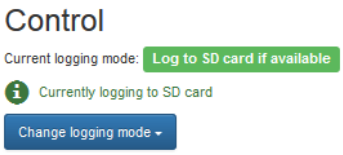


Figure 78: Diagnostics - Record measurement data - Change logging mode - Example

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

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

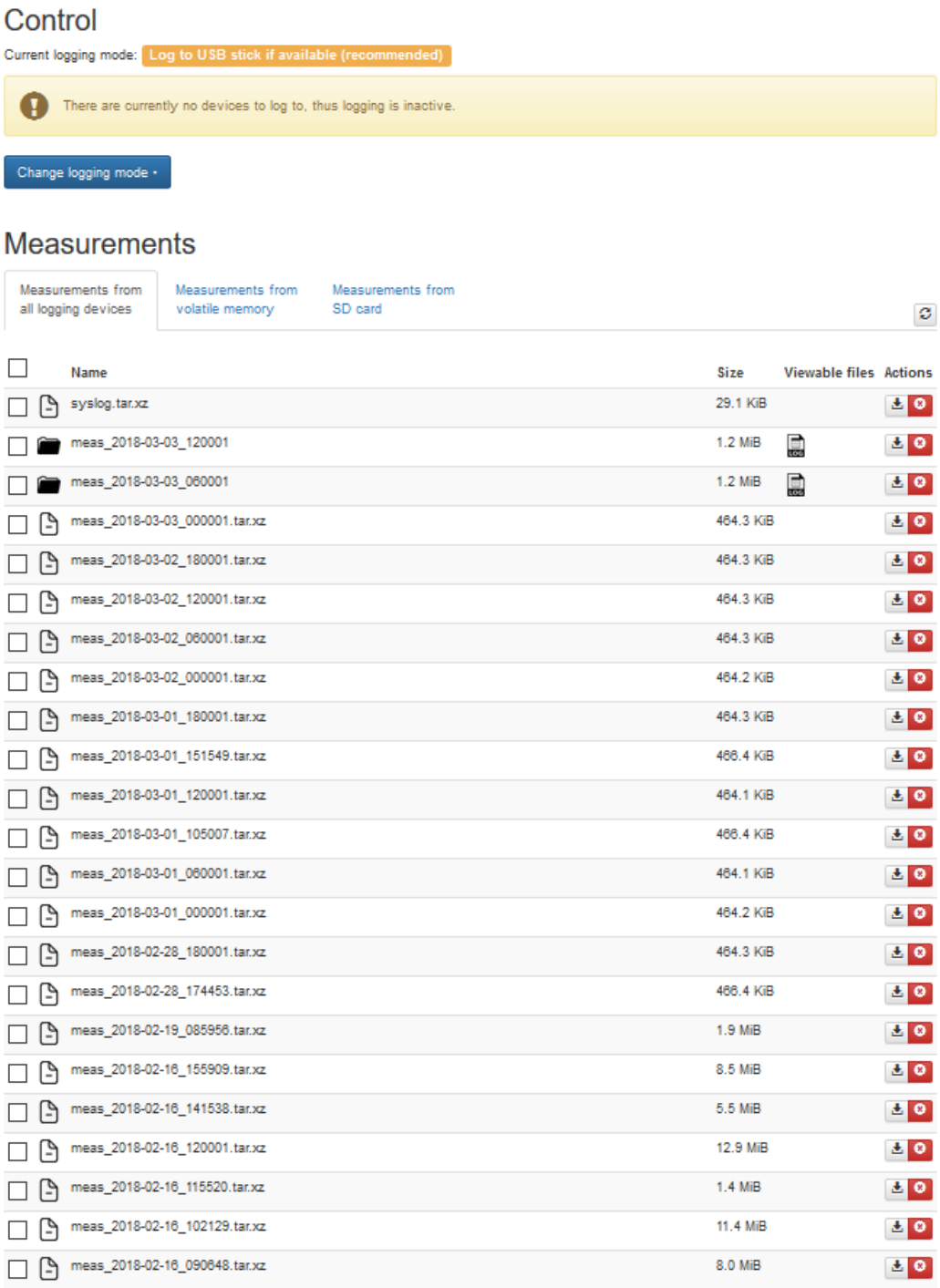


Figure 79: Diagnostics - Record measurement data

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 Reset

*Figure 80***:** *Diagnostics - Packet monitor*

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

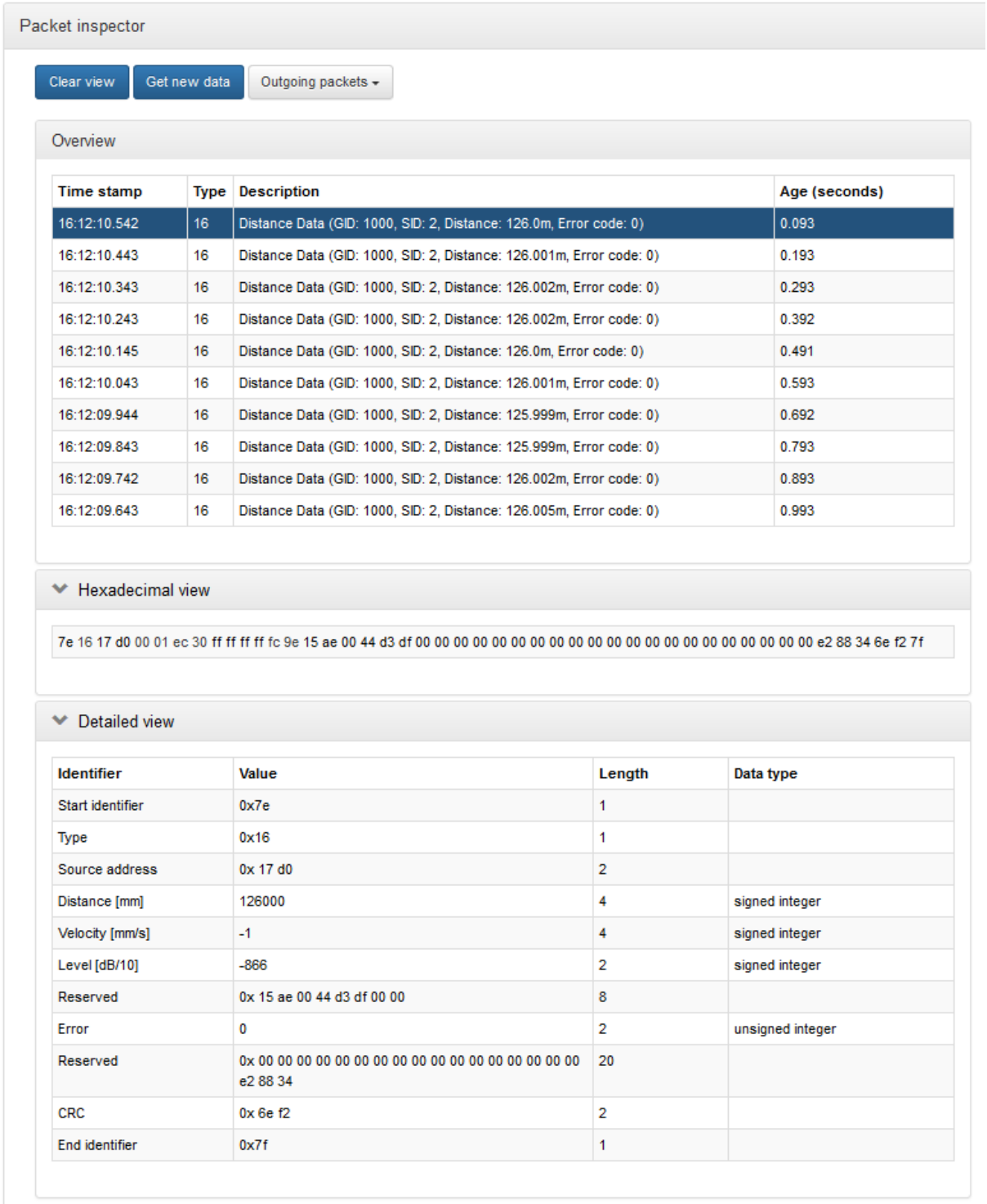
