



Edition

08/2022

OPERATING INSTRUCTIONS

SIMATIC

Network transitions

PN/CAN LINK

SIMATIC

Network transitions SIMATIC PN/CAN LINK

Operating Instructions

<u>Introduction</u>	1
<u>Safety instructions</u>	2
<u>New properties/functions</u>	3
<u>System overview</u>	4
<u>Functions</u>	5
<u>Application planning</u>	6
<u>Mounting/Extending</u>	7
<u>Connecting</u>	8
<u>Commissioning</u>	9
<u>Configuring/Programming</u>	10
<u>Diagnostics</u>	11
<u>Maintenance and service</u>	12
<u>Technical specifications</u>	13
<u>Appendix</u>	A

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.

Table of contents

1	Introduction	7
1.1	Preface	7
1.2	Documentation guide	9
2	Safety instructions	11
2.1	Safety instructions	11
2.2	Security information	13
3	New properties/functions	15
3.1	Version overview	15
3.2	Changes compared to the previous version	15
3.3	Installation and handling of the new HSP	24
4	System overview	31
4.1	Field of application	31
4.2	System configuration	34
4.3	System requirements	35
4.4	Design	35
5	Functions	37
5.1	CANopen	37
5.1.1	Basic functions	37
5.1.1.1	Overview	37
5.1.1.2	Object dictionary	38
5.1.1.3	Process data objects (PDO)	39
5.1.1.4	Service Data Objects (SDO)	40
5.1.1.5	EMCY messages	41
5.1.1.6	Heartbeat / Node Guarding	42
5.1.1.7	SYNC messages	43
5.1.1.8	Data exchange between controller and PN/CAN LINK	44
5.1.1.9	Conversion of data formats between PROFINET and CANopen	47
5.1.2	CANopen Manager	48
5.1.2.1	State model	48
5.1.2.2	Control and status information	51
5.1.2.3	Acyclic data exchange between controller and PN/CAN LINK	54
5.1.2.4	Monitoring functions	57
5.1.3	CANopen Slave	59
5.1.3.1	Object dictionary	59
5.1.3.2	State model	60
5.1.3.3	Control and status information	63
5.1.3.4	Monitoring functions	66
5.1.4	Response to errors	67

5.2	CAN transparent	69
5.2.1	Overview	69
5.2.2	State model	69
5.2.3	CAN messages	71
5.2.4	Control and status information	72
5.2.5	Cyclic data exchange between controller and PN/CAN LINK for configured CAN messages	73
5.2.6	Cyclic data exchange between controller and PN/CAN LINK for programmed CAN messages	75
5.2.7	Response to errors	82
6	Application planning	83
6.1	Installation guidelines	83
6.2	Installation location	84
6.3	Transportation	87
6.4	Storage	87
6.5	Scope of delivery	87
7	Mounting/Extending	89
7.1	Installing the device	89
8	Connecting	91
8.1	Safety instructions and guidelines	91
8.2	Potential ratios	93
8.3	24 V DC power supply	94
8.4	Connecting the functional ground	96
8.5	Connecting PROFINET	96
8.6	Connecting the CAN bus	98
9	Commissioning	99
9.1	Commissioning the PN/CAN LINK	99
10	Configuring/Programming	101
10.1	Configuring CANopen Manager	104
10.1.1	Overview	104
10.1.2	Configuration view in the TIA Portal	105
10.2	Configuring CANopen Slave	127
10.2.1	Overview	127
10.2.2	Configuring in the TIA Portal	127
10.3	Configuring CAN transparent	136
10.3.1	Overview	136
10.3.2	Configuring in the TIA Portal	137
10.4	Programming	142
10.4.1	PLC tags	142

11	Diagnostics	145
11.1	Status LEDs	145
11.1.1	Operating state of the PN/CAN LINK / PROFINET diagnostics	145
11.1.2	Connection status CAN bus in the two CANopen operating modes	147
11.1.3	Connection status CAN bus in "CAN transparent" operating mode	148
11.2	Diagnostic messages to the S7 controller	149
11.2.1	Events that trigger a diagnostic message	149
11.2.2	Diagnostic messages	152
12	Maintenance and service	155
12.1	Replacing the PN/CAN LINK	155
12.2	Recycling and disposal	156
13	Technical specifications	157
13.1	Technical specifications	157
13.2	Dimension drawing	161
A	Appendix	163
A.1	Certificates and approvals	163
A.2	Contact address	164
A.3	Licenses	164
A.4	Service & Support	165
A.4.1	Technical Support	165
A.4.2	Siemens Industry Online Support	165
A.4.3	Online catalog and ordering system	165
	Glossary	167
	Index	171

Introduction

1.1 Preface

Purpose of this documentation

These operating instructions include all information required for configuration, installation, commissioning and operation of the PN/CAN LINK.

These operating instructions are intended for qualified personnel in the following target groups:

- Commissioning engineers
- Operating and service personnel
- System integrator

Knowledge required

The following knowledge is required in order to understand the operating instructions:

- Knowledge of programming a SIMATIC S7 controller
- Knowledge in the application of the TIA configuration environment
- Knowledge of working with the PROFINET fieldbus
- In-depth knowledge of the CAN or CANopen communication protocols
- General knowledge in the field of automation technology
- General knowledge of communication networks

Trademarks

SIMATIC® is a registered trademark of Siemens AG.

History

Edition	Note
03/2017	First edition
03/2018	Addition of naming scheme for generated PLC tags; Minor improvements and additions
03/2022	Addition of the "Simple slave functionality" Minor improvements and additions
08/2022	Addition of the "S2 redundancy functionality" Minor improvements and additions

Naming conventions

The term "PN/CAN LINK" or "device" is used in this documentation instead of the full product name "SIMATIC PN/CAN LINK".

The term "S7 controller", or "S7" for short, is also used for the SIMATIC S7 controller.

1.2 Documentation guide

Below you will find a list of documents which supplement these operating instructions for the PN/CAN LINK and which are available on the Internet.

Additional documentation

Subject	Documentation	Most important contents
Designing interference-free controllers	Function Manual Designing interference-free controllers (https://support.industry.siemens.com/cs/ww/en/view/59193566)	• Basics • Electromagnetic compatibility • Lightning protection
PROFINET	SIMATIC PROFINET System Description (https://support.industry.siemens.com/cs/ww/en/view/19292127)	• Basics • Installation • Functions • Configuration examples

The latest manuals for SIMATIC products are available for download free of charge from the Internet (<https://support.industry.siemens.com/cs/ww/en/ps/man>).

The information system of the TIA Portal also helps you configure and program your automation system and the PN/CAN LINK.

Safety instructions

2.1 Safety instructions

CAUTION
--

Observe the safety instructions on the inside front cover of this documentation.
--

SIMATIC PN/CAN LINK devices correspond to the approvals printed on the type plate. If you have questions about whether it is permissible to install the device in the planned environment, please contact your service representative.

NOTICE

Alterations to the devices are not permitted.

Failure to observe this requirement shall constitute a revocation of the CE approval and manufacturer's warranty.

Intended use

NOTICE

The PN/CAN LINK may only be used for the applications described in the catalog and in the associated technical documentation. If the device is used in a manner other than the one specified by Siemens, the protection offered by the device might be impaired.
--

See also the section "Legal notices" at the beginning of this manual.

Repairs

WARNING
--

The device contains no user-serviceable parts.

May cause death or serious injury
--

Unauthorized opening or improperly performed repairs can cause considerable damage to property and/or danger to users. Contact Siemens Support (https://support.industry.siemens.com/cs/ww/en/) in case of error.
--

Safety information

WARNING

Connection only over safety extra-low voltage / protective extra-low voltage

May cause death or serious injury

The device is designed for operation using directly connectable safety extra-low voltage (SELV) with safe electrical separation according to IEC 60950-1 / EN 60950-1 / VDE 0805-1 or IEC 61131-2 / EN 61131-2 / DIN EN 61131-2.

To obtain the safe property of low-voltage circuits of the PN/CAN LINK, the 24 V rated voltage supply and external connections to communication interfaces must be supplied from approved sources that meet requirements set forth by various standards for SELV/PELV voltage-limited sources.

Therefore only connect safety extra-low voltages (SELV) with safe electrical separation according to IEC 60950-1 / EN 60950-1 / VDE 0805-1 to the supply voltage connections and the communications interfaces.

Working on the device or on connected components

WARNING

Risk of electric shock

May cause death or serious injury

- Voltages > 60 V DC or 30 V AC may be present in the control cabinet. Therefore appropriate safety precautions must be taken to prevent contact during commissioning and maintenance work.
- Before carrying out any work on the device or on connected components, make sure that the installation is in a zero-voltage state.
- Use cable types with UL approval for UL-approved systems.

2.2 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit (<https://www.siemens.com/industrialsecurity>).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customers' exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed visit (<https://www.siemens.com/cert>).

Protective measures for SIMATIC PN/CAN LINK

NOTICE
Only authorized personnel are permitted to access the system and carry out modifications.

New properties/functions

3.1 Version overview

HSP/FW versions

TIA Portal version	HSP required	HSP version	FW version	Note
V14 SP1	Yes	HSP_V14_0197_001_Link_PN_CAN_1.0	V1.0	"Update module description" necessary
V15.1	Yes	HSP_V15_1_0197_001_Link_PN_CAN_1.0	V1.0	
V16	Yes	HSP_V16_0197_001_Link_PN_CAN_1.0	V1.0	
V17	No	-	V1.0	
V17	Yes	HSP_V17_0358_001_Link_PN_CAN_2.0	V1.0; V2.0	"Simple slave functionality" included
V17	Yes	HSP_V17_0358_002_Link_PN_CAN_2.0	V1.0; V2.0; V2.1	"S2 redundancy functionality" included

3.2 Changes compared to the previous version

What's new as of firmware version V2.1 in HSP_V17_0358_002_Link_PN_CAN_V2.0?

There are now 3 entries in the HW catalog for the PN/CAN LINK module with firmware versions V1.0, V2.0 and V2.1. The PN/CAN LINK V2.1 contains the "S2 redundancy functionality".

The "S2 redundancy functionality" enables the PN/CAN LINK to work with a redundant system S7-1500R/H.

Note

Using PN/CAN LINK V2.1

Before downloading a configuration of the PN/CAN LINK V2.1, a firmware update of the device to version V2.1 is required.

Note

Backward compatibility (firmware version 2.1 and higher)

At an existing configuration of the PN/CAN LINK V2.0 (and higher), a downgrade from V2.0 (and higher) to V1.0 is not possible within a TIA Portal project. When a downgrade is required, you must create a new PN/CAN LINK module for V1.0 within a TIA Portal project. In this case, however, the functions which exist in higher versions are not available.

You can perform a firmware update/firmware downgrade without any restrictions.

New parameters

Under "PROFINET interface [X1] > Advanced options"

- **Menu "Media redundancy"**

For PN/CAN LINK V2.1 the "Media redundancy" menu is now available.

The "Media redundancy role" is set by default to "Not device in the ring". You can select the Media redundancy role "Client" in the selection list.

- **Port [X1 P1] as well as Port [X1 P2]**

For PN/CAN LINK V2.1 the ports are changed to ring ports for the media redundancy (MRP): Port [X1 P1 R] as well as Port [X1 P2 R].

- **Menu "Port options"**

For PN/CAN LINK V2.1 as well as V2.0 all Boundaries can now be set.

Under "CANopen Manager > Communication"

- **Check box Broadcast NMT Operational command**

When this option is activated, the manager sends the NMT Operational command with the address 0 to all nodes.

Implementation of NMT reset command

An NMT reset command can be sent via the CANopen network to the respective node. If the manager themselves wants to send a reset command, they have to use the WRREC instruction with the data record No. 0x213.

Note

This functionality is only available in the "CANopen Manager" operating mode.

Byte	Node ID
0	"3" (Reset node with node ID = 3)
1	"5" (Reset node with node ID = 5)
...	...
Up to 126	The most recent node ID
Note: The structure contains a list of a node IDs which require a reset. The length of the list is flexible and depends on the number of nodes to be reset. Each node is represented with a 1-byte node ID. The approved values for node ID move in the range of 1 to 127. The node must be configured as a slave in the TIA Portal. To reset the entire CANopen network set the "Reset bit" instead on the control byte.	

The structure of the NMT reset command has to be specified with WRREC (write data record).

What is new as of firmware version V2.0 in HSP_V17_0358_001_Link_PN_CAN_V2.0?

There are now two entries in the HW catalog for the PN/CAN LINK module with firmware versions V1.0 and V2.0. The difference between versions V1.0 and V2.0 is the "Simple slave functionality" included in PN/CAN LINK V2.0.

The "Simple slave functionality" is available as of TIA Portal V17 and enables the PN/CAN LINK to work with CANopen devices that do not fully comply with the CANopen standards defined by the CiA group (<https://www.can-cia.org/>). You can find additional information below.

Note

Using PN/CAN LINK V2.0

Before downloading a configuration of the PN/CAN LINK V2.0, a firmware update of the device to version V2.0 or higher is required.

Note

Use of a new PN/CAN LINK V2.0 (firmware version 2.0 and higher) as replacement for a device with firmware V1.0

It is **not** possible to use a device with firmware V2.0 with a project that requires firmware V1.0.

You have the following options to bypass this restriction:

- You must upgrade the PN/CAN LINK in the project from V1.0 to V2.0.
- Perform a firmware update to V2.1 of the device used as a replacement.
- Perform a firmware downgrade to V1.0 of the device used as a replacement.

More information is available in the section "Using an existing configuration" in the chapter Installation and handling of the new HSP (Page 24).

If you are not making any changes after the upgrade, the new device will work just like the old one.

Note

Backward compatibility

For an existing configuration of the PN/CAN LINK V2.0 (or higher), a downgrade from V2.0 (or higher) to V1.0 is not possible within a TIA Portal project. When a downgrade is required, you must create a new PN/CAN LINK module for V1.0 within a TIA Portal project. In this case, however, the functions which exist in higher versions are not available.

You can perform a firmware update/firmware downgrade of the device without any restrictions.

New parameters

Under "CANopen Manager > Communication"

- **Max. SDO timeout**

Some "simple slave" devices are slow to respond to commands of the CANopen Manager. Such devices work on other, more important tasks and CANopen communication has low priority. The reaction to the command from the manager is therefore delayed. In this case, the manager waits for the "max SDO timeout" (ms). The SDO- request is aborted when the preset time has elapsed. There is also a 1 second delay before a new request is sent.

The SDO Timeout is only displayed to the user when an SDO with the data record number 0x200 - 0x20F is requested. The timeout is displayed instead of the 4-byte code "Additional error information code" as 0x05040000 (code number taken from CiA standard "CiA 301"). This code occupies the 6th to 9th byte of the data record read.

- **Max. BootUp timeout**

The max. bootup timeout gives the maximum response time in seconds for the startup process of a node. When a node does not respond to the requests of the manager within the specified time, the diagnostic message "BootUp, node not responding" is sent to the PLC. The diagnostic message is deleted as soon as the node responds correctly to the manager.

Under "CANopen Manager > Diagnostics"

For PN/CAN LINK V2.0, the menu "CANopen Manager > Response to EMCY message" is changed to "CANopen Manager > Diagnostics" .

- **Check box Response to EMCY message: Pass event as diagnostics to S7**

This option has merely been renamed.

When you select this option, all received EMCY messages are sent to the IO controller as diagnostic alarms.

- **Check box Enable diagnostic alarms for not mandatory nodes**

The option applies only to nodes that are not mandatory.

When you disable this option, the disconnection of the nodes from the CAN bus or error messages that are pending in the CANopen network are not sent to the diagnostic buffer and the ERROR LED remains off.

When you select this option, error messages from such nodes are displayed in the diagnostic buffer and the ERROR LED lights up.

All other nodes on the CAN bus are not affected by this option.

- **Check box Enable additional diagnostics alarms**

When you disable this option, the device does not send diagnostic alarms related to the operating mode (CANopen Manager, CANopen Slave and CAN transparent). Both error LEDs remain off.

- **Check box Block Error passive alarm**

When you select this option, the error passive state of the CAN bus is not reported as an alarm in the diagnostic buffer. The error LED remains off.

(ISO 11898 CAN Layer 2 device: If one of the error counters is above 127, the device goes into the "Error Passive" state of the CAN bus. The next error is signaled by a "Passive Error Flag", which consists of 6 recessive bits. This signal does not destroy any other communication on the bus. The device is fully operational unless an error counter exceeds 255 and the device goes into the "Bus Off" state.)

Under "CANopen Manager > Receive process data objects (PDOs) > Receive PDO definition"

- **Check box Disable checking of PDO length**

When you select this option, the data length (number of received bytes) of the received PDOs is adjusted. Error, warning or diagnostic messages are not generated. The value is adjusted to the correct data length as follows:

- Data below the defined length are supplemented with the value 0.
- If data exceeds the defined length, the more significant bytes are deleted.

When you disable this option, all data from a received PDO with a length deviating from the standard is discarded and replaced with the value of the last valid PDO (last received PDO with the correct length). The CANopen Manager calls up an error message in the diagnostic buffer.

Under "CANopen node universal > Communication"

- **Check box No NMT / Layer 2 slave**

When you select this option, the requested NMT status of the node is not evaluated by the Manager. The CANopen configuration phase is completely skipped for this node. The configuration menus for EMCY, Heartbeat and Node Guarding as well as the PDOs are blocked (write-protected) and show the values from the object dictionary (EDS file).

Exception: A node can be monitored by the manager using the Heartbeat/Node Guarding functions. An error is only signaled to the CPU when the Heartbeat/Node Guarding message is not received in time. The NMT status of the message is not evaluated; any status is accepted.

Typical use case for this option are slave nodes that do not require NMT commands for their commissioning and use. After power-on, such devices immediately enter the operating mode and start sending the PDO messages configured by default.

If you have made parameter changes before setting the "No NMT / Layer 2 slave" option, these values are retained. However, they have no effect on the actual configuration of the node in the system.

- **Check box Loose configuration**

The main purpose of this option is to ignore unexpected errors during the configuration phase. The configuration of the node is always completed even when a configuration error occurs.

This option only affects the configuration phase after startup or after resetting the bus or node. The status of a node is read by the master during the configuration phase, although it is ignored. In this way, the master can complete the configuration with devices that reject incoming messages randomly or with devices that communicate differently, contrary to the definition in their EDS file.

When a node does not support one of the mandatory objects 1000, 1018.01, 1018.02, 1018.03, this check box is always selected and cannot be cleared.

- **Check box Disable this node temporarily**

You have configured a series of nodes in the TIA Portal, but one node does not physically exist in the CAN network. To work with the "reduced" network, you can temporarily disable one or more nodes. Such a CANopen node with its entire configuration remains in the project but is **not** downloaded to the PN/CAN LINK. The node **does not exist** in the configuration that is used by the PN/CAN LINK. No errors or warnings are generated by the PN/CAN LINK.

Under "CANopen Slave > Diagnostics"

This menu is new for PN/CAN LINK V2.0 in "CANopen Slave" mode.

- **Check box Enable additional diagnostics alarms**

When you disable this option, the device does not send diagnostic alarms related to the operating mode (CANopen Manager, CANopen Slave and CAN transparent). Both error LEDs remain off.

- **Check box Block Error passive alarm**

When you select this option, the error passive state of the CAN bus is not reported as an alarm in the diagnostic buffer. The error LED remains off.

(ISO 11898 CAN Layer 2 device: If one of the error counters is above 127, the device goes into the "Error Passive" state of the CAN bus. The next error is signaled by a "Passive Error Flag", which consists of 6 recessive bits. This signal does not destroy any other communication on the bus. The device is fully operational unless an error counter exceeds 255 and the device goes into the "Bus Off" state.)

Under "CAN transparent > Diagnostics"

This menu is new for PN/CAN LINK V2.0 in "CAN transparent" mode.

- **Check box Enable additional diagnostics alarms**

When you disable this option, the device does not send diagnostic alarms related to the operating mode (CANopen Manager, CANopen Slave and CAN transparent). Both error LEDs remain off.

- **Check box Block Error passive alarm**

When you select this option, the error passive state of the CAN bus is not reported as an alarm in the diagnostic buffer. The error LED remains off.

(ISO 11898 CAN Layer 2 device: If one of the error counters is above 127, the device goes into the "Error Passive" state of the CAN bus. The next error is signaled by a "Passive Error Flag", which consists of 6 recessive bits. This signal does not destroy any other communication on the bus. The device is fully operational unless an error counter exceeds 255 and the device goes into the "Bus Off" state.)

New data type "Boolean"

The "Boolean" data type is now available for transmit/receive data OD and transmit/receive messages.

Editable OD table (manually defined object dictionary)

You can find additional information in the section "Handling of the OD table" in the section Configuration in the TIA Portal (Page 113).

Implementation of the 0x1F82 object - NMT request

The object 0x1F82 NMT request is accessible from another CANopen device via the CANopen network upon RD-SDO request. Contrary to the definition in the CiA standard "CiA 302 Part 2", this object is implemented read-only. Write access is not permitted. When the manager itself wants to read data of this object, it must use the RDREC instruction with data record number 0x211 for this.

Note

This functionality is only available in the "CANopen Manager" operating mode.

It returns an array of 127 bytes for the status of the node ID from 1 to 127.

RET ARRAY[0] = Status of node 1

RET ARRAY[1] = Status of node 2

...

RET ARRAY[126] = Status of node 127

Note

Reading from 0x1F82OD with the SDO command only returns a status byte of a node instead of an array of bytes. For each node, therefore, an SDO command must be sent with the ID of the requested node as an input parameter.

The status of a node can have the following values (according to CiA standard "CiA 302 Part 2"):

- 0 = unknown state or NMT/BOOTUP
- 1 = node missing
- 4 = NMT/STOPPED
- 5 = NMT/OPERATIONAL
- 127 = NMT/PRE-OPERATIONAL

3.3 Installation and handling of the new HSP

Installing the HSP_V17_0358_002_Link_PN_CAN_V2.0 or the HSP_V17_0358_001_Link_PN_CAN_V2.0

To work with firmware version V2.1 and the new functions, you must use the HSP_V17_0358_002_Link_PN_CAN_V2.0. You can configure a PN/CAN LINK with firmware version V1.0 as well as V2.0 using the same HSP.

To work with firmware version V2.0 and the new functions, you must at least use the HSP_V17_0358_001_Link_PN_CAN_V2.0. You can configure a PN/CAN LINK with firmware version V1.0 using the same HSP.

If necessary, you can download and install the HSP_V17_0358_002_Link_PN_CAN_V2.0 or the HSP_V17_0358_001_Link_PN_CAN_V2.0 from Siemens Industry Online Support.

You can find the Hardware Support Packages (HSP) as a download on the Internet (<https://support.industry.siemens.com/cs/us/en/view/72341852>).

The HSP_V17_0358_002_Link_PN_CAN_V2.0 as well as the HSP_V17_0358_001_Link_PN_CAN_V2.0 are only available for the TIA Portal Version V17.

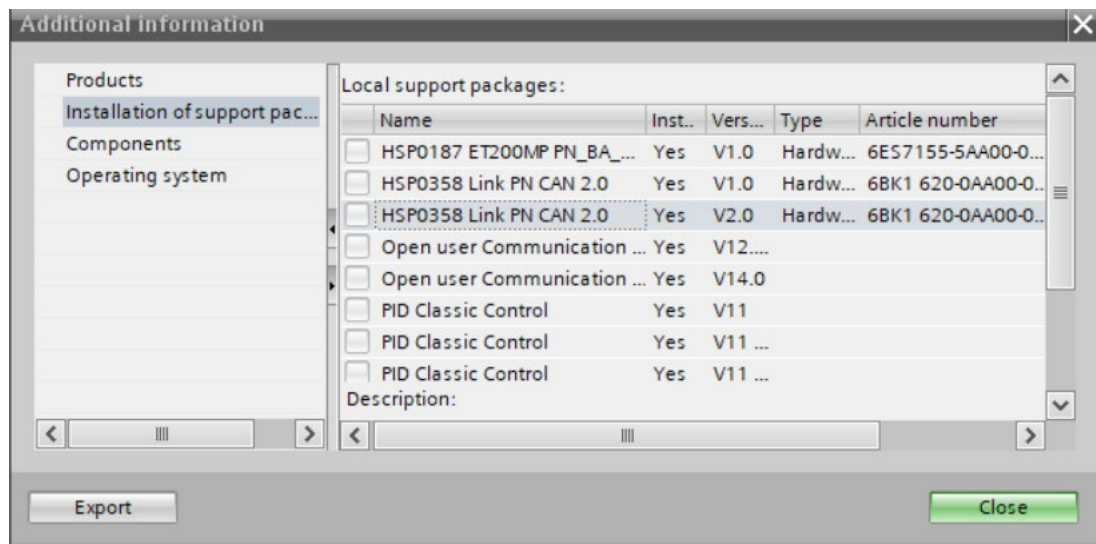


Figure 3-1 Selecting an HSP

There are now 3 entries in the HW catalog for the PN/CAN LINK module with firmware versions V1.0, V2.0, as well as V2.1. The difference between PN/CAN LINK V1.0 and V2.0 lies in the new functions included in the PN/CAN LINK V2.0. The PN/CAN LINK V2.1 contains the "S2 redundancy functionality".

Note**Using PN/CAN LINK 2.1**

A firmware update of the device to version V2.1 is necessary before a configuration of the PN/CAN LINK V2.1 can be downloaded.

Note**Using PN/CAN LINK 2.0**

A firmware update of the device to version V2.0 and higher is necessary before a configuration of the PN/CAN LINK V2.0 can be downloaded.

Note**Use of the PN/CAN LINK V2.0 (firmware version 2.0) as a replacement for a device with firmware V1.0**

It is **not** possible to use a device with firmware V2.0 with a project that requires firmware V1.0.

You have the following options to bypass this restriction:

- You must upgrade the PN/CAN LINK in the project from V1.0 to V2.0.
- Perform a firmware update to V2.1 of the device used as a replacement.
- Perform a firmware downgrade to V1.0 of the device used as a replacement.

More information is available in the section "Using an existing configuration" below.

If you are not making any changes after the upgrade, the new device will work just like the old one.

Note**Backward compatibility (firmware version 2.0 or higher)**

For an existing configuration of the PN/CAN LINK V2.0, a downgrade from V2.0 (and higher) to V1.0 is not possible within a TIA Portal project. When a downgrade is required, you must create a new PN/CAN LINK module for V1.0 within a TIA Portal project. In this case, however, the "Simple slave functionality" is not available.

You can perform a firmware update/firmware downgrade without any restrictions.

Adding a new PN/CAN LINK to your configuration

Using the HSP_V17_0358_002_Link_PN_CAN_V2.0 you can configure the PN/CAN LINK with firmware version V1.0, V2.0, and V2.1.

Using the HSP_V17_0358_001_Link_PN_CAN_V2.0 you can configure the PN/CAN LINK with firmware version V1.0 and V2.0.

When selecting the PN/CAN LINK, you can choose the desired firmware version in the HW catalog.

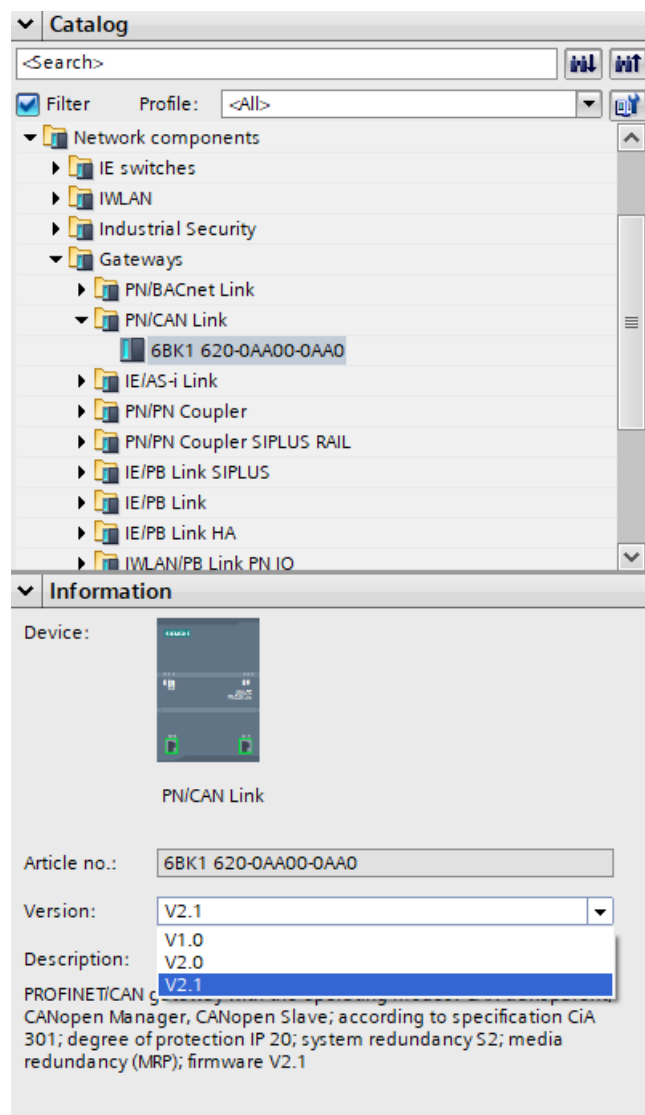


Figure 3-2 Selecting a firmware version in the HW catalog

The new "Simple slave functionality" is only available as of version V2.0.

