SIEMENS

Power Line Booster

Operating Instructions

07/2015

A5E36203125A-AA

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Division Digital Factory
Postfach 48 48
90026 NÜRNBERG
GERMANY

Order number: A5E36203125A-AA
℗ 07/2015 Subject to change

Table of contents

Preface

1

Purpose of the manual

This manual describes the hardware and software components of the Power Line Booster system.

This manual provides information based on the requirements as defined by DIN EN 62079 regarding mechanical engineering documentation. This information relates to the place of use, transport, storage, installation, use and maintenance.

Target group

This manual is intended for:

- Installation personnel
- Configuration engineers
- Operating personnel
- Maintenance personnel

Required knowledge

General knowledge in the area of automation engineering is required to understand this manual.

Experience in the use of PROFINET is also helpful.

System overview and introduction

2

The Power Line Booster system is a communication system for data transmission on conductive media. The system provides Ethernet-based communication connections between stationary plant controllers and mobile plant units. The media can be sliding contact systems (graphite/copper on copper) such as in electric overhead conveyors or flexible cables such as the ones used in crane systems.

The Power Line Booster is designed for operation in industrial environments.

The PLB system has the following basic properties:

- It transmits Ethernet signals from a plant controller (e.g. SIMATIC CPU or controller) to up to 50 communication devices (e.g. field devices).
- It prioritizes cyclical PROFINET telegrams to ensure real-time conditions.
- It ensures that all devices can receive or submit the high-priority PROFINET IO data within a defined period of time.
- It also provides good bandwidth for transmission of lower priority data
- It supports the use of the proven SIMATIC PROFINET automation components on mobile plant units.
- It can be easily integrated into the SIMATIC product portfolio.
- Product maintenance and innovation are guaranteed in the course of further SIMATIC development

---

Note

If you have any questions regarding system design and installation, feel free to contact the technical support for the Power Line Boosterplb-support.industry@siemens.com or your local Siemens representative.

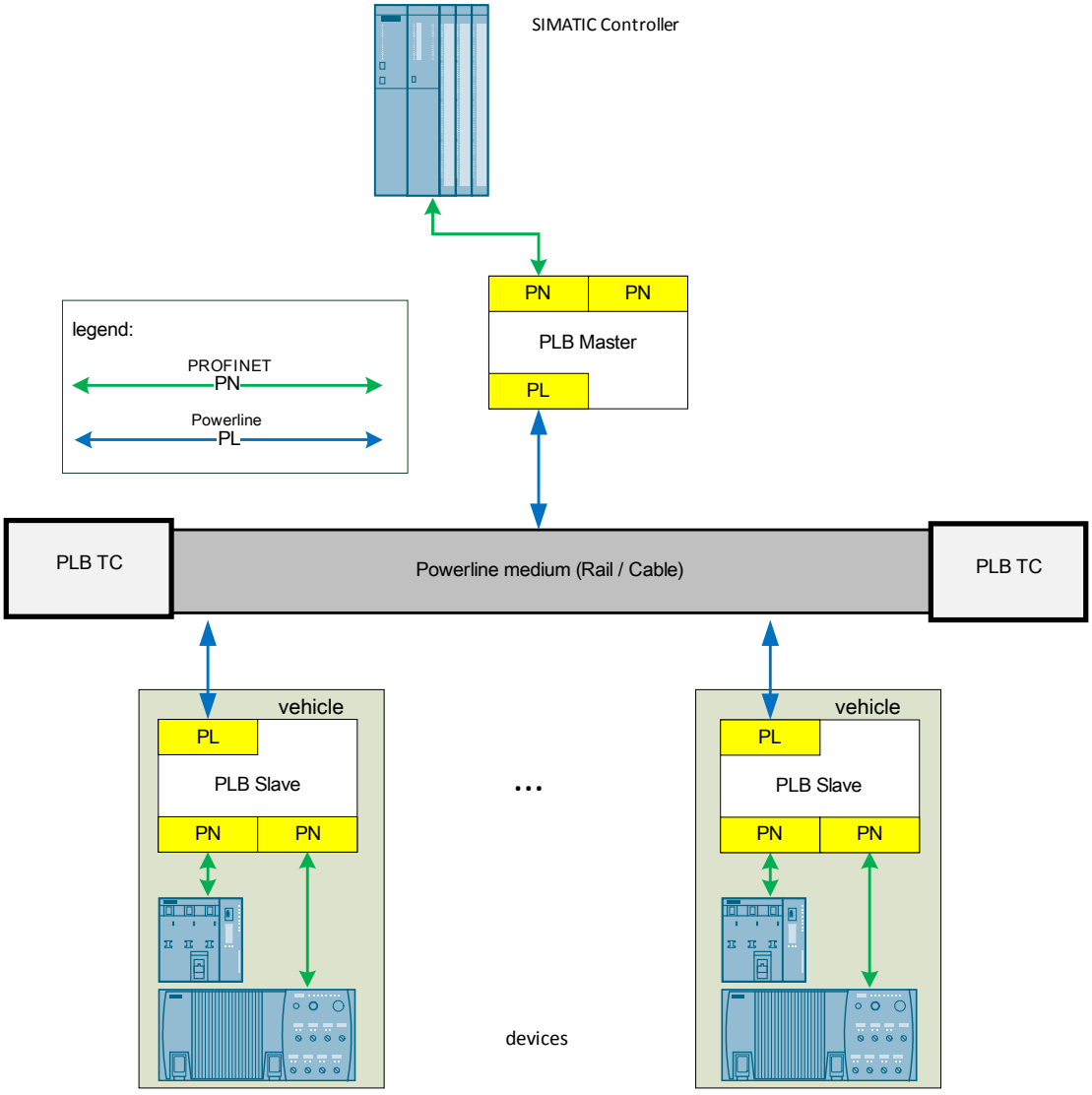


Figure 2-1 Design example of a Power Line Booster system

The Power Line Booster ensures that all devices communicate cyclically and that high-priority PROFINET telegrams are transmitted first.

Technology

The Power Line Booster uses a communication technology that can be used to implement the transmission of Ethernet-based telegrams, especially PROFINET, over power lines and/or control lines. One main area of application is in transport applications based on sliding contacts, such as electric monorail systems as well as storage and retrieval systems.

In this instance, the Power Line Booster modulates the data telegrams that are received by standard Ethernet (IEEE 802.3i / 10BASE-T; IEEE 802.3u / Fast Ethernet; IEEE 802.3y / 100BASE-T2) to different carrier frequencies. These carrier frequencies are located in the range between about 2 MHz up to about 70MHz. By the same token, the device demodulates the data telegrams it receives from the other end.

Functional description

3

3.1 System limits

3.1.1 Insolation

The Power Line Booster (PLB) or Power Line Booster system is intended for operation in low voltage systems with up to 500 V AC between the phases. The recommended components require all voltages within the system to be within the following limits:

- Low voltage: max. 500 V AC +15% line-to-line voltage with balanced earth
  This high limit applies to the **system support lines**, e.g. L1, L2, L3 (not for the communication lines) and refers to the isolation system of the PLB system
- Extra-low voltage: max. 42 V AC +15%
  This restriction applies to the **communication lines**. Operation of the system is also possible when these rails or lines are deenegized. Operation is not possible when both communication lines are short-circuited.
- PLB supply voltage: 24 V DC ± 20 %
  The power supply unit for the **supply voltage** of the Power Line Booster must meet the "National Electrical Code (NEC) Class 2" specification. The device cannot be operated without supply voltage.

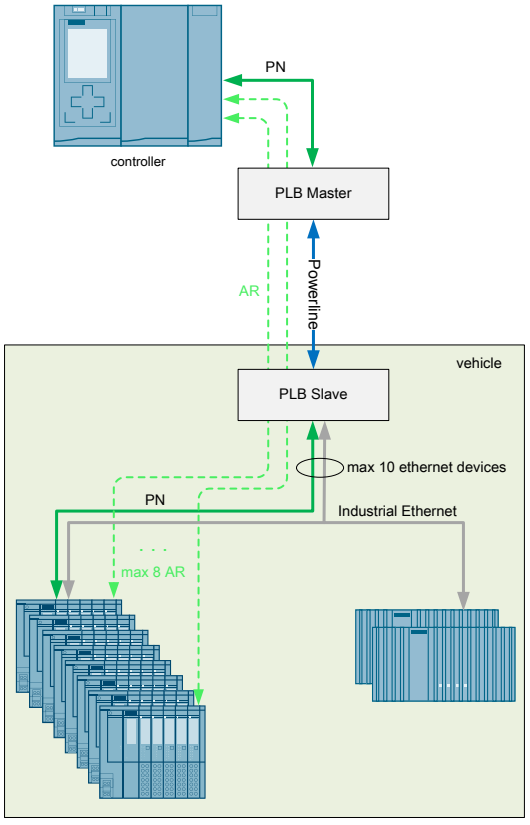
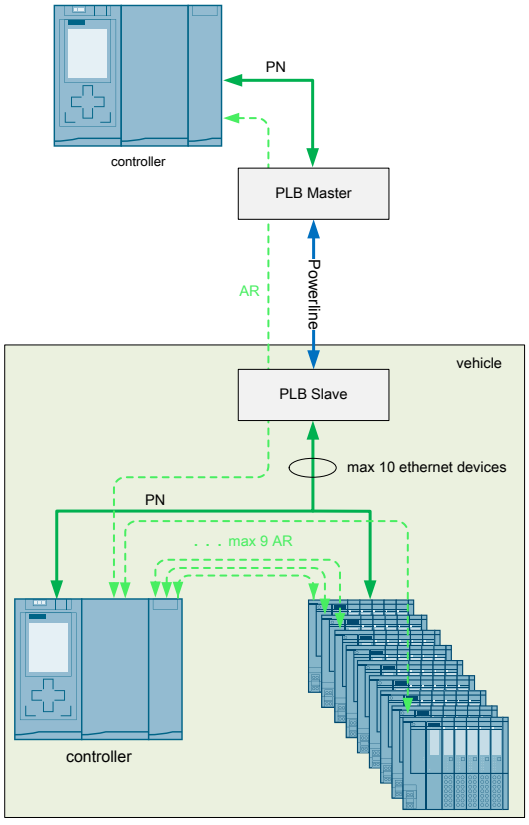
3.1.2 Configuration limits

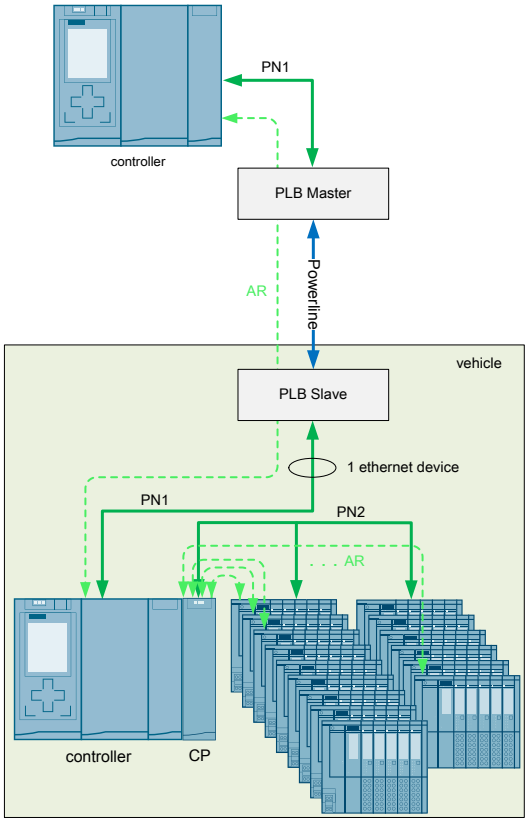
Product properties:

All rules below must be observed.