7.11.8 Diagnostics - Packet Inspector

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.



Time stamp	Type	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

Identifier	Value	Length	Data type
Start identifier	0x7e	1	
Type	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 00 00 00 00 00 00 e2 88 34	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.

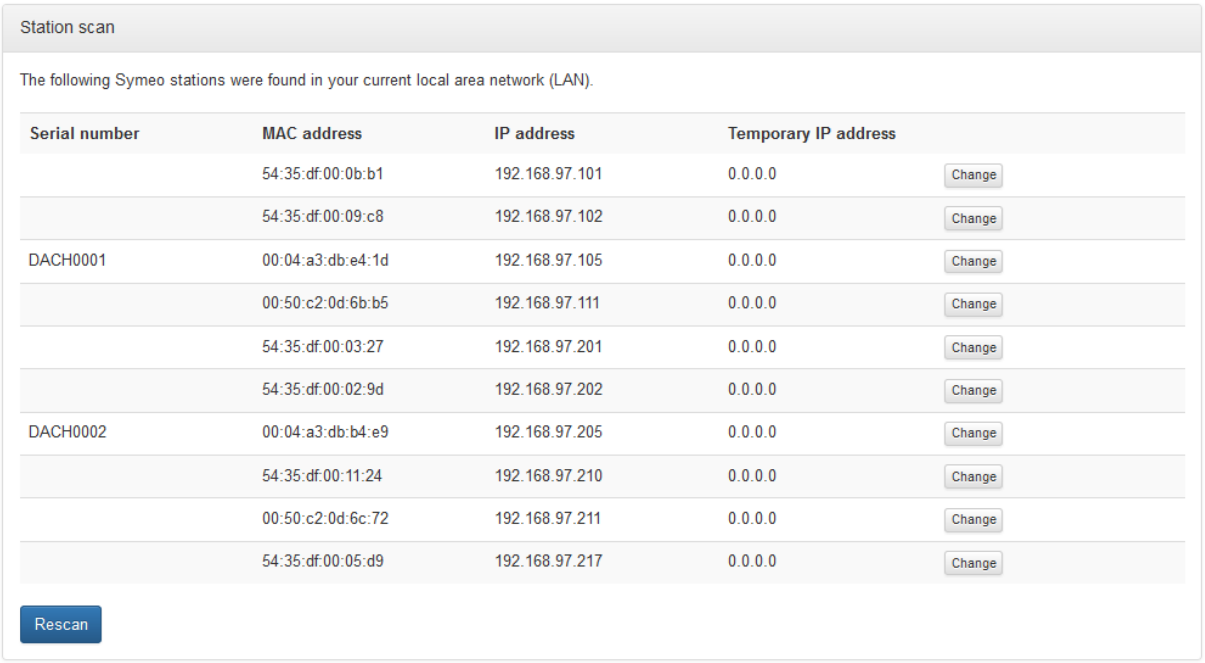


Figure 82: Diagnostics - Station scan

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.