The new "S2 redundancy functionality" is only available as of version V2.1.

Using an existing configuration

The following upgrades of the PN/CAN LINK versions are possible:

PN/CAN LINK V1.0 to V2.0

PN/CAN LINK V1.0 to V2.1

PN/CAN LINK V2.0 to V2.1

Note

A downgrade of PN/CAN LINK V2.1 to V2.0 is possible.

Example:

Upgrading PN/CAN LINK from V1.0 to V2.0 (Precondition: Use a PN/CAN LINK V2.0 in your plant)

1. Select the PN/CAN LINK in the device view.
2. To upgrade the PN/CAN LINK, click the "Change firmware version" button under "General > Catalog information".
3. Confirm the "Change device - PN/CAN LINK" dialog with "OK".

3.3 Installation and handling of the new HSP

4. As a downgrade from V2.0 to V1.0 is not possible, the "Change firmware version" button is disabled afterwards.
5. Make sure that the device has the correct firmware version 2.0 before loading the changed configuration.

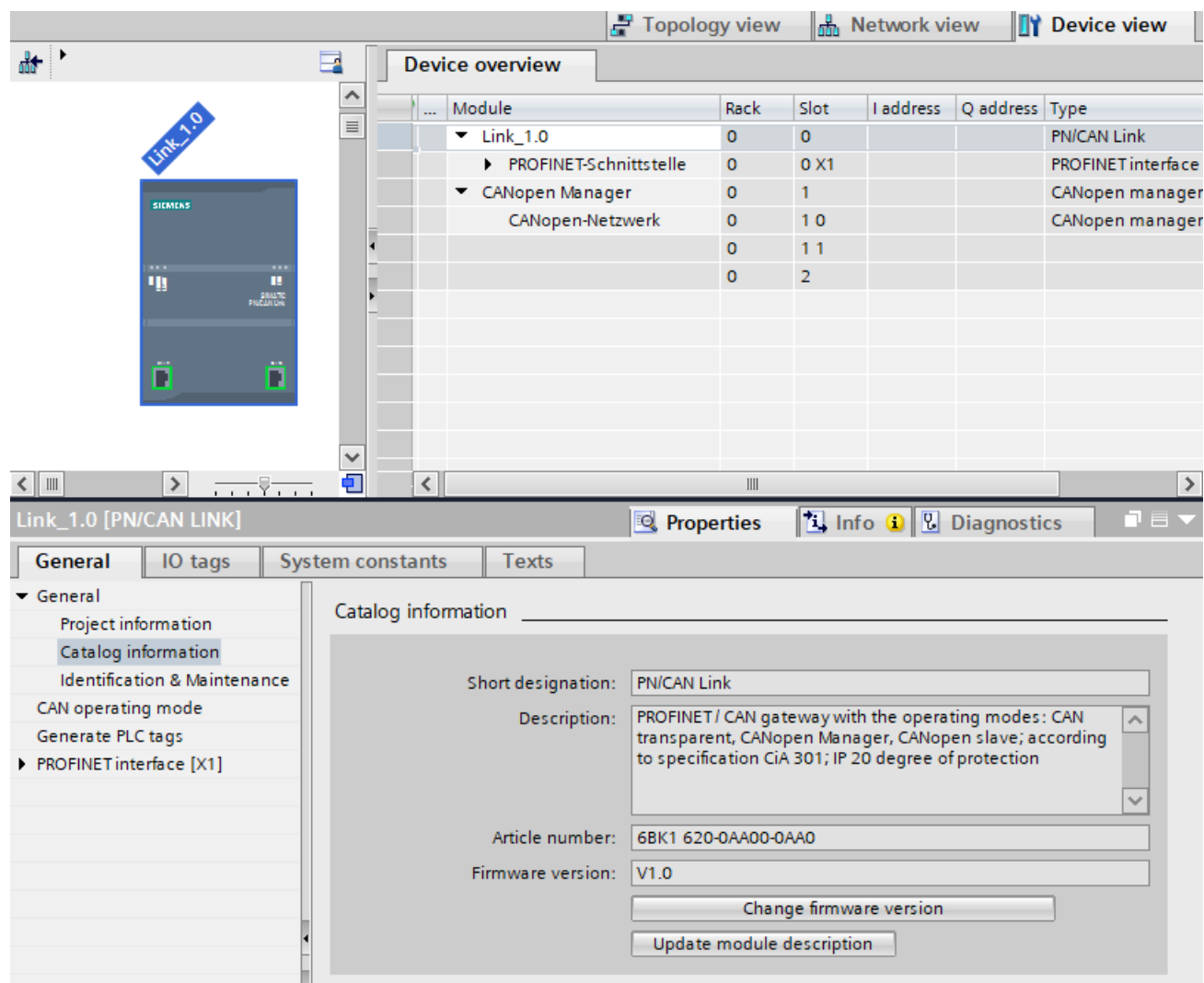


Figure 3-3 Changing the firmware version

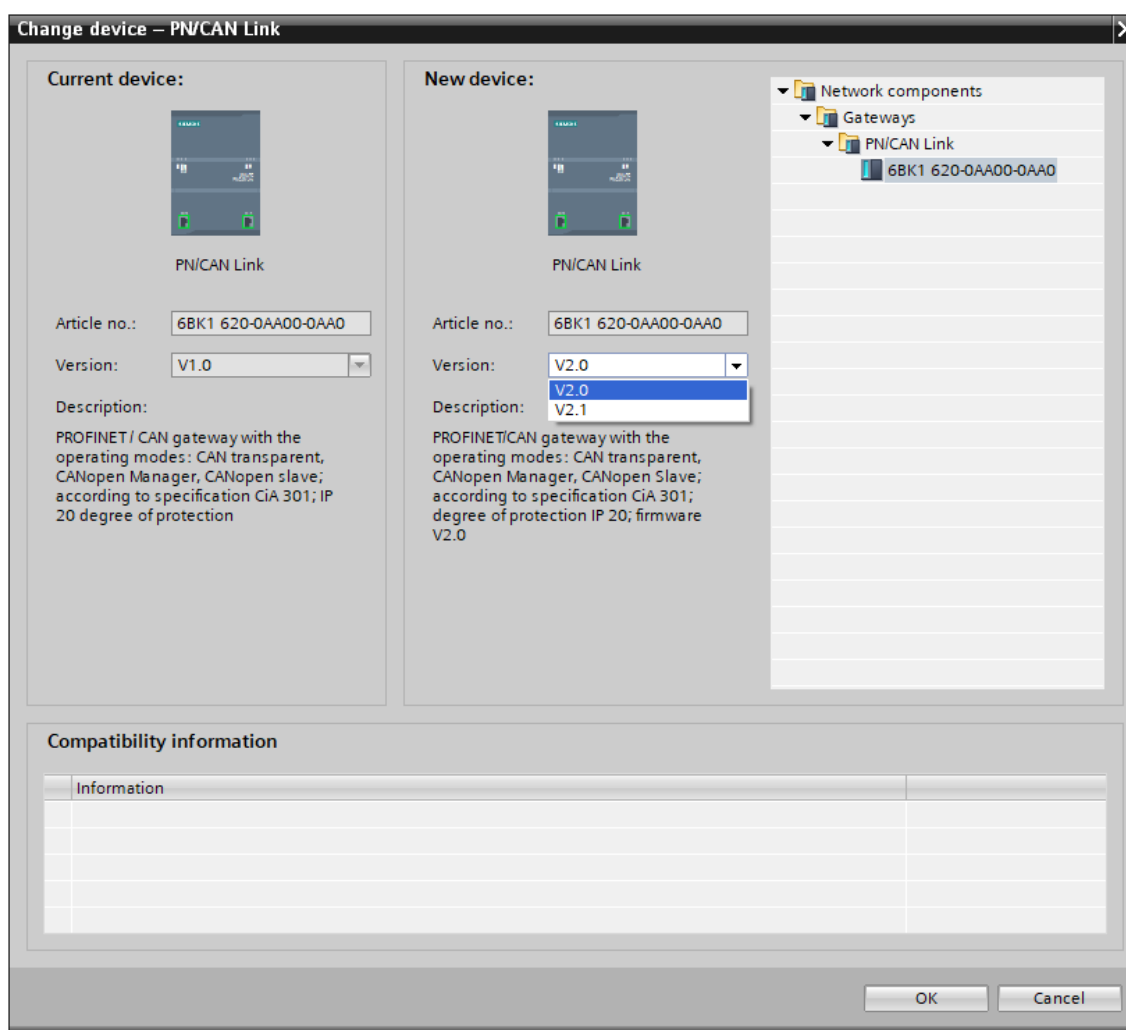


Figure 3-4 Change device

Notes for projects configured with TIA Portal V14 SP1

To use a PN/CAN LINK created in V14 SP1, follow these steps:

1. Click "Update module description". You must repeat this step for each individual PN/CAN LINK. After clicking the "Update module description" button, the "Change firmware version" button appears, and a message is shown at the bottom right stating that the PN/CAN LINK was updated successfully. Now you can use the PN/CAN LINK with its OD entries and nodes as needed.
2. If you want to use the firmware version V2.0 or higher, click "Change firmware version" and confirm the message output by clicking "OK". The firmware version 2.0 or higher is shown in the hardware catalog. All nodes and OD entries are visible and work as intended.

NOTICE

You are not permitted to transfer nodes, process data, messages between V1.0 and V2.0 within devices.

To avoid inconsistencies and ensure correct configuration, you must update the module description on all devices as follows:

- Use the "Update module description" button if you want to use firmware version V1.0.
- Use the "Update module description" and "Change firmware version" buttons if you want to use firmware version V2.0 or higher.

The transfer of nodes, process data, messages between V2.1 and V2.0 within devices is permitted.

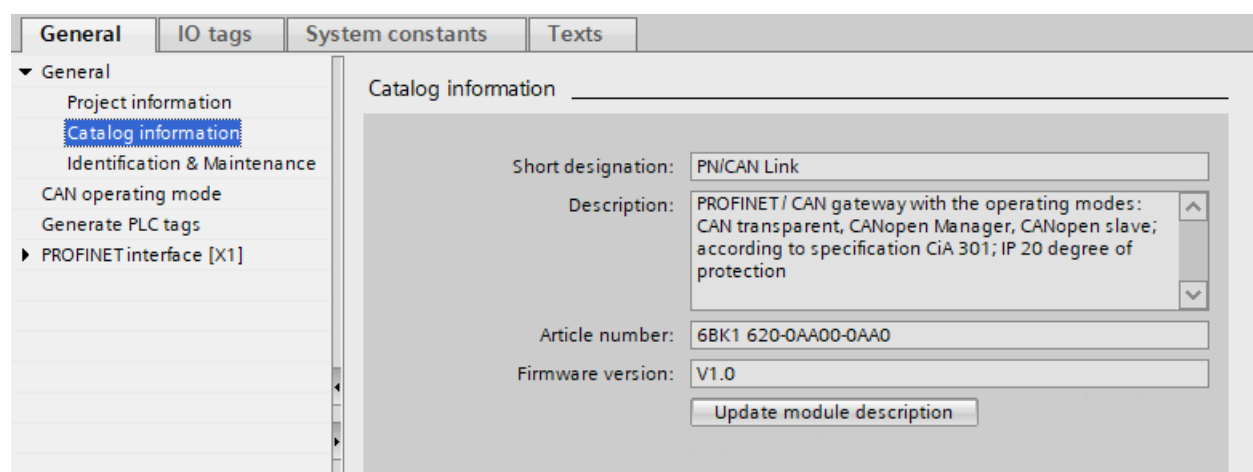


Figure 3-5 Update module description

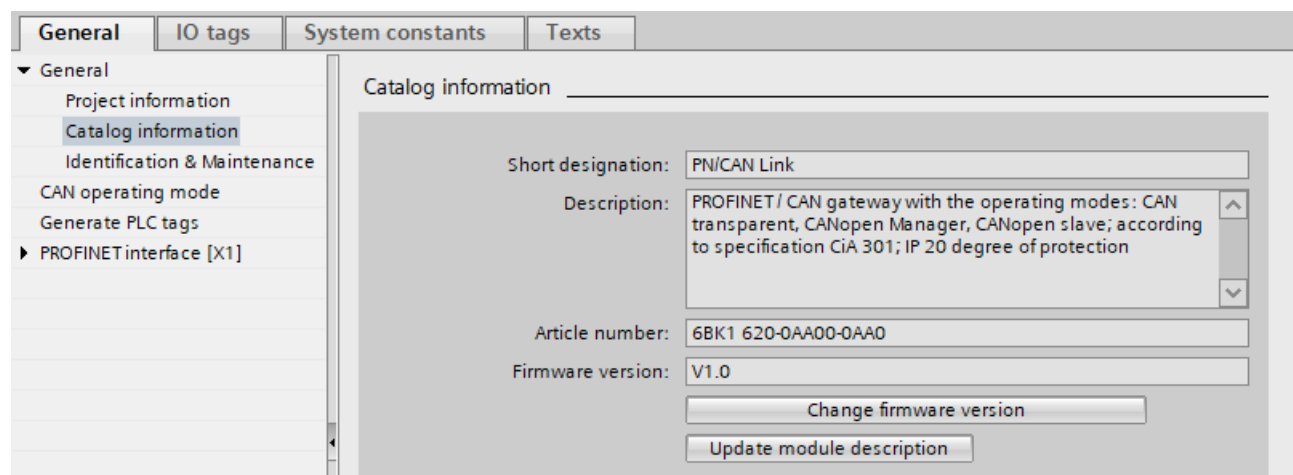


Figure 3-6 Changing the firmware version

System overview

4.1 Field of application



Figure 4-1 SIMATIC PN/CAN LINK

The SIMATIC PN/CAN LINK is a communication gateway and allows for the connection of SIMATIC controllers to the CAN fieldbus over PROFINET. This connection enables the exchange of information and data between PROFINET and CAN.

General features

- CAN interface according to ISO 11898-2 (High Speed CAN)
- 2 PROFINET interfaces (integrated switch) enable PROFINET line operation according to Conformance Class B (CC-B).
- In addition to the PROFINET and CAN protocol, the PN/CAN LINK also offers the CANopen protocol. This means the PN/CAN LINK can be operated as a CANopen node and can also take on the role of CANopen Manager in the CANopen network. The PN/CAN LINK can be operated in the following three modes:
 - CANopen Manager
 - CANopen Slave
 - CAN transparent
- The operating mode for the PN/CAN LINK is set via the associated HSP in the TIA Portal.
- The PN/CAN LINK supports both the standard format (CAN 2.0A) as well as the extended CAN format (CAN 2.0B).
- The PN/CAN LINK can operate up to 126 nodes in the CAN network in Manager mode.
- The CAN side supports baud rates from 50 kBaud up to 1000 kBaud.
- The maximum permissible cable length of the CAN network is up to 1000 m (dependent on data transmission rate, cable cross-section, number of nodes).

CANopen Manager

- CANopen implementation according to CANopen specification "CiA 301"
- The PN/CAN LINK can operate up to 126 slaves as CANopen Manager in the CANopen network.
- Network management functions according to CiA standard "CiA 302 Part 2".
If the PN/CAN LINK is operated as CANopen Manager, it takes over the following functions:
 - NMT Master: The PN/CAN LINK controls the NMT state of the other CAN devices and executes the boot-up procedure according to the CiA standard "CiA 302 Part 2".
 - Configuration Manager: The PN/CAN LINK configures the CANopen slaves during the boot-up procedure by means of SDO write access.
 - The PN/CAN LINK also supports the following CANopen standards:
 - CiA 303 Part 1 - Cabling and pin assignment V1.8.0
 - CiA 303 Part 3 - LED control - Display specification, V1.4.0
 - CiA 309 Part 4 - Mapping of data types and their conversion (Amendment 7 to Fieldbus Integration into PROFINET IO, V1.0.0)
 - The PN/CAN LINK does not support the following standards:
 - CiA 305 - regarding LSS functionality
 - CiA 306 - regarding XDD files
 - CiA 1301+CiA 601 - regarding CANopen FD (Flexible Data)

- I/O data are transmitted on the CANopen side with the help of process data objects (PDOs).
- All PDO transmission rates specified in the CiA301 standard are supported.
- Segmented SDO data transmission is supported.
- SYNC function as producer (sender) as well as consumer (receiver)
- "Heartbeat" function as producer (transmitter) as well as consumer (receiver)
- "Node Guarding" function as producer (transmitter) as well as consumer (receiver)
- "EMCY" (Emergency) function

CANopen Slave

- The PN/CAN LINK can be used as an "NMT slave" according to "CiA 302 Part 2". When the PN/CAN LINK is an NMT slave, another CANopen Manager configures the OD and thus which data is exchanged with which other devices.

CAN transparent

- The PN/CAN LINK can be operated in "CAN transparent" mode.
- All CANopen functions are disabled in "CAN transparent" mode.
- Control information as well as status information is exchanged cyclically between the PN/CAN LINK and the S7 controller in "CAN transparent" mode.
- Messages can be used in standard format as well as extended CAN format.
- Configured CAN messages with fixed message ID and fixed length can be used in "CAN transparent" mode.
- Programmed CAN messages for which the message ID and the length (max. 8 bytes) is not determined by the S7 user program until runtime can be used in "CAN transparent" mode.
- Users can send and receive CAN messages in the S7 automation program. For this purpose, "Transmit proxy modules" and "Receive proxy modules" can be configured in the TIA Portal.
- The PN/CAN LINK can forward data from received CAN messages to the S7 controller as PROFINET input data.
- The PN/CAN LINK can send CAN messages with PROFINET output data of the S7 controller.

4.2 System configuration

System configuration

The figure below shows a basic system configuration with a PN/CAN LINK as communication gateway between a PROFINET network and a CAN network.

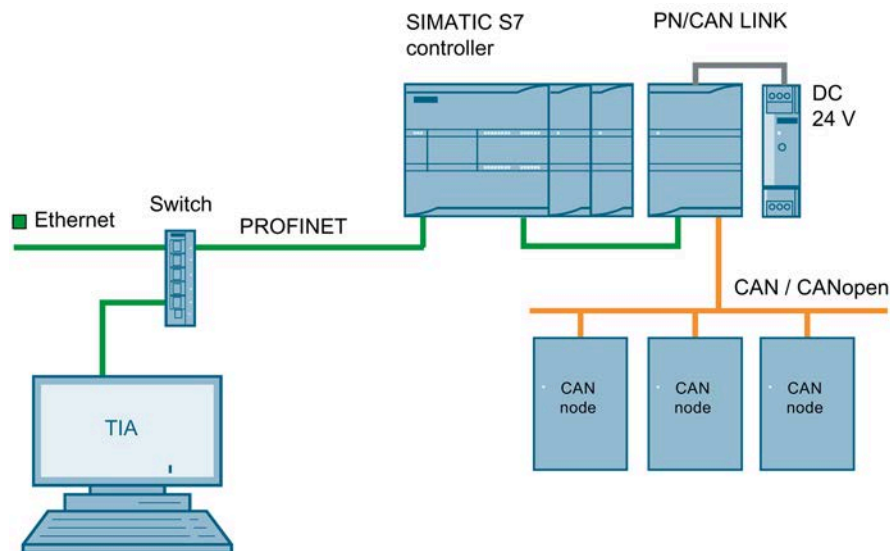


Figure 4-2 System configuration with PN/CAN LINK

Purpose and function of the system components

The PN/CAN LINK enables the connection of PROFINET to CAN.

The communication of the PN/CAN LINK with the CPU of the S7 controller takes place exclusively over the PROFINET interface.

From the PROFINET view, the PN/CAN LINK is an IO device according to Conformance Class B (CC-B).

The cyclic data exchange between the PN/CAN LINK and the connected SIMATIC CPUs is based on updating the IO image. Acyclic communication takes place by means of "Read/write data record" services.

An external power supply unit with 24 V DC or the 24 V power supply of the SIMATIC S7 system provides the power supply of the PN/CAN LINK.

The TIA Portal is used for configuring. A corresponding HSP is available for this purpose. The configuration of CANopen slaves is based on device description files (EDS) that are imported.

4.3 System requirements

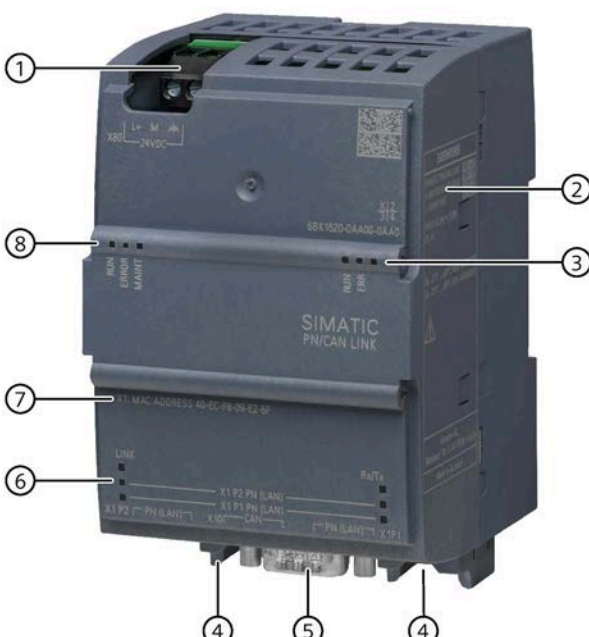
System requirements

- PN/CAN LINK
- Controller: SIMATIC S7-1200, SIMATIC S7-1500, SIMATIC ET 200SP and SIMATIC Open Controller are supported.
- 24 V voltage supply
- CAN bus
- PROFINET bus
- Windows PC (for configuring, commissioning and diagnostics)
- TIA Portal V14 or higher, you can find the required HSP on the Internet (<https://support.industry.siemens.com/cs/us/en/view/72341852>)

You can find an overview of all HSP/firmware versions in the chapter Version overview (Page 15).

4.4 Design

PN/CAN LINK design

Design	
	① 24 V DC + functional grounding
	② Nameplate
	③ Status LEDs CAN
	④ Ethernet connector (PROFINET)
	⑤ CAN connection
	⑥ Status LEDs Ethernet
	⑦ MAC address
	⑧ Status LEDs device + PROFINET

See also

24 V DC power supply (Page 94)

Operating state of the PN/CAN LINK / PROFINET diagnostics (Page 145)

Connecting PROFINET (Page 96)

Connecting the CAN bus (Page 98)

Functions

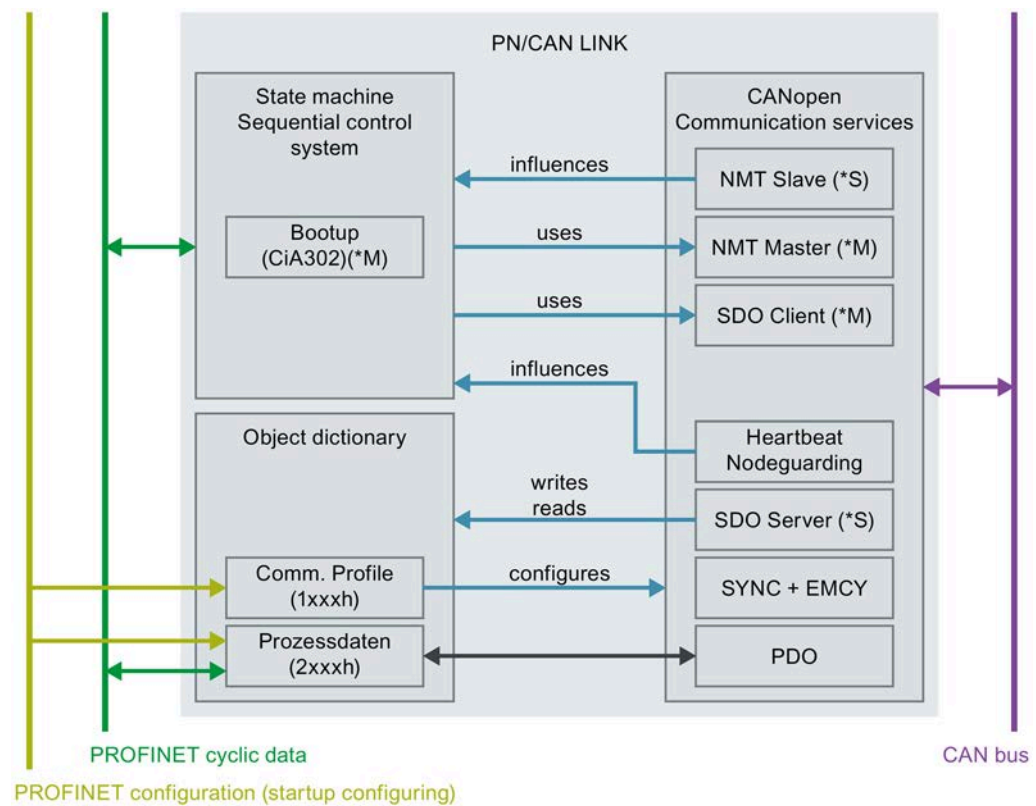
5.1 CANopen

5.1.1 Basic functions

5.1.1.1 Overview

Overview

The following overview diagram shows the correlations in the communication between CAN and PROFINET.



*M Only available in Manager mode

*S Only available in Slave mode

Figure 5-1 PN/CAN LINK principle of communication with CANopen

5.1.1.2 Object dictionary

Structure of the object dictionary (OD)

All communication objects and all user objects are organized in the object dictionary (OD).

The areas used by the PN/CAN LINK are:

OD entry	Meaning
0x1000 ... 0x1FFF	Communication profile
0x2000 ... 0x2FFF	Process data from/to PROFINET

Default settings and initialization

The default values specified for process data in the TIA Portal are used only for initialization of the values in the OD. The OD entries are created by the S7 controller during configuration of the PN/CAN LINK and preallocated with the configured values.

In "CANopen Manager" mode, the PN/CAN LINK remembers for all OD entries whose content was sent as cyclic PROFINET data to the S7 controller whether a PDO with the data has already been received since the last reset to the default values. In "CANopen Slave" mode, the PN/CAN LINK monitors whether the entries were written at least once per SDO or if a matching PDO was received. This information is compressed into one bit and sent cyclically as group status of all data in the PROFINET data to the S7 controller.

According to the CiA standard "CiA 301", the default values are always applied to the OD in the NMT state "Initialization", substate "Reset Application".

This state is passed through in the following cases:

- After configuration/reconfiguration of the PN/CAN LINK by the S7 controller
- After reset of the PN/CAN LINK by the reset bit from the S7 controller
- After receipt of the NMT command "Reset Node" (only in "CANopen Slave" mode)
- After reset of the PN/CAN LINK and all nodes due to a heartbeat error (only in "CANopen Manager" mode and only when the error response is configured accordingly, see Monitoring functions (Page 57))

The following actions are being executed in the process:

- The default value is written to the OD.
- The information whether the OD entry has been written by the CANopen side once before is reset.

5.1.1.3 Process data objects (PDO)

Process data objects

Process data are transmitted on the CANopen side by means of PDOs.

The PN/CAN LINK supports 512 PDOs for transmitting/receiving.

One entry exists in the OD for the "Communication parameters" and one entry for the "Mapping parameters" for each receive PDO (RX-PDO) and each transmit PDO (TX-PDO).

In the configuration you specify:

- The COB ID of the CAN message
- The format of the COB-ID (11b or 29b)
- The transmission mode (synchronous, event-controlled with timer, RTR)
- Whether or not the PDO is active
- The OD entries onto which the transmitted or received PDOs are mapped

Transmission types

The PN/CAN LINK supports the following PDO transmission types:

Transmission method	Description
Acyclic synchronous	PDO is transmitted during the next "SYNC" after a value change
Cyclic synchronous	Depending on the configuration, PDO is transmitted for each first to 240th "SYNC" regardless of value changes
RTR only	On request only (RTR message synchronous / asynchronous) PDO is only transmitted after a RTR message with the COB ID of the PDO was received. The PN/CAN LINK only supports transmission method "RTR only" for transmit PDOs and not for receive PDOs.
Manufacturer-specific event control Application-specific event control	These transmission types are event-controlled (asynchronous). PDO is transmitted following an event, that is a value change, as well as after expiration of a configured timeout, regardless of "SYNC". Event-controlled transmit-PDOs with transmission type 254 (manufacturer-specific) and transmission type 255 (application-profile specific) are also transmitted during the transition to the NMT state "Operational".