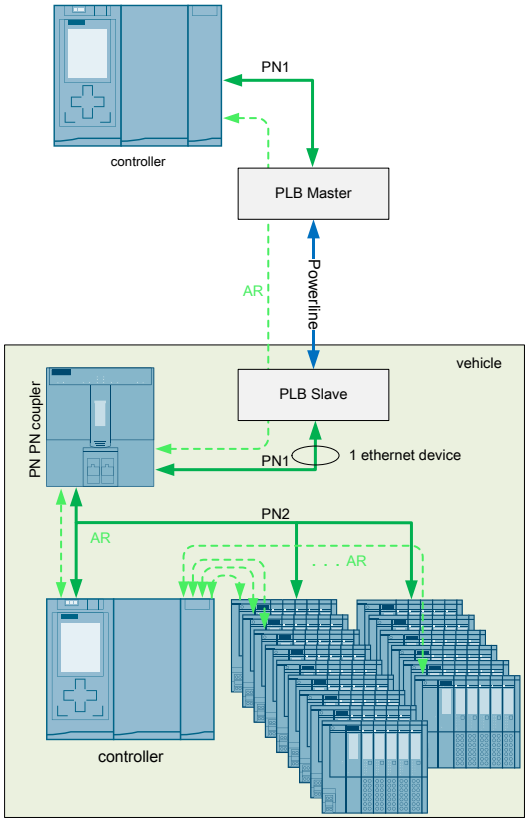
- max. 50 PLB slaves per PLB master
- max. 50 PROFINET (PN) connections (PN Application Relation) per PLB master
- Max. 250 m segment length
- Max. 8 PN connections via the PL connection per PLB slave
- Max. 10 Ethernet nodes (TN) in local PLB slave network
- Max. 64 bytes IO data per PN connection in each direction of communication
- At least 128 ms PN cycle time with 50 PLB slaves
- At least 64 ms PN cycle time with 20 PLB slaves

Table 3- 1 Examples for the configuration limits

	
Maximum of 8 application relations (AR) via PL and maximum 10 Ethernet nodes on one PLB slave	Maximal 10 Ethernet connections per PLB slave. The PROFINET stations on the carrier are connected to the PN controller on the carrier. The carrier controller is connected to the stationary controller via powerline using a single AR as I-device.



Second PROFINET (PN2) has no effect on the powerline connection.
Supply disconnection by CP.



Supply disconnection by a PN PN coupler.
The second PROFINET does not have an effect on the powerline connection.

3.1.3 Rated conditions

- The operation of Power Line Booster devices in public supply networks is not planned.
- The operation of standard powerline components in the system environment is not permitted.
- Stations connected to the PLB master can only communicate with stations connected to a PLB slave. Inter-station communication, i.e. direct data exchange between stations connected to different PLB slaves, is not possible.

3.2 Components

3.2.1 Introduction

You usually need the following components to implement a Power Line Booster system:

- Power Line Booster (PLB BM) as master and slave with modem module (PLB MM) and BusAdapter,
- Termination and coupling modules (PLB TC),
- Carrier power supply
  see also "Carrier power supply (infeed system) (Page 21),
- and other system-dependent components
  see also "The components of a PLB system (Page 25)

3.2.2 Power Line Booster (device)

3.2.2.1 Overview

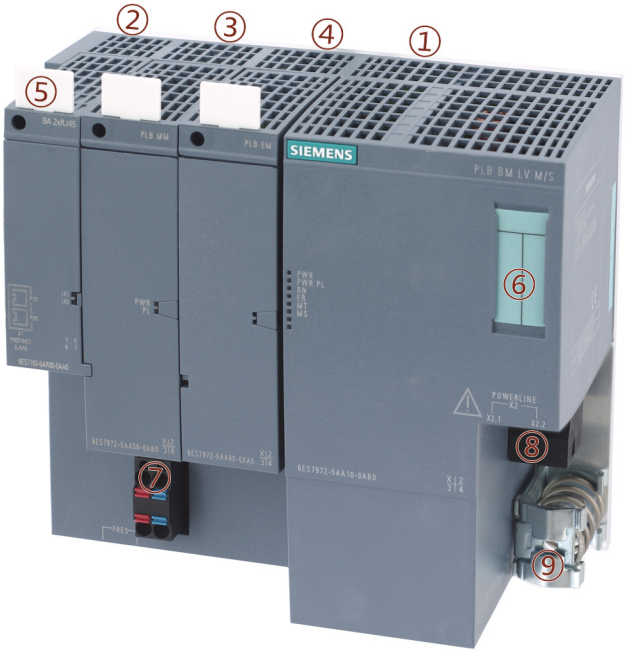


Figure 3-1 Fully equipped device

Der Power Line Booster consists of a **PLB BM** (basic module) ① which is equipped with the following modules:

- 1 **ET200SP BA** (BusAdapter) ②
- 1 **PLB MM** (Modem Module) ③
- 1 **PLB EM** (Empty Module enclosure) ④

Accessories include the 24 V DC power supply connection plug ⑦ and the powerline connection plug ⑧.

You have the option to equip the Power Line Booster with

- the label ⑤,
- the shield ⑥ and
- the shield clamp ⑨.

You can configure the Power Line Booster as PLB master or PLB slave. There can be only one PLB master in a communication segment. It has to be mounted stationary. A PLB slave is usually mounted on a carrier. You can use several slaves in one segment.

NOTICE
Plug or remove the modules only in the de-energized state. **Use the DIP switches for configuration only in the de-energized state.**

3.2.2.2 PLB Basic module

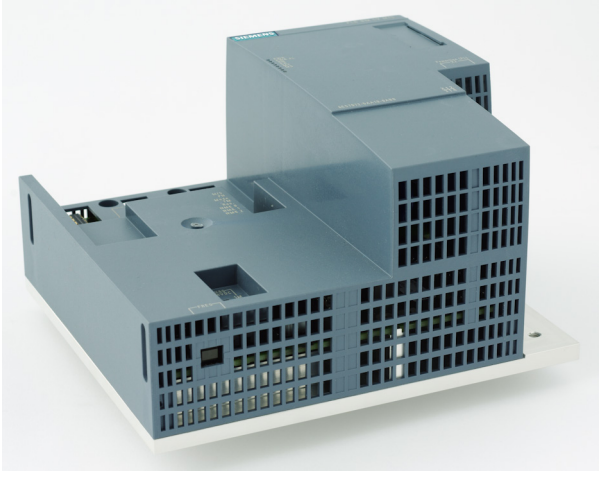


Figure 3-2 PLB Basic module

The Power Line Booster is available in this version.

PLB device	MLFB
PLB Basic module: PLB BM LV M/S	6ES7972-5AA10-0AB0

The basic module holds the Power Line Booster modem modules and the BusAdapter module.

This device must receive its power supply only through the supply input X80 (24 V DC).

The voltage on the lines used for communication must not exceed 48 V AC (42 V AC +15%).

3.2.2.3 ET200SP BA (BusAdapter)

Figure 3-3 BA 2xRJ45 (BusAdapter RJ-45)

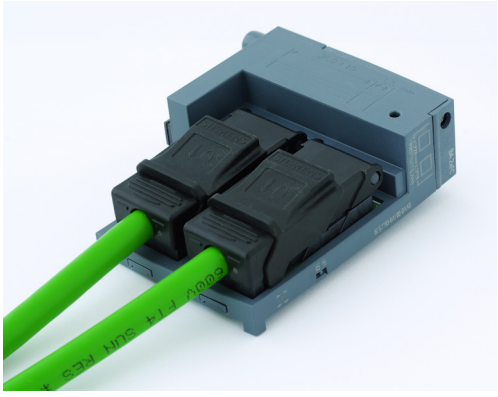


Figure 3-4 BA 2xFC (BusAdapter Fast Connect)

Figure 3-5 Slot for the BusAdapter

Device	Area of application	MLFB
BusAdapter RJ-45 ET200SP BA 2xRJ45	This module is used for ETHERNET or PROFINET connections to the PLB system via RJ45 plug connectors.	6ES7193-6AR00-0AA0
BusAdapter Fast Connect ET200SP BA 2xFC	This module is used for direct connection of ETHERNET or PROFINET connections to the PLB system.	6ES7193-6AF00-0AA0

The BusAdapter offers to switch ports for the connection of Ethernet or PROFINET cables.

Because the BusAdapter has two LAN ports, you can set up a line architecture.

Note

You cannot use any BusAdapters other than the ones described above (such as those with fiber optic cable port, for example).

3.2.2.4 PLB MM (Modem Module)

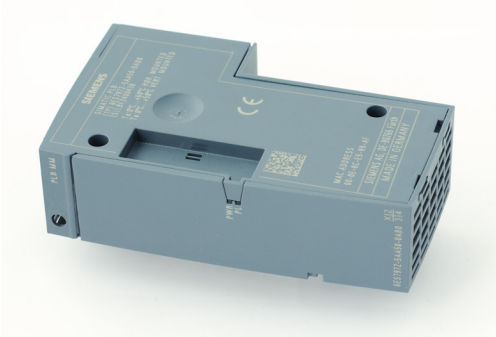


Figure 3-6 PLB MM

Figure 3-7 Slot for the PLB MM

PLB device	MLFB
PLB Modem Module: PLB MM	6ES7972-5AA50-0AB0

This device modulates or demodulates the Ethernet data telegrams into a form that is suitable for the "Powerline" transmission medium (e.g. sliding contact lines).

NOTICE
It is technically possible to plug the modem module into the right slot (X5). However, this configuration is not supported! If you are plugging the modem into slot X5 on the right or if you are not plugging a modem at all, the Power Line Booster signals an error.

3.2.2.5 PLB EM (Empty Module)

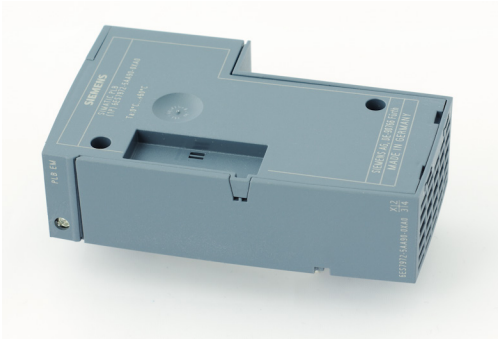


Figure 3-8 PLB EM

Figure 3-9 Slot for the PLB EM

PLB device	MLFB
PLB Empty Module: PLB EM	6ES7972-5AA80-0XA0

The empty enclosure is used to cover the module bay and the DIP switches.

The slot of the empty module is intended for expansions at a later time.

3.2.3 PLB TC (Termination and coupling module)

Figure 3-10 PLB TC

You must install the PLB TC (TC module) in an enclosure (e.g. a busbar terminal box) to ensure its isolation.

PLB device	MLFB
TC module PLB TC	6ES7972-5AB00-0XA0

The PLB TC is used termination of segments. Both ends of the communication lines of the respective segment are terminated by the termination module.

⚠ CAUTION
Disconnect the system from the power supply prior to installation!

See also

PLB TC (Page 36)

3.2.4 Carrier power supply

3.2.4.1 Carrier power supply (infeed system)

The AC carrier power supply is only required in sliding contact systems. The infeed system consists of the circuit breaker, transformer and filter.

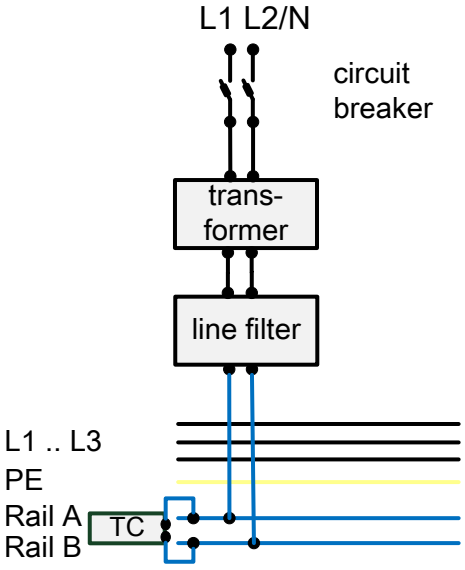


Figure 3-11 Segment infeed system

3.2.4.2 Circuit breaker for the carrier power supply

Select the circuit breaker so that the supply transformer, its supply line and all downstream components and lines are protected.

3.2.4.3 Carrier voltage transformer

The transformer for carrier power supply must meet the following requirements:

- Output voltage: 42 V AC at rated current
  31 V AC to 48 V AC (42 V AC -26%/+15%)
- Insulation: Basic isolation of primary and secondary winding to parts that can be touched (e.g. core) 500 V; overvoltage category III
  Reinforced isolation or double isolation from primary to secondary end for 230 V; overvoltage category III
  Degree of pollution according to mounting position (usually VG 2)
  The associated product standards are available in the section CE conformity (Page 65)
- Rated current: min. 1.0 A

If the voltage tolerance of the supply network is in a range from -26 % to +15 %, we recommend that you use the transformer in the example below.