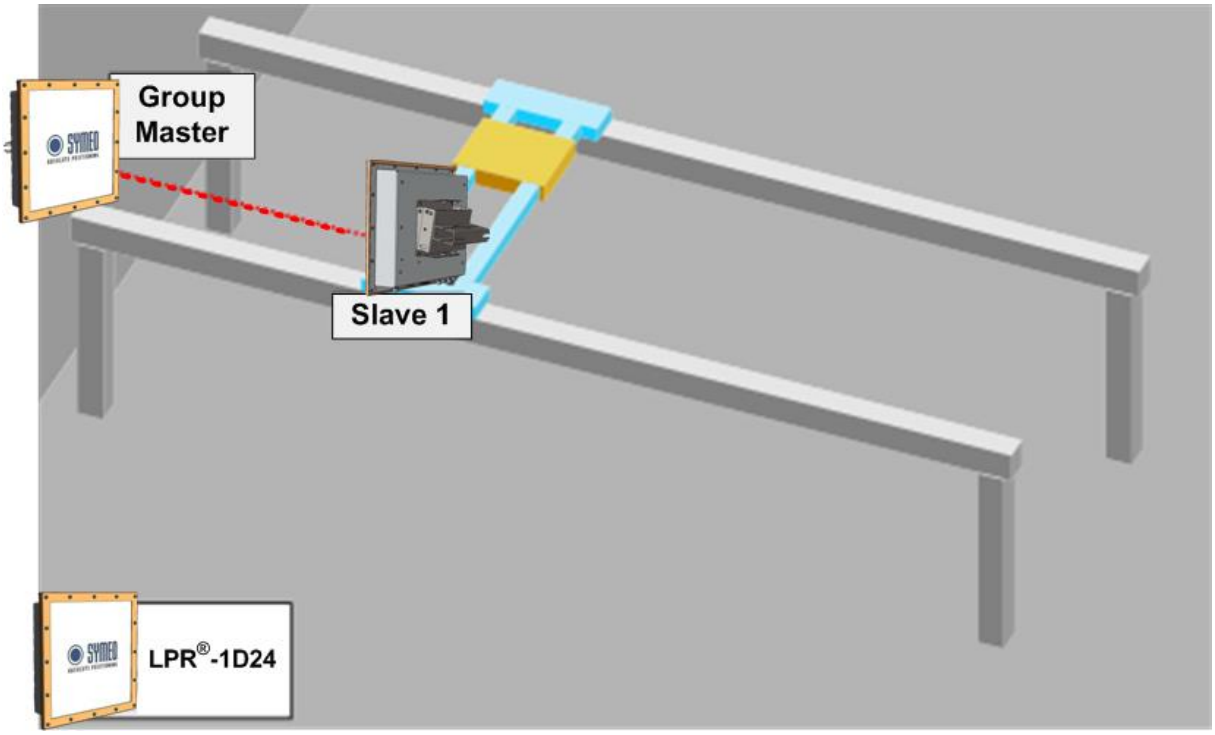


Figure 83: Distance measurement between two LPR®-1D24

The necessary settings for this must be made under „*Device -> Settings -> Measurement”:*

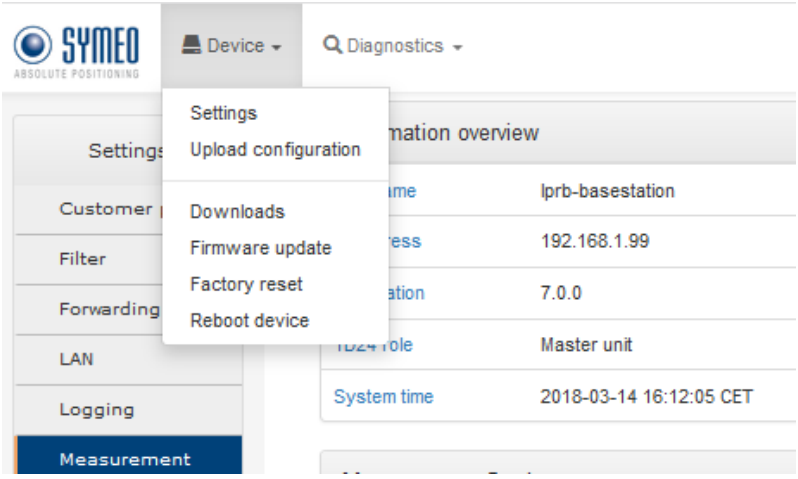


Figure 84: Menu Device - Settings - Measurement

Example Configuration of One Pair of LPR®-1D24:

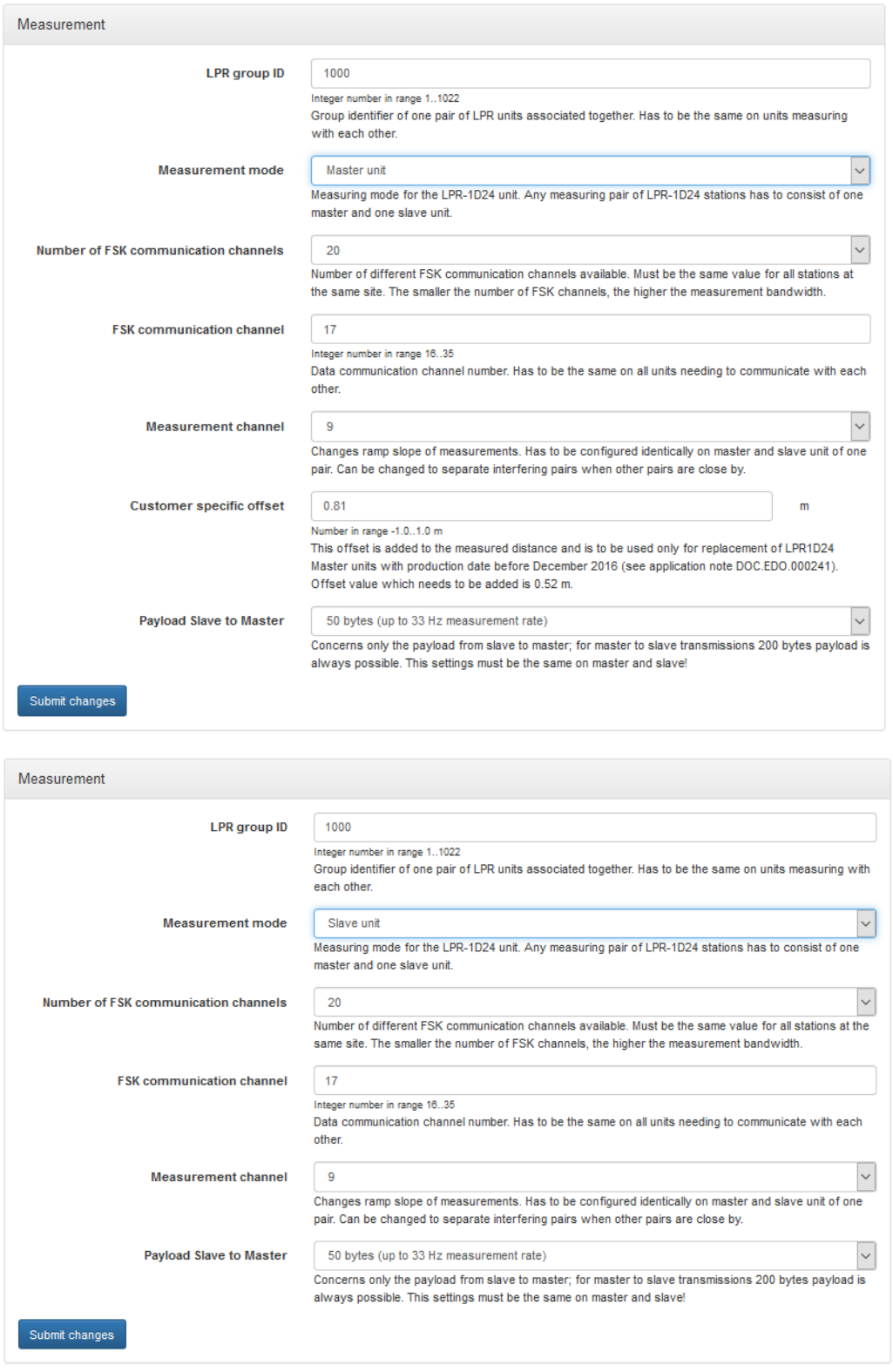


Figure 85: Example Configuration of one measuring pair - Master and Slave unit

Note

Configuration rules:

- To prevent mutual disturbance of multiple LPR®-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®-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®-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).

Warning

The customer specific offset may only be used for exchanging of the LPR®-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

Note	This application is only available if the LPR®-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).

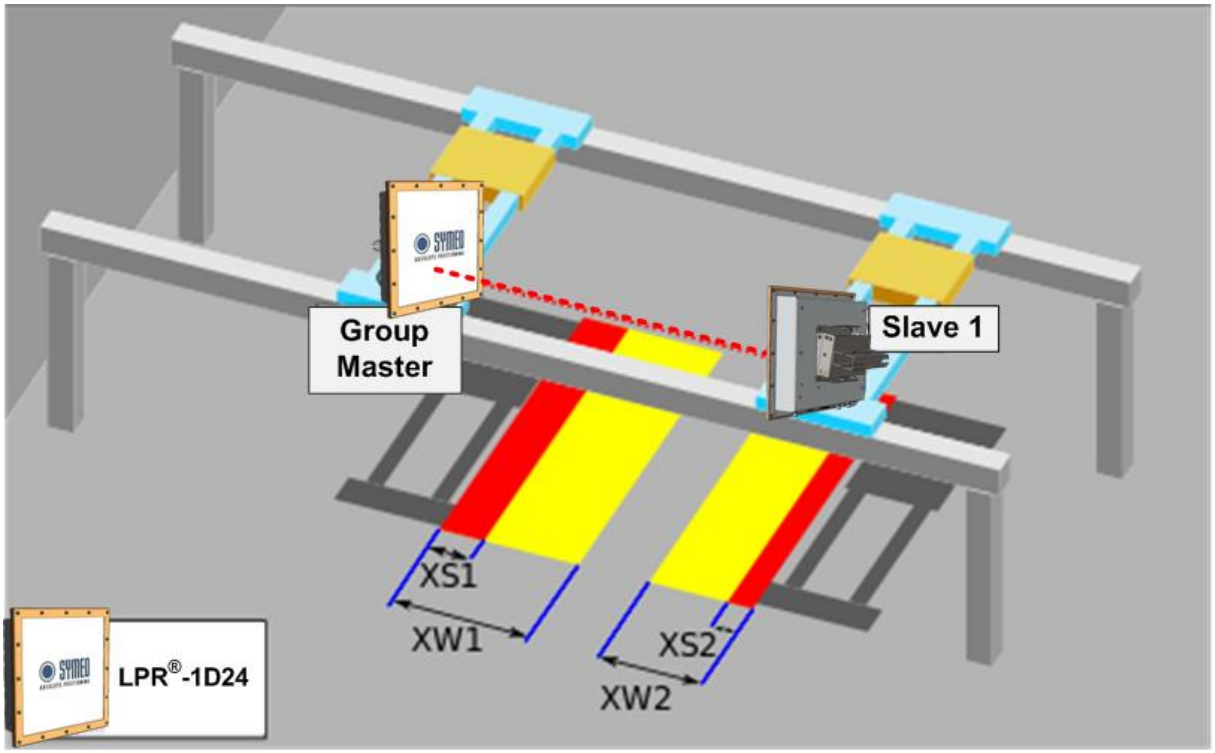


Figure 86: Distance measurement between two cranes with relay control

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.