5.1.1.4 Service Data Objects (SDO)

The PN/CAN LINK enables read/write access from the S7 user program to the OD of other CANopen nodes by means of SDO.

The PN/CAN LINK provides 16 data records on the PROFINET side of the PN/CAN LINK which the S7 user program can access with the help of the acyclic PROFINET IO services RDREC (Read data record) and WRREC (Write data record).

Note

This functionality is only available in the "CANopen Manager" operating mode.

Detailed information is available in the section Acyclic data exchange between controller and PN/CAN LINK (Page 54).

5.1.1.5 EMCY messages

EMCY messages

The PN/CAN LINK transmits the following EMCY messages:

Error code	Meaning
0x8Fxx	Heartbeat or node guarding error for node <xx> Is transmitted when the PN/CAN LINK is in "CANopen Slave" operating mode and the heartbeat for a monitored node fails.
0x8130	General heartbeat or node guarding error. Is transmitted when the PN/CAN LINK is in "CANopen Slave" operating mode, node guarding is enabled and monitoring by the master fails.
0xFF90	Is transmitted when the connection to the S7 controller fails, that is when the connection (Application Relation) is terminated or when the data from the S7 controller has the IO provider status "Bad". When the PN/CAN LINK is operated as "CANopen Slave", this EMCY message is transmitted again when the NMT Manager tries to set the PN/CAN LINK to the "Operational" state.
0xFF91	Is transmitted when the PN/CAN LINK is operated as "CANopen Slave" and the desired state transmitted by the S7 controller in the cyclic data changes to "OFF". Is also transmitted when the NMT Manager tries to set the PN/CAN LINK to "Operational" state while the desired state transmitted in the cyclic data from the S7 controller is still "OFF".

The EMCY messages always use the default COB ID intended for this purpose.

5.1.1.6 Heartbeat / Node Guarding

The PN/CAN LINK supports the monitoring functions heartbeat and node guarding as sender (producer) as well as receiver (consumer).

- "CANopen Manager" operating mode: The parameters for heartbeat or node guarding are specified as part of the configuration.
- "CANopen Slave" operating mode: The settings for these two functions are written to the OD (0x100C, 0x100D, 0x1016 and 0x1017) of the PN/CAN LINK through SDO access by the CANopen Manager in charge of the CANopen network.

The HSP ensures that either heartbeat or node guarding is configured in "CANopen Manager" mode.

Note

The setting of the monitoring function made in the HSP applies to the entire network with all CANopen nodes. Mixed operation with different monitoring functions is not possible. Nevertheless, slave nodes without the Heartbeat or Node Guarding functions can also be put into operation.

Note

If a node does not support monitoring functions (or if Heartbeat and Node Guarding are disabled), a failure or fault of the node is **not** recognized by the PN/CAN LINK as CANopen Manager. Even when you select the "Node is mandatory on the network" option for this node, you must ensure that the required monitoring is in place.

Fault reaction

When a monitored CANopen device fails, the PN/CAN LINK signals corresponding diagnostic information to the S7 controller. In addition, an EMCY message is transmitted on the CANopen side, and the fault reaction configured or specified in the OD (0x1029) is executed.

The possible fault reactions for manager / slave are available in the following sections:

- CANopen Manager: Monitoring functions (Page 57)
- CANopen Slave: Monitoring functions (Page 66)

5.1.1.7 SYNC messages

The PN/CAN LINK supports the SYNC protocol as sender (producer) as well as receiver (consumer).

The SYNC consumer function is required for PDOs with "synchronous" transmission types (see Process data objects (PDO) (Page 39)).

In the configuration you specify whether the PN/CAN LINK is SYNC producer or SYNC consumer as well as the send interval. In "CANopen Manager" mode, a different CANopen slave can be configured as SYNC producer. The COB ID that must be used for this purpose can be changed in "CANopen Slave" mode by the manager with SDO. The default value for the COB ID is 0x80 in "CANopen Manager" mode.

Note

During SYNC, not less than 100 µs (internal time limit) can be set. Lower setting of OD 0x1006 is rejected if SYNC transmitter bit is detected in OD 0x1005.

Note

The SYNC function only has an effect on the CANopen side. It is not used to synchronize the data transmission on the CANopen side and the PROFINET side.

5.1.1.8 Data exchange between controller and PN/CAN LINK

Cyclic data exchange: Process data, control and status information

The process data configured in the HSP are transmitted cyclically as PROFINET data between S7 controller and PN/CAN LINK.

The exchanged process data are stored in the PN/CAN LINK as entries in the object dictionary (OD) (in index 0x2000 to 0x2FFF). The values of the process data received by the S7 controller are written to the OD by the PN/CAN LINK. The values of the process data to be transmitted to the S7 controller are read from the object directory.

Control information and status information is exchanged cyclically between the PN/CAN LINK and the S7 controller in "CANopen Manager" and in "CANopen Slave" mode.

The following controller information is cyclically transmitted by the S7 controller to the PN/CAN LINK:

- **Control bit for the state of the PN/CAN LINK**
The user can influence the data transmission in the PN/CAN LINK from the S7 program using a control bit.
- **Reset bit**
The user can reset the CANopen side in the PN/CAN LINK from the S7 program using a reset bit.

Detailed information on the control and status information is available here:

CANopen Manager (Page 51)

CANopen Slave (Page 63)

Cyclic data exchange: Calculation of net and gross data

PROFINET limits

Gross data length for input/output data of an IO device: 1440 bytes

Gross data length for input and output data of an IO device: 2880 bytes

Net data length for input/output data of an IO device: 1280 bytes

Net data length for input and output data of an IO device: 2560 bytes

The calculation of the gross and net data of an IO device is performed during the compile. If the limit values are exceeded, an error message is displayed at the interface.

Net data

The net data of the PN/CAN LINK is the data for which I/O addresses are assigned, i.e. for modules (CANopen Manager, CANopen Slave, CAN transparent) and CAN process data.

Gross data

In cyclic data exchange, additional status bytes are transmitted to ensure consistency. The sum of net data and status bytes provides the gross data.

- Each submodule with IO data has one status byte for input data and one status byte for output data. These submodules are PN/CAN LINK (rack 0, slot 0), interface and ports.
- In addition to the configured data bytes (net data), each submodule with only input or output data has a status byte for input data and a status byte for output data. These submodules are the CAN process data (OD data, messages).
- Each submodule with input and output data has two status bytes for input data and two status bytes for output data in addition to the configured data bytes (net data). These submodules are the CAN process data (proxies).

Submodule	Input data (bytes)	Output data (bytes)	Status byte input data	Status byte output data
PN/CAN LINK (rack 0, slot 0)	0	0	1	1
Interface	0	0	1	1
Port 1	0	0	1	1
Port 2	0	0	1	1
CANopen network	1	1	2	2
Transmit data/transmit message	0	x	1	1
Receive data/receive message	y	0	1	1
Transmit and receive data	y	x	2	2

Example with PN/CAN LINK

Device overview							
...	Module	Rack	Slot	I address	Q address	Type	Article no.
	▼ Link_1	0	0			PN/CAN Link	6BK1 620-0AA00-0AA0
	▼ PROFINET-Schnittstelle	0	0 X1			PROFINET interface	
	Port_1	0	0 X1 P1			Port	
	Port_2	0	0 X1 P2			Port	
	▼ CAN transparent	0	1			CAN transparent	6BK1 620-0AA00-0AA0
	CAN network	0	1 0	0	0	CAN transparent	
	Transmit message_1	0	1 1		1...8	Transmit message	
	Transmit message_2	0	1 2		9...12	Transmit message	
	Receive message_1	0	1 3	1...8		Receive message	
	Receive proxy_1	0	1 4	9...21	13	Receive proxy	
	Transmit proxy_1	0	1 5	22	14...26	Transmit proxy	
		0	1 6				

Figure 5-2 Example PN/CAN LINK transparent

5.1 CANopen

Submodule	Input data (bytes)	Output data (bytes)	Status byte input data	Status byte output data
PN/CAN LINK (rack 0, slot 0)	0	0	1	1
Interface	0	0	1	1
Port 1	0	0	1	1
Port 2	0	0	1	1
CAN network	1	1	2	2
Transmit message_1	0	8	1	1
Transmit message_2	0	4	1	1
Receive message_1:	8	0	1	1
Receive proxy_1	13	1	2	2
Transmit proxy_1	1	13	2	2
Sum	23	27	13	13

In this example, the following values are calculated:

- Net data: 23 bytes for input data and 27 bytes for output data
- Gross data: 36 bytes for input data and 40 bytes for output data

Acyclic data exchange

The PN/CAN LINK provides 16 data records on the PROFINET side of the PN/CAN LINK which the S7 user program can access with the help of the acyclic PROFINET IO services RDREC (Read data record) and WRREC (Write data record).

Detailed information can be found under Acyclic data exchange between controller and PN/CAN LINK (Page 54).

5.1.1.9 Conversion of data formats between PROFINET and CANopen

The process data are automatically converted from PROFINET to CANopen data format and vice versa according to the configured data type.

The S7 controller interprets data in the "Big Endian" format. CANopen and the processors used in the PN/CAN LINK use the "Little Endian" format. This means the sequence of bytes is adjusted for all data types that exceed 1 byte.

Conversion takes place prior to writing the process data received by the S7 controller to the OD or before the process data read from the OD are sent to the S7 controller.

The following table provides an overview of the data types supported by the PN/CAN LINK and their conversion.

Conversion

PROFINET data type	CANopen data type	Conversion
Integer 8	INTEGER 8	None
Integer 16	INTEGER 16	Byte sequence is automatically converted.
Integer 32	INTEGER 32	
Integer 64	INTEGER 64	
Unsigned 8	UNSIGNED 8	None
Unsigned 16	UNSIGNED 16	Byte sequence is automatically converted.
Unsigned 32	UNSIGNED 32	
Unsigned 64	UNSIGNED 64	
Float 32 / float	REAL 32	
Float 64 / double	REAL 64	
Bool	Bool	None

Note

The "Bool" data type is only available as of firmware version PN/CAN LINK 2.0.

5.1.2 CANopen Manager

The PN/CAN LINK can be used as a CANopen Manager according to CiA 302 Part 2.

If the PN/CAN LINK is operated as CANopen Manager, it takes over the following functions in CANopen:

- NMT Master: The PN/CAN LINK controls the NMT state of the other CAN devices and executes the boot-up procedure according to the CiA standard CiA 302 Part 2.
- Configuration Manager: The PN/CAN LINK configures the CANopen slaves during the boot-up procedure by means of SDO write access.

5.1.2.1 State model

State model

The state model in "CANopen Manager" mode is based on the NMT state model described in the CiA standard "CiA 301" taking into account the network management function.

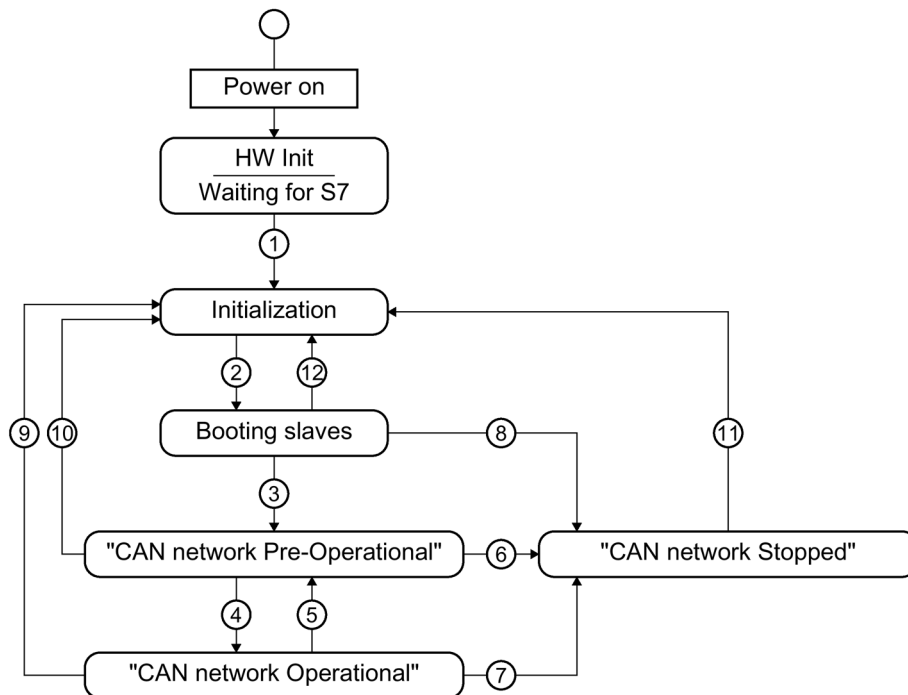


Figure 5-3 State model CANopen Manager

PN/CAN LINK states

Below you will find a description of the states in the "CANopen Manager" mode:

PN/CAN LINK state	Meaning
HW Init / Waiting for S7	The state of the PN/CAN LINK during booting and when the PN/CAN LINK has not been fully configured by the S7 controller yet.
Initialization	Initialization state: Resetting the OD to the values configured in the HSP and resetting the communication. The state is not "visible" on the CANopen side because there is no CAN communication in this state. The NMT state of the slaves connected via CANopen does not change.
Booting slaves	The PN/CAN LINK runs the boot-up procedure according to CiA standard "CiA 302 Part 2" and configures the CANopen slaves with SDO. The PN/CAN LINK has the NMT state "Pre-Operational". The NMT state of the slaves connected via CANopen is "Pre-Operational" after booting.
CAN network Pre-Operational	All slaves connected via CANopen and the PN/CAN LINK are in the "Pre-Operational" state.
CAN network Operational	All slaves connected via CANopen and the PN/CAN LINK are in the "Operational" state.
CAN network Stopped	All slaves connected via CANopen and the PN/CAN LINK are in the "Stopped" state.

State transitions

Below you will find a description of the state transitions in the "CANopen Manager" mode:

Transition	Meaning / trigger
1	Takes place as soon as the PN/CAN LINK is configured by the S7 controller for the first time after booting.
2	Takes place automatically. A "Boot-Up" message is sent because the PN/CAN LINK changes to NMT state "Pre-Operational".
3	Takes place when all configured "mandatory" CANopen slaves are available and have been booted successfully.
4	Takes place when the control bit in the cyclic data from the S7 controller is set to "ON". With this transition all CANopen slaves that are completely booted are set to "Operational" by NMT.
5	Takes place when the control bit in the cyclic data from the S7 controller is set to "OFF". With this transition all CANopen slaves that are completely booted are set to "Pre-Operational" by NMT.
6, 7, 8	Is triggered by a heartbeat / node-guarding error of a "mandatory" slave if configured accordingly (NMT Master error behavior is "Stop the PN/CAN LINK and all nodes"). With this transition all CANopen slaves are set to "Stopped" by NMT.
9, 10, 11, 12	Triggered by: • A heartbeat / node-guarding error of a "mandatory" slave if configured accordingly (NMT Master error behavior is "Restart of the PN/CAN LINK"). • Reset bit contained in the cyclic data from the S7 controller • Reconfiguration by the S7 controller • Error during boot-up (except heartbeat/node-guarding errors)

5.1.2.2 Control and status information

Controller information

The following controller information is cyclically transmitted by the S7 controller to the PN/CAN LINK:

Table 5- 1 Structure of controller information in the PROFINET IO data (from S7 controller to PN/CAN LINK, 1 byte)

Bit	Meaning	Value	Note
7 ... 3	Reserved	Must be "0"	--
2	Configuration bit	1	The manager configures nodes in the boot-up state. A successfully configured node can switch to the "Pre-Operational" state.
		0	The manager cannot configure nodes in the boot-up state (the NMT status with the boot-up state has been received by the node).
1	Reset bit	1	The CANopen side is reset when the bit changes to "1". All nodes are reset by NMT command "Reset node" and the start-up procedure is restarted. All OD entries are reset to initial values. The PN/CAN LINK acknowledges receipt of the reset command by setting the reset acknowledgment bit in the data for the S7 controller to "1". The S7 controller can then set the reset bit to "0".
		0	When the reset has been performed and the reset bit is "0", the PN/CAN LINK sets the reset acknowledgment bit to "0". Only then can a reset be performed again.
0	Control bit	0	CANopen network is not supposed to be "Operational". If the current state of the CAN network is "Operational", a switchover to "CAN network Pre-Operational" state occurs, that is all nodes and the PN/CAN LINK are set to "Pre-Operational" with an NMT command.
		1	CANopen network should be "Operational". If the current state of the CAN network is "Pre-Operational", a switchover to "CAN network Operational" state occurs: All nodes and the PN/CAN LINK are set to "Operational" with an NMT command. Note: If the configured NMT Master error behavior is "Restart the triggering node" or when slaves are not configured as "mandatory", it is possible that not all slaves are booted completely with this state transition. The slaves are not started with an NMT command "to all" in this case. An NMT command is sent instead to each fully booted slave individually. As soon as the other slaves are completely booted, they are also switched to "Operational" with an NMT command.

Status information

The following status information is transmitted cyclically from the PN/CAN LINK to the S7 controller:

Table 5- 2 Structure of status information in the PROFINET IO data (from PN/CAN LINK to S7 controller, 1 byte)

Bit	Meaning	Possible values		Note
7	NMT status feedback	0	One/multiple slaves are rebooted or the gateway state is not "CAN network Pre-Operational" or "CAN network Operational"	Bit indicates whether all slaves have already returned the NMT status that matches the PN/CAN LINK status.
		1	Gateway state is "CAN network Pre-Operational" or "CAN network Operational" and all nodes have the gateway state that is signaled in bit 5 ... 3.	--
6	Reset acknowledgment bit	0	PN/CAN LINK is ready for reset.	To provide feedback about the resetting of the CANopen side to the user program running on the S7 controller, the reset acknowledgment bit is used in the data that is cyclically sent from the PN/CAN LINK to the S7 controller. As soon as the command for resetting the CANopen side has been received, this bit is set to "1". Afterwards the user program running on the S7 controller must set the reset bit to "0". When the reset of the CANopen side is complete, the PN/CAN LINK sets the reset acknowledgment bit to "0".
		1	The PN/CAN LINK is currently performing or has performed a reset but the reset bit of the S7 controller is still set to "1".	--
5 ... 3	PN/CAN LINK state	0	Booting slaves	--
		1	CAN network "Pre-Operational"	--
		2	CAN network "Operational"	--
		3	CAN network "Stopped"	--
		4	Waiting for boot-up enable	If this state is being signaled continuously, bit 2 in the control byte must be set to "1".
		5...7	Reserved	--
2	Group status of all data	0	There are receive OD entries whose values have not yet been updated by a corresponding PDO since the last reset.	--
		1	All receive OD entries have been updated at least once by a PDO since the last reset.	--

Bit	Meaning	Possible values		Note
1 ... 0	State of the CAN controller	0	Off	When specified accordingly by the S7 controller.
		1	Bus Off	Error counter ¹⁾ has exceeded the specified threshold, or PN/CAN LINK needs more than 2 seconds to synchronize itself to the CAN bus. As a result, the PN/CAN LINK stops transmitting/receiving any packages.
		2	Error Passive	Error counter ¹⁾ has reached the specified threshold. The PN/CAN LINK continues to transmit/receive packages.
		3	Error Active	Error counter ¹⁾ is below a specified threshold. This is the normal state. Everything is okay.

1) The error counters customary in CAN and their associated thresholds are internal functions that are not visible to the user.

Note

For values made up of multiple bits, the first bit is the MSB and the last bit is the LSB.

Example: Bit 1 ... 0 = "2" means that bit 0 = "0" and bit 1 = "1".

5.1.2.3 Acyclic data exchange between controller and PN/CAN LINK

Acyclic data exchange

The PN/CAN LINK provides multiple data records for the CANopen Manager module on the PROFINET side, which the S7 user program can access with the acyclic PROFINET IO services RDREC (read data record) und WRREC (write data record). These data records are not available to the configured CANopen slaves.

16 data records are available for SDO reading and for SDO writing.

The data record indices in use are 0x200 to 0x20F.

Note

A data record for a (sub)module in PROFINET is uniquely defined by an "index" that specifies the data record number. The index is a 32-bit integer. Different data records differ in their index.

Each data record represents an independent communication channel that can be used independently of the other channels. SDO communication is initiated with the corresponding data record with the help of the services RDREC (read data record) and WRREC (write data record). A WRREC is always run first to transfer the desired SDO command to the PN/CAN LINK; it is followed by a RDREC to the same index to retrieve the result. RDREC may have to be repeated multiple times if the PN/CAN LINK returns information that SDO access has not yet finished (status code = "Busy").

A maximum of 128 bytes are transmitted during an SDO access.

WRREC: Write data record

Data record size: 7 bytes for SDO read access, 7 bytes + <data length> for SDO write access

Table 5- 3 Structure of the data to be written with WRREC (write data record)

Byte	Value for "Read SDO"	Value for "Write SDO"
0	Command = 0x52 = 82 ("R")	Command = 0x57 = 87 ("W")
1	Node ID	
2 ... 3	OD index (Big Endian, which means MSB of the value in byte 2 and LSB in byte 3)	
4	OD subindex	
5 ... 6	Number of bytes to be read with SDO (Big Endian), permitted are 1 ... 128	Number of bytes to be written with SDO (Big Endian)
7 ... <END>	<missing>	Bytes to be written

WRREC access can be successful or return one of the following error codes.

These are standardized error codes in PROFINET, which are used in adapted form for transmission of SDOs.

Table 5- 4 Error codes

Error code (Hex)	Meaning
DF80B200	Module is incorrect (data record must be called on "CANopen Manager" submodule)
DF80B000	Data record index is incorrect (not 0x200 ... 0x20F)
DF80B100	Written size of data record from S7 controller is too small
DF80B800	"Code" field not "R" or "W"
DF80B800	"NodeID" invalid (node not configured)
DF80B800	"Number of bytes" field invalid (permitted: 1 ... 128)
DF80B500	No completely and validly configured PROFINET connection (Application Relation) is established
DF80A900	PN/CAN LINK is not "CANopen Manager"
DF80C300	Node not completely booted or heartbeat/node guarding error after booting
DF80C200	Communication channel (data record index) is already "busy". The PN/CAN LINK first expects a RDREC before it permits a new WRREC.

When an error is recognized, SDO access is not even triggered.

RDREC: Read data record

Data record size: 12 + <data length> bytes for SDO read access, 10 bytes for SDO write access

The values of the SDO command, that is the prior WRREC operation, are returned in the first 5 bytes. This means S7 can ensure that a data record is not used in multiple locations of the S7 application at the same time.

Byte	Value for "Read SDO"	Value for "Write SDO"
0	Command = 0x52 = 82 ('R')	Command = 0x57 = 87 ('W')
1	Node ID	
2 ... 3	OD index (Big Endian, which means MSB of the value in byte 2 and LSB in byte 3)	
4	OD subindex	
5	Status code	
6 ... 9	Additional information error code (Big Endian, which means MSB of the value in byte 6 and LSB in byte 9)	
10 ... 11	Number of read bytes (Big Endian) (only available when status code = OK)	<missing>
12 ... <END>	Data (only available when status code = OK)	<missing>

RDREC access can be successful or return one of the following error codes.

Table 5- 5 Error codes

Error code (Hex)	Meaning
DE80B200	Module is incorrect (data record must be called on the CANopen Manager submodule)
DE80B000	Incorrect data record index (not 0x200 to 0x20F)
DE80B500	No completely and validly configured PROFINET connection (Application Relation) is established
DE80A900	PN/CAN LINK is not CANopen Manager
DE80C300	No previous successful WRREC
DE80B700	Read buffer too small

If RDREC returns no error, the S7 user program can evaluate the data transmitted by the PN/CAN LINK. The "Status code" field can have the following values:

Status code	Meaning
0	OK, SDO completed successfully
1	SDO aborted or not yet started because a reset was triggered by PROFINET or the boot operation for the node was restarted
2	SDO aborted or not yet started because once the node was successfully booted it had a heartbeat or node-guarding error
3	SDO started but aborted by the PN/CAN LINK (cause according to CiA 301 in error code additional information)
4	SDO started but SDO abort received (received cause according to CiA 301 in additional information error code)
255	Busy = SDO access not complete yet. RDREC must be repeated.

Following an abort of SDO access (triggered by the PN/CAN LINK itself or by the slave addressed via SDO), the "Additional information error code" field is filled with the SDO abort code according to CiA 301.

The SDO access for the PN/CAN LINK is completed with the finished RDREC. The device is then ready for a new SDO command. An additional RDREC without preceding successful WRREC returns an error code.

5.1.2.4 Monitoring functions

The PN/CAN LINK supports the monitoring functions "Heartbeat" and "Node guarding" as sender (producer) as well as receiver (consumer). One of these two monitoring functions must be activated. You can select the monitoring function under CANopen Manager > Error control (heartbeat / node guarding) .

Heartbeat

The PN/CAN LINK can be operated as heartbeat producer and as heartbeat consumer.

The required monitoring times (transmit interval, receive interval) can be configured in the device configuration in TIA Portal.

Note

If a problem with the configuration occurs with the "Heartbeat" function, set the error response to "Stop the link and all nodes" and check the diagnostic buffer.

Note

As of firmware version V2.0

The "Heartbeat" function can be disabled by setting the Transmit interval and the Monitoring time to "0".

Node guarding

A node guarding monitoring can be configured. The parameters required for this purpose "Monitoring time" and "Repetition factor" can be set. The PN/CAN LINK can be both a transmitter and a receiver.

Note

As of firmware version V2.0

The "Node Guarding" function can be disabled by setting the Repetition factor or the Monitoring time to "0".

Error responses

The PN/CAN LINK saves the current state of the slaves configured in the HSP. When a monitored CANopen slave fails or changes to an unexpected state, the PN/CAN LINK signals corresponding diagnostic information to the S7 controller. If the slave is configured as "mandatory in the network", the specified error response is executed.

The following reactions can be set for the failure of a mandatory node:

Reaction	Description
Restart of triggering node	The CANopen slave is reset with NMT and the boot-up procedure including configuration is restarted for this slave. The state of the PN/CAN LINK and the state of the other CANopen slaves does not change.
Restarting the device (PN/CAN LINK) and all nodes	All CANopen slaves are reset via NMT and the boot-up procedure including configuration is restarted for all slaves.
Stop link and all nodes	The state of the PN/CAN LINK changes to "CAN network Stopped" and all CANopen slaves are set to "Stopped" via NMT. The state can be exited with a reset (either by the reset bit in the cyclic data from the S7 controller or by configuring the PN/CAN LINK again with the S7 controller). Note: Use this response to troubleshoot the CAN bus.

Note

- CANopen slaves that are not configured as "mandatory" by the user do not trigger the set error response. When such a slave fails or signals an unexpected state, the slave is reset with NMT and the boot-up procedure including configuration is restarted for this slave. The gateway state and the state of the other CANopen slaves does not change.
- If the error response is "Restart of the device (PN/CAN LINK) and all nodes" or "Stop link and all nodes", the following applies: The triggered error response has an effect on the "mandatory" slaves as well as those that were not configured as "mandatory" by the user.

As of firmware version V2.0:

- When the "Enable diagnostic alarms for not mandatory nodes" check box is selected, the master works exactly as the original device version 1.0. This means all error messages are sent to the diagnostic buffer and the ERROR LED lights up.
 - When the "Enable diagnostic alarms for not mandatory nodes" check box is cleared, no error messages are sent to the diagnostic buffer and the ERROR LED remains off.
-

5.1.3 CANopen Slave

When the PN/CAN LINK is operated in "CANopen Slave" mode, it does not take over the function of the NMT Master or that of the Configuration Manager.

If the PN/CAN LINK is operated in "CANopen Slave" mode, most of the configuration settings, such as those for heartbeat or for PDOs, are not made in the TIA Portal but are written to the OD of the PN/CAN LINK during boot-up by the CANopen Manager responsible for the CANopen network via SDOs.

Note

Retentive storage in the PN/CAN LINK of the configuration received from a CANopen Manager in "CANopen Slave" mode is not supported.

5.1.3.1 Object dictionary

In "CANopen Slave" mode the PN/CAN LINK offers the following OD entries. The "Access type" column specifies whether the entry can be read (R) or written (W) via SDOs.