Table 3- 2 Example of a transformer for supply of the carrier voltage

Primary voltage	230/400 V AC
Secondary voltage	42 V AC
Secondary current	1.5 A
Rated power	63 VA
Manufacturer	mdexx
Order designation	TAM3242-8JV00-0EA0

3.2.4.4 Line filter

Prevents crosstalk of the communication signals to other lines as well as coupling of interference to the communication lines. This is particularly important when you are supplying multiple segments from one carrier voltage or when you are operating multiple carrier voltage transformers in a shared low-voltage network.

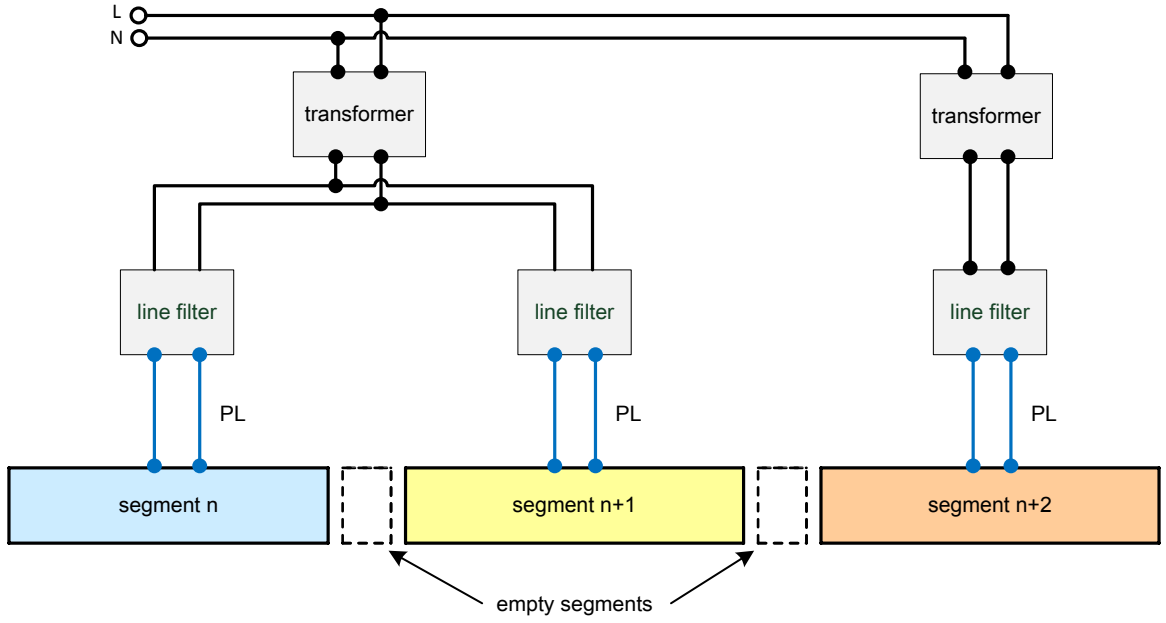


Figure 3-12 Application examples for the line filter

You must use a suitable line filter for decoupling the transformer from the segment.

Table 3- 3 Line filter requirements

Attenuation for common mode signals and push-pull signals between 2 MHz and 70 MHz	≥ 50 dB
Output impedance (between 2 MHz and 70 MHz)	> 100 Ω
The isolation strength of the filter (especially against PE/FE) has to be matched to the isolation coordination in the system.	

NOTICE

In sliding contact systems with dangerous contact voltages, there is the risk of a short-circuit between these voltages and the communication lines. This means you have to design the isolation of all components to prevent such a situation.

The short-circuit mentioned above is then considered to be the first fault. It must not result in a dangerous state.

The connected components must therefore have basic isolation. The dangerous contact voltage is then considered the rated voltage.

Example:

Faulty contacting of the sliding contact can result in a connection between the system supply (L1/L2/L3) and the communication lines (Rail A/B). This means the communication lines are carrying a voltage of 230 V, for example. These 230 V are then the rated voltage for the basic isolation of the filter, the PLBs as well as additional components connected to the communication lines.

Table 3- 4 Example of a line filter

Manufacturer	Type	Order number
Schurter	Line filter (up to 16 A)	5500.2218.01

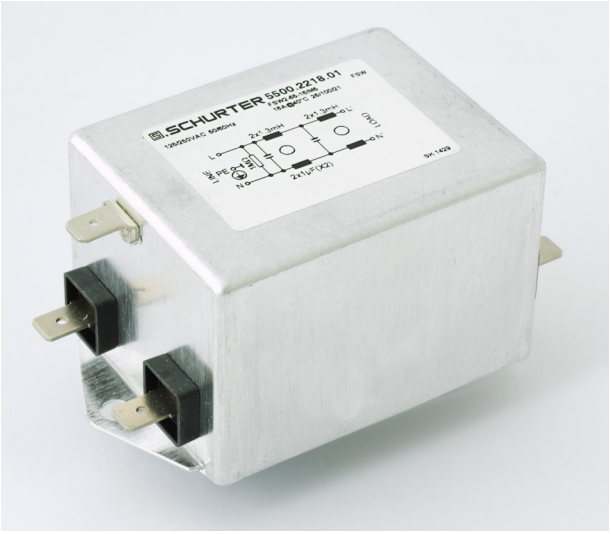


Figure 3-13 Line filter up to 16 A

See also "Connection of the line filter (Page 38)

3.2.4.5 Component example for a carrier power supply

Table 3- 5 Example

Supply network	230 V AC rated voltage, + 15%
Circuit breaker (for transformer and downstream lines)	Recommended 1.0 A, type B maximum 1.9 A (SIEMENS 3RV1011-1BA10 / 1.9 A.)
Lines between circuit breaker and transformer, transformer and filter, filter and rail	Lapp cable: ÖLFLEX Lapp no. 1123339 2x 2.5 mm²
Supply transformer	mdexx: TAM3242-8JV00-0EA0
Lines between rail and PLB TC (terminal box)	Single core, 2.5 mm²
Line filter (LF)	Schurter: 5500.2218.01

Plant planning

4

4.1 The components of a PLB system

4.1.1 Overview

In addition to the previously described Power Line Booster (device), the TC module and the carrier power supply, additional components are used, for example, in an electric monorail system:

- Rails and sliding contact lines
- Elements for connection system
- Plant controller
- possibly Isolation monitor

4.1.2 Rails and sliding contact lines

Select such a combination for the rail/sliding contact system which ensures a permanent low resistance contact (< 1 Ohm) when being operated under the conditions specified by the manufacturer. You must ensure that the contact is also guaranteed at joints and transitions such as switches, intersections and expansion points.

Note

You have to connect the PE rail additionally to the carrier rail at all TC connection points. The connection must be short and direct (max. length 20 cm).

A PE connection on supply point only is not sufficient.

See also

PLB TC (Page 36)

Arrangement of the sliding contact lines

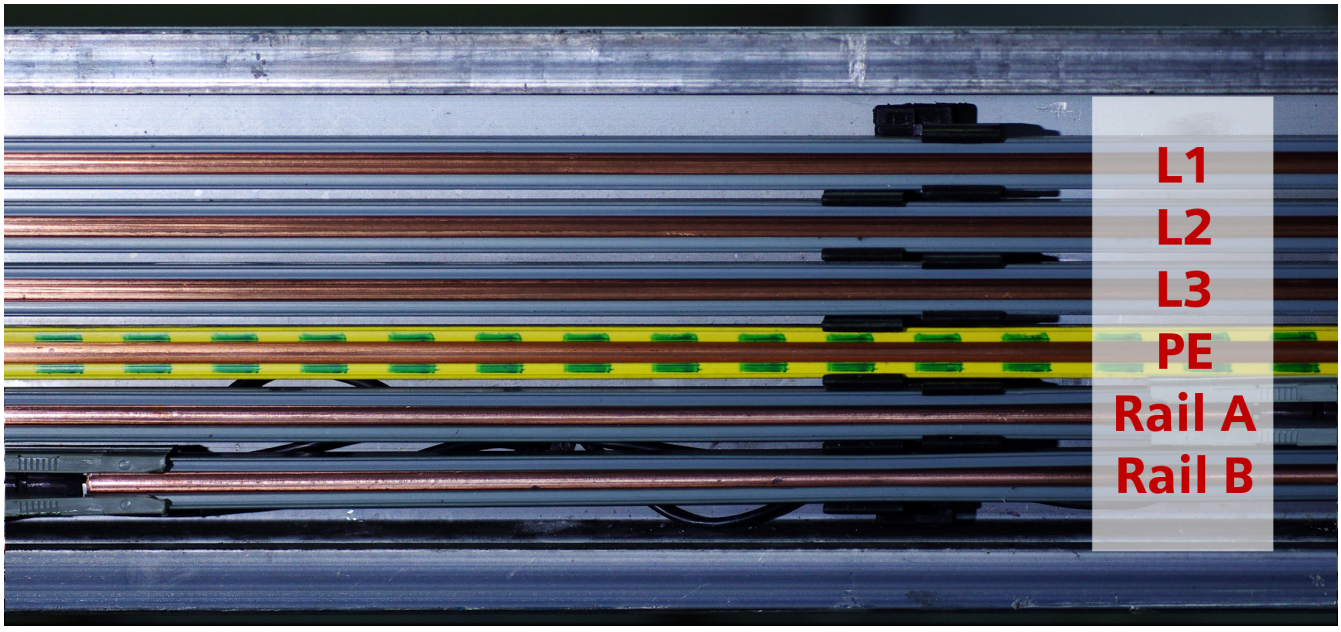


Figure 4-1 Arrangement of the rails

The following arrangement is required for reliable function of the PLB communication.

Rails: L1, L2, L3, PE, Rail A and Rail B. There may be no additional sliding contact line between PE, Rail A and Rail B in particular!

Due to the positioning of the PE, additional spacing between the live parts with dangerous contact voltage (L1..L3) and the communication rails Rail A/B is created. This additional spacing reduces the crosstalk of the communication signals and the risk of short-circuits.

If additional sliding contacts are required below the communication rails Rail A and Rail B, you must separate them with an additional PE rail or a shield plate as separator.

NOTICE
Use rails Rail A and Rail B for PL communication only!

Note

Rail quality

An electrical connection (contact resistance across the entire distance < 1 Ohm) of the sliding contacts is required to ensure the function of the Power Line Booster.

4.1.3 Connection system

If you are using shielded cables according to the specifications in this manual, you can use different contacting options for easy implementation of the shield connection at the transition to the power rails. You must apply the shield over a large area and connect it professionally to the suitable metal parts of the system.

To connect the carrier power supply to the rail or to connect a stationary PLB to the rail, we recommend the following alternatives:

1. Metal terminal box with EMC gland: e.g. Bopla, order number: 01118000 http://www.bopla.de/de (http://www.bopla.de/en). In combination with an EMC cable gland Harting 19620005080 (for line diameters 6.5 .. 9.5 mm)
2. Plastic terminal box (Bopla, Rose, Vahle, …) in combination with a shield clamp (SK terminal, s. accessories Article numbers (Page 67)).

4.1.4 Isolation monitor

The operation of an isolation monitor may be necessary for safety reasons (see section Installation planning). This remains the responsibility of the plant constructor.

Figure 4-2 Example of an isolation monitor

CAUTION

The isolation monitor from Bender which we are using as an example here cannot be used in some commercial power supply networks (e.g. in the U.S.). Note the maximum permitted operating voltage as specified in the manufacturer documentation!

See also

Installation planning (Page 30)

4.1.5 Plant controller

Figure 4-3 S7-1500 plant controller in an EMS environment

Connect the plant controller (e.g. a PROFINET IO controller) with all PLB masters in the plant.

4.2 Plant attenuation

The Power Line Booster uses permanently set sending and receiving levels for the communication signals. The height of these levels has been optimized to ensure communication within a plant unit while preventing communication to other plant units. You must adhere to the setup and configuration guidelines in order to meet both requirements.

The difference between the level that is sent at a certain point in the plant and the level that is received at another point in the plant is referred to as attenuation (usually given in dB and scaled logarithmically). We are referring to the attenuation within a communication area as longitudinal attenuation and between the different plant units as lateral attenuation.

Keep in mind that the communication takes place on carrier frequencies from 2 MHz – 70 MHz and that each of these frequencies may have a different attenuation. You must consider the minimum attenuation across all carrier frequencies in lateral attenuation.