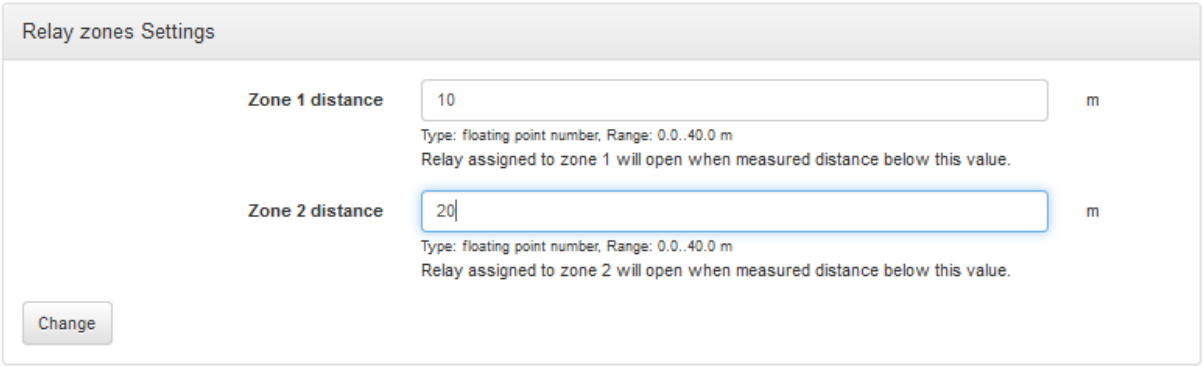


Figure 87: Setting of Zone (usually identical on Master and Slave by crane toward crane measurement)

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*“.

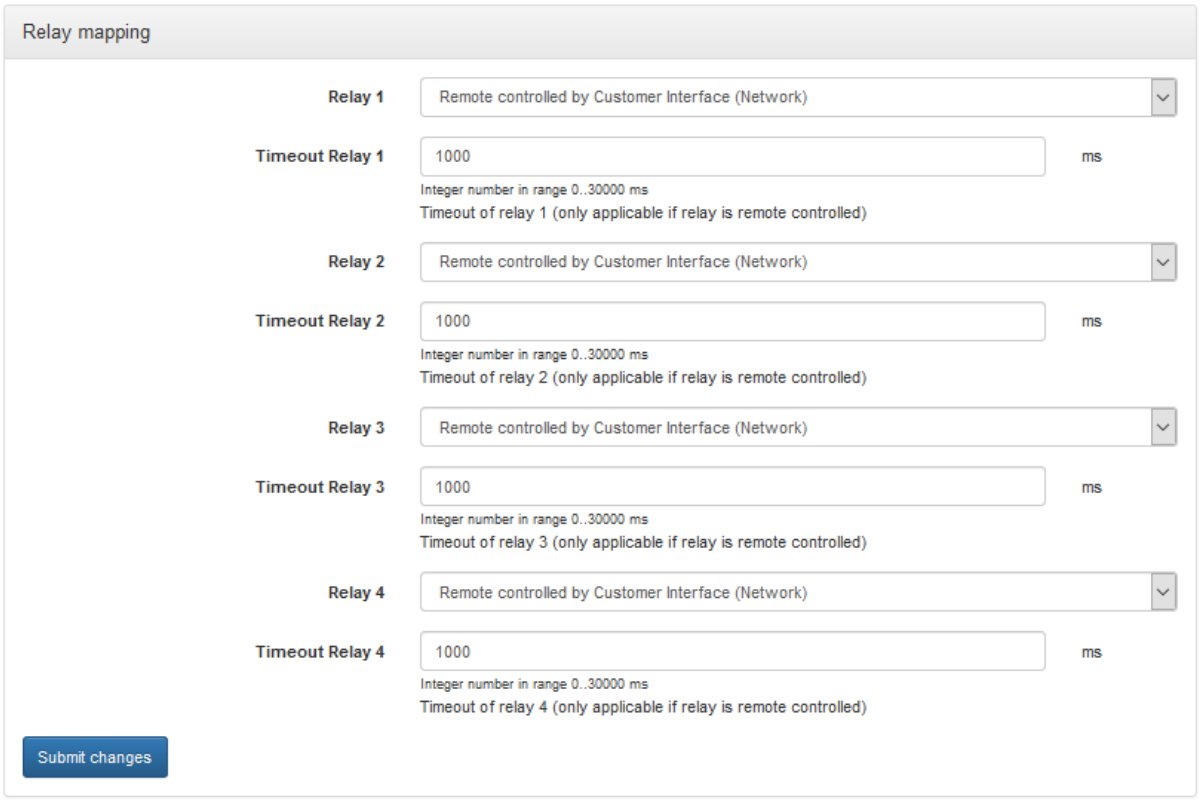


Figure 88: Relay mapping (usually identical on Master and Slave for crane to crane measurement)

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*".