OD entry	Access type	Meaning
0x1000	R	Device type (always "0")
0x1001	R	Current error state
0x1003	R	List of errors that occurred (max. 4 entries)
0x1005	RW	COB ID for SYNC message together with the setting of whether the PN/CAN LINK is a SYNC producer.
0x1006	RW	Interval for SYNC messages
0x1008	R	Device name as character string. Default: "PN/CAN LINK Slave"; the entry can be edited, see Configuring in the TIA Portal (Page 127), section "Setting communication parameters > Vendor device name"
0x1009	R	Hardware version as character string. Corresponds to the HW version that can also be read out via PROFINET and IM0.
0x100A	R	Software version as character string. Corresponds to the SW version that can also be read out via PROFINET and IM0, for example, "V 1.0.0 [Build xxx]".
0x100C	RW	"Guard Time" for the node guarding protocol
0x100D	RW	"Life Time Factor" for the node guarding protocol
0x1014	RW	COB ID for EMCY messages sent by the PN/CAN LINK
0x1016	RW	Field for "Receiver Heartbeat Time", that is the setting of which CANopen nodes the PN/CAN LINK monitors via heartbeat.
0x1017	RW	"Heartbeat producer time" Interval at which the PN/CAN LINK sends heartbeat messages.
0x1018	R	Identity Object, identifies the device
0x1029	RW	Determines the error behavior of the PN/CAN LINK. Only the entry for "Communication errors" is implemented.
0x1200	R	SDO Server Channel
0x1400-0x15FF	RW	RX-PDO Communication parameters

0x1600-0x17FF	RW	RX-PDO Mapping parameters
0x1800-0x19FF	RW	TX-PDO Communication parameters
0x1A00-0x1BFF	RW	TX-PDO Mapping parameters
0x2xxx	RW	Entries for the process data to be exchanged with the S7 controller. Entries for input data, that is data that comes from the S7 controller, are "Read Only" in CANopen.

5.1.3.2 State model

State model

The state model in "CANopen Slave" mode is based on the NMT state model described in the CiA standard "CiA 301".

The figure below shows the states of the PN/CAN LINK in "CANopen Slave" mode.

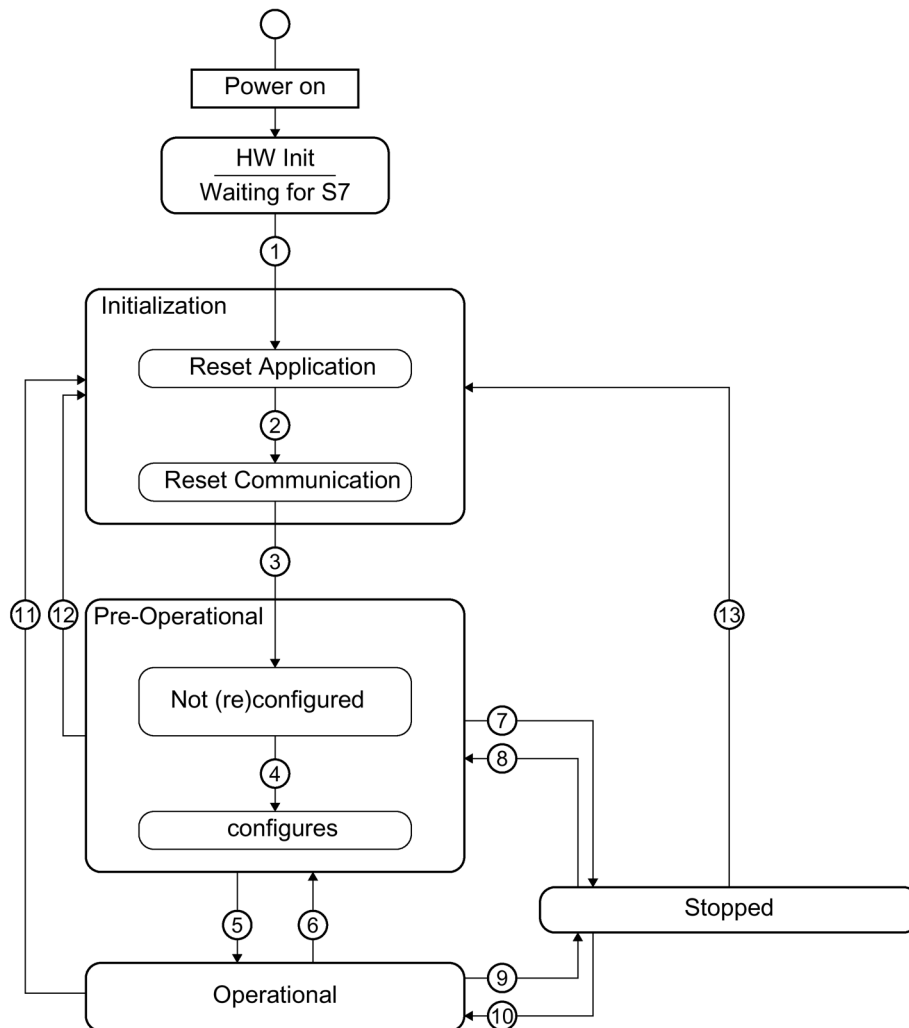


Figure 5-4 State model CANopen Slave

PN/CAN LINK states

The PN/CAN LINK can take on the following states in "CANopen Slave" mode:

State	Meaning
HW Init / Waiting for S7	The state of the PN/CAN LINK during booting and when the PN/CAN LINK is not yet completely configured by the S7 controller. Note: This is not an NMT state defined in CANopen standard.
Initialization	Initialization state The entries made by the CANopen Manager in the "Communication parameters" are reset to factory settings. All parameters configured in the HSP are reset to the values set in the HSP. Communication is reset as well. CANopen distinguishes between substates: "Reset Application": The OD entries not equal to 0x1xxx are reset. For PN/CAN LINK these are the process data exchanged with the S7 controller. "Reset Communication": The OD entries of the "Communication Profile Area" (OD 0x1xxx) are reset and thus the CANopen communication.
Pre-Operational	In this state the CANopen Manager can configure the slaves and synchronize them with SYNC. Except for PDOs all other types of communication are active (e.g.: SYNC, SDO, Heartbeat)
Operational	Normal operation, all types of communication are active
Stopped	Only heartbeat / node guarding are active but device can still be controlled via NMT, "application OFF state"

State transitions

State transitions in "CANopen Slave" mode:

Transition	Meaning / trigger
1	Takes place automatically if the PN/CAN LINK has been configured for the first time since boot-up of the S7 controller
2	Takes place automatically.
3	Takes place automatically. A "Boot-up" message is sent.
4	No "real" transition because CANopen does not know "configured" / "not configured" state. But: During configuration by the CANopen Manager, the communication behavior of the PN/CAN LINK changes, for example, when the manager has configured "Heartbeat".
5	Triggered by an NMT command from the CANopen Manager.
6	Triggered by an NMT command from the CANopen Manager, by a communication error when OD 0x1029 was configured accordingly or when the control bit sent by the S7 controller in the cyclic data changes to "OFF".
7	Triggered by an NMT command from the CANopen Manager or by a communication error when OD 0x1029 was configured accordingly.
8	Triggered by an NMT command from the CANopen Manager.
9	Triggered by an NMT command from the CANopen Manager or by a communication error when OD 0x1029 was configured accordingly.
10	Triggered by an NMT command from the CANopen Manager.
11, 12, 13	Can be triggered by: • An NMT command from the CANopen Manager (depending on the command, transition to "Reset Application" or "Reset Communication" substate) • The reset bit from the S7 controller (transition to "Reset Application" substate) • Reconfiguration by the S7 controller (transition to "Reset Application" substate)

5.1.3.3 Control and status information

Controller information

The following controller information is cyclically transmitted by the S7 controller to the PN/CAN LINK:

Table 5- 6 Structure of controller information in the PROFINET IO data (from S7 controller to PN/CAN LINK, 1 byte)

Bit		Value	Meaning
7 ... 2	Reserved	Must be "0"	--
1	Reset bit	1	The CANopen side is reset when the bit changes to "1". All OD entries are reset to initial values and the boot-up message is sent. The CANopen Manager must configure and start the PN/CAN LINK again in this case. The PN/CAN LINK acknowledges receipt of the reset command by setting the reset acknowledgment bit in the data for the S7 controller to "1". The S7 controller can then set the reset bit to "0".
		0	When the reset has been performed and the reset bit is "0", the PN/CAN LINK sets the reset acknowledgment bit to "0". Only then can a reset be performed again.
0	Control bit	0	The PN/CAN LINK must not be in the NMT state "Operational". If the current state is "Operational", the PN/CAN LINK changes to the state "Pre-Operational". Commands from the NMT master to change to the "Operational" state are ignored.
		1	The PN/CAN LINK can be switched by the NMT master via NMT command to the "Operational" state.

Status information

The following status information is transmitted cyclically from the PN/CAN LINK to the S7 controller:

Table 5-7 Structure of status information in the PROFINET IO data (from PN/CAN LINK to S7 controller, 1 byte)

Bit	Meaning	Possible values		Note
7	Reserved	--	--	--
6	Reset acknowledgment bit	0	The PN/CAN LINK is ready for reset.	A reset acknowledgment bit is used in the data that are transmitted cyclically from the PN/CAN LINK to the S7 controller to provide feedback to the S7 controller regarding the reset of the CANopen side. As soon as the command for resetting the CANopen side has been received, this bit is set to "1". The S7 controller must then set the reset bit to "0". When the reset of the CANopen side is complete, the PN/CAN sets the reset acknowledgment bit to "0".
		1	The PN/CAN LINK is currently performing or has performed a reset but the reset bit of the S7 controller is still set to "1".	
5 ... 3	PN/CAN LINK state	0	Reserved	--
		1	PN/CAN LINK state "Pre-Operational"	--
		2	PN/CAN LINK state "Operational"	--
		3	PN/CAN LINK state "Stopped"	--
		4 ... 7	Reserved	--
2	Group status of all data	0	There are receive OD entries whose values have not yet been updated by a corresponding PDO since the last reset.	--
		1	All receive OD entries have been updated at least once by a PDO or SDO since the last reset.	--

Bit	Meaning	Possible values		Note
1 ... 0	State of the CAN controller	0	Off	When specified accordingly by the S7 controller.
		1	Bus Off	Error counter ¹⁾ has reached the specified second threshold. As a result, the PN/CAN LINK can no longer transmit/receive any packages. Note: "Bus-Off" is also signaled when the PN/CAN LINK needs more than two seconds to synchronize with the CAN bus.
		2	Error Passive	Error counter ¹⁾ has exceeded the specified first threshold. The PN/CAN LINK still transmits/receives packages.
		3	Error Active	Error counter ¹⁾ is below a specified threshold. The PN/CAN LINK transmits/receives packages. This is the normal state. Everything is okay.

1) The error counters customary in CAN and their associated thresholds are internal functions that are not visible to the user.

Note

For values consisting of multiple bits, the first bit is the MSB and the last bit the LSB.

Example: Bit 1 ... 0 = "2" means that bit 0 = "0" and bit 1 = "1".

5.1.3.4 Monitoring functions

The device supports heartbeat and node guarding as sender (producer) as well as receiver (consumer). The settings for these two functions are written to the OD of the PN/CAN LINK through SDO access by the CANopen Manager in charge of the CANopen network.

When a monitored CANopen device fails, the PN/CAN LINK signals corresponding diagnostic information to the S7 controller. In addition, an EMCY message is transmitted on the CANopen side, and the error response specified in the OD entry "ErrorBehaviour" at address 0x1029, subindex 0x01, is executed.

Error responses

The following error responses are supported:

Subindex value	Description
0x00	Change to the "Pre-Operational" state only when the current state is "Operational"
0x01	Current state is retained, that is no response
0x02	Change to "Stopped" state

5.1.4 Response to errors

Diagnostic information

When an error occurs, the corresponding error LED on the CAN side (ERR-LED) is triggered. A corresponding diagnostic message is sent on the PROFINET side. The diagnostic message can be read out with the TIA Portal.

Information on the events that trigger a diagnostic message is available in the section Events that trigger a diagnostic message (Page 149). Section Diagnostic messages (Page 152) includes a detailed description of the error that triggers the diagnostic message and possible measures. This information is also stored in the TIA Portal.

Failure of communication via PDOs

When communication via PDOs fails, the values in the corresponding OD entries remain valid. Data contents remain valid until a new value is present.

Failure of a CAN node

The failure of a fieldbus node as well as bus problems on the CAN side are signaled to the S7 controller using diagnostic information.

Error Register

The Error Register entry (OD 0x1001) indicates the current error state of the device.

The PN/CAN LINK uses the following bits from this entry:

Bit		Meaning
7	Manufacturer-specific error	Bit is set when the PN/CAN LINK is configured as "CANopen Slave" and the control bit transmitted by the S7 controller in the cyclic data is "OFF".
4	Communication error	Bit is set when - the S7 connection fails - the PROFINET connection (Application Relation) has been terminated - the data from the S7 controller has the IO provider status "Bad".
0	Generic error	Bit is set in "any error situation", according to CiA standard "CiA 301", which means when a specific error bit is set and for errors that are not mapped to specific error bits.

EMCY messages

The EMCY messages sent in case of error are permanently specified and cannot be configured by the user.

In "CANopen Manager" mode, users can configure whether diagnoses are sent to the S7 controller by the PN/CAN LINK in case of error.

Received EMCY messages are signaled to the IO controller in extended PROFINET diagnoses. This function can be activated or deactivated through configuration.

See EMCY messages (Page 41).

LEDs

The PN/CAN LINK signals its state in "CANopen Manager" mode and in "CANopen Slave" mode with the LEDs on the front of the housing. The meaning of the LEDs is described in section Operating state of the PN/CAN LINK / PROFINET diagnostics (Page 145).

5.2 CAN transparent

5.2.1 Overview

All CANopen functions are disabled in "CAN transparent" mode. The PN/CAN LINK only communicates with the CAN2.0A(B) protocol over the bus according to ISO standard 11898 (ISO 11898-2). The operating mode for the PN/CAN LINK is set via the associated HSP in the TIA Portal.

5.2.2 State model

In "CAN transparent" mode the PN/CAN LINK has the two states "OFF" and "ON".

PN/CAN LINK state "OFF"

No CAN frames are transmitted or received in this state. The CAN controller does not participate in the CAN bus communication. It does not transmit or receive messages or any error frames.

If the PN/CAN LINK is not connected to an S7 controller or if the data from the S7 controller has the IO provider status "Bad", the PN/CAN LINK goes to "OFF" state.

PN/CAN LINK state "ON"

In this state the PN/CAN LINK participates in the CAN bus communication, that is it transmits and receives CAN frames unless the CAN controller is in Bus Off state.

Dependency of the PN/CAN LINK state from the status of the PROFINET connection and from the state of the S7 controller

Event	Reaction
PN/CAN LINK has never been connected to the S7 controller or has not yet been configured since boot-up	PN/CAN LINK state is "OFF"
S7 controller connected / not yet completely configured	The PN/CAN LINK receives the necessary configuration data from the S7 controller. For the "receive message modules" the input data is preassigned according to the parameter assignment. PN/CAN LINK state is "OFF".
S7 controller connected / completely configured / no cyclic PROFINET data exchange or data from the S7 controller has IO provider status "Bad"	PN/CAN LINK state is "OFF"
Cyclic PROFINET data exchange is active and data from the S7 controller has IO provider status "Good"	PN/CAN LINK goes to the state conforming to the control bits ("OFF" or "ON"). The control bits are contained in the cyclic data that come from the S7 controller.
S7 controller changes to STOP	PN/CAN LINK state is "OFF"
S7 controller changes to RUN	PN/CAN LINK goes to the state conforming to the control bits ("OFF" or "ON"). The control bits are contained in the cyclic data that come from the S7 controller.
Termination of the S7 connection (after the PN/CAN LINK has been configured once by the S7 controller)	PN/CAN LINK state is "OFF"
Reconfiguration by S7 controller	The PN/CAN LINK receives the necessary configuration data from the S7 controller. For the "receive message modules" the input data is preassigned according to the parameter assignment. PN/CAN LINK state is "OFF".

5.2.3 CAN messages

In "CAN transparent" mode, data can be exchanged using configurable or programmable messages, both of which can be used in parallel.

Configurable CAN messages

The configurable CAN messages have a fixed message ID and a fixed length. The "Transmit message" and "Receive message" submodules are available in TIA for configuring (see Configuring CAN transparent (Page 136)).

Messages in standard format CAN 2.0A (11-bit message ID) and in extended CAN format 2.0B (29-bit message ID) can be used.

Note

No provision is made for flow control. That is, if data arrives via CAN messages faster than it can be sent via PROFINET, intermediate values may be overwritten. The same happens in the opposite direction when data are changed faster by PROFINET than they can be sent via CAN. Changes on the CAN bus may not be visible in this process.

The operating principle of the fixed CAN messages is based on data mapping. This means a loss of intermediate values is acceptable.

Fixed messages can be sent in the following two ways:

- When the data to be transmitted changes
- Time-controlled, that is as soon as the configured cycle time has elapsed.

With this transmission type, the user data of the CAN messages is transmitted between the S7 controller and the PN/CAN LINK in the cyclic IO image.

Programmable CAN messages (proxy)

CAN messages for which the message ID and the length (max. 8 bytes) is not determined by the S7 user program until runtime can be used in "CAN transparent" mode.

With this transmission type, protocol information in addition to the actual user data is transmitted between the S7 controller and the PN/CAN LINK in the cyclic IO image.

The message ID format (11 bits or 29 bits) is determined by bit 29 in the message ID. If this bit is set, the message ID format with 29 bits must be used.

The sending and receiving of CAN messages from the S7 user program is possible using transmit and receive proxy modules. See: Cyclic data exchange between controller and PN/CAN LINK for programmed CAN messages (Page 75)

5.2.4 Control and status information

Control and status information

The following controller information is cyclically transmitted by the S7 controller to the PN/CAN LINK:

Table 5- 8 Controller information in the PROFINET IO data (from S7 controller to PN/CAN LINK, 1 byte)

Bit	Meaning	Possible values		Note
7 ... 1	Reserved	0	Values must be "0"	--
0	Control bit	0	No CAN communication	The CAN controller should be "OFF".
		1	CAN communication active	The CAN controller should be "ON".

The following status information is transmitted cyclically from the PN/CAN LINK to the S7 controller:

Table 5- 9 Status information in the PROFINET IO data (from PN/CAN LINK to S7 controller, 1 byte)

Bit	Meaning	Possible values		Note
7 ... 3	Reserved	--	--	
2	Group status of all data	0	Not all configured receive messages have been received at least once since the last transition to "ON".	--
		1	All configured receive messages have been received at least once since the last transition to "ON".	--
1 ... 0	State of the CAN controller	0	Off	As specified by the S7 controller
		1	Bus Off	Error counter ¹⁾ has exceeded the specified threshold, or PN/CAN LINK needs more than 2 seconds to synchronize itself to the CAN bus. As a consequence, the PN/CAN LINK stops transmitting/receiving packets.
		2	Error Passive	Error counter ¹⁾ has reached the specified threshold. PN/CAN LINK still transmits / receives packets.
		3	Error Active	Error counter ¹⁾ is below a specified threshold. This is the normal state. Everything is okay.

1) The error counters customary in CAN and the associated thresholds are internal functions that are not visible to the user.

Note

For values made up of multiple bits, the first bit is the MSB and the last bit is the LSB.

Example: Bit 1 ... 0 = 2 means: Bit 0 = "0" and bit 1 = "1".

5.2.5 **Cyclic data exchange between controller and PN/CAN LINK for configured CAN messages**

CAN messages with PROFINET output data (transmit messages)

"Transmit messages" can be configured in the TIA Portal. Each of these messages has its own message ID, which is configured in the TIA Portal, and its own data, which is transmitted cyclically to the PN/CAN LINK via PROFINET in the output process image of the S7 controller.

The PN/CAN LINK sends a CAN message with the message ID and the current data:

- When the data changes
- When a CAN RTR frame (Remote Transmit Request) has been received with the matching message ID
- During transition of the PN/CAN LINK to "ON" state
- Cyclically, if configured accordingly

The triggers are independent of one another. That is, the configured transmit cycle is retained even if a message based on a data change or an RTR has been sent in the interim.

If configured, the PN/CAN LINK changes the order of specific data bytes for fixed CAN messages prior to sending to compensate for the different "endianness" of PROFINET and CAN. PROFINET uses "Big Endian", CAN usually uses "Little Endian". In the case of programmed CAN messages, however, the order of the data bytes is not changed.

CAN messages with PROFINET input data (receive messages)

"Receive messages" can be configured in the TIA Portal. Each of these messages has its own message ID, which is configured in the TIA Portal, and its own data, which is transmitted cyclically from the PN/CAN LINK to the S7 controller via PROFINET as part of the input process image.

The values of the input data are assigned during configuration of the PN/CAN LINK by the S7 controller according to the configuration.

If a CAN frame with the configured message ID has been received, the order of the data bytes is first changed, if necessary, to correct the "endianness" before the data is transferred to the input data for the S7 controller.

A setting can be made during configuration so that the PN/CAN LINK transmits an RTR frame with the configured message ID during transition to the PN/CAN LINK state "ON" on the CAN bus. This frame requests that the associated counterpart sends the corresponding data message.

As soon as a PN/CAN LINK changes to "ON" state, it monitors the receipt of CAN messages of all configured message IDs and transmits information about them, compressed into one status bit, to the S7 controller. As long as there is at least one configured message ID from which a CAN message has not yet been received, a zero is transmitted to the S7 controller in the status bit.

5.2.6 Cyclic data exchange between controller and PN/CAN LINK for programmed CAN messages

"Transmit proxies" and "Receive proxies" can be set up in the TIA Portal.

These proxies serve as a "communication channel" that enables the S7 user program to send and receive any CAN messages not configured beforehand.

The use of multiple transmit / receive proxies facilitates programming of the S7 user program because independent communication channels are involved.

Example of transmit proxy module:

Two code locations want to transmit CAN messages. When you set up two transmit proxies, these messages do not have to be synchronized or matched. Each code location uses its own proxy.

Example of receive proxy module:

Because each receive proxy module has its own "receive filter list", you can use multiple proxy modules to pre-filter messages by CAN ID, for example, one receive proxy for "commands" only and one receive proxy for "status messages".

Transmit proxy module

CAN messages can be transmitted from the S7 user program with the help of a transmit proxy module. It comprises cyclic PROFINET input and output data.

In the output data from the S7 controller to the PN/CAN LINK, the following information is transmitted for the frame to be sent to the PN/CAN LINK:

- Message ID
- Length
- User data
- Flag, indicating whether RTR or CAN data message

In the input data from the PN/CAN LINK to the S7 controller, the PN/CAN LINK acknowledges entry of the message in the CAN transmit buffer in the PN/CAN LINK. This does not always mean, however, that the message has been transmitted on the CAN bus.

Note

The order of the data bytes in the CAN messages to be sent is not changed in the PN/CAN LINK. Any necessary adaptation to compensate for "endianness" must be made in the S7 user program.

Note

For values made up of multiple bits, the first bit is the MSB and the last bit is the LSB.

Example: Byte.Bit 3.0 ... 4.6 = 2 means: Byte 3 bit 0 = "0", byte 4 bit 7 = "1" and byte 4 bit 6 = "0".

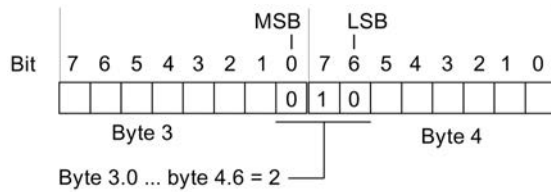


Table 5- 10 Structure of output data for transmit proxy modules (from S7 controller to PN/CAN LINK, 13 bytes)

Byte.Bit	Meaning
0.7 ... 0.5	Reserved, must be "0"
0.4 ... 0.1	Number of data bytes Permitted values are 0 to 8. Values 9 to 15 result in the CAN message being discarded and the "Last data faulty bit" to be set.
0.0	Send When the bit changes to 1, the other data are applied and a corresponding CAN message is entered in the transmit buffer. The PN/CAN LINK acknowledges receipt of the transmit command by setting the transmit acknowledgment bit in the data for the S7 controller to "1". The S7 controller can then set the transmit bit to "0" and must wait until the PN/CAN LINK has also set the transmit acknowledge bit to "0". Only then can a new transmit command be issued. Note: If the control bit is "0", the CAN messages are not entered in the transmit buffer but are discarded instead.
1.7	Reserved, must be "0"
1.6	RTR flag 0 = Send normal data frame 1 = Send RTR frame
1.5	29/11-bit message ID 0 = 11-bit message ID 1 = 29-bit message ID
1.4 ... 4.0	Message ID (in Big Endian) For 11-bit message IDs byte 3 bit 2 is the most significant bit and byte 4 bit 0 is the least significant bit. The remaining bits are ignored. For 29-bit message IDs byte 1 bit 4 is the most significant bit and byte 4 bit 0 the least significant bit.
5-12	Data bytes In the order in which they are going to be sent

Table 5- 11 Structure of input data for transmit proxy modules (from PN/CAN LINK to S7 controller, 1 byte)

Byte.Bit	Meaning
0.7 ... 0.3	Reserved, must not be evaluated
0.2	Transmit buffer overflow Is set to "1" by the PN/CAN LINK when a CAN message could not be entered in the transmit buffer because it is full. A corresponding diagnostic information is also sent in this case. The bit is reset to "0" when the transmit acknowledgment bit is set to "0".
0.1	Last data faulty Is set to "1" by the PN/CAN LINK when the "Number of data bytes" is greater than 8. The bit is reset to "0" when the transmit acknowledgment bit is set to "0".
0.0	Transmit acknowledgment Is set to "1" by the PN/CAN LINK as soon as the send bit is "1". When the send bit changes to "0", the PN/CAN LINK sets the send acknowledgment bit to "0" as soon as it has transmitted the message to be sent to the send buffer of the CAN controller.

Receive proxy module

CAN messages can be received from the S7 user program with the help of a receive proxy module. The module manages a list of message IDs (filters) on the PN/CAN LINK side that it receives on the CAN bus.

The list can be filled during configuration and changed during runtime from the S7 user program by writing a corresponding data record.

If a corresponding CAN message is received, it is entered in a receive buffer. The message is transmitted from this buffer to the S7 controller in the cyclic input data. The size of the receive buffer is specified in the configuration.

With the help of the output data (from the S7 controller to the PN/CAN LINK) the S7 user program can:

- Acknowledge the successful transmission of a CAN message from the PN/CAN LINK to the S7 controller
- Instruct the PN/CAN LINK to ignore the receive filter As a result, all CAN messages are copied to the receive buffer.
- Instruct the PN/CAN LINK to delete all CAN messages in the receive buffer

In the input data from the PN/CAN LINK to the S7 controller, the PN/CAN LINK transmits received CAN messages and information on whether there was a receive buffer overflow. Such an overflow occurs when too many CAN messages with matching message ID were received before they could be transmitted to the S7 controller.

Note

The order of the data bytes in the received CAN messages is not changed in the PN/CAN LINK. Any necessary adaptation to compensate for "endianness" must be made in the S7 user program.

Note

For values made up of multiple bits, the first bit is the MSB and the last bit is the LSB.

Example: Byte.Bit 3.0 ... 4.6 = 2 means that byte 3 bit 0 = "0", byte 4 bit 7 = "1" and byte 4 bit 6 = "0".

Table 5- 12 Structure of output data for receive proxy modules (from S7 controller to PN/CAN LINK, 1 byte)

Byte.Bit	Meaning
0.7	Receive buffer 0 = No action 1 = All CAN messages in the receive buffer are deleted
0.6	Receive filter 0 = Only received CAN messages that match the receive filter are entered in the receive buffer and later forwarded to the S7 controller 1 = All received CAN messages are entered in the receive buffer and later forwarded to the S7 controller
0.5 ... 0.1	Reserved, must be "0"
0.0	Receive enable If the bit has the value 1 and the PN/CAN LINK has a CAN message in the receive buffer of the receive proxy, the PN/CAN LINK enters the message in the data for the S7 controller and sets the "Message exists" bit to "1". The S7 controller must then set the receive enable bit to "0" and must wait until the PN/CAN LINK has also set the "Message exists" bit to "0". Only then may the S7 controller set the receive enable bit to "1" again.

Table 5- 13 Structure of input data for receive proxy modules (from PN/CAN LINK to S7 controller, 13 bytes)

Byte.Bit	Meaning
0.7	Message exists 0 = No message in the receive buffer 1 = Message(s) in the receive buffer Bit is always "1" when the transfer bit = 1 because the message stays "in the buffer" until the transfer is "completed".
0.6	Receive filter 0 = A valid receive filter is set. 1 = No valid receive filter was set. When the receive filter bit is "0", no messages at all are forwarded to the S7 controller.
0.5	Receive buffer overflow 1 = The receive buffer is full. At least one message was discarded. Note: May only be evaluated when the transfer bit is "1".
0.4 ... 0.1	Number of data bytes in the received CAN message The value range is 0 to 8. Note: May only be evaluated when the transfer bit is "1".