The Power Line Booster has been developed and tested according to current standards regarding electromagnetic compatibility. This means it is immune to interference tested

according to current standards. Practical experience has shown, however, that plant-specific constellations, for example, due to accumulation of multiple interferences or even individual devices due to poor wiring can result in interferences that significantly exceed the range that is tested according to the current standards.

To deal with such interferences, it is possible to deactivate frequency bands on the Power Line Booster which exhibit an excessive amount of interference. Please contact Technical Support to make the necessary settings.

If you are operating the Power Line Booster with the factory settings, interferences up to 73 dB µV (QPk, corresponds to 1 Vpp, see EN 6100-6-4:2007) do not result in communication errors.

If the incoming level of a device in the plant (e.g. of a master) is greater than the receiving level of another device in the plant (e.g. slave), then both devices can communicate. If they are located in different plant units, this is an undesirable effect which is referred to as crosstalk. Crosstalk must be prevented by lateral attenuation. It must be at least 40 dB.

The following effects result in a low lateral attenuation:

- Cabling error in the carrier, on the rails and at the ports of the carrier voltage
- Missing or incorrectly connected termination at the line ends
- Line sections of the communication lines (Rail A/B) and supply lines (L1, L2, L3) running parallel with very little distance. Compare Rails and sliding contact lines (Page 25)
- Connection elements between Rail A/B and L1, L2, L3 such as relays, short-circuits, etc.
- Lacking / insufficient filter elements in carrier power supply or connecting cables that are too long or unshielded.

The longitudinal attenuation is influenced by the following:

- Length of the distance (impedance per meter)
- Length of the Power Line Booster connecting cable
- Quality of the rails, connecting pieces, sliding contacts and lines
- Rail elements such as switches, lifters, etc.
- Number of carriers in the segment (dynamic)

Because the number of carriers in the segment can change dynamically, keep in mind that the outcome can be two extreme cases. The extreme case for lateral attenuation is a segment without any carrier at all and for longitudinal attenuation it is a segment with the maximum number of carriers. In the first case, there must still be no crosstalk of the signal; in the second case, stable communication between the master and all carriers must still be possible. This results in the requirement that the PLB master must always be connected in the segment center.

If there is crosstalk between two plant units, you may encounter communication failures (when the two masters can detect each other, for example, or when slaves log into the wrong segment). It may also be that only the cycle times get longer because both segments must now share the medium. This is also the case when a different channel is selected in a different plant (see settings).

If you adhere to the specifications in this manual, it should be possible to operate a segment (without switches) with up to 30 carriers without crosstalk. This number is reduced if you are

using switches, lifters or similar in the segment. We therefore recommend that you leave these plant elements in the plant areas where no communication takes place.

Note

For more complex plants, it may be best to involve Technical Support for the Power Line Booster as early as the planning phase.

If it is necessary to operate more than 30 carriers (up to 50 carriers) in a communication segment, additional attenuation measures are required. Please contact Technical Support (plb-support.industry@siemens.com).

4.3 Installation planning

Plan the installation based on a plant layout.

NOTICE
The Power Line Booster system can be operated in low-voltage plants up to 500 V AC. A single short-circuit between a phase (L1 or L2 or L3) and Rail A or Rail B may represent a fault for this device as indicated by the error LED, but this does not prevent communication. However, this means that dangerous contact voltages are present on Rail A or Rail B (and the connected components) without the function being impaired. You need to take this into consideration during maintenance. **If you are using an isolation monitor (such as Bender Isowächter, in Europe) for safety reasons, it must be connected between the supply transformer and the line filter.**

Note

The applications described in this manual, refer to a distance of rail (without branches) with up to 30 carriers. If you are planning a more complex plant, contact the Technical Support for the Power Line Booster plb-support.industry@siemens.com).

4.4 Segment limits

4.4.1 Segment

Plant in one segment

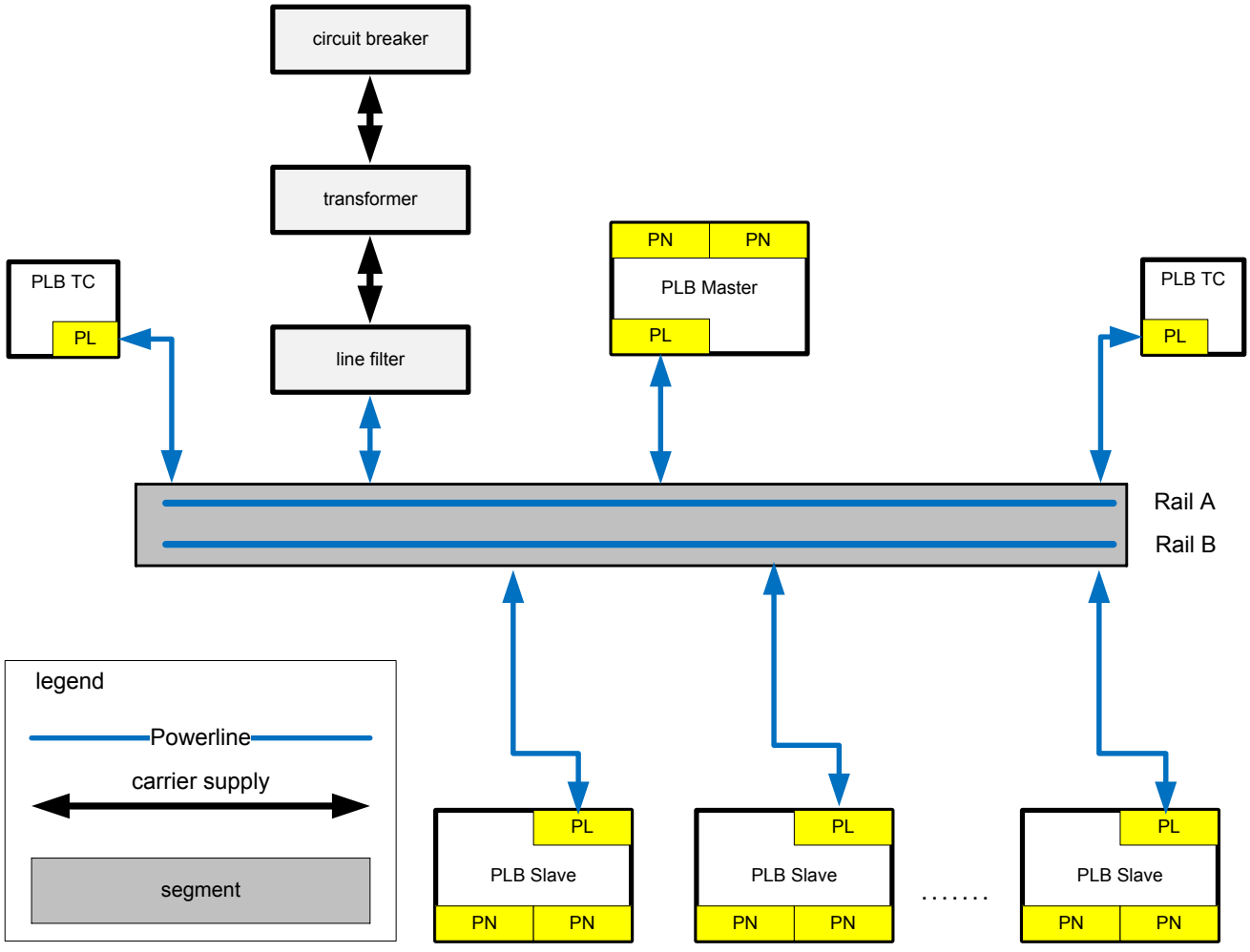


Figure 4-4 Linear plant

Segment separations

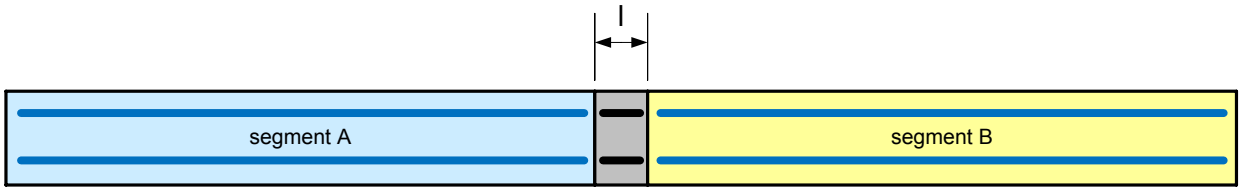


Figure 4-5 Segment transition, separator

You usually have to create segments in electric monorail systems.

You must isolate the transition of a segment (in the example: Segment A) into the next (in the example: Segment B) with a separator in the rail pairs. The length "*l*" of this separator must be greater than the longest current collector (sliding contact) in the EMS system. However, the separator should only be about 0.05 m longer than the current collector. This way you ensure that there is no extension or connection of the communication segments. It makes no difference in this case if PLB communication takes place on both segments or only on one.

Cut the segments of the communication lines Rail A and Rail B at the same height (not offset).

Note

When you separate a plant into several segments, communication between controller and device is not possible in the empty segments.

Note

Keep in mind that all Power Line Booster devices in a plant or plant section must be configured to the same channel (see Settings (Page 51)). Otherwise, communication is not possible with all stations.

We recommend that you use different channels for each plant section in adjacent but separate plants (i.e. plant units).

Note

Special case

Closed rings in plants must be opened up, which means an empty segment must be inserted at one point in the ring, separated by two separators. Due to the powerline technology, the empty segment must have a minimum length in accordance with the traveling time of at least 5 s so that the PLB slave can log out and in again.

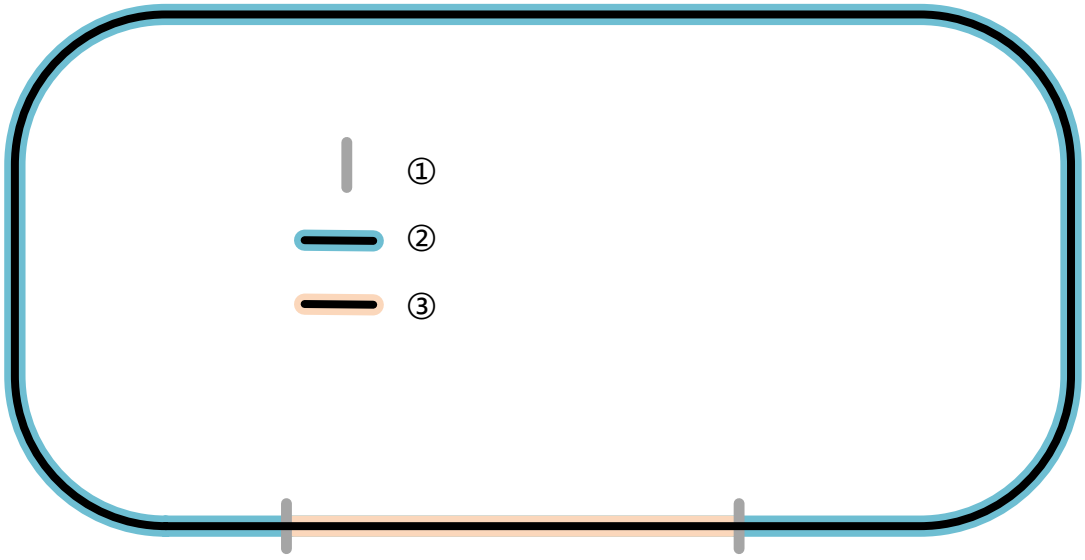


Figure 4-6 Basic ring

Legend	
①	Separator
②	Communication segment (e.g. segment A)
③	Empty segment (e.g. segment B)

The login time is defined in the section Startup and login time (Page 34).

4.4.2 Segment length

Plan the length of the communication segment so that it does not exceed the maximum permitted segment length (see Installation planning (Page 30)).

The maximum segment length of a communication segment is 250 m. You must ensure that the maximum number of permitted carriers in the segment is never exceeded during operation of the plant.

You can maintain this, for example, by selecting the segment length in such a way that no more than 50 carriers can actually fit into the communication segment.

4.5 Startup and login time

4.5.1 Plant startup

Cold restart of an electric monorail system with regard to the Power Line Booster, takes place in the following phases:

Table 4- 1 Phases of a cold restart

Phase	Description	Duration
Startup phase and establishing the Power Line Booster communication	Start starts with 24 V DC in. All slaves of a segment establish a connection with their master. The master integrates the added devices into its cycle one after the other. The length of this phase depends on the number of PLB slaves in the segment.	With 50 stations maximum 120 s
Establishing the plant communication	Here, the higher-level communication between the plant controller and the field devices on the carriers or the local PLC is established. In case of a PROFINET connection, an AR (Application Relation) must be established.	Depending on the type and communication protocol of the plant.