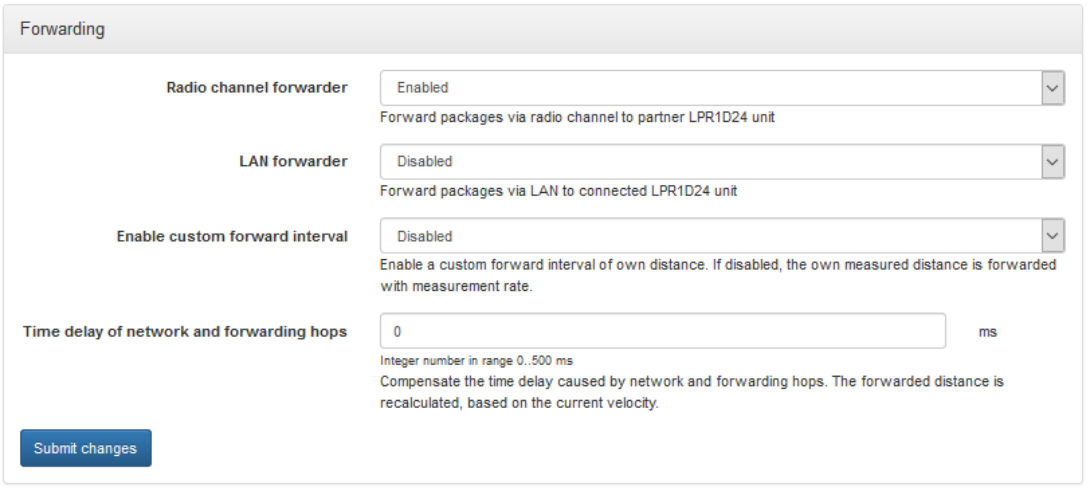


Figure 89: Settings - Forwarding

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*.

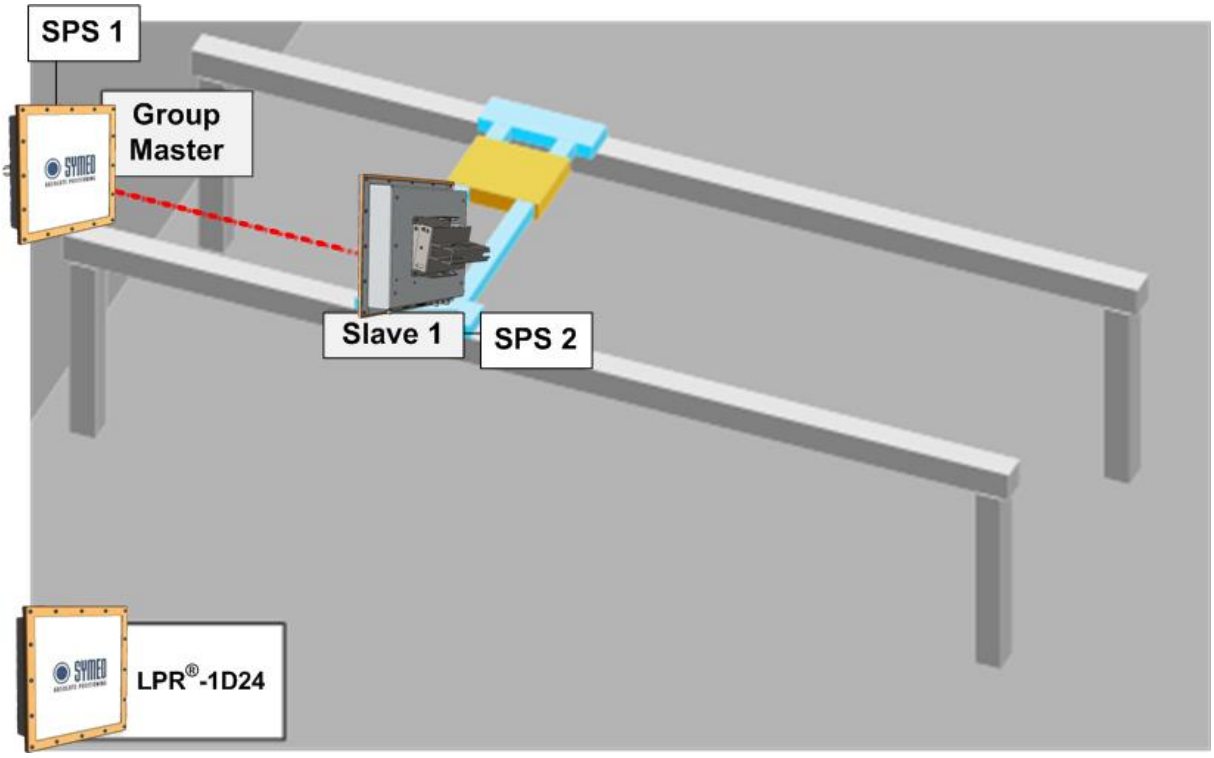


Figure 90: Simple distance measurement between two units and user data transmission