Byte.Bit	Meaning
0.0	Transfer If the bit is "1", a received message is transferred. The S7 controller should then set the receive enable bit to "0".
1.7	Reserved, must be "0"
1.6	RTR flag of the received CAN message 0 = Normal data message 1 = RTR message Note: May only be evaluated when the transfer bit is "1".
1.5	29/11-bit message ID of the received CAN message 0 = 11-bit message ID 1 = 29-bit message ID Note: May only be evaluated when the transfer bit is "1".
1.4 ... 4.0	Message ID of the received CAN message (in Big Endian) For 11-bit message IDs byte 3 bit 2 is the most significant bit and byte 4 bit 0 the least significant bit (the other bits are ignored). For 29-bit message IDs byte 1 bit 4 is the most significant bit and byte 4 bit 0 the least significant bit. Note: May only be evaluated when the transfer bit is "1".
5-12	Data bytes of the received CAN message In the order in which they were received. Only the corresponding "Number of data bytes in the received CAN message" may be evaluated. Note: May only be evaluated when the transfer bit is "1".

Note on the use of a receive proxy

Representation of bits

1. "Receive enable" is a bit that can be used to copy data to the SIMATIC S7 controller (you can control this bit).
2. "Message exists" is a bit that signals that there is a message in the input buffer.
3. "Transfer" signals that the current position from the input buffer is actively transferred to the SIMATIC S7 controller.

Procedure

1. Set "Receive enable" to "1" and wait until "Message exists" is also "1".
2. When this happens, the first message is copied to the SIMATIC S7 controller and "Transfer" is set to "1".
3. Set "Receive enable" to "0" and wait until "Transfer" is set to "0".
4. Repeat the operation starting at step 1.

Changing the receive filters during runtime

The receive filter can be changed from the S7 user program at runtime by writing a data record to the data record index 0x210 of a receive proxy module.

The PN/CAN LINK makes the corresponding data record available on the respective receive proxy module.

Each receive proxy module can have up to 16 receive filters. If a received CAN message matches one of the filters, it is entered in the receive buffer.

Each individual filter consists of a 32-bit value "Criterion" and a 32-bit value "Mask".

If a bit in "Mask" is "0", the received CAN messages are **not** checked against the corresponding bit in the "Criterion".

To ensure that a bit set in "Criterion" acts as a filter, the corresponding bit in the "Mask" must be set to "1".

Structure of the data to be written with WRREC

Data record size: $8 * n$ bytes; n = Number of filters = 1 to 16.

```
Criterion filter 1 (32-bit, Big Endian)
Mask filter 1 (32-bit, Big Endian)
Criterion filter 2 (32-bit, Big Endian)
Mask filter 2 (32-bit, Big Endian)
...
Criterion filter 16 (32-bit, Big Endian)
Mask filter 16 (32-bit, Big Endian)
```

Note

If the number of written bytes is not a multiple of "8", the extra bytes are ignored. A maximum of 16 filters with 4 bytes each for Criterion and Mask are permitted. If the number of written bytes is ≥ 128 , the write access (WRREC) is rejected with PROFINET error code 0xDF80B100 and the filter remains unchanged.

Coding of the bits in "Criterion" and "Mask"

The bits in "Criterion" and "Mask" are coded as follows.

Note

For values made up of multiple bits, the first bit is the MSB and the last bit is the LSB.

Example: Bit 28 ... 27 = "2" means that bit 28 = "1" and bit 27 = "0"

Bit	Meaning
31	Filter valid (only with "Criterion") 0 = Filter is valid 1 = Filter is invalid and is ignored by the PN/CAN LINK For "Mask" the bit is reserved and must always be 0.
30	RTR 0 = Only data messages are entered in the receive buffer 1 = Only RTR messages are entered in the receive buffer
29	29/11-bit message ID 0 = Only CAN messages with 11-bit message ID are entered in the receive buffer 1 = Only CAN messages with 29-bit message ID are entered in the receive buffer
28 ... 0	Message ID Only CAN messages with the message ID are entered in the receive buffer. Note: For received CAN messages with 11-bit message ID, bits 28 ... 11 in the message are accepted as "0". If one of the bits 28 ... 11 is set in "Criterion" as well as "Filter", the filter will not match any of the received 11-bit messages.

Example:

If a filter is to be set so that only 29-bit data messages with message ID "0x?????9" are received, the following conditions must be met:

- RTR for "Criterion" = 0 and "Mask" = 1
- 29/11-bit message ID for "Criterion" = 1 and "Mask" = 1
- Message ID for "Criterion" = 0x9 and "Mask" = 0xF

This means "Criterion" = 0x20000009 and "Mask" = 0x6000000F.

The bytes to be written as data record therefore are "0x20 0x00 0x00 0x09 0x60 0x00 0x00 0x0F".

Note

If less than 8 bytes are written or if bit 31 = "1" is true for "Criterion" for all filters, the receive proxy has "no valid receive filter". That is signaled in the corresponding bit in the input data for the S7 controller.

5.2.7 Response to errors

Configured CAN messages

If communication fails when communicating via configured CAN messages, the last transmitted values continue to be valid. Data contents remain valid until a new value is present.

If the length of a received CAN package does not match the configured length, the data are not applied and a corresponding diagnostic message is sent to the S7 controller.

Diagnostic information

The PN/CAN LINK sends diagnostic information to the S7 controller with the usual PROFINET methods.

When an error occurs, the corresponding error LED on the CAN side (ERR-LED) is triggered. A corresponding diagnostic message is sent on the PROFINET side. The diagnostic message can be read out with the TIA Portal.

Information on the events that trigger a diagnostic message is available in the section Events that trigger a diagnostic message (Page 149). Section Diagnostic messages (Page 152) includes a detailed description of the error that triggers the diagnostic message and possible measures. This information is also stored in the TIA Portal.

LEDs

In "CAN transparent" mode the PN/CAN LINK signals its state by means of the fieldbus LEDs on the front of the housing. The meaning of the LEDs is described in section Operating state of the PN/CAN LINK / PROFINET diagnostics (Page 145).

Application planning

6.1 Installation guidelines

General installation guidelines

The following guidelines must be observed when installing and connecting the PN/CAN LINK:

- Make sure that you observe all applicable and binding standards when connecting the PN/CAN LINK. Adhere to the relevant national and regional regulations when installing and operating the device. Check with the local authorities regarding the standards and rules to be followed in your particular case.
- Ensure a zero-voltage state during assembly and connection work.
- Adhere to the installation and wiring guidelines of your automation system and the CAN system.

Guidelines for installation of PN/CAN LINK devices

- The PN/CAN LINK is classified as open equipment based on standards for electrical devices.
- You must install the PN/CAN LINK in an enclosure, control cabinet or in a control center.
- Only authorized personnel must have access to the enclosure, control cabinet or control center.
- Installation and operation of the PN/CAN LINK is only permitted in a dry environment.
- Only one connection to SELV circuits is permitted. Only these offer protection from electric shock in a dry environment.
- The installation must offer the required mechanical protection and environmental protection for open equipment in your specific location category according to the applicable electrical regulations and building code.
- Proper grounding and wiring of the PN/CAN LINK is important for optimal operation and for sufficient immunity of your system and your application.

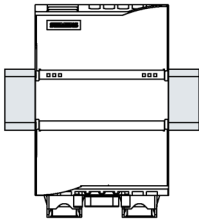
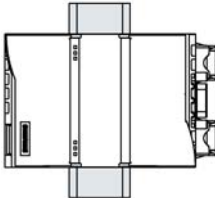
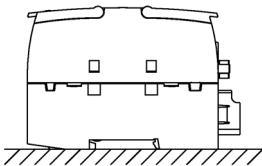
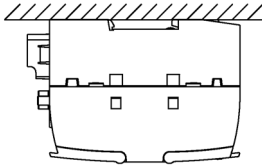
6.2 Installation location

Selection of the installation site / mounting position

You can install the PN/CAN LINK either in a control panel or on a standard mounting rail:

Permitted mounting positions and permitted ambient temperature

The table below show the permitted temperature range for the different mounting positions.

Mounting position		Permitted ambient temperature
Horizontal		-25 ... +60 °C
Vertical		-25 ... +55 °C
Lying		-25 ... +45 °C
Hanging		-25 ... +45 °C

Ensure that condensation is not produced at a relative humidity between 10% and 95%.

Ensure that the atmospheric pressure is between 795 hPa and 1080 hPa. This corresponds to an installation height of -1000 m to +2000 m.

The PN/CAN LINK is designed for natural heat dissipation through convection. Therefore observe sufficient clearances:

- For horizontal mounting position: At least 35 mm above and below the PN/CAN LINK
- For vertical mounting position: At least 35 mm to the left and right of the PN/CAN LINK

Provide sufficient space for the connection of supply voltage, Ethernet and CAN bus.

Also make sure that a depth of at least 25 mm remains clear between the module front and the inside of the enclosure / control panel.

Table 6- 1 Device dimensions

PN/CAN LINK dimensions	
Width	70 mm
Height	111.5 mm (including overhangs)
Depth	75 mm (including overhangs)

The dimension drawing of the PN/CAN LINK is available in the section Dimension drawing (Page 161).

NOTICE
Damage due to overheating You must comply with all the instructions regarding the installation site and mounting position. Otherwise the device may malfunction or incur permanent damage as a result of overheating.

Pollution degree

The PN/CAN LINK is designed for pollution degree 2. Pollution degree 2 according to the EN 50178 standard is non-conductive contamination in the normal case which can briefly become conductive as a result of condensation when the device is not in operation.

Pollution of conductive parts through dust, humidity and air pollution can result in fault conditions and electrical faults in the PN/CAN LINK.

Degree of protection

The housing of the PN/CAN LINK has degree of protection IP20 according to IEC 60529.

The PN/CAN LINK is also rated as "open type" or "open equipment" according to UL 61010-2-201 or IEC 61010-2-201.

If the PN/CAN LINK is located in an area in which pollution of conductive parts can occur, the PN/CAN LINK must be protected by an enclosure with the corresponding degree of protection. IP54 is a protection class that is generally used for electronic systems in heavily polluted environments and may be suitable for your application.

Electromagnetic compatibility (EMC) / overvoltage protection

NOTICE
Damage to the device Inadequately dimensioned overvoltage protection can result in severe damage to the device. Always ensure, therefore, that the overvoltage protection is adequate (see Chapter 24 V DC power supply (Page 94)).

Installation in control cabinet / device connection box

NOTICE
The device is intended for installation in a control cabinet or in a device connection box. It is important to note that installation in a control cabinet or device connection box is essential for compliance with the UL regulations. The control cabinet / device connection box must satisfy the regulations regarding fire-protection housing. Ensure that all cables and leads that protrude externally are equipped with adequate strain relief.

6.3 Transportation

The devices must be transported in a clean and dry state, preferably in their original packaging. The transport temperature must be between -40 °C and +70 °C. Temperature fluctuations greater than 20 K per hour are not permitted.

6.4 Storage

The devices must be stored in clean and dry rooms, preferably in their original packaging. The storage temperature must be between -40 °C and +70 °C.

6.5 Scope of delivery

- PN/CAN LINK
- 2 retaining collars for the Ethernet connections (installed on the device in the delivery state)
- Insert
- CD with license terms

Unpacking and checking the delivery

1. Unpack the device.
2. Check the delivery for completeness.
3. Check the device for transport damage by visual inspection.

NOTICE
Damage to the system Damaged parts can result in damage to the system. Do not use devices that show evidence of damage!

Mounting/Extending

7.1 Installing the device

The PN/CAN LINK can be mounted to a 35 mm standard mounting rail according to DIN EN 60715 or installed on a control panel.

Information on the selection of the location of use as well as reliable mounting positions and minimum clearances is available in the section Installation location (Page 84).

Mounting on a standard mounting rail

Proceed as follows:

1. Mount the PN/CAN LINK on the mounting rail.
2. Swivel the PN/CAN LINK backwards until it engages audibly.



Figure 7-1 PN/CAN LINK DIN rail mounting

NOTICE

If the device is not installed on a control panel, the mounting sliders (see figure Control panel mounting item ①) must always be in the default positions set at the factory. Otherwise the mounting sliders may warp if they are exposed to hot and humid ambient conditions for a long time.

Mounting to a control panel

Proceed as follows:

1. Drill holes (M4). The dimensions for the drill holes are available in the figure below.
2. Move the sliders ① to the outside until they latch in place.
3. Fasten the module with a cylinder head screw M4 as well as a spring lock washer and a flat washer.

Note

Do not use a countersunk head screw.

The type of screw required depends on the type of material on which the module is mounted. Fasten the screw with the corresponding torque until the spring lock washer is pressed flat.

Do not fasten the screws with excessive torque.

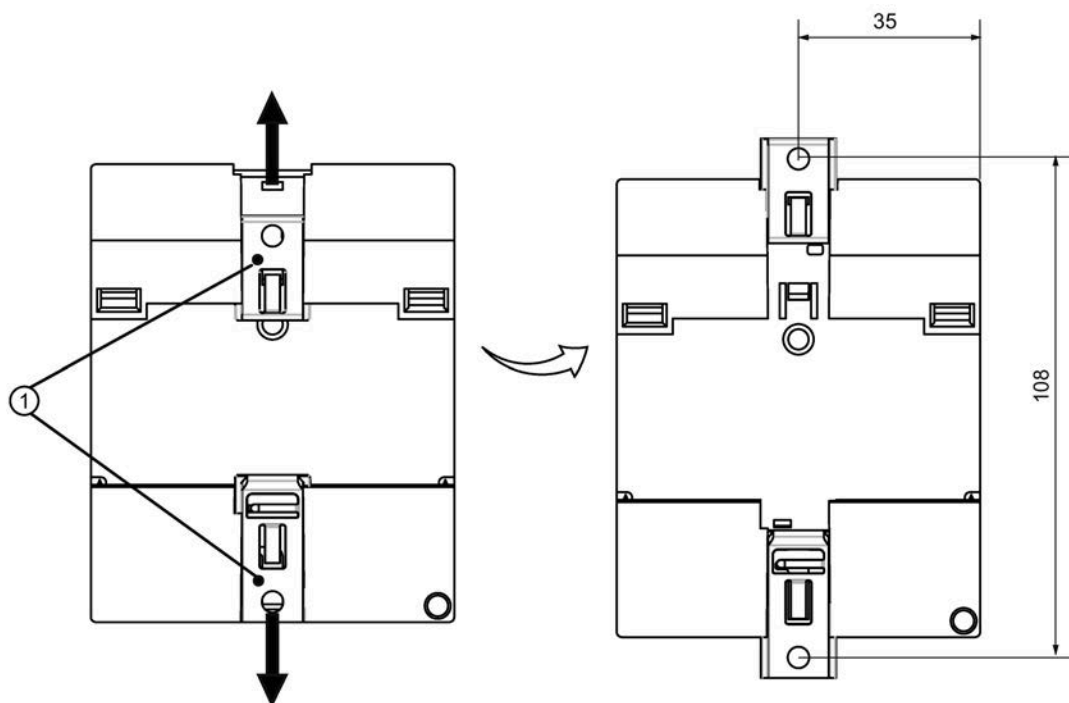


Figure 7-2 Control panel mounting of the PN/CAN LINK

Connecting

8.1 Safety instructions and guidelines

Safety information

 WARNING
Connection only over safety extra-low voltage / protective extra-low voltage May cause death or serious injury The device is designed for operation using directly connectable safety extra-low voltage (SELV) with safe electrical separation according to IEC 60950-1 / EN 60950-1 / VDE 0805-1 or IEC 61131-2 / EN 61131-2 / DIN EN 61131-2. To obtain the safe property of low-voltage circuits of the PN/CAN LINK, the 24 V rated voltage supply and external connections to communication interfaces must be supplied from approved sources that meet requirements set forth by various standards for SELV/PELV voltage-limited sources. Therefore only connect safety extra-low voltages (SELV) with safe electrical separation according to IEC 60950-1 / EN 60950-1 / VDE 0805-1 to the supply voltage connections and the communications interfaces.

Working on the device or on connected components

 WARNING
Risk of electric shock May cause death or serious injury • Voltages > 60 V DC or 30 V AC are present in the control cabinet. Therefore appropriate safety precautions must be taken to prevent contact during commissioning and maintenance work. • Before working on the PN/CAN LINK or the connected components, ensure the system is disconnected.

Wiring guidelines

When wiring the PN/CAN LINK, observe the wiring guidelines of your automation system (e.g. SIMATIC S7-1200, SIMATIC S7-1500, SIMATIC ET 200SP).

Also observe the installation instructions and configuration guidelines for routing of the PROFINET cables.

Cable routing and grounding

Note**Electromagnetic interference**

Make sure that sufficient potential equalization is implemented in all plants or systems in which the PN/CAN LINK is installed. E.g. by means of a low-impedance connection to a ground potential.

Note**Strain relief**

Ensure that all cables and leads that protrude externally are equipped with adequate strain relief.

Other requirements

NOTICE
Damaged cables • The cables must be suitably dimensioned to ensure that they cannot be damaged. Make sure that the cables are suitable for the individual application. • Observe the bending radii.
CAUTION
For system for UL approval: The cables must be specified for an ambient temperature of at least +75 °C.

8.2 Potential ratios

Electrical isolation

Electrical isolation for the PN/CAN LINK exists between the following switching components:

- The signals of the PROFINET interfaces are galvanically isolated from each other, from the electronics or 24 V supply voltage and from the fieldbus interfaces.
- The CAN interface is galvanically isolated from the power supply.

Shielding

The shields of the PROFINET interface are galvanically connected.

NOTICE

Sufficient interference immunity is only achieved through EMC compliant application of the cable shields of the PROFINET cables to a shield rail.

The shields of the CAN interface are capacitively decoupled from the shields of the PROFINET interface to prevent compensating currents over the cable shields.

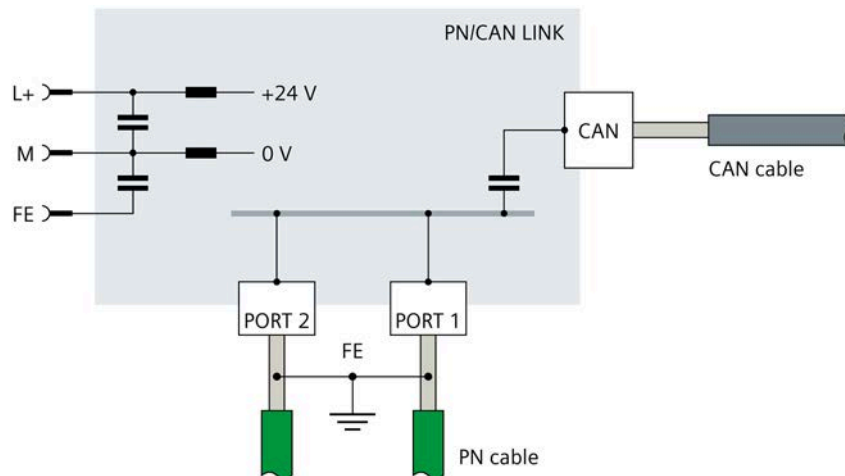


Figure 8-1 Block diagram shielding

8.3 24 V DC power supply

24 V DC power supply

The connection of the external 24 V power supply and the functional earth connection takes place via a 3-pin screw-type terminal. It is located below the top housing cover (see Design (Page 35)).

A suitable power supply is, for example, SIMATIC S7-1200 Power Supply PM1207 (6EP1332-1SH71).

Safety information

WARNING

Connection only over safety extra-low voltage / protective extra-low voltage

May cause death or serious injury

The device is designed for operation using directly connectable safety extra-low voltage (SELV) with safe electrical separation according to IEC 60950-1 / EN 60950-1 / VDE 0805-1 or IEC 61131-2 / EN 61131-2 / DIN EN 61131-2.

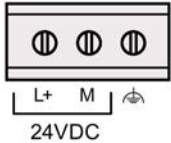
To maintain the safety property of the low voltage circuits of the PN/CAN LINK, the 24 V rated power supply as well as external connections to communication ports must be supplied from reliable sources that meet the requirements for SELV / PELV limited voltage sources according to different standards.

Therefore only connect safety extra-low voltages (SELV) with safe electrical separation according to IEC 60950-1 / EN 60950-1 / VDE 0805-1 to the supply voltage connections and the communications interfaces.

Connector pin assignment

The figure below shows the assignment of the terminal for the 24 DC power supply.

Table 8- 1 Terminal assignment for the 24 DC power supply

	L+	24 V supply for PN/CAN LINK (+)
	M	24 V supply for PN/CAN LINK (-)
		Functional ground

Permissible torques for screw terminal:

- Minimum tightening torque: 0.5 Nm
- Maximum tightening torque: 0.6 Nm

External lightning protector

An external lightning protector can be installed in the 24 V DC supply line to protect against powerful pulses on the supply lines:

We recommend the Dehn Blitzductor BXT ML2 BD 180, article number 920 247 (on basis BXT BAS) or an equivalent protection element.

Manufacturer:

DEHN+SOEHNE GmbH+Co.KG, Hans-Dehn-Str.1, Postfach 1640, D-92306 Neumarkt, Germany The lightning protection module must be installed and used in accordance with the manufacturer's specifications.

8.4 Connecting the functional ground

Connect the ground (e.g. from mounting rail) for discharge of EMI, such as bursts or surges, to the FE terminal (see 24 V DC power supply (Page 94)).

Permissible conductor cross-section:

- 0.5 - 6 mm², AWG 26 - AWG 12

Note

EMC-compliant functional grounding

- Use as short a stranded-wire conductor as possible with a large cross section.
- Compliance with the technical specifications of the device is only assured with a correct functional ground connection.

8.5 Connecting PROFINET

Connecting PROFINET

PROFINET connection	
	Connect Ethernet cable according to PROFINET specification to higher-level controller and / or the next PROFINET node ①. Use a shielded Ethernet cable with shielded connector for the connection. We recommend RJ45 connectors from the Siemens FastConnect system as connectors for the Ethernet cabling. Always apply the shields of the PROFINET Ethernet cable at both ends.

Note

To increase the mechanical stability, optimized retaining collars ② for the two Ethernet connectors are installed on the bottom part of the housing in the delivery state. These retaining collars are intended for the Siemens FastConnect connectors.

NOTICE

Make sure you observe the minimum bending radius of the Ethernet cable; otherwise the shield effect of the cable shield may be impaired. There is also the risk that the cable shield breaks.

NOTICE

EMC stability is only guaranteed with shielded PROFINET cables.



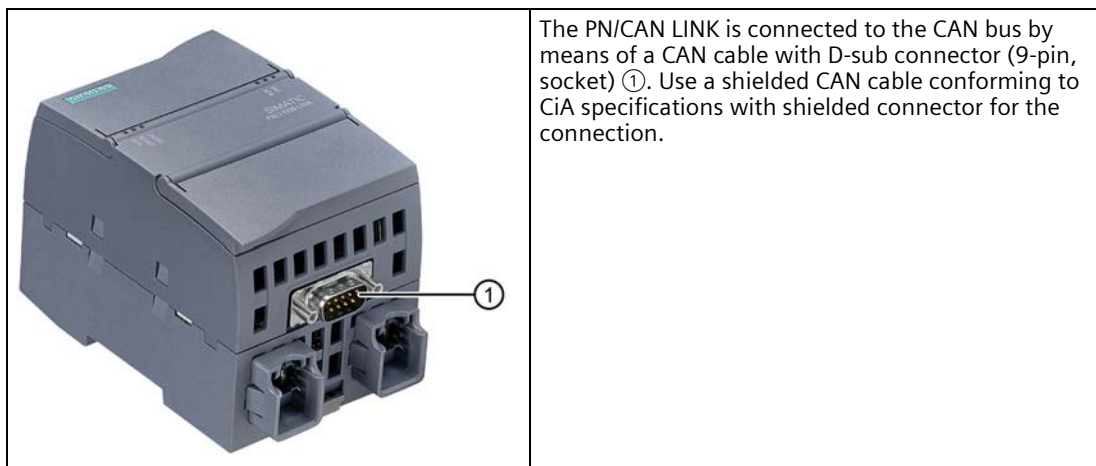
CAUTION

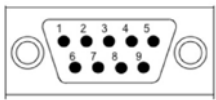
Critical plant state

The Ethernet switch installed in the PN/CAN LINK is only in operation after run-up of the PN/CAN LINK. A restart of the PN/CAN LINK interrupts the Ethernet switch function.

Existing Ethernet connections over the switch are interrupted for the duration of the PN/CAN LINK run-up. This can result in critical plant states.

8.6 Connecting the CAN bus



 CAN connection pin assignment	1	--	Terminating resistor 120 Ω (install jumper from pin 1 to pin 2 for use)
	2	CAN_L	CAN_L bus cable (dominant low)
	3	CAN_GND	CAN Ground
	4	--	Not connected
	5	CAN_SHLD	CAN shield
	6	CAN_GND	CAN Ground
	7	CAN_H	CAN_H bus cable (dominant high)
	8	--	Not connected
	9	--	Not connected

NOTICE

The connection CAN Ground to ground is necessary to ensure EMC stability.

The common return (CAN_GND) may only be connected in one place to the ground potential in the CAN network.

NOTICE

EMC stability is only guaranteed with shielded CAN cables.

Commissioning

9.1 Commissioning the PN/CAN LINK

Prerequisites

- The PN/CAN LINK is installed and connected to a SIMATIC S7-CPU via PROFINET.
- The CAN bus is connected to the PN/CAN LINK.
- The PN/CAN LINK and all other components are wired and connected.

Basic commissioning procedure

After commissioning of the hardware perform the additional steps required for commissioning in the TIA Portal.

TIA Portal

1. Checking in the TIA Portal whether the "PN/CAN LINK" module exists in the hardware catalog.

If necessary, download and install the HSP "HSP0197 PN/CAN LINK" from Siemens Service&Support (<https://support.industry.siemens.com/cs/us/en/>).

Firmware version V2.1 supports new functions that are made available with the following Hardware Support Package (HSP): HSP_V17_0358_002_Link_PN_CAN_V2.0.

Firmware version V2.0 supports new functions that are made available for the first time with the following Hardware Support Package (HSP):
HSP_V17_0358_001_Link_PN_CAN_V2.0.

The HSP_V17_0358_002_Link_PN_CAN_V2.0 as well as the
HSP_V17_0358_001_Link_PN_CAN_V2.0 are only available for the TIA Portal Version V17.

2. Assign a PROFINET device name and an IP address for the PN/CAN LINK.
3. Creating a project
4. Configuration using HSP in the TIA Portal (see also Configuring/Programming (Page 101)).
5. Download project to the S7 CPU

9.1 Commissioning the PN/CAN LINK

6. Set SIMATIC CPU to "RUN" operating state. The corresponding configuration data is automatically downloaded from the S7-CPU to the PN/CAN LINK.
7. When the S7 program sets the control bit in the cyclic IO image to "1", the left "RUN" status LED on the PN/CAN LINK lights up green and signals that the device is in error-free operating state.

Note

In "CANopen Manager" mode, bit 2 must also be set to "1" in the control information transmitted from the S7-CPU to the PN/CAN LINK (see Control and status information (Page 51)).

Result

Successful commissioning of the PN/CAN LINK.

Configuring/Programming

The following section contains concise descriptions of the configuring steps for the three operating modes of the PN/CAN LINK:

- CANopen Manager
- CANopen Slave
- CAN transparent

The descriptions are not based on any specific example configuration. They are intended to illustrate the basic method for configuring the PN/CAN LINK and provide a quick introduction to configuring the PN/CAN LINK.

The figures refer to TIA Portal V17.

Firmware version V2.1 supports new functions that are made available with the following Hardware Support Package (HSP): HSP_V17_0358_002_Link_PN_CAN_V2.0 (HSP_V17_0358_002_Link_PN_CAN_2.0.isp17).

To work with firmware version V2.1, you must use the HSP_V17_0358_002_Link_PN_CAN_V2.0. With this HSP you can also configure the PN/CAN LINK with firmware version V1.0 as well as V2.0.

Firmware version V2.0 supports new functions that are made available for the first time with the following Hardware Support Package (HSP): HSP_V17_0358_001_Link_PN_CAN_V2.0 (HSP_V17_0358_001_Link_PN_CAN_2.0.isp17).

To work with firmware version V2.0, you must use at least the HSP_V17_0358_001_Link_PN_CAN_V2.0. With this HSP you can also configure the PN/CAN LINK with firmware version V1.0.

The HSP_V17_0358_002_Link_PN_CAN_V2.0 as well as the HSP_V17_0358_001_Link_PN_CAN_V2.0 are only available for the TIA Portal Version V17.

The new functions of firmware V2.1 refer to all operating modes.

The new functions of firmware V2.0 mainly refer to using the CANopen Manager mode.

Note

TIA Portal Openness

The PN/CAN LINK supports only mandatory attributes in TIA Portal Openness.

When selecting the PN/CAN LINK, you can choose the desired firmware version in the HW catalog.