4.5.2 Login

An electric monorail system consists of plant units which offer communication (communication segments) and parts on which communication is not possible (empty segments).

When a carrier exits a communication segment, its PLB modem module loses the connection to the PLB master in this segment. This leads to a restart of the modem. After the restart, the modem is once again ready to establish a connection to another master.

The following times have to be take into consideration in the process:

Table 4- 2 Login phases

Phase	Description	Duration
Cold restart	PLB modem performs a reboot. This phase may take place in the empty segment if the carrier stays in it long enough.	typ. 15 s max. 20 s
Login phase	Establishing a powerline connection in the new communication segment. This phase starts as soon as the carrier arrives in the new communication segment and the reset of the modem is complete.	typ. 4 s max. 10 s

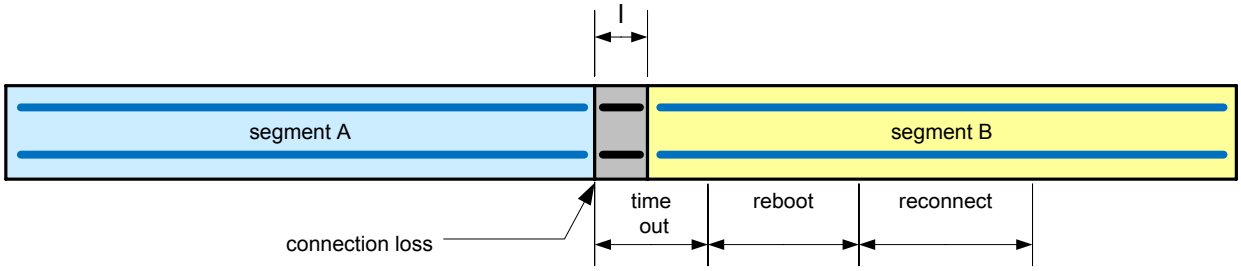


Figure 4-7 Transition from one communication segment to another

4.6 Installation

4.6.1 Line selection

A two-wire, shielded cable with 2x 2.5 mm² is required for the connecting cables between PLB master and rail or rail and switch as well as for the carrier power supply of the segment.

For example: Lapp ÖLFLEX cable, 2x 2.5 mm², shielded, Lapp no. 1123339 (100 m - ring)

The connecting cables between the TC module and the rails Rail A and Rail B should be 2.5 mm².

4.6.2 Grounding

You must connect the Power Line Booster to the function earth.

Ground made with the DIN rail. Keep the ground connection of the DIN rail relatively short and extensive.

4.7 Wiring

4.7.1 Cable lengths

Maximum permissible cable lengths

Connection between ..	shielded	unshielded
PLB master - rail	2.0 m	1.0 m
42 V transformer – line filter (LF)	-	unlimited
Line filter (LF) - rail	unlimited (note voltage drop)	1.0 m
Rail - PLB slave	10 m	1.0 m

Connection between ..	shielded	unshielded
24 V power supply unit (e.g. SITOP) – 24 V-supply input of the PLB	-	unlimited (note voltage drop), as of a cable length of 30 m, a device for transient limitation (e.g., lightning protection unit) must be installed in front of the PLB
PLB TC (terminal box) - rail	-	0.5 m
Trailing cable	30 m	-

4.7.2 Shield connection

For connections with shielded cable, you must connect a shield at both ends for a length greater than 2 m and at one end for a length of 2 m or less. In case of a metal rail terminal box, grounding is provided by the EMC cable gland. Otherwise, use a shield clamp in close proximity to the terminal box.

Figure 4-8 Connection via terminal box

4.7.3 Cable routing

4.7.3.1 PLB TC

Connect the end of the rail pair Rail A/B with the ports X1.1 and X1.2 of the PLB TC (see Figure 3-10 PLB TC (Page 20)). You must either mutually isolate the ports X1.3, X2.1 and X2.2 with shrink-on sleeves or connect each of the terminals to an empty terminal in the rail terminal box.

Terminal	Connection	Color
X1.1	A (Rail A)	Violet
X1.2	B (Rail B)	Black
X1.3	Reserve (individually isolated)	Brown
X2.2	Reserve (individually isolated)	Blue
X2.1	Reserve (individually isolated)	Green

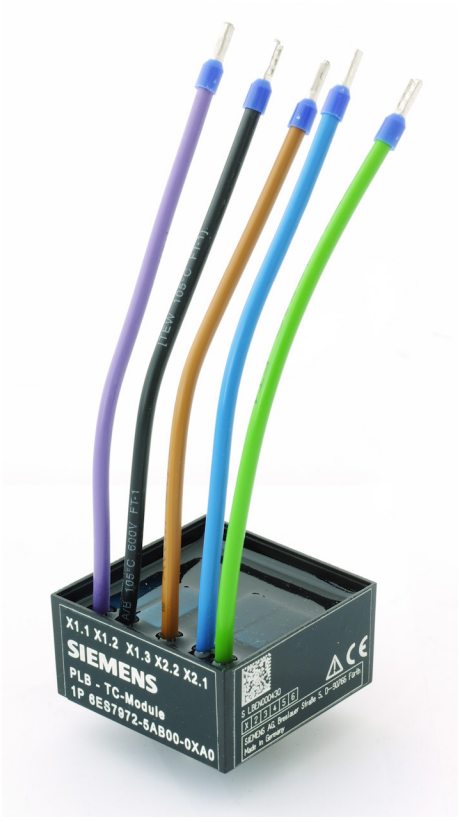


Figure 4-9 PLB TC (TC module)

CAUTION

Make sure that all cable ends are attached or insulated when installing the PLB TC. Any loose cable ends that are not insulated are not permitted because they may be live!

See also

PLB TC (Termination and coupling module) (Page 20)

4.7.3.2 Connection of the line filter

Install the line filter between the transformer of the carrier power supply and the communication rails Rail A and Rail B (see Figure 3-11 Segment infeed system (Page 21)).

Terminal	Connection
L (LINE)	L from transformer
N (LINE)	N from transformer
PE (LINE)	PE
L' (LOAD)	Rail A
N' (LOAD)	Rail B

See also

Carrier power supply (infeed system) (Page 21)

4.7.3.3 Supply line of the carrier power supply

Use a shielded cable as supply line for the carrier power supply (42 V AC) at Rail A and Rail B (min. 2x 2.5 mm²); connect it to the corresponding rails by means of a rail terminal box.

Route the shielded supply line or communication lines close to the rails/sliding contacts. If you are using unshielded single cores to extend the connecting cable behind the sliding contacts, these may only be 1.0 m long.

You can route the shielded supply lines across cable racks, consoles or perforated cable trays or even "freely suspended" (reference routing type E, according to **DIN VDE 0298-4**). Routing in closed systems, such as pipes or through non-perforated cable channels, is only permitted with a larger core cross-section for thermal reasons taking into consideration DIN VDE 0298-4.

4.7.4 PLB master

You must install and connect the PLB master in the center of the segment (± 10 m).

4.8 Installation

Installation of the Power Line Booster

Plug the Power Line Booster onto a vertically mounted DIN rail (TS 35; DIN Rail) (see photo).

Figure 4-10 PLB mounted onto a DIN rail; rear view

If you plug the Power Line Booster onto a vertical DIN rail or one installed horizontally, the maximum permissible ambient temperature is reduced to 50 °C.

You must always keep a clearance of 60 mm above and below the Power Line Booster.

Installation of modem and BusAdapter

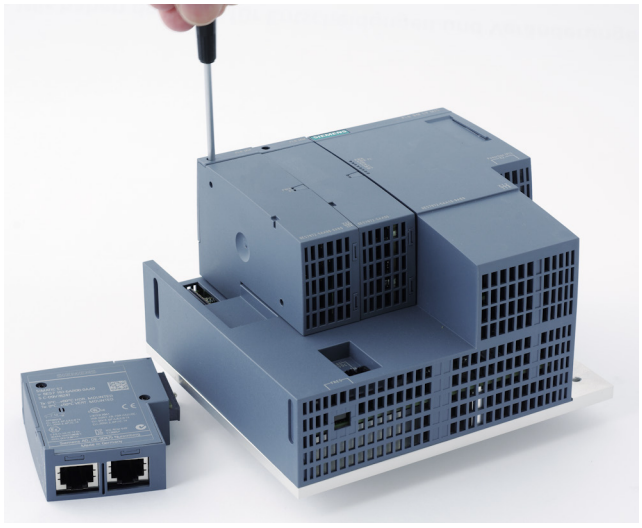


Figure 4-11 Installation of the modules

Plug the modem and the empty enclosure as well as the BusAdapter into the Power Line Booster and fasten the respective module with its fixing screw (tightening torque 0.2 Nm). Suitable tool: Preferably Torx screwdriver TX10 or slotted (Philips) screw driver 0.5x3 (0.5x3.5).

Installation sequence:

1. Modem, empty enclosure
2. BusAdapter

For stability reasons, you must attach the Ethernet connecting cables at a suitable location with a cable tie, for example.

Installation of the connectors

The connectors to the ports X2 (Port X2 (Page 49)) and X80 (Port X80 (Page 49)) are spring-loaded terminals. If you are using cables with a higher flexibility, it may be necessary to open the clamping spring with a 0.5x3 slotted (Philips) screw driver to install the cables.

To remove the cables, you must use a 0.5x3 slotted (Philips) screw driver to open the clamping spring.

4.9 Commissioning

Make the settings and configuration as described in the section Settings (Page 51).

Operator controls, displays, ports, slots

5

5.1 Operator controls

5.1.1 FRES button

The Factory RESET (FRES) button is located on the bottom of the PLB.

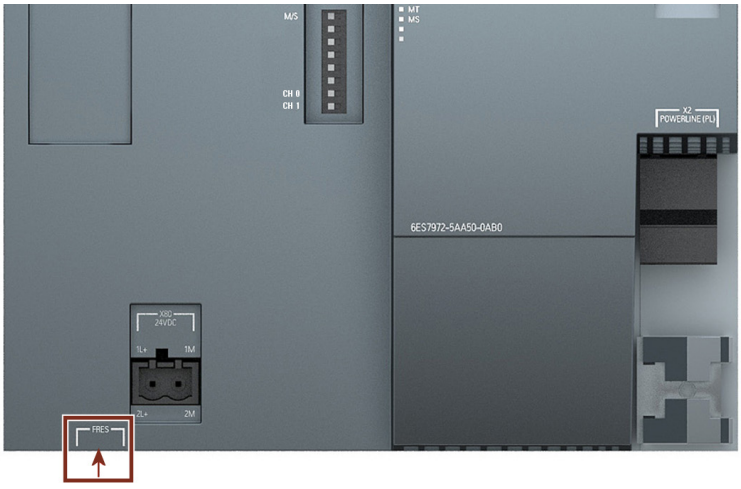


Figure 5-1 FRES button

Figure 5-2 Position of the FRES button

Keeping the FRES button pressed for more than 5 seconds, results in a restart and the factory settings are restored on the device (see also PROFINET/Ethernet (Page 53)).