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.*

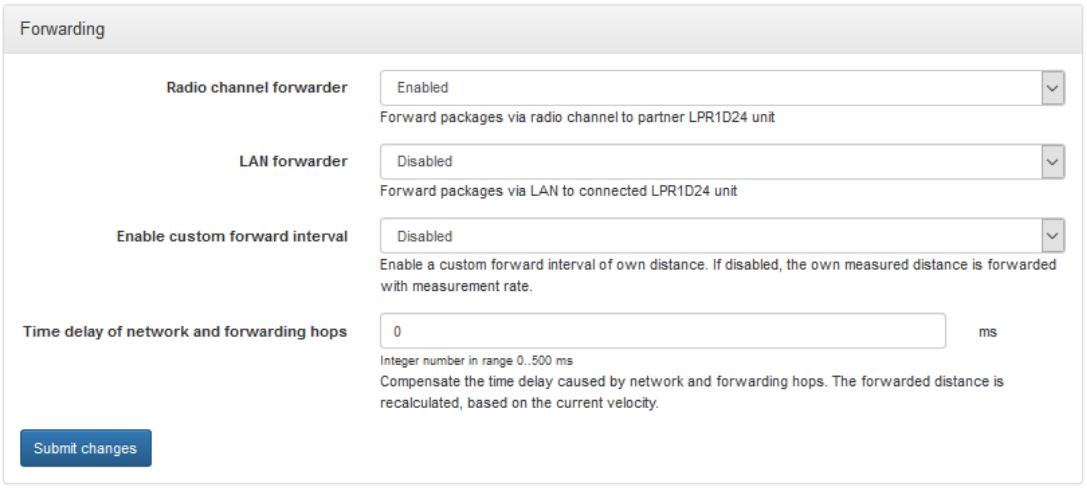


Figure 91: Forwarding Settings

8.4 Application 4: L-Functionality

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

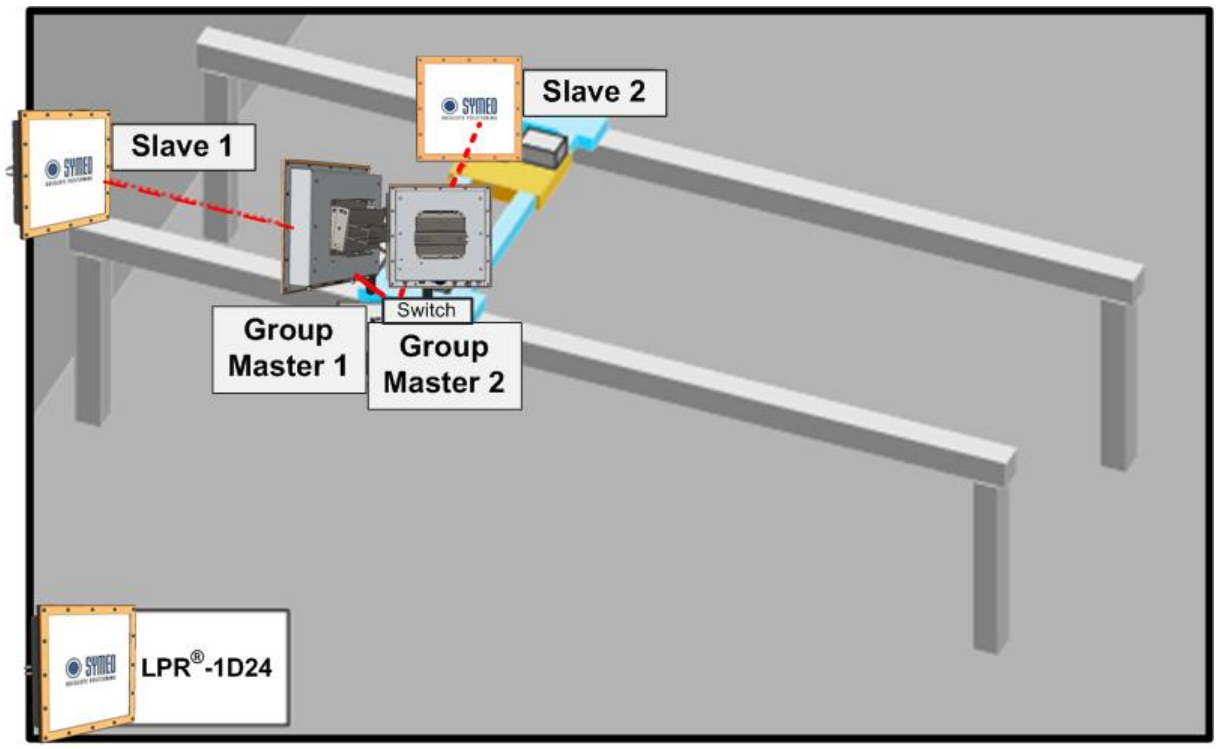


Figure 92: L-Functionality

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*.

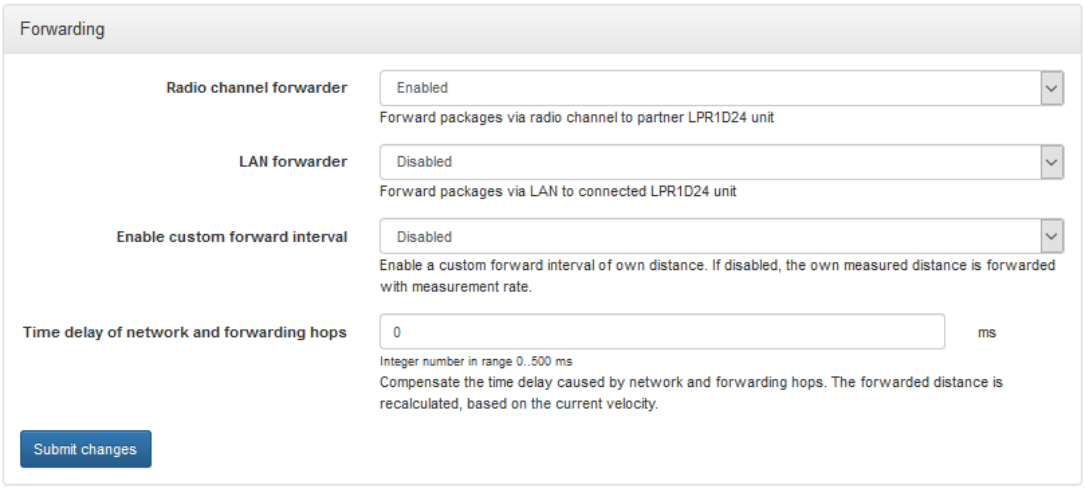


Figure 93: Forwarding Settings

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.