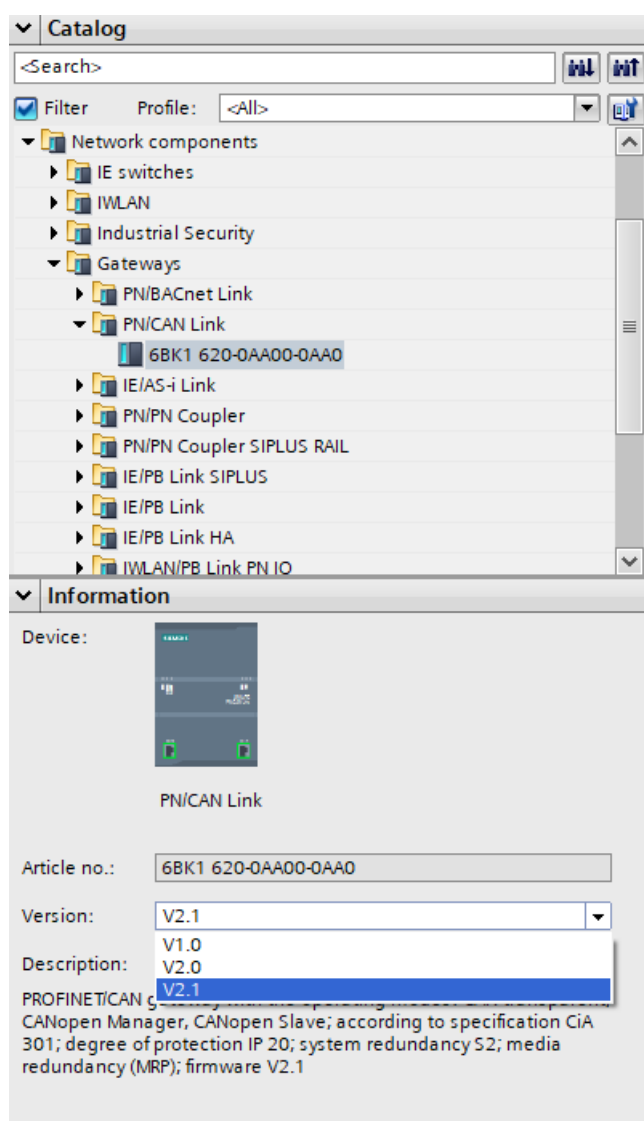


Figure 10-1 Selecting a firmware version in the HW catalog

Or you can select the "Change firmware version" option for a PN/CAN LINK that has already been configured.

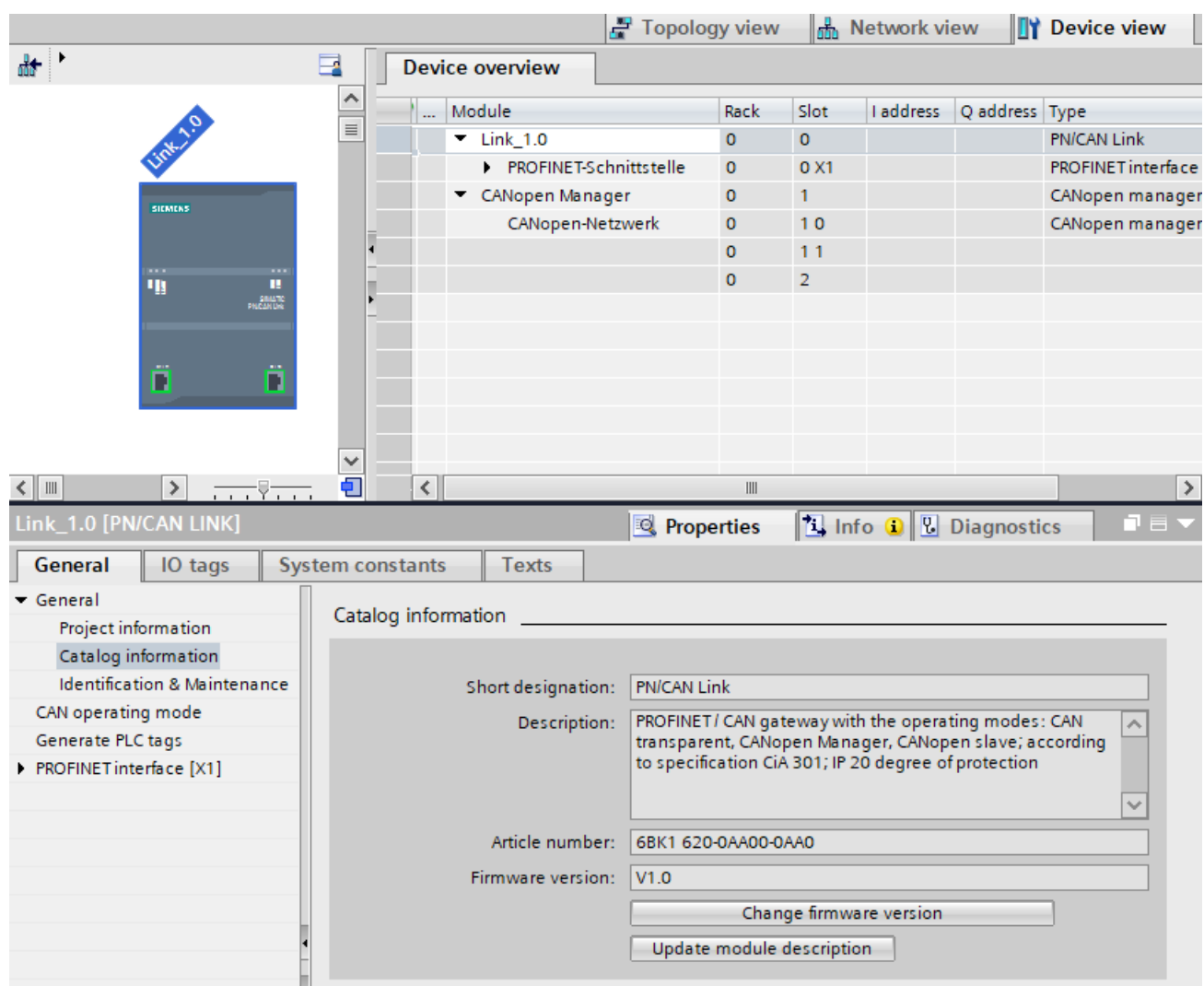


Figure 10-2 Changing the firmware version

10.1 Configuring CANopen Manager

10.1.1 Overview

The PN/CAN LINK is configured in the TIA Portal. For "CANopen Manager" operating mode, configuring consists mainly of the following steps:

1. Drag PN/CAN LINK from the HW catalog to the project.
2. Set the PROFINET-specific parameters.
3. Specify operating mode of the PN/CAN LINK (here, "CANopen Manager").
4. Set the bus-specific parameters, e.g. node ID and transmission rate.
5. Integrate additional CAN nodes; import EDS files or create a new OD table when a node does not have an EDS file (V2.0 and higher).
6. Define transmit PDOs and receive PDOs of the node.
7. Create OD entries for the transmit and receive data to be exchanged in the manager module.
8. Define the corresponding receive PDOs and transmit PDOs in the manager module.
9. If necessary, make additional settings, such as heartbeat, node guarding and SYNC.
10. Check and compile the configuration.

10.1.2 Configuration view in the TIA Portal

TIA Portal: Devices & networks

Follow these steps:

1. Select the PN/CAN LINK with its specific article number from the HW catalog ①.
2. Select the firmware version (V1.0 or V2.0) of the PN/CAN LINK. ② This step is only possible if the HSP_V17_0358_001_Link_PN_CAN_V2.0 is installed. The PN/CAN LINK appears in the "Devices & networks" window.

If the HSP_V17_0358_002_Link_PN_CAN_V2.0 is installed, you can also select the firmware version V2.1.

3. Connect the CPU and PN/CAN LINK by means of a PROFINET connection. CPU and PN/CAN LINK are connected in the "Devices & networks" window with a green PN line ③.
4. Assign the parameters of the PROFINET interface of the PN/CAN LINK ④ according to the configuration of your PROFINET network.

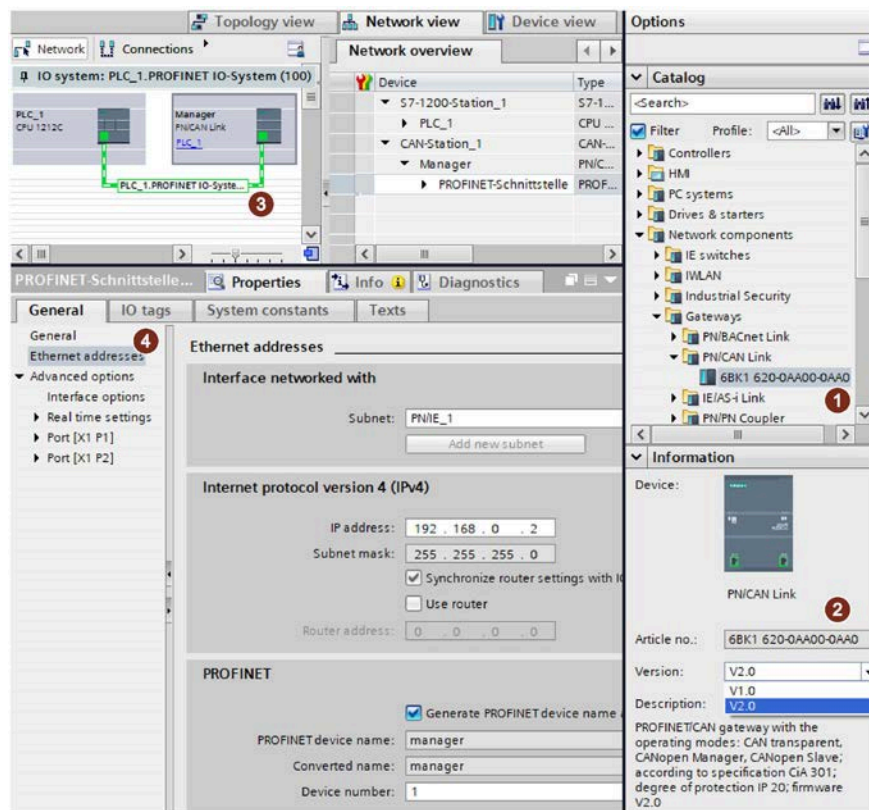


Figure 10-3 TIA Portal: Devices & networks

Setting parameters of the PROFINET interface of the PN/CAN LINK

The PN/CAN LINK supports the S2 redundancy as of firmware version 2.1.

The redundant S7-1500R/H system uses media redundancy (MRP) in the PROFINET ring. All devices of the ring must support the MRP.

- **Menu "Media redundancy"**

For PN/CAN LINK V2.1 the "Media redundancy" menu is now available.

The Media redundancy role is set by default to "Not device in the ring".

- **Port [X1 P1 R] as well as Port [X1, P2 R]**

For PN/CAN LINK V2.1 the ports were changed to ring ports for the Media redundancy (MRP): Port [X1 P1 R] as well as Port [X1 P2 R].

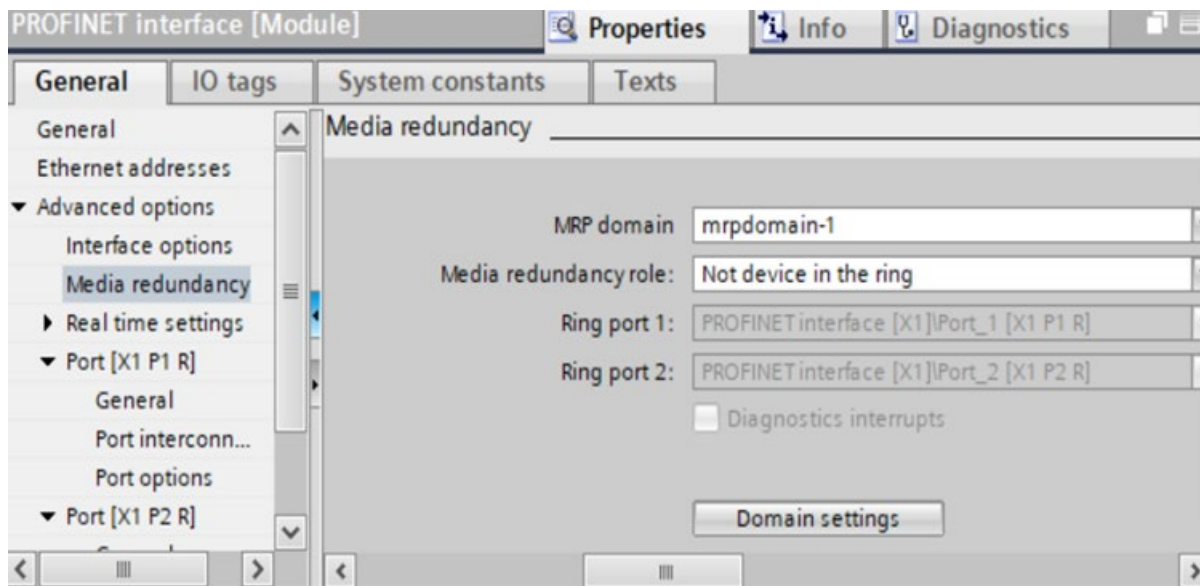


Figure 10-4 Port [X1 P1 R] and Port [X1 P2 R]

- **Menu "Port options"**

For PN/CAN LINK V2.1 as well as V2.0 all Boundaries can now be set.

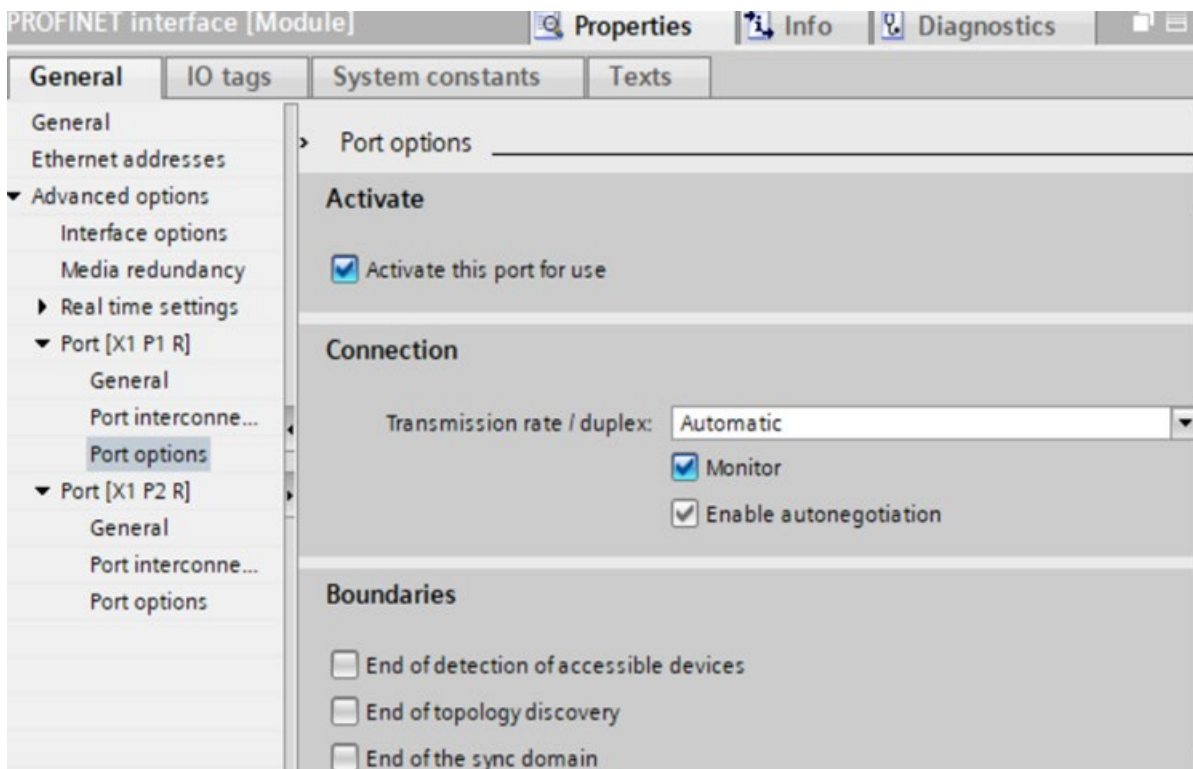


Figure 10-5 Menu "Port options"

Selecting the CAN operating mode of the PN/CAN LINK

The CAN operating mode is selected using the "Set operating mode" drop-down list with the following selection options:

- CANopen Manager
- CANopen Slave
- CAN transparent

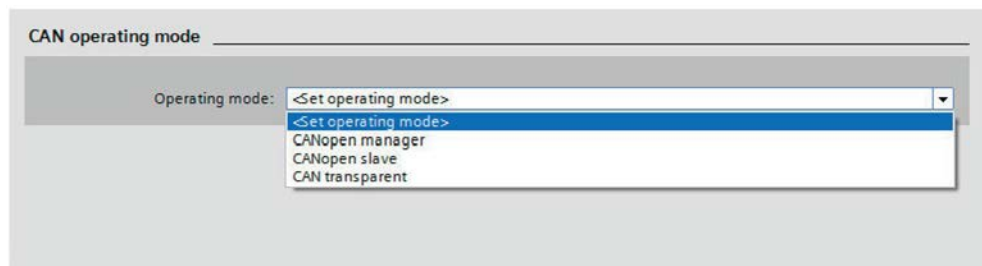


Figure 10-6 Selecting the CAN operating mode

Select the "CANopen manager" operating mode.

After selection of the operating mode the parameters associated with the selected mode can be set. All settings for the CANopen Manager module of the PN/CAN LINK are made in slot 1.

Setting the communication parameters

Set the bus-specific parameters, for example, node ID and transfer rate.

As of firmware version 2.0, you can set the parameters "max. SDO Timeout" and "max. BootUp Timeout".

As of firmware version 2.1 it is possible to set the parameter "Broadcast NMT Operational command".

- **Check box Broadcast NMT Operational command**

When this option is activated, the manager sends the NMT Operational command with the address 0 to all nodes.

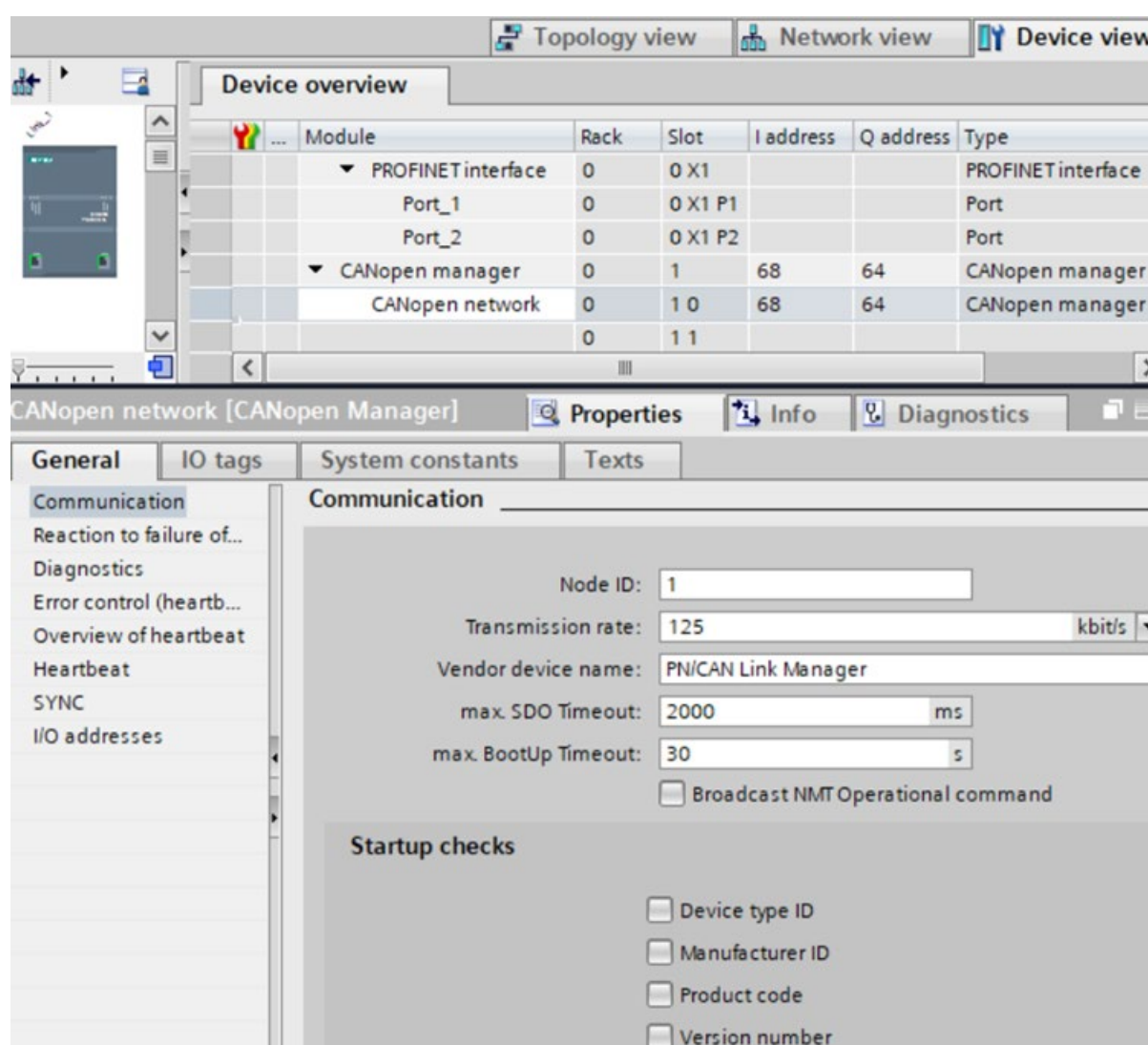


Figure 10-7 Communication

Setting the diagnostic parameters

- **Check box Response to EMCY message: Pass event as diagnostics to S7**

When you select this option, all received EMCY messages are sent to the IO controller as diagnostic alarms.

- **Check box Enable diagnostic alarms for not mandatory nodes**

The option applies only to nodes that are not mandatory.

When you disable this option, the disconnection of the nodes from the CAN bus or error messages that are pending in the CANopen network are not sent to the diagnostic buffer and the ERROR LED remains off.

When you select this option, error messages from such nodes are also displayed in the diagnostic buffer and the ERROR LED lights up. All other nodes on the CAN bus are not affected by this option.

- **Check box Enable additional diagnostics alarms**

When you disable this option, the device does not send diagnostic alarms related to the operating mode (CANopen Manager, CANopen Slave and CAN transparent). Both error LEDs remain off.

- **Check box Block Error passive alarm**

When you select this option, the error passive state of the CAN bus is not reported as an alarm in the diagnostic buffer. The error LED remains off.

(ISO 11898 CAN Layer 2 device: If one of the error counters is above 127, the device goes into the "Error Passive" state of the CAN bus. The next error is signaled by a "Passive Error Flag", which consists of 6 recessive bits. This signal does not destroy any other communication on the bus. The device is fully operational unless an error counter exceeds 255 and the device goes into the "Bus Off" state.)

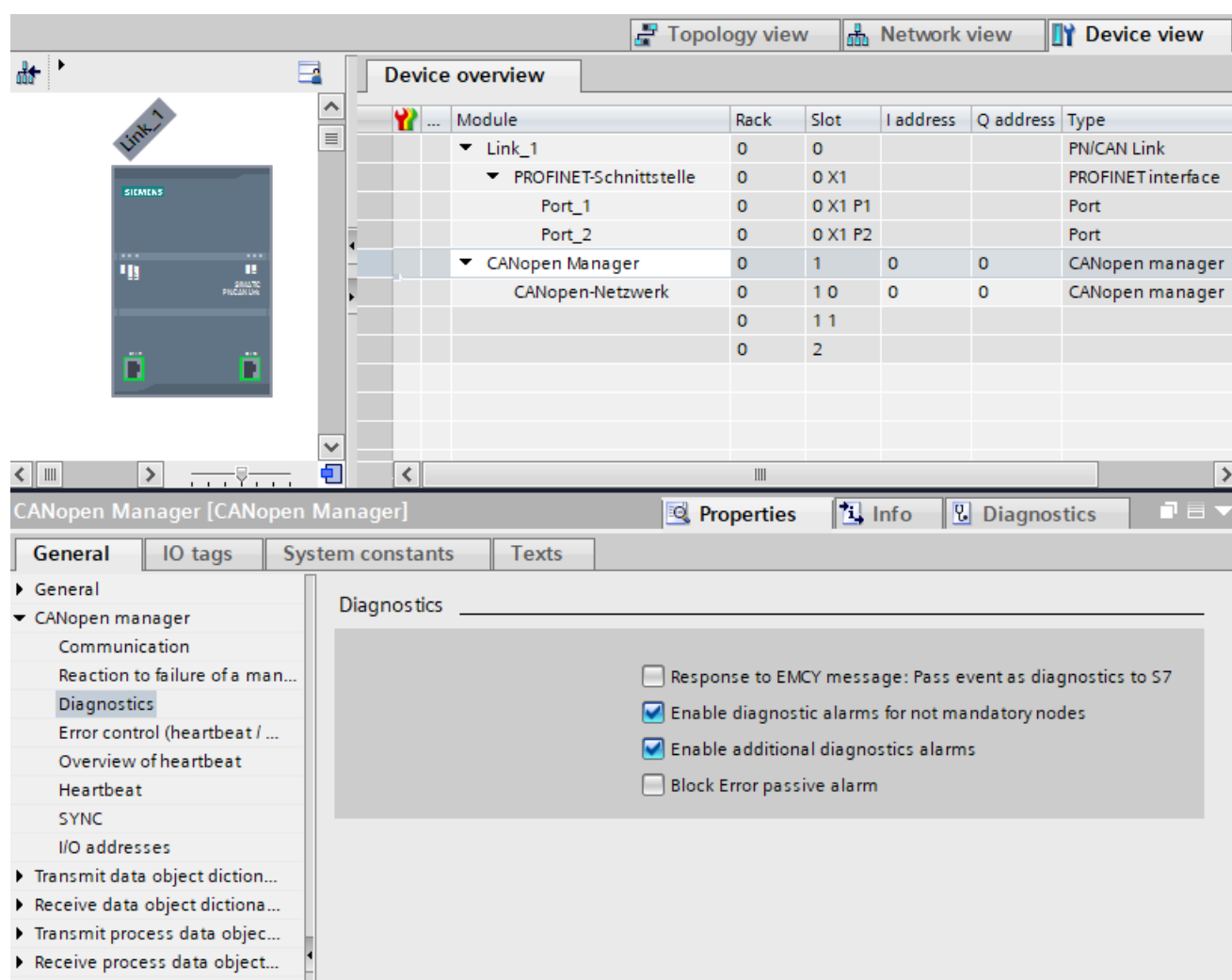


Figure 10-8 Setting the diagnostic parameters

Adding CAN nodes

CAN nodes are placed in PN/CAN LINK as a module from the HW catalog and thus symbolically connected to the CAN bus.

1. Add a "CANopen node universal" ① from the hardware catalog. This CAN node is a placeholder for the CAN device and appears in slot 2.