The factory settings are:

- IP address: 0.0.0.0
- PN name: deleted, i.e. empty

See also

Settings (Page 51)

5.1.2 DIP switches

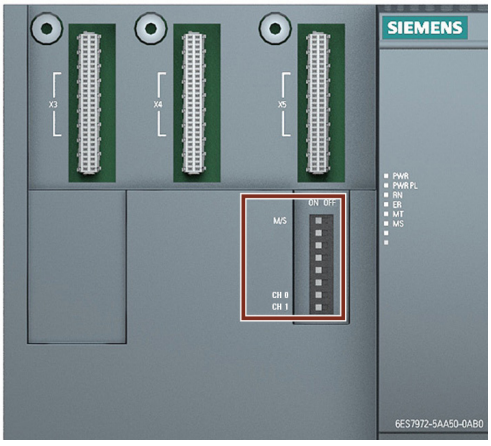


Figure 5-3 DIP switches

For details on setting of the DIP switches, see Table 6-1 Operator controls (Page 51)

See also

Settings (Page 51)

5.2 Displays

5.2.1 LED displays on the PLB basic module

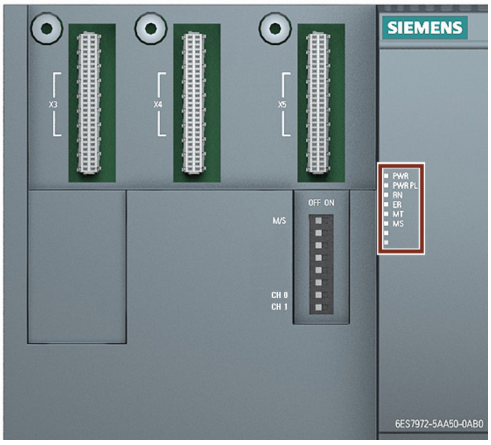


Figure 5-4 LED displays on the PLB basic module

Table 5- 1 LED PLB BM

LED labeling Meaning	Color	State	Description
PWR Power	Green	Off	24 V supply missing or too low
		On	LED test for about 0.5 s during startup 24 V supply
PWR PL Power - powerline	Green	Off	Powerline supply missing
		Flashes (approx. 1 Hz)	PL supply voltage too high Short-circuit to PE or to L1, L2 or L3
		On	LED test for about 0.5 s during startup
RN Run	Green	Off	No PROFINET Startup
		Flashes (approx. 1 Hz)	Normal operation without PROFINET Startup or parameter assignment for PROFINET Station flash test (PN) together with the port LEDs of the ET200SP BusAdapter (BA)
		Flashes (approx. 4 Hz)	Firmware update of the basis in progress (together with ER and MT)
		On	LED test for about 0.5 s during startup PN-AR with IO data exchange

LED labeling Meaning	Color	State	Description
ER Error	Red	Off	No error
		Flashes (approx. 1 Hz)	Station flash test (PN) together with the port LEDs of the ET200SP BusAdapter (BA) External error: Short-circuit between a phase and Rail A or Rail B External error: Ground fault of Rail A or Rail B
		Flashes (approx. 4 Hz)	Firmware update of the basis in progress (together with RN and MT)
		On	LED test for about 0.5 s during startup Wrong modem or modem not installed
MT Maintenance	Yellow	Off	No maintenance required
		Flashes (approx. 1 Hz)	Station flash test (PN) together with the port LEDs of the ET200SP BusAdapter (BA)
		Flashes (approx. 4 Hz)	Firmware update of the basis in progress (together with ER and RN)
		On	LED test for about 0.5 s during startup Maintenance required: e.g. FW update has failed. A new update is necessary (see Auto-Hotspot)
MS Master	Green	Off	PLB slave
		On	LED test for about 0.5 s during startup PLB master

5.2.2 LED displays on the modem module

Figure 5-5 LED displays on the modem module

Table 5- 2 LED PLB MM

LED labeling Meaning	Color	State	Description
PWR Power	Green	Off	Modem without power supply, inactive or in RESET
		On	LED test for about 0.5 s during startup Modem power supply OK
PL Powerline	Green	Off	No powerline connection
		Flashes (approx. 8 Hz)	Powerline data traffic
		On	LED test for about 0.5 s during startup Modem active, PL connection exists

5.2.3 LED displays on the BusAdapter

Figure 5-6 LED displays on the BusAdapter

Table 5- 3 LED BusAdapter

LED labeling Meaning	Color	State	Description
LK1/LK2 Link Port 1 / Link Port 2	2x Green	Off	No link at Port 1 or Port 2
		Flashes (approx. 1 Hz)	Station flash test (PN) together with the MT, RN and ER LEDs of the PLB basic module
		On	LED test for about 0.5 s during startup Link at Port 1 or Port 2

5.3 Ports and slots

5.3.1 Slot X3

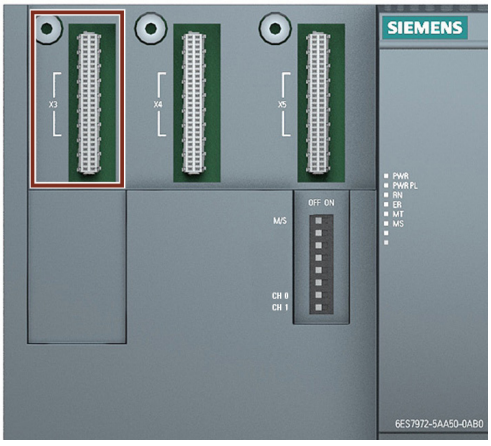


Figure 5-7 Slot X3 for the ET200SP BA (BusAdapter)

5.3.2 Ports X1

Figure 5-8 LAN ports X1

You can connect up to two external Ethernet or PROFINET cables (LAN) on the BusAdapter.

5.3.3 Slot X4

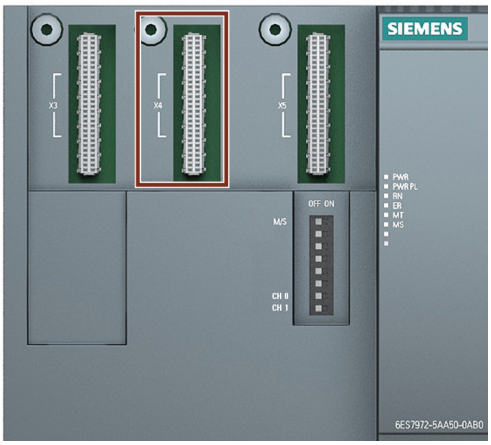


Figure 5-9 Slot for the PLB MM (Modem Module)

5.3.4 Slot X5

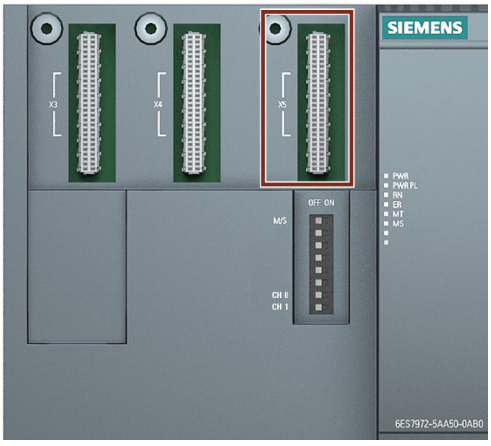


Figure 5-10 Slot for the PLB EM (Empty Module)

5.3.5 Port X2

Figure 5-11 Powerline port X2

Terminal	Connection	Name
X2.1	42 V AC	Rail A
X2.2		Rail B

5.3.6 Port X80

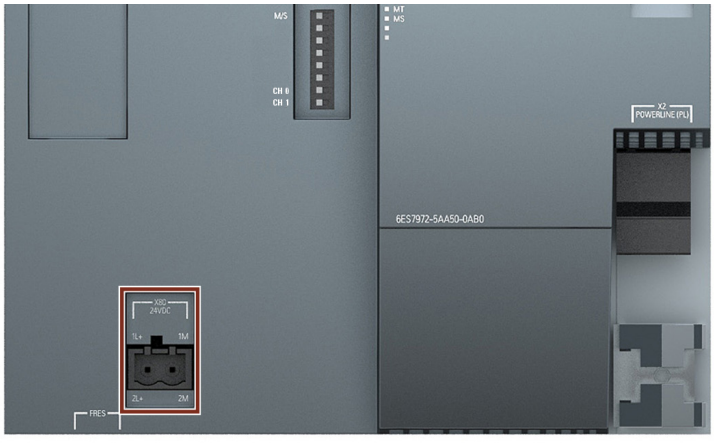


Figure 5-12 24 V DC power supply port X80

Terminal	Connection
X80.1	+ 24 V DC (SELV of the LV/C)
X80.2	0 V

Settings

6

No settings are necessary (factory state) when you use the Power Line Booster as slave. To use the PLB as master, however, you must set the D0.0 DIP switch "M/S" accordingly.

In some special cases, you may have to make additional settings.
The possible settings are listed in the "Operator controls" table.

There are three DIP switches to configure the PLB (one 8x DIP switch). You may only operate these switches in the de-energized state. The switches are located below the PLB EM (Empty Module).

NOTICE
Use the DIP switches for configuration only in the de-energized state.

Table 6- 1 Operator controls

Operator control	Labeling	State	Function
Button	FRES	Off	
		On ≥ 5s	see FRES button (Page 41)
DIP switch master/slave	M/S	Off (factory state)	PLB slave operation
		On	PLB master operation
DIP switch channel	CH 0 CH 1	00 (factory state)	
		00, 01, 10, 11	Setting of 4 different channels.

You can prevent communication errors caused by crosstalk between different plants with the correct setting of the channel. In this case, all devices (master and slaves) in a plant must be set to the same channel.

Table 6- 2 Set master/slave operating mode

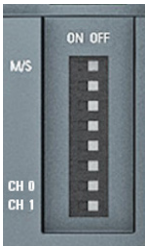
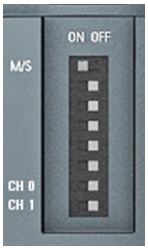
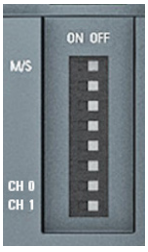
	
Power Line Booster in slave operating mode	Power Line Booster in master operating mode

Table 6- 3 Channel setting (examples)

	
Power Line Booster configured for channel 00	Power Line Booster configured for channel 10

PROFINET/Ethernet 7

7.1 Configuration

You can assign a PROFINET name (PN name) and an IP address to the Power Line Booster by using a configuration software that supports DCP. The name is then displayed, for example, during network scans. The IP address is required for maintenance purposes, e.g. updating.

You can set the name and the IP address with the standard configuration software that supports the "Discovery and Configuration Protocol" (DCP). For example:

- PST (Primary Setup Tool)
- STEP7
- TIA Portal

You can also use these tools to set the Power Line Booster to flash mode (the so-called "station flash test") to determine the installation location of the Power Line Booster in the plant. You can also use these configuration programs to reset the Power Line Booster to the factory setting.

Note

The Power Line Booster system works with a "shared medium". This means all stations share one medium so that only one station at a time can send data in a given direction.

Note

Topology recognition is not possible with a "shared medium" as the one used by the Power Line Booster.

Note

The PLB system can forward **PROFIsafe**. When planning this safety function, you have to take into consideration the times from the section below.

7.2 Timing and runtimes

7.2.1 Overview

The Power Line Booster system implements a transparent transmission of Ethernet telegrams via powerline. In addition, it ensures optimum utilization of the media with regard to real-time capability of IO data.

To do this, the PLB master runs a cycle in which it contacts each accessible PLB slave one after the other; it also synchronizes the PROFINET IO data of the automation components connected downstream from this PLB slave. It also transmits Ethernet packets of other protocols at the same time, but only so many that a specified PLB cycle time across all accessible slaves is not exceeded.

Note

To ensure uninterrupted operation, we recommend you only use the Power Line Booster communication system for the PROFINET communication.

7.2.2 Configuration of the cycle time

The PN cycle time should not be less than the mean PLB cycle time.

Table 7- 1 The specified PLB cycle time is listed in the table below.

Number of accessible slaves	Mean PLB cycle time
Up to 20	64 ms
21 to 50	128 ms

Because synchronization of the IO data takes about 2 ms per PLB slave on average, we can assume that the specified PLB cycle time is usually not exceeded. A requirement is that no more than eight devices (e.g. local PLC, frequency converters, etc.) with up to 64 bytes of IO data each are connected to the PLB slave.

7.2.3 Configuration of the monitoring time

The following effects may still result in the mean PLB cycle time being exceeded:

1. Login of PLB slaves in a segment.
   Trimming of the carrier frequencies of the master and slave modem resulting during the login process, results in a media assignment that makes the media unavailable for the cycle.
2. Logout of PLB slaves from a segment.
   As soon as a slave can no longer be reached, you experience interruptions in the PLB cycle due to timeout periods.
3. Impedance change due to plant elements such as switches and trailing cables. The trimming of carrier frequencies can also result in a longer cycle in this case.
4. Interference on the medium, e.g. caused by EMC or short-term deterioration of the contact quality of the sliding contacts.
5. Crosstalk of the powerline signals from other plants or plant units. (Should already be prevented by suitable isolation and attenuation during installation of the plant).

To determine the timeout period, you must expect a maximum PLB cycle time of about 300 ms in total (worst case value caused by latency of the PLB system) for a segment with 50 carriers. In addition to this latency, additional effects (e.g. response time of PLC and field devices, processing times as well as upstream/downstream cycles, such as the PN cycle) must be taken into consideration.