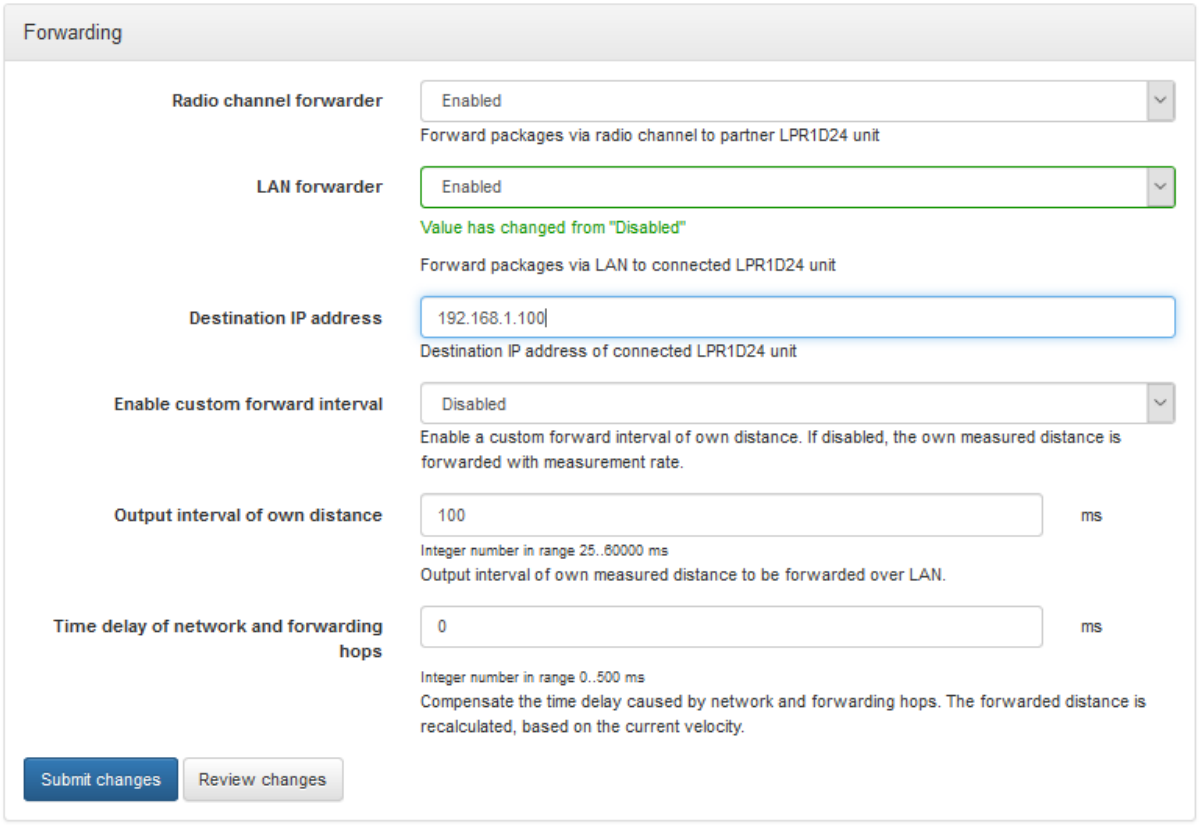


Figure 94: Forwarding Settings – Submit/Review changes

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.

Warning 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®-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.

Figure 95: Structure of the 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®-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®-1D24.

Caution

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®-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.

Caution

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®-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.

Caution

If data is sent to the LPR®-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®-1D24 and then transmitted to another LPR®-1D24 via the frequency channel. There the user data can be readout.

Direction: LPR®-1D24 ↔ User

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

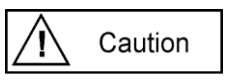
Direction: LPR®-1D24 → User

Content	Length (byte)	Data type	Value
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®-1D24 continuously. It informs the user that the LPR®-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 → LPR®-1D24

Content	Length (byte)	Data Type	Value
START	1	unsigned integer	0x7E
TYPE	1	unsigned integer	0x03
Destination (LPR®-1D24 address)	2	See chapter 9.3.1	0x####
Relay Selection (Bitmask) (Bit 1..4 → Relay 1..4) Bit significance 0-7 starting with 0 as 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 = $0xFF_{hex}$ = 11111111_{bin} will switch relays 2 and 4 ON - the state of the other relays remains unchanged.

No acknowledgment of the relay switch command will be sent because this data frame can be forwarded to other LPR®-1D24 and thus no reception on the destination unit is guaranteed.

9.2.4 Type 0x16 - Distance Data

Direction: LPR®-1D24 → User

Content	Length (byte)	Data Type	Value
START	1	unsigned integer	0x7E
TYPE	1	unsigned integer	0x16
Source (LPR® 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®-1D24 via the customer port and then transmitted to another LPR®-1D24 via the frequency channel.

Direction: User → LPR®-1D24

Content	Length (byte)	Data type	Value
START	1	unsigned integer	0x7E
TYPE	1	unsigned integer	0x25
Source address	2	see chapter 9.3.1	0x####
Flags (Bitmask)[1)]	1	unsigned integer	0x##
Inactive Shapes (Bitmask)[2)]	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

[1)] 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

[2)] Inactive Shapes bitmask: Contains information about the current state of the hoist and load shapes (bit=0: shape active, bit=1: shape inactive)

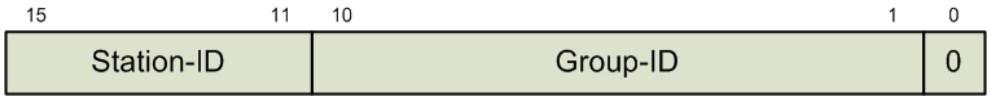
Bit 0: hoist shape
Bit 1 – 3: load shapes
Bit 4 – 7: reserved

[3)] 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®-1D24 Address

LPR®-1D24 addresses are completely defined by a 16 bit value:



0	Reserved
Group-ID:	The Group-ID of the unit (1..1022)
Station-ID: for Distance Data: for Relays Switching Command:	The Station-ID of the unit (SID) Master and Slave SID is *always* 2 (SID = 2) SID = 1 for Master und SID = 2 for Slave

Table 12: LPR®-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 → measurement valid
0x01	No measurement signal
0x02	Peak to low → 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)
0xff	No data received

Table 13: Error codes