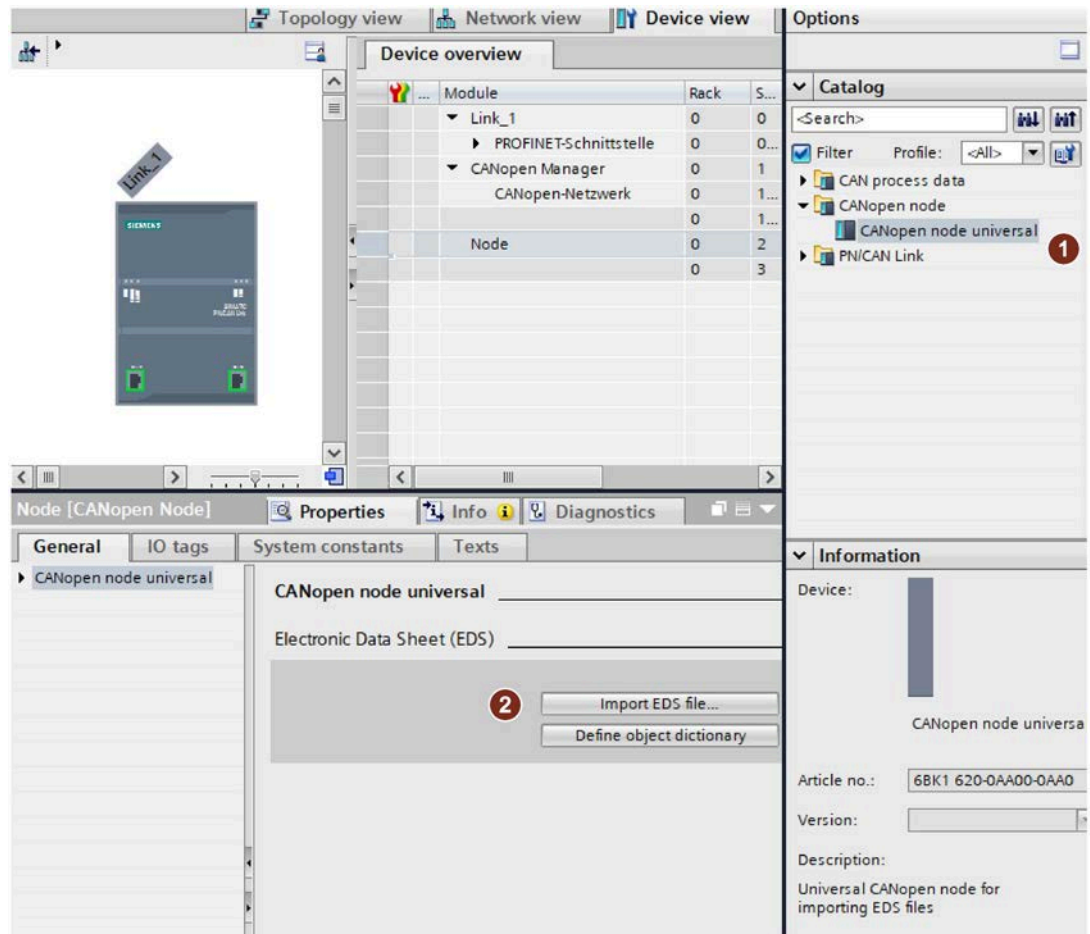


Figure 10-9 Adding CAN nodes

2. Import the EDS (Electronic Data Sheet) file associated with the CAN device. A click on the "Import EDS file..." ② button opens the corresponding file selection dialog.

Defining the object dictionary manually

As of firmware version 2.0, you can manually define the object dictionary (OD).

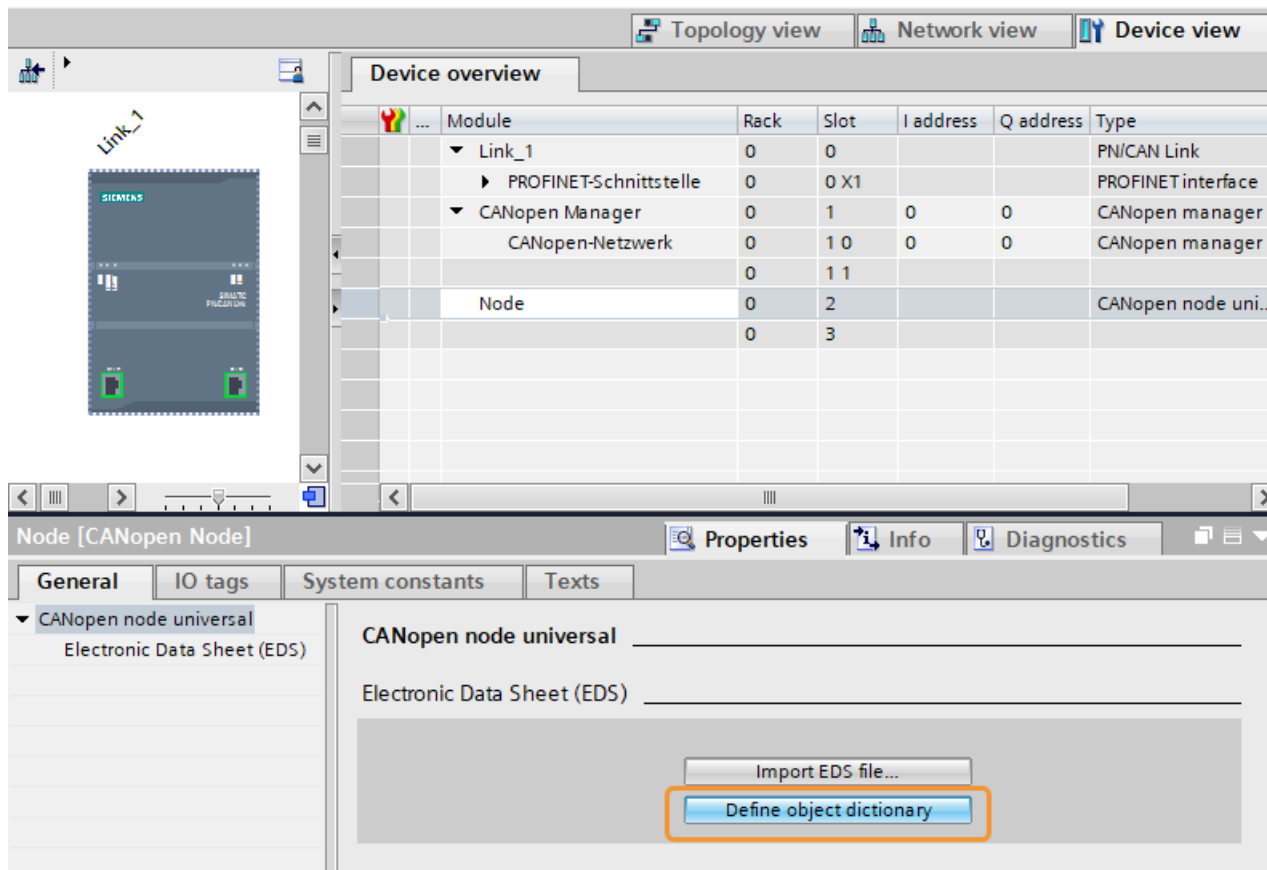


Figure 10-10 Define object dictionary (as of firmware version 2.0)

The basis for working with the CANopen node is the object dictionary (OD) that is usually made available by the manufacturer as an EDS file.

You can import an existing EDS file by clicking on the "Import EDS file..." button. If no EDS file is available yet, create the object dictionary (OD) manually. To do this, use the "Define object dictionary" button. Both steps will result in an object dictionary (OD).

The import of an EDS file can take several minutes depending on the size and complexity of the file. You can significantly shorten the time required for the import by reducing the EDS file to just the entries that are actually needed.

For users of the firmware version V1.0

Once the EDS file is imported, all necessary information is part of the TIA Portal project so that the EDS file is no longer needed.

To edit an EDS file properly, you need to know the structure of the EDS file well or use a specific EDS editor.

Data from the EDS file cannot be updated at a later time. If the EDS file needs to be imported again due to changes (e.g. corrections), you must delete the node and create it again.

Check the object dictionary (OD) of the CAN device for completeness and correctness. We assume hereafter that the OD can be used without changes.

For users of the firmware version V2.0 (and higher)

The object dictionary (OD) is no longer write-protected so that you can edit, add and delete entries.

An imported EDS-file creates an object dictionary (OD) that can be used immediately. However, you must confirm a manually created object dictionary (OD) by pressing the "Apply and check data" button.

As of V2.0, you can correct any incorrect OD entry directly without deleting the node.

Relationship between an OD and configuration menus:

You perform the entire configuration in the corresponding menus and **not** in the OD table. Settings from the menus are **not** visible in the OD table. You can find additional information in the section "Handling of the OD table" below.

Handling of the OD table

After you have added a CANopen node, you have two options in the "Electronic Data Sheet (EDS)" menu:

1. Using an existing EDS file via the "Import EDS file..." button

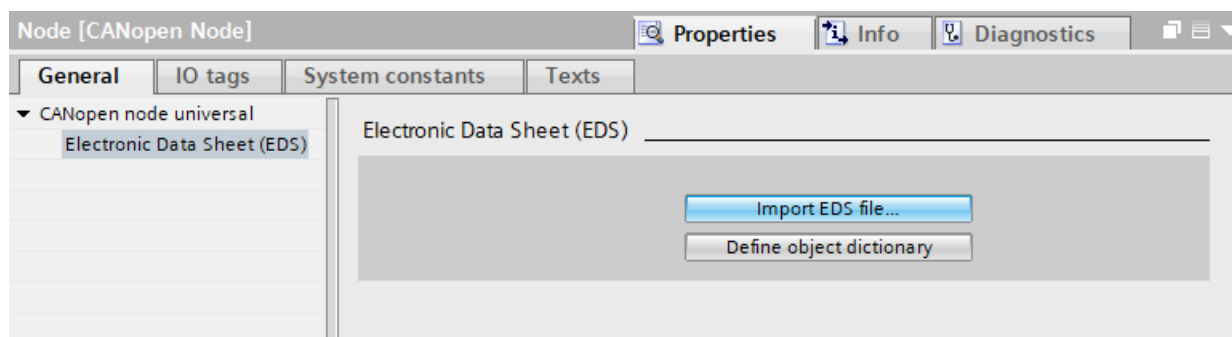


Figure 10-11 Importing the EDS file

2. Manual creation of an object dictionary (OD) using the "Define object dictionary" button:
A template is displayed in the "Object dictionary (OD)" menu.

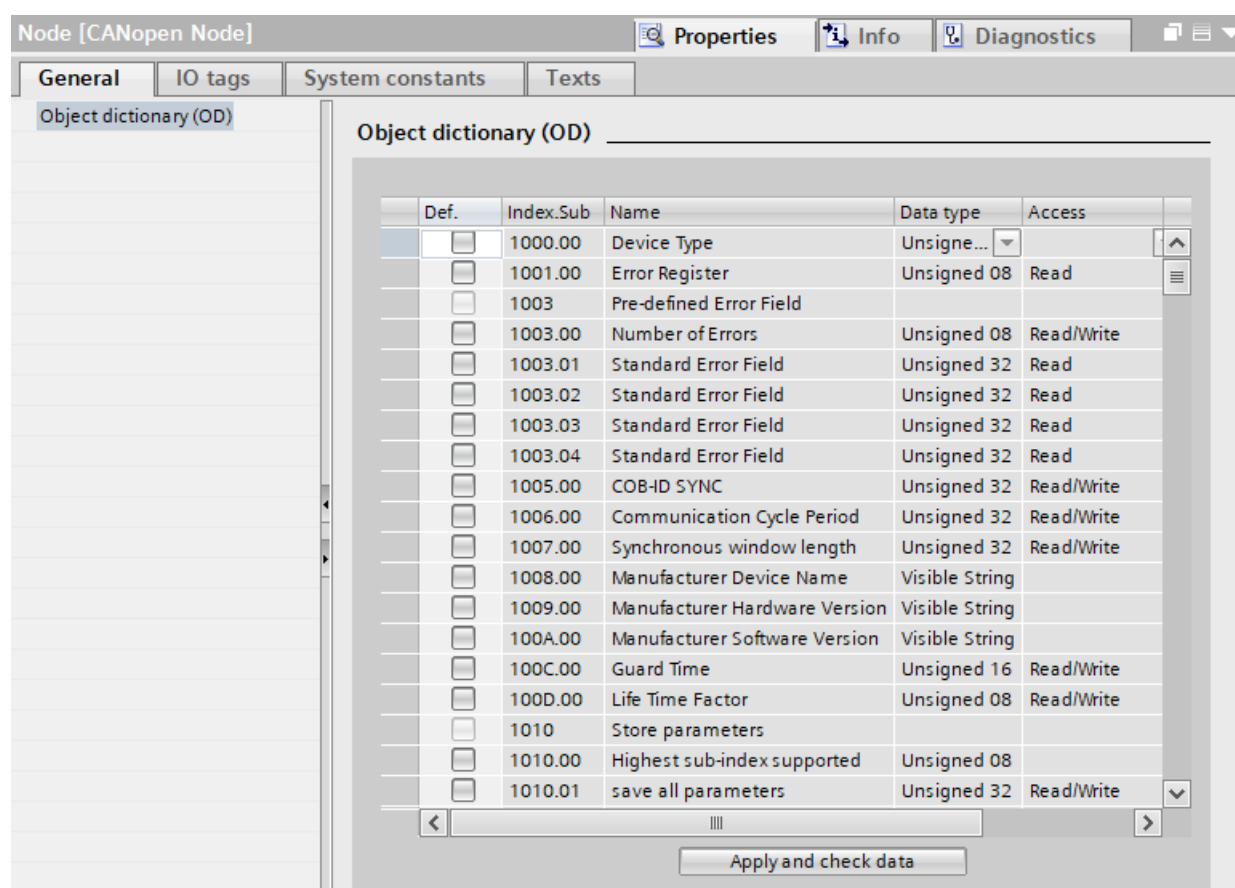


Figure 10-12 Defining the object dictionary

Here you can describe all objects that are available in your device. To do this, select the check box in the "Def." column or add a new entry at the end of the table.

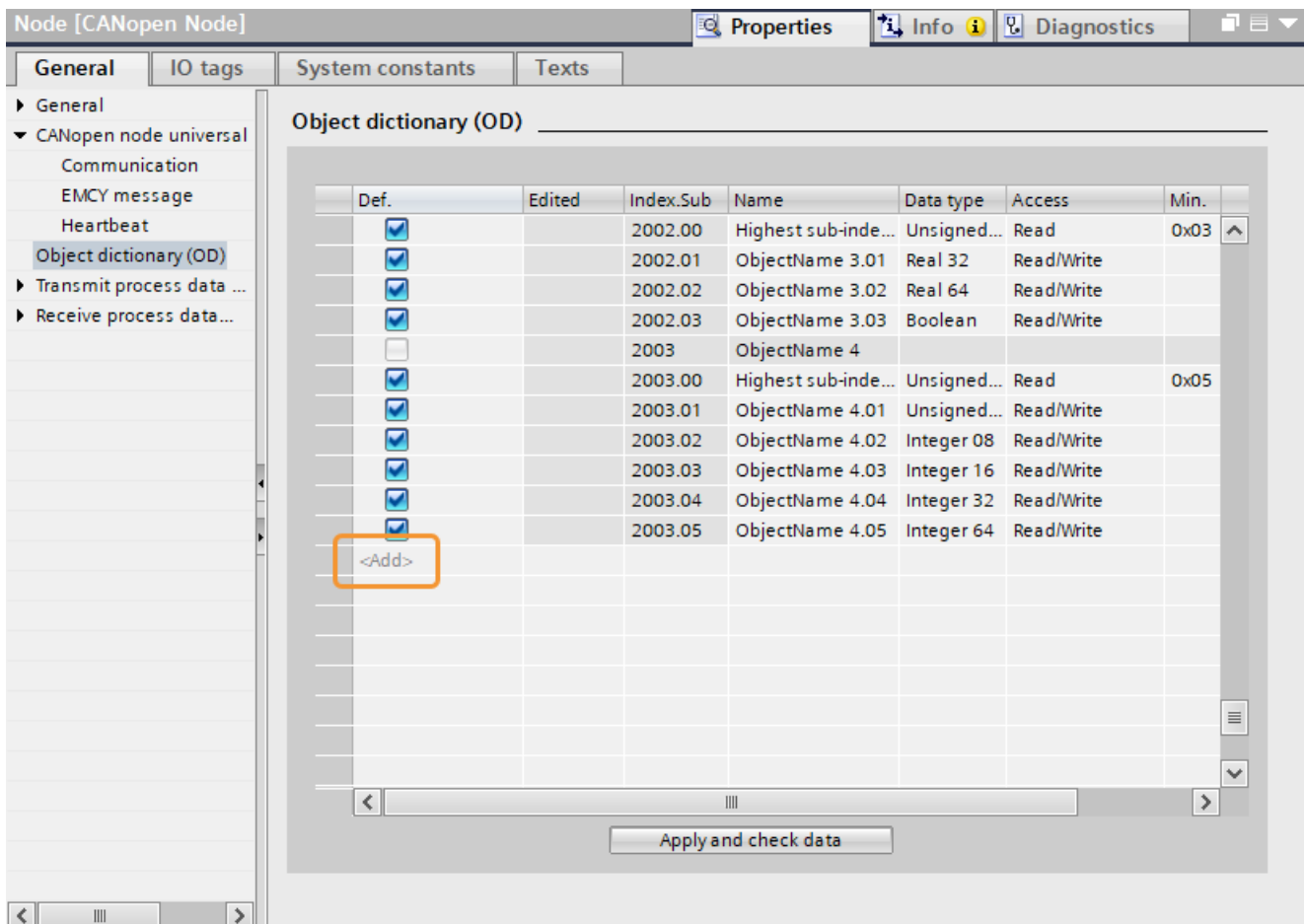


Figure 10-13 Add new entry

To add new rows, double-click the selected cell.

You can delete existing rows by using the shortcut menu of a table row. If you are not sure whether you want to delete an entry, disable it. The entry will be ignored during the next configuration.

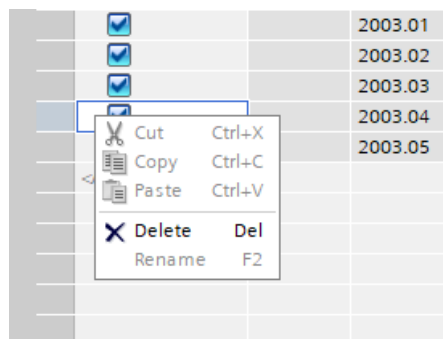


Figure 10-14 Shortcut menu of a table row

You must complete the finished OD table by clicking on the "Apply and check data" button. Once the data are applied, the other menus will become active and visible.

As soon as the OD table is completed by clicking on the "Apply and check data" button, you use it as you would an imported and manually defined EDS.

The following rules apply:

- The OD can be changed at any time but this may invalidate settings that were valid before the change.
- Changes in the OD table must be confirmed with the "Apply and check data" button to have an effect on the menus.
- Settings in the menus are **not** visible in the corresponding OD entries of the OD table (changes in the menus are not transferred to the OD table).
- You cannot bypass the menus and make corresponding configuration settings directly in the OD. This does **not** work.
- Only new object values that are not subject to a configuration menu can be set directly in the OD (these entries can be edited).
- Only entries with a selected check box in the "Def." column are considered to be available in the node device.
- You can add any object that is missing in the template or your EDS file.
- The "Apply and check data" button is hidden by default. It appears only when you make a change in the OD table.

Note

It is necessary that you set all entries (including values, min./max. ranges and other parameters) that are supported by the node in the new empty OD table. The CANopen Manager uses this data to configure the node during the boot-up phase and for verifying the correct values in the settings.

Details on the individual columns

"Def." column (Define):

- Entries can be edited depending on the "Def." column.
- When an EDS file is read in (similar to firmware version V 1.0), the default setting is Def.=True (enabled) for all entries. When "Define object dictionary" is selected, the default value is Def.=False (disabled) for all entries.
- When the "Def." option is selected, the CANopen node supports this object.

"Edited" column:

- "Yes" in the "Edited" column indicates that you have made a change in this row since the last check ("Apply and check data" button).
- The column is always write-protected.
- After you have pressed the "Apply and check data" button, the marking for a "valid" row is removed.
- After you have successfully checked everything, "Yes" is no longer displayed in the column and the "Apply and check data" button disappears again.

Editing an entry

You can edit any entry with a fully defined field in the Index.Subindex column. There is also a type of row where only one index is defined. Such a row can **never** be edited. It only involves a header with a name of OD.

You can only edit entries when the check box in the "Def." column is selected.

Editable columns:

- Name
- Data type
- Access
- Min.
- Max.
- Initial value
- New value
- PDO assignable
- Index.Subindex - You can only edit this column when you have added a new entry. It can no longer be edited once you press the "Apply and check data" button.

The following consistency checks are performed between the columns during editing:

- Data type ↔ Min./Max. ↔ Initial value/New value
- Access ↔ PDO assignable

These changes are only local for the OD table until you press the "Apply and check data" button. No other menu is affected.

Pressing the "Apply and check data" button initiates the following checks and updates:

1. A test is performed to see whether entries were added. These entries are then placed at the correct location in the list. Only the newly added entries are taken into account during sorting. You can only edit the "Index.Sub" field when you have added an entry. The field remains editable until the entry is sorted in the table. After that, you can no longer change the "Index.Sub" field. If you want to change it, you have to delete the entry and add it again.
2. A check is performed to determine whether the object can be read or written to so that data exchange is possible.

3. Checking the mandatory ODs:

The OD entries (OD 1000, OD 1018.01, OD 1018.02, OD 1018.03) are checked, regardless of whether an EDS file is imported or the object dictionary (OD table) is edited.

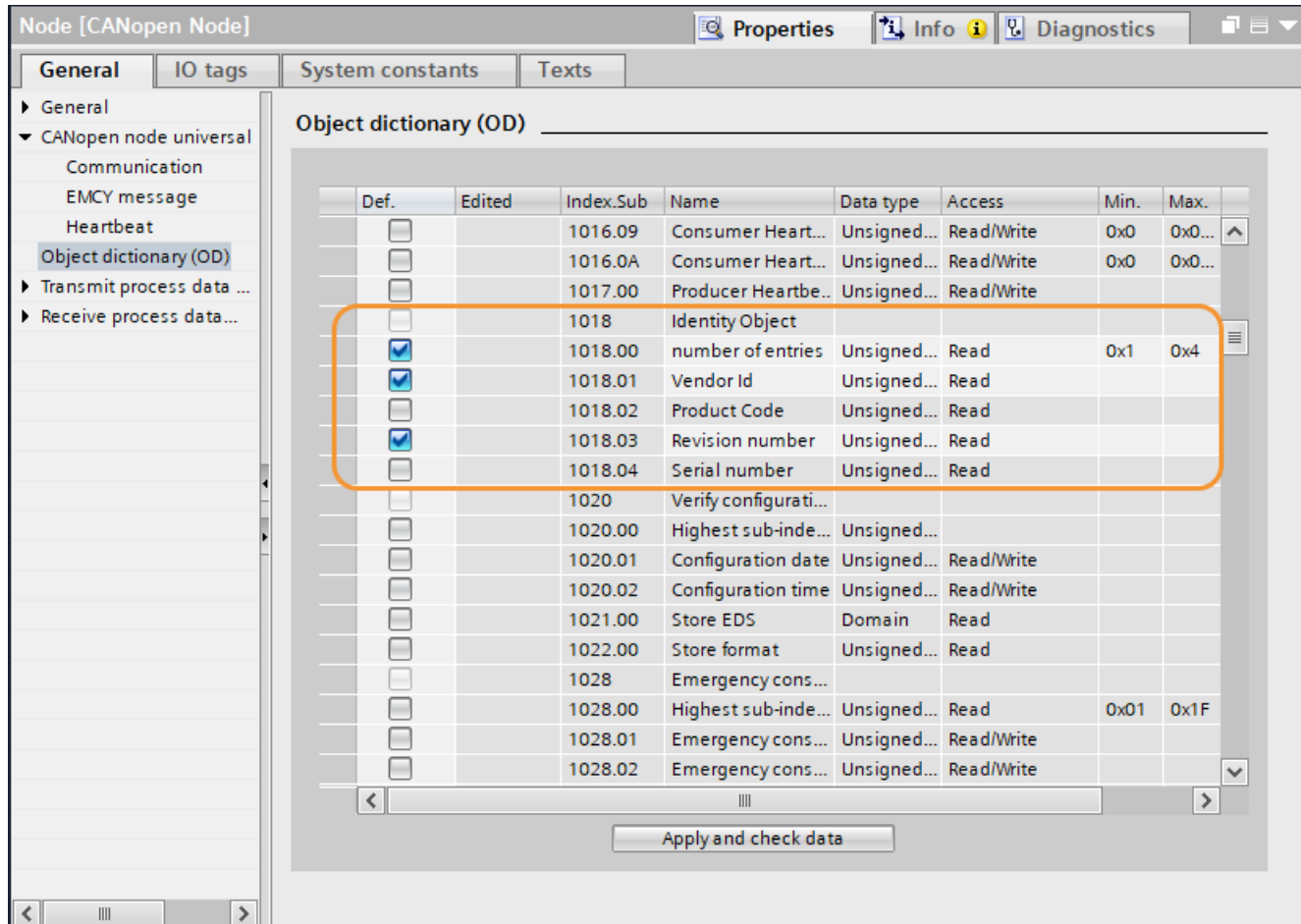


Figure 10-15 Verification of the OD entries

When one of these ODs is not available in the EDS file or is not selected in the OD table, the "Loose configuration" check box is selected and disabled in the "CANopen node universal > Communication" menu.

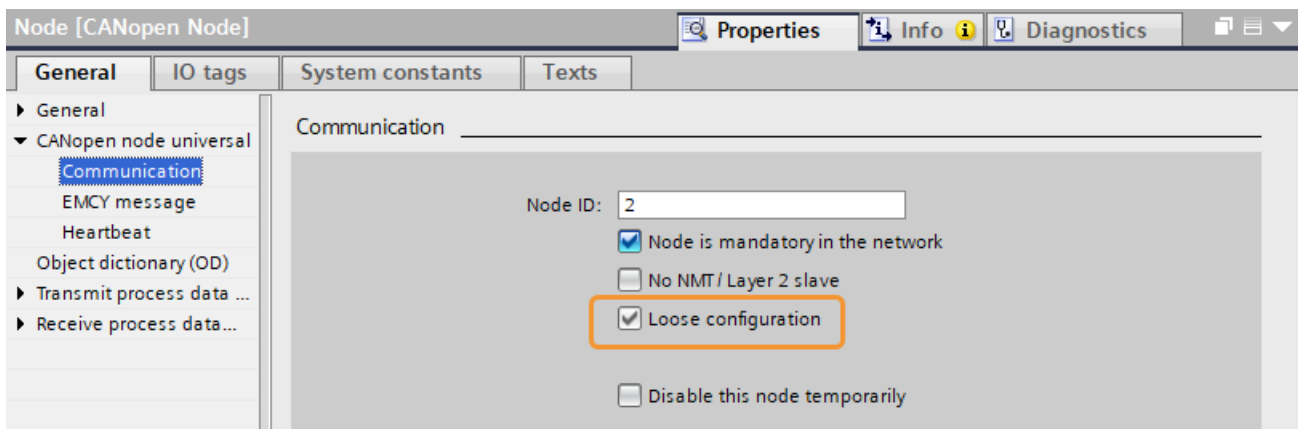


Figure 10-16 Loose configuration

4. Creating new temporary lists for RX-PDOs and TX PDOs according to the entries in the OD. When entries are incomplete (missing subindex or mapping entry), the PDO is rejected (this can have an effect on the previously correctly defined PDO).
5. A check is performed to determine whether changes were made that require an update of the list of mappable objects or objects actually mapped. All affected lists are updated.

Note

When you make changes to OD entries that have an effect on a previously configured PDO, these configurations are lost. You must make this configuration again.

Creating an OD entry for transmit data in the Manager

1. Double-click "Transmit data object dictionary" ① in the HW catalog. This places an OD entry as a submodule in the "CANopen Manager" module.

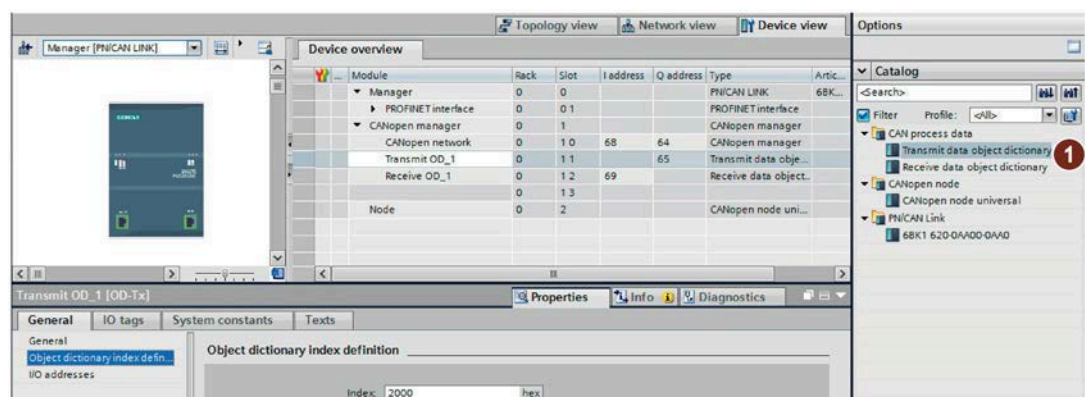


Figure 10-17 Creating a transmit data OD

Defining a transmit OD index and subindex

1. Select the transmit data object dictionary (OD) entry in the device overview with a mouse click.
2. Enter the OD index ① and the name for the created transmit data OD entry.