Below you can find a calculation of the maximum system latency using PROFINET as an example.

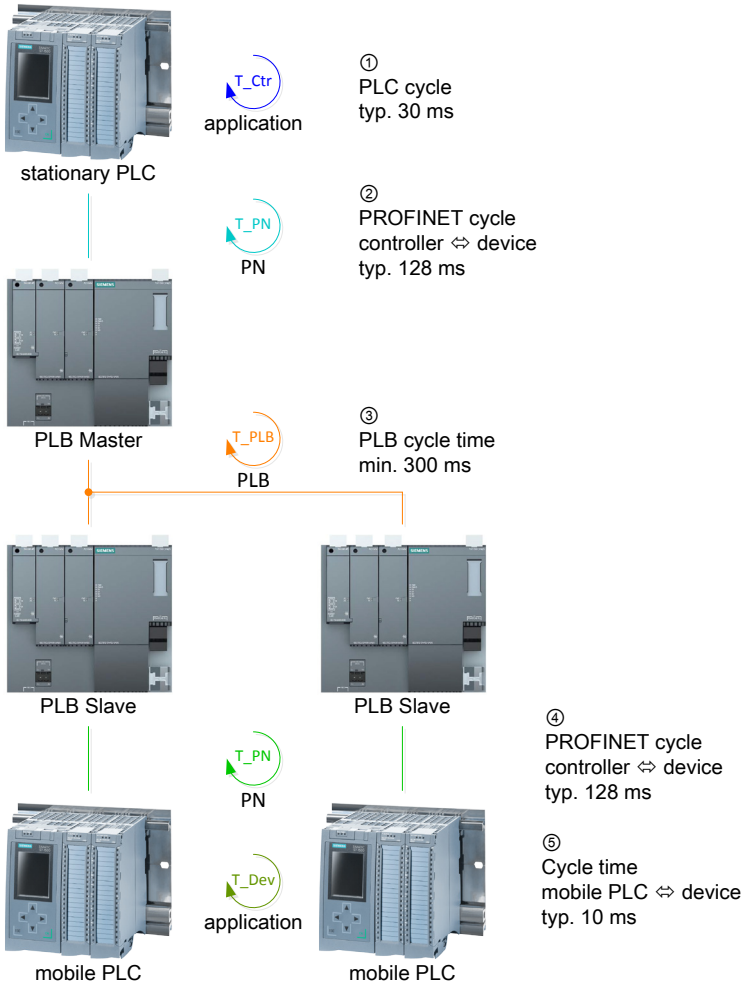


Figure 7-1 Cycles between plant and carrier controller

① Cycle of the controller at which it can process IO data.

② PROFINET cycle configured between controller and device.

③ PLB cycle at which the powerline system moves data to the slaves. This cycle is independent of the number of slaves and from interference. You can assume 300 ms for this cycle.

④ PROFINET cycle configured between controller and device.

⑤ Cycle between carrier controller and the devices.

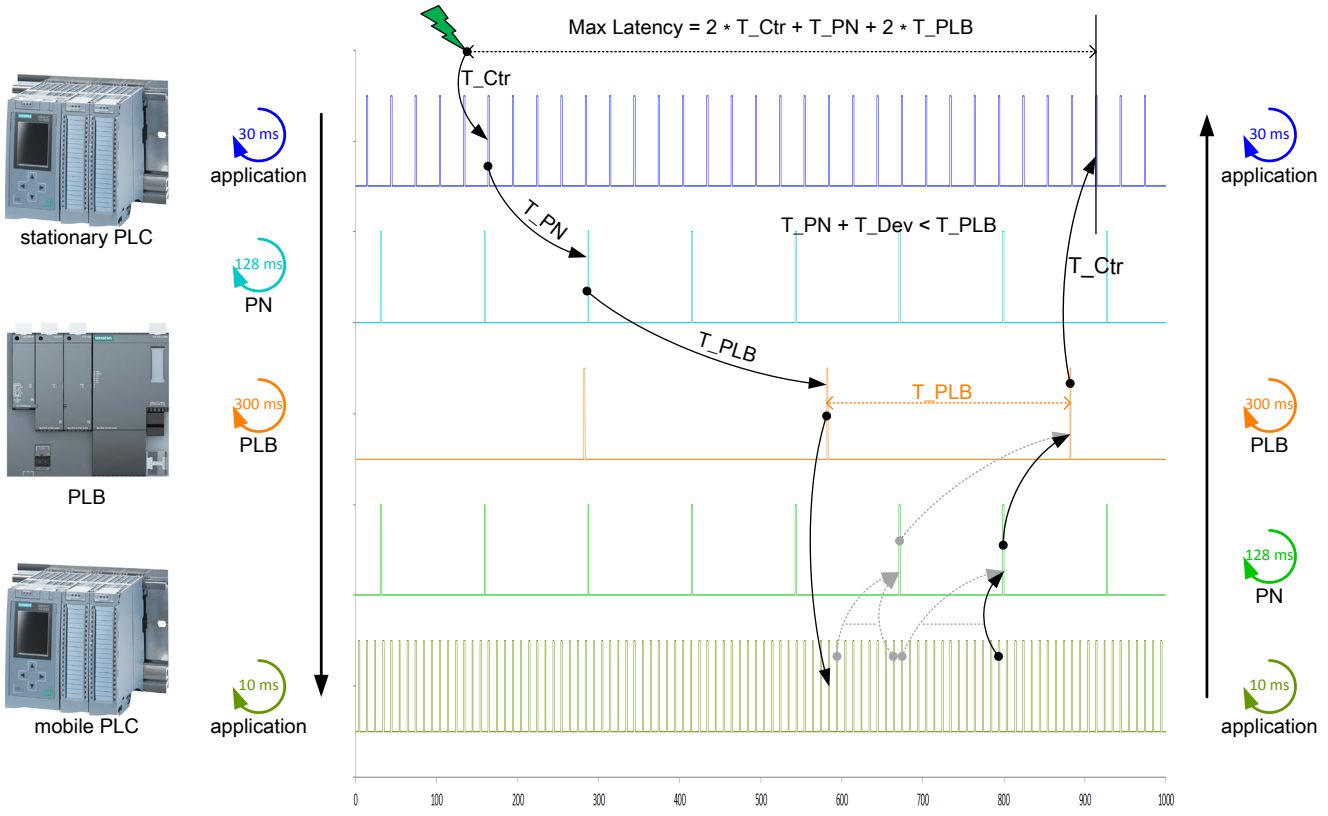


Figure 7-2 Maximum latency time for bidirectional communication

Bidirectional communication here means that the IO controller sends a query and the IO device responds using the same communication path, e.g. by sending an acknowledgment.

Bidirectional communication results in the chart as seen in the figure above. We assume here that the PN cycle time T_{PN} is significantly shorter than the latency time caused by the PLB system T_{PLB}.

The result is the time below:

$T_{Lat} = 2 * T_{Ctr} + T_{PN} + 2 * T_{PLB}$

When you substitute these with typical values (T_{Ctr} = 30ms, T_{PN} = 128ms, T_{PLB} =300ms, T_{Dev} = 10ms) you get:

T_{Lat} =2 * 30ms + 128ms + 2 * 300ms = 788ms.

Note

When using PROFINET

take into consideration a threshold monitoring time of

- 7 update cycles at 128 ms PN cycle time or

- 9 update cycles at 64 ms PN cycle time.

When using Ethernet

take into consideration a latency time of

- 800 ms, if there can be more than 20 carriers in the segment or

- 600 ms, if there can be fewer than 20 carriers in the segment.

Note

With typical PLB applications (e.g. electric monorail system), we can assume that several carriers do not leave the communication segments at the same time. This means we assume that no more than one carrier and therefore one PLB slave exit the communication segment within a time period of 2 s. If more PLB slaves were to exit the segment at the same time (e.g. due to an error), the maximum latency time calculated above may be exceeded.

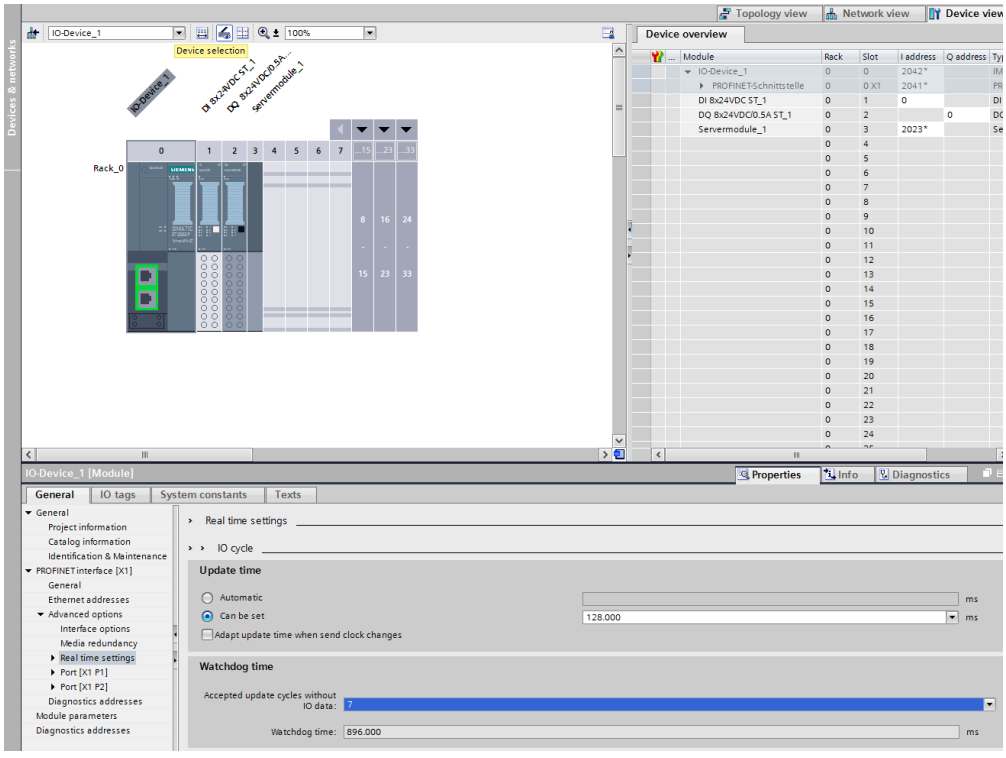


Figure 7-3 Example for configuring the threshold monitoring time in the TIA Portal

Operating software

8

If your plant should require an individual operating software, for example, with adapted timing, feel free to contact the Technical Support for the Power Line Booster plb-support.industry@siemens.com or your local Siemens representative.

Maintenance and service

9

9.1 Spare parts and repairs

Repairs

In case of repair, the HMI device must be shipped to the Return Center in Fürth. Repairs may only be carried out at the Return Center in Fürth.

Depending on the work necessary to repair the device, the Center may decide to give you a credit. A credit note is only granted if the sender orders a new device.

The address is:

Siemens AG
Digital Factory / Process Industries / Drives
Retouren-Center Fuerth
Siemensstr. 2
D-90766, Fürth
Germany

During longer operation environmental influences act on the device, for example, temperature, humidity and air pressure. Send the device to the Return Center for a verification of the function and measuring accuracy. Flat-rate charges are specified for the verification and, if necessary, for the repair.

Spare parts

Spare parts and accessories can be found in section Article numbers (Page 67).

9.2 Recycling and disposal

The devices described in this manual can be recycled due to their ecologically compatible components. Contact a certified disposal service company for environmentally sound recycling and disposal of your old devices.

Technical specifications and approvals 10

10.1 Technical specifications

10.1.1 Mechanics

Dimensions and weight

Table 10- 1 Power Line Booster BM with equipped BA, MM, EM

Width	Length	Depth	Weight
146 mm	130 mm	83 mm	0.90 kg

Note: Information without DIN rail mounting bracket

Table 10- 2 PLB TC

Width	Length	Depth	Weight
50 mm	50 mm	30 mm	0.20 kg

Note: Dimensions without connecting cables

Degree of protection

Table 10- 3 Power Line Booster

Degree of protection	IP20

For the fully-equipped device, including all modules (each in inserted state)

Table 10- 4 PLB TC

Degree of protection	IP00

Due to open ends of the cable.