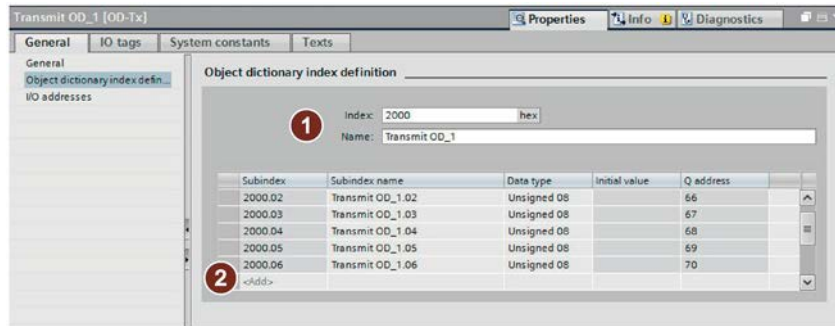


Figure 10-18 Object dictionary index definition

3. Create the subindices ② associated with the OD index.
To create additional subindex entries, double-click "Add".

Creating additional OD entries for transmit data in the Manager

Repeat the above steps until all desired transmit data has been created in the OD of the Manager.

Note

You can create a maximum of 100 OD entries.

This maximum number is independent of the distribution of entries between the transmit data OD and receive data OD.

Defining transmit process data objects (PDOs) in the Manager

1. Select the CANopen Manager.
2. Select the "Transmit PDO definition" window ①.

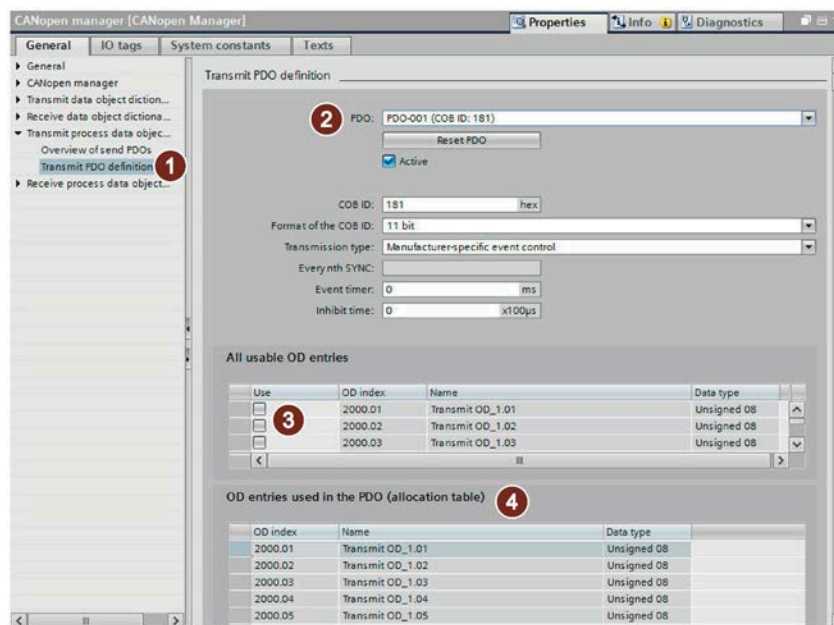


Figure 10-19 Transmit PDO definition

3. Select a free PDO number to which a COB ID has not yet been assigned in the "PDO" line ② and click on the "Define PDO" button.
Set the COB ID to the same value that is also used by the corresponding receive PDO in the slave.
4. Assign transmit data to the transmit PDO.
To assign the data, select the data that is to be transmitted in the transmit PDO from the "All usable OD entries" table with the buttons in the "Use" column ③.
5. The selected OD entries can now be seen in the table "OD entries used in the PDO" ④.
Two additional tables below make for easy reference to see how any previously defined receive PDOs with the same COB ID are structured.

Note

The length of the transmit data assigned to a transmit PDO must match the length of the receive data in the corresponding receive PDO at the end of configuring.

Defining receive data OD and assigning receive PDOs

The steps for defining and assigning the receive data are analogous to those for transmit data:

1. Create receive data object directory
2. Define receive OD index and subindex
3. Define receive PDOs
4. Assignment of the OD entries used in the PDO

Note

The length of the receive data assigned to a receive PDO must match the length of the transmit data in the corresponding transmit PDO at the end of configuring. If necessary, the length of the receive PDO must be adapted by using predefined dummy OD entries.

Disable checking of PDO length (for configuration with HSP_V17_0358_001_Link_PN_CAN_V2.0)

As of firmware version 2.0, you can select the "Disable checking of PDO length" option (see figure below).

Option enabled

When you select this option, the data length (number of received bytes) of the received PDOs is adapted. Error, warning or diagnostic messages are not generated.

The value is adjusted to the correct data length as follows:

- Data below the defined length are supplemented with the value 0.
- If data exceeds the defined length, the more significant bytes are deleted.

Option disabled

If you disable this option, all data from a received PDO with a length deviating from the standard is discarded and replaced with the value of the last valid PDO (last received PDO with the correct length). The CANopen Manager calls up an error message in the diagnostic buffer.

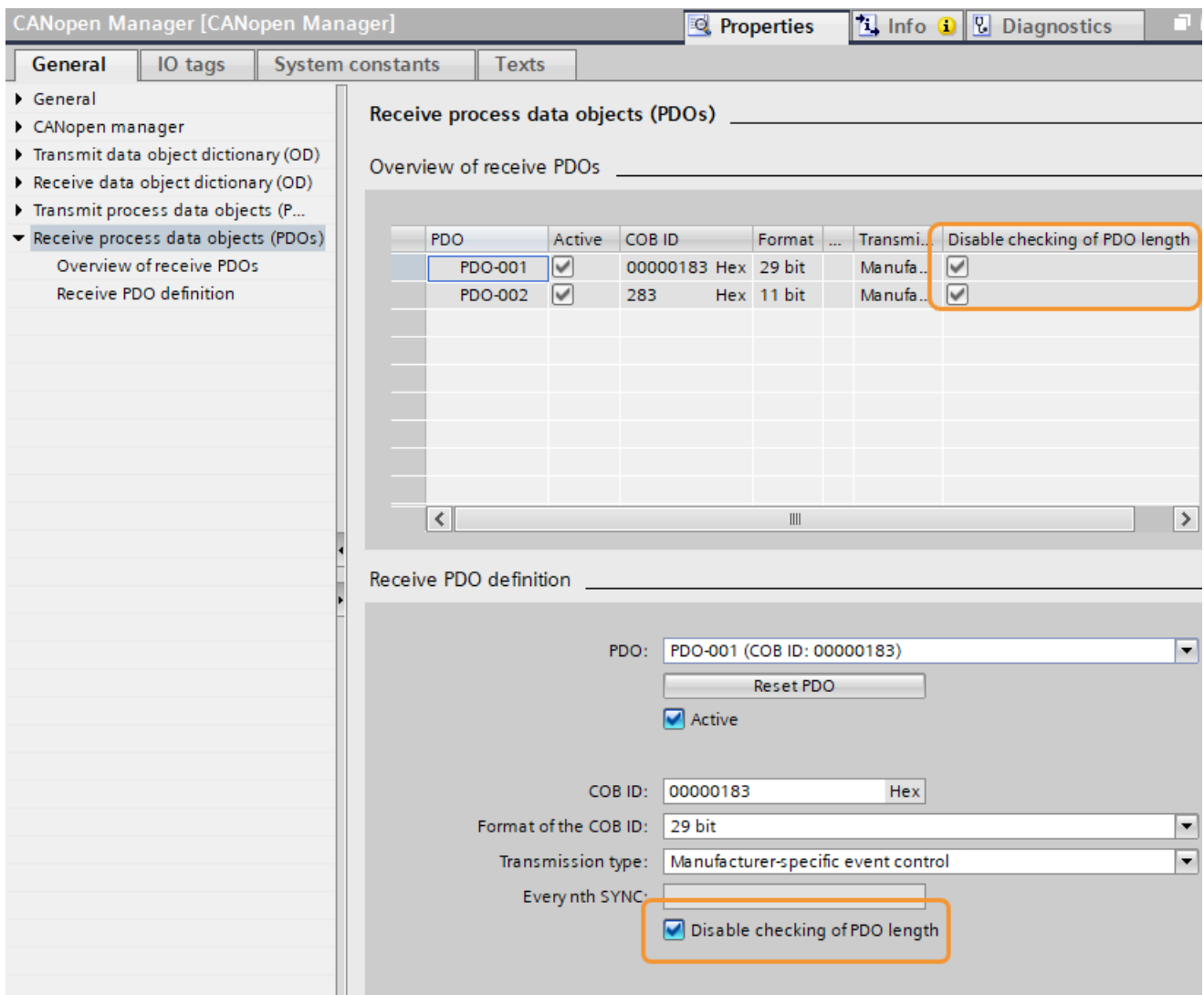


Figure 10-20 Disable checking of PDO length

Adapting I/O addresses

If necessary, you must adapt the I/O addresses assigned automatically by the TIA Portal. This is possible, for example, in the "Device overview" window. Here you can also find the I/O addresses used by the slots. In particular, the addresses assigned to slot 1, that is the CANopen Manager, are important because the control and status information is exchanged with the S7 program via these addresses. It is important for startup of the PN/CAN LINK that the control information transmitted here from the S7 program is set correctly.

Disabling a node temporarily (when configuring with HSP_V17_0358_001_Link_PN_CAN_V2.0)

You have configured a series of nodes in the TIA Portal, but one node does not physically exist in the CAN network. To work with the "reduced" network, you can temporarily disable one or more nodes. Such a CANopen node with its entire configuration remains in the project but is **not** downloaded to the PN/CAN LINK. The node **does not exist** in the configuration that is used by the PN/CAN LINK. No errors or warnings are generated by the module.

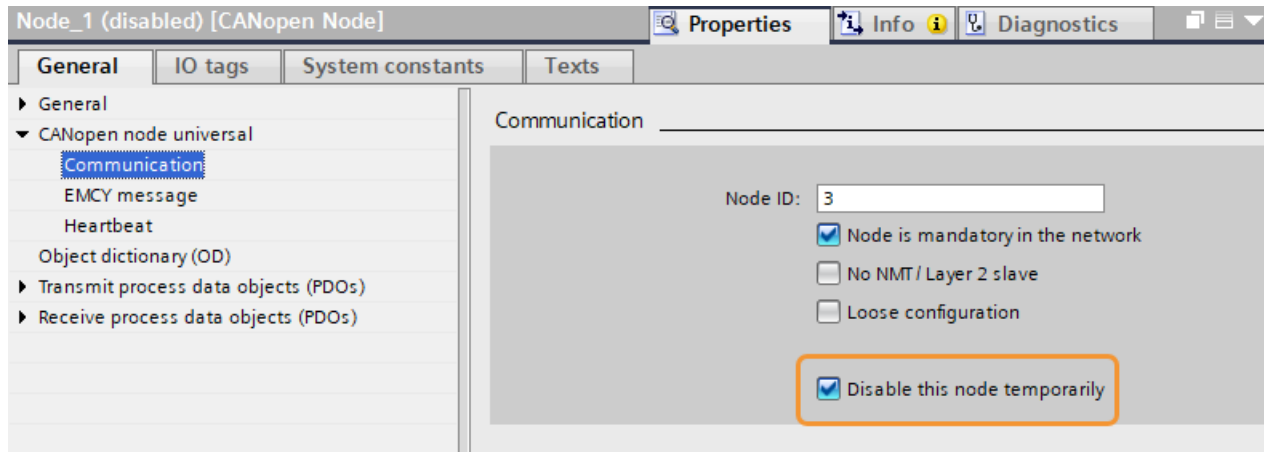


Figure 10-21 Disabling a node temporarily

When such a node appears in the menu, it is marked as "(disabled)".

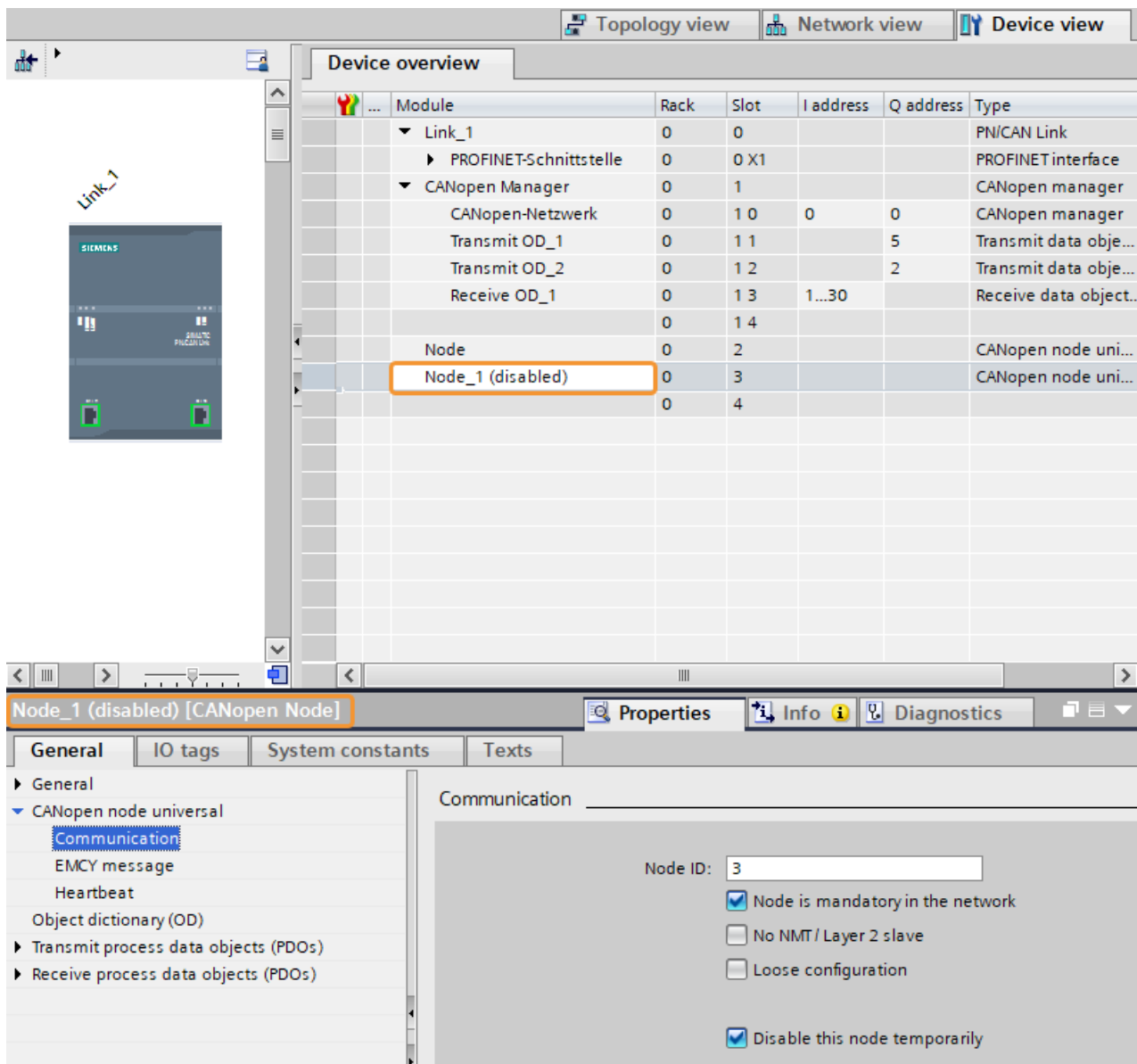


Figure 10-22 Node disabled

Checking data consistency

You can check the consistency of the assignments for the receive data and transmit data as well as the data types used with a compilation.

Setting PN/CAN LINK to "Operational" with the S7 user program

To enable transmission of data between the S7 controller and the PN/CAN LINK, you must set the control bit to "1" using the S7 user program. This control bit is cyclically transmitted from the S7 controller to the PN/CAN LINK as part of the IO data.

Note

In "CANopen Manager" mode, bit 2 must also be set to "1" in the control information transmitted from the S7-CPU to the PN/CAN LINK. You can find additional information on the effect of the control bit under Control and status information (Page 51).

10.2 Configuring CANopen Slave

10.2.1 Overview

Configuring using HSP in the TIA Portal (PN/CAN LINK is NMT slave)

The PN/CAN LINK is configured in the TIA Portal. The configuration for "CANopen Slave" operating mode mainly consists of the following steps:

1. Import PN/CAN LINK HSP into the TIA Portal.
2. Drag PN/CAN LINK from the HW catalog to the project.
3. Set the PROFINET-specific parameters.
4. Set the "CANopen Slave" operating mode.
5. Set bus-specific parameters for the "CANopen Slave" module: Node ID and transmission rate
6. Create OD entries for the process data to be exchanged between the S7 controller and the CANopen network.
7. Check and compile the configuration.
8. Export the EDS file.

10.2.2 Configuring in the TIA Portal

TIA Portal: Devices & networks

Follow these steps:

1. Select the PN/CAN LINK with its specific article number from the HW catalog ①.
2. Select the firmware version (V1.0 or V2.0) of the PN/CAN LINK. ② This step is only possible if the HSP_V17_0358_001_Link_PN_CAN_V2.0 is installed. The PN/CAN LINK appears in the "Devices & networks" window.

If the HSP_V17_0358_002_Link_PN_CAN_V2.0 is installed, you can also select the firmware version V2.1.

3. Connect the CPU and PN/CAN LINK by means of a PROFINET connection.
CPU and PN/CAN LINK are connected in the "Devices & networks" window with a green PN line ③.
4. Assign the parameters of the PROFINET interface of the PN/CAN LINK ④ according to the configuration of your PROFINET network.

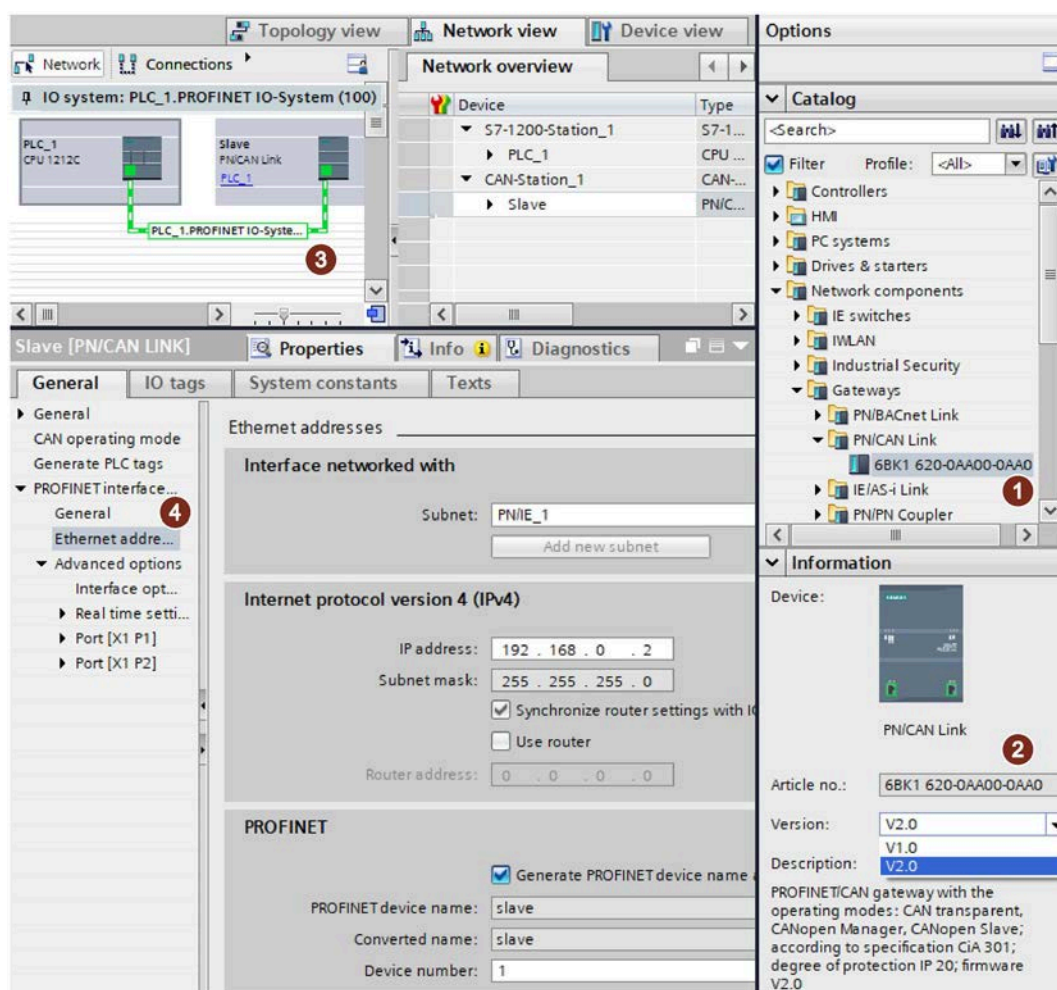


Figure 10-23 TIA Portal: Devices & networks

Setting parameters of the PROFINET interface of the PN/CAN LINK

The PN/CAN LINK supports the S2 redundancy as of firmware version 2.1.

The redundant S7-1500R/H system uses media redundancy (MRP) in the PROFINET ring. All devices of the ring must support the MRP.

- **Menu "Media redundancy"**

For PN/CAN LINK V2.1 the "Media redundancy" menu is now available.

The Media redundancy role is set by default to "Not device in the ring".

- **Port [X1 P1 R] as well as Port [X1, P2 R]**

For PN/CAN LINK V2.1 the ports were changed to ring ports for the media redundancy (MRP): Port [X1 P1 R] as well as Port [X1 P2 R].

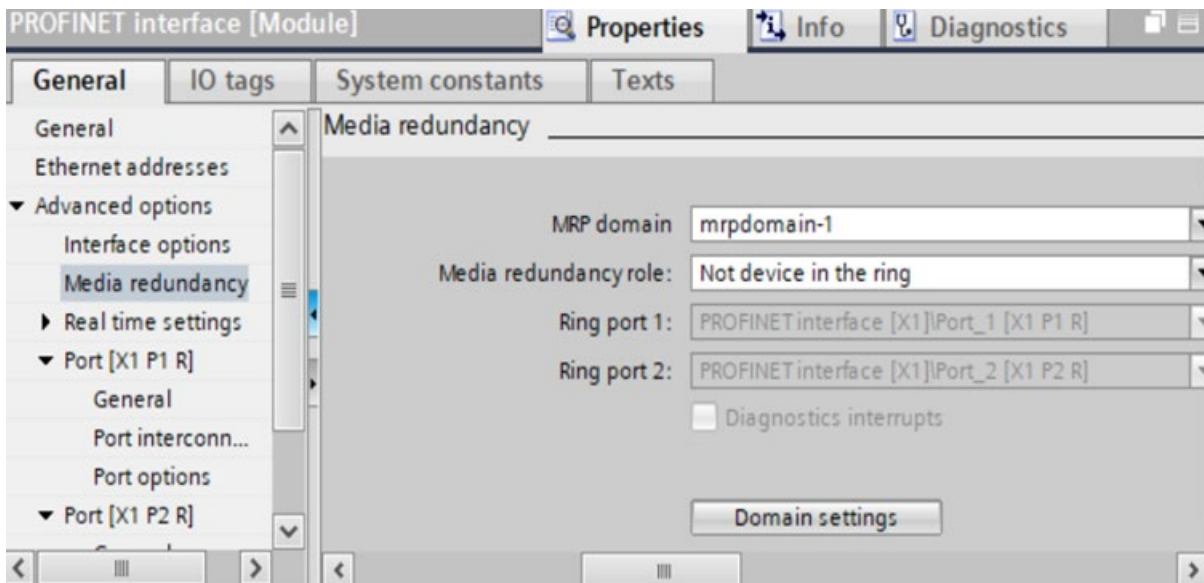


Figure 10-24 "Port [X1 P1 R]" and "Port [X1 P2 R]"

- **Menu "Port options"**

For PN/CAN LINK V2.1 as well as V2.0 all Boundaries can now be set.

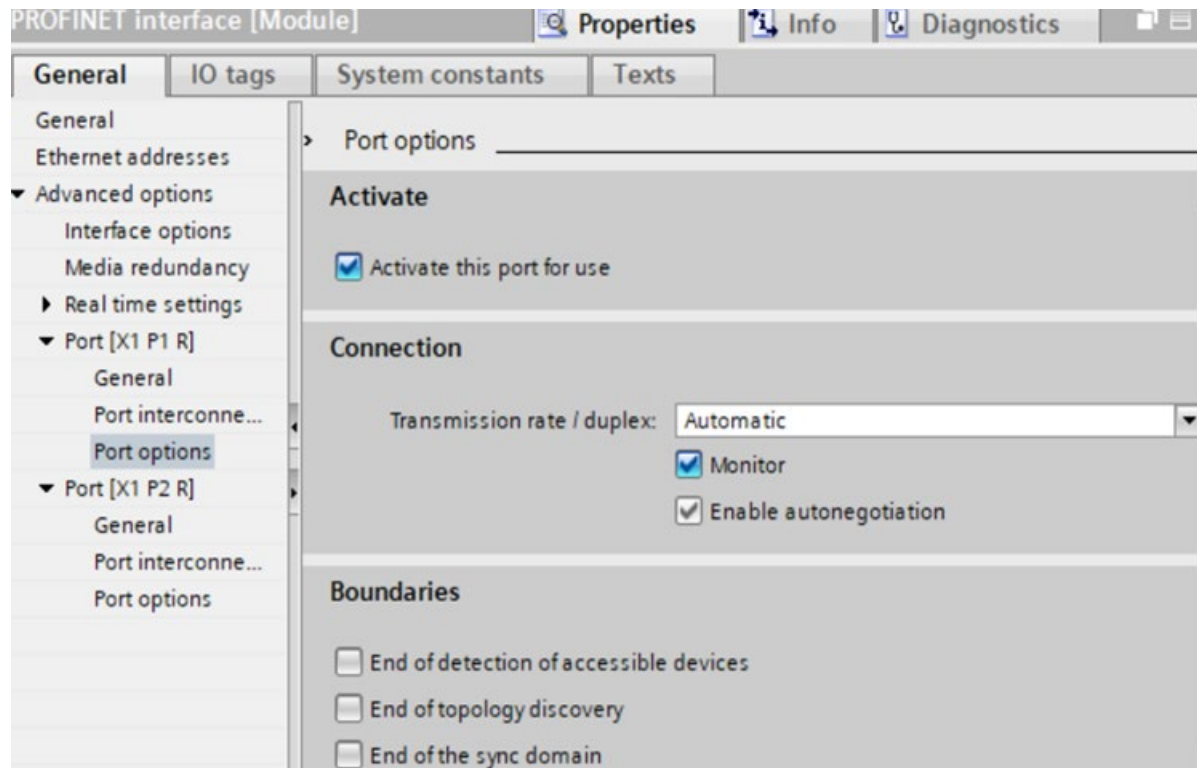


Figure 10-25 Menu "Port options"

Selecting the CAN operating mode of the PN/CAN LINK

The CAN operating mode is selected using the "Set operating mode" drop-down list with the following selection options:

- CANopen Manager
- CANopen Slave
- CAN transparent

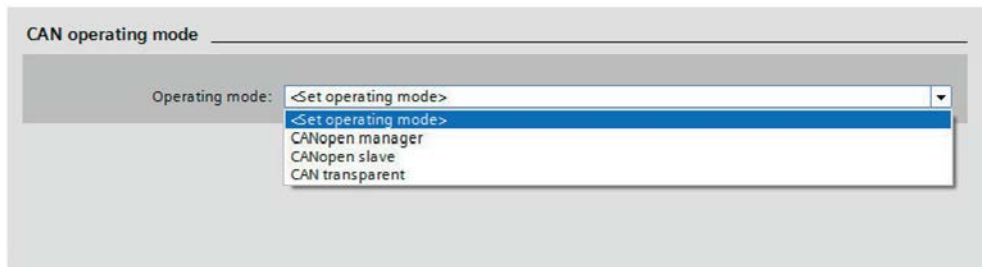


Figure 10-26 Selecting an operating mode

Select the "CANopen Slave" operating mode.

After selection of the operating mode the parameters associated with the selected mode can be set. All settings for the CANopen Slave module of the PN/CAN LINK are made in slot 1.

Setting the communication parameters

Set the bus-specific parameters for the CANopen Slave module: Node ID and transmission rate

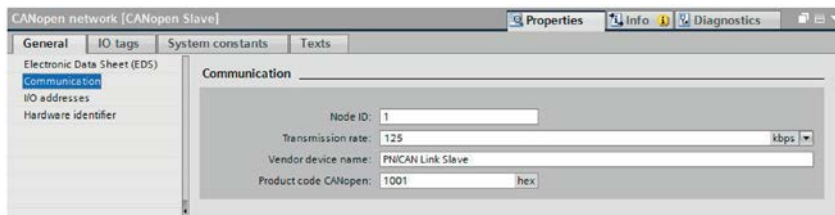


Figure 10-27 Setting the communication parameters

Setting the diagnostic parameters

As of firmware version 2.0, you can select the new menu "Diagnostics", which contains two check boxes.

- **Check box Enable additional diagnostics alarms**

When you disable this option, the device does not send diagnostic alarms related to the operating mode (CANopen Manager, CANopen Slave and CAN transparent). Both error LEDs