Installation

You can clip the PLB onto a 35 mm DIN rail (TS 35, EN50022). You can use the DIN rail in the horizontal or vertical version. Note the distance to the adjacent devices in the section Climate (Page 64).

You must install the PLB TC into a separate enclosure due to its connecting cables (e.g. rail terminal boxFigure 4-8 Connection via terminal box (Page 36)).

See also

PLB TC (Termination and coupling module) (Page 20)

Shield connection (Page 36)

10.1.2 Electrical characteristic values

Device	Rated voltage		Current consumption		Power consumption	
	min.	max.	Typical	max.	Typical	max.
PLB BM LV M/S incl. Modules (MM, BM) • X80 • X2	19.2 V DC 0 V AC	28.8 V DC 48.3 V AC	0.29 A Reactive current	0.63 A -	7.0 W -	12.0 W
PLB TC	31.1 V AC	48.3 V AC	Reactive current		-	

Overvoltage category	III
Degree of pollution	2

The associated product standards are available in the section CE conformity (Page 65)

10.1.3 MTBF

Mean Time Between Failures

	FIT	MTBF
PLB BM	2532	394,944 h or **45.1 years**
PLB MM	904	1,106,194 h or **126.3 years**
BA 2xRJ45 [BA 2xFC]		**917.6 years** [1,024 years]
Power Line Booster (PLB BM, PLB MM, BA 2xRJ45)	3319	301,296h or **34.4 years**

10.1.4 Climate

You can operate all devices at ambient temperatures of **0 .. +60 °C in standard mounting position** (DIN rail mounting horizontal on a vertical mounting surface). If you want to install the Power Line Booster on a vertical DIN rail on a vertical mounting surface or on a horizontal mounting surface, the maximum ambient temperature is reduced to +50 °C.

Distance to adjacent devices: 60 mm above and below the PLB

The storage temperature is -40 °C … +70 °C.

Max. operation altitude: 2000 m above sea level

All components are designed for continuous operation (24 h/7 d).

10.2 Approvals

10.2.1 CE conformity

The PLB modules

- PLB BM,
- PLB MM and
- PLB TC

in the version sold by us conforms with the directives of the following European guidelines:

2004/108/EC Directive of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility

2006/95/ECDirective of the European Parliament and Council of 12 December 2006 on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits.

Compatibility with the directives is verified by compliance with the following standards:

EN 61000-6-2:2005 (PLB BM, PLB MM)

EN 61000-6-4:2007+A1:2011 (PLB BM, PLB MM)

EN 61010-1:2010 (PLB BM, PLB MM, PLB TC)

EN 61010-2-201:2013 (PLB BM, PLB MM, PLB TC)

10.3 Security information

Siemens offers products and solutions with industrial security functions which support the secure operation of plants, solutions, machines, devices and/or networks. They are important components in a comprehensive industrial security concept. The Siemens products and solutions continue to be developed under this aspect. Siemens recommends that you keep yourself regularly informed about product updates.

To enssure safe operation of Siemens products and solutions, it is necessary to take appropriate security measures (cell protection concept, for example) and to integrate each component in a comprehensive industrial security concept that is state-of-the-art. This should also cover the third-party products used. You can find more information about industrial security under http://www.siemens.com/industrialsecurity.

To stay informed about product updates as they occur, sign up for a product-specific newsletter. For more information, visit http://support.automation.siemens.com.

Article numbers

11

Components of the Power Line Booster device

PMD product name	Component	Order number
SIMATIC Power Line Booster Base Module Low Voltage Master/Slave	PLB BM LV M/S	6ES7972-5AA10-0AB0
SIMATIC PLB MM (Modem Module)	PLB MM	6ES7972-5AA50-0AB0
SIMATIC PLB Termination and Coupling	PLB TC	6ES7972-5AB00-0XA0
SIMATIC PLB Empty Module (empty enclosure as cover)	PLB EM	6ES7972-5AA80-0XA0
ET200SP Bus Adapter RJ45	BA 2xRJ45	6ES7193-6AR00-0AA0
ET200SP Bus Adapter Fast Connect	BA 2xFC	6ES7193-6AF00-0AA0
Label	for PLB BM [PU = 500 pcs.]	6ES7193-6LR10-0AA0
optional: Reference identification label "flag"	for PLB MM, BA [PU = 10 pcs.]	6ES7193-6LF30-0AW0

Accessories

Product name	Component	Order number
Connectors	.X2 (PLB BM) **TKFC 2.5/2-ST-5.08 BK** [PU = 50 pcs.] X80 (PLB BM) **SPC 5/2-ST-7.62 BK** [PU = 50 pcs.]	Phoenix Contact: Order no:17.24.239 Phoenix Contact: Order no.:17.07.524
Shield clamp	for .X2 (PLB BM) [PU = 10 pcs.] **SKS 14-D** for .X2 (PLB BM) [PU = 10 pcs.] **LF(Z) / SKL 8..11** (additional M4x 6 fixing screw required)	Phoenix Contact: Order no.:32.40.214 icotek: Order no.:36925

PST

The Primary Setup Tool is available from Siemens on the Internet at the following entry ID: 19440762 (http://support.automation.siemens.com/WW/view/en/19440762)

Appendix

12

12.1 Glossary

Plant controller

Stationary PLC (programmable logic controller). For example, responsible for the drive commands and preventing collisions. Communicates with the → carrier controller.

Threshold monitoring time

If an IO Device is not supplied by the IO controller with input/output data (IO data) within the threshold monitoring time, it switches to the safe state.

Application Relation (AR)

Logical PROFINET connection between a PN IO controller and a PN IO device.

Rated voltage

Voltage for which the isolation must be designed (dependent on plant standard).

Dangerous contact voltage

→ Voltage, dangerous contact

Reactive current

Current whose phase length is offset by 90° to the voltage. In this case, we are referring to a capacitive reactive current that rushes ahead of the voltage by 90°.

Flash test, station

→ Station flash test

Boot system

Software which loads the operating system or prepares the start of the operating system.

DCP

Discovery and Configuration Protocol, see IEC 61158.

Expansion point

Constructive measure in the rail system to compensate for temperature expansion.

Device

→ Field device

Real-time capability

The real-time capability characterizes the property of a system to supply specific information reliably and within a specified time interval.

EMS

Automatically controlled electric monorail system (EMS) for internal transport - for example, a conveyor system.

EMS plant control system

Central control of an → EMS. The EMS controller addresses several → plant segment controllers to control the assigned → plant segments and, therefore, the → EMS carriers of these segments.

EMC

Electromagnetic compatibility (EMC) is the property of electrical devices which prevents that these devices interfere each other via fields or cables.

Vehicle

Mobile component of the EMS and carrier of the → carrier controller.

Carrier controller

Mobile PLC. Controls the carrier, reads product information and controls the motors. The carrier controller communicates with the → plant controller.

FE

Functional Earth.

Field device

Corresponds to the slave bus nodes for PROFINET (IO device) but also in other protocols.

Freeware

Software that is made available free of charge by the author and can be used for commercial and private purposes.

Frequency converter

A primary component of a three-phase motor to adapt the frequency and the amplitude of the alternating voltage for the motor.

Functional Earth (FE)

Earth required for the function of the system. FE: Functional Earth

I-device

An I-device is an "intelligent CPU as IO device“. With this function, PROFINET not only supports communication to lower-level devices, such as IO controllers, but also IO communication to other higher-level or central controllers connected as IO devices.

IO controller

Device used to address connected I/O devices (e.g. distributed I/O). This means, The IO controller exchanges input and output signals with assigned IO devices. The IO controller is often the SIMATIC CPU on which the user program runs.

IO data

Corresponds to the cyclical user data that are exchanged between an IO controller and an IO device.

IO device

→ Field device

Extra-low voltage

Extra-low voltage usually covers the area with voltages that are not dangerous to contact. The high limit varies depending on the referenced standard.

Communication segment

Rail section in which communication is always possible. All PLB slaves in this rail section communicate with a PLB master that has been assigned to this section.

Short-circuit

A short-circuit is an error state. It is usually a low resistance connection of two or more conductors due to a break-down of the isolation.

Empty segment

An empty segment is an autonomous mechanical section of the EMS (Electric Monorail System) in which **data traffic** between a → plant segment controller and the → EMS carriers located within it does not take place.

Circuit breaker

Protective device to prevent an overload by currents from cables.

Low voltage

The limits of the low voltage depend on the reference standard. It usually covers the area with dangerous contact voltages < 1 kV AC or < 1.5 kV DC.

PE

Protective Earth.

PELV

Protective extra-low voltage in accordance with the PELV standard for the protection against electrical shock. PELV is used whenever it is necessary for operational reasons to ground active conductor rails of the extra-low voltage or equipment chassis.

Powerline

The industrial powerline used here uses powerline technology to transmit Industrial Ethernet signals via conductive media that are originally not intended for broadband communication.

PST (Primary Setup Tool)

Free software for configuration of the communication settings of programmable controllers with network interface. Can be used for PROFINET devices and select SIEMENS automation components.

RAIL A/B

RAIL is derived from the English term Railing; in this document it relates to the EMS rail. In an EMS, we refer to the two sliding contacts of the EMS rail used for data communication as RAIL.

PROFINET

PROcess FIeld NETwork, open Industrial Ethernet Standard that continues the PROFIBUS and Industrial Ethernet. A cross-vendor communication, automation, and engineering model defined by the PROFIBUS International e. V. as automation standard.

Rail

Component of the carrying structure of the EMS. As a carrier rail, it serves to suspend and move the → carriers. The → sliding contacts installed on the EMS rail provide the means for the power supply and communication. The sliding contacts are made of an insulated standard U profile that is contacted on its inside by the current collectors.

The combination of UMC rails and bypass sections forms the rail system of the → EMS.

Rail system

The total of all → rails of an → EMS.

Rail intersection

The rail intersection separates the → RAIL A/B sliding contacts electrically.

Shield clamp

Equipment for electrical and mechanical connection of shielded cables to a conductive basis.

Sliding contact

Electrical part of the EMS rail. Up to 8 sliding contacts are mounted on the EMS rail. The sliding contacts are used for energy supply of the → carrier and data traffic. The two sliding contacts for data traffic are referred to as → RAIL A/B.

Protective Earth (PE)

Earth required for protection of persons and goods. PE: Protective Earth

Heavy duty EMS

The heavy duty EMS has been designed for transporting extremely heavy weights. It can be designed with two tracks and often has a scissor lifting system. When it is equipped like this, the carrier can change its speeds and positions independently in travel direction and stroke.

Segment

See → Communication segment, → -Empty segment → Separator

SELV

Safety extra-low voltage in accordance with the SELV standard for the protection against electrical shock.

SFTP

Refers to the SSH FTP (Secure File Transfer Protocol). SFTP is a protocol for encrypted exchange of data between communication devices. Encryption is provided by the HTTPS server.

Shared Medium

Medium shared by several communication devices. Only one device can send data over such a medium at a specific time. The medium is blocked for all other devices during the time.

Signature

Used to check the authenticity of a software component to identify modified or incorrect software.

Voltage, dangerous contact

Voltage which represents danger for persons. The absolute voltage value is defined in the applicable plant standard.

STEP7

SIEMENS S7 software for configuration of programmable controllers. It also covers especially the communication settings.

Station flash test

Process for locating a device in the plant. The flash test is triggered by the TIA Portal or STEP7, for example.

TIA Portal

Totally Integrated Automation Portal. Software for configuration of programmable controllers. It also covers especially the communication settings. The TIA Portal is the successor of → STEP7.

Timeout

Time interval after the expiration of which a feedback from the communication partner is no longer expected.

Topology recognition

Topology recognition can be used to determine the communication structure of an automation plant. Each device in the plant can be identified and it can be determined to which other devices (e.g. switches) it is connected. Topology recognition requires that all devices in the communication network support the so-called neighborhood detection with the help of the LLDP protocol (Link Layer Discovery Protocol). Topology recognition is not supported by the PLB system.

Carrier voltage

Voltage onto which the powerline signals are modulated. It is present, for example, at the sliding contacts Rail A/B.

Separator

A separator is a short mechanical section of the EMS (Electric Monorail System) in which **data traffic** between a → plant segment controller and the → EMS carriers located within it cannot take place. It is used to separate a → communication segment and an → empty segment or an additional → communication segment.

Crosstalk

Undesirable propagation of the communication signals into other communication segments and communication lines.

Index

R

S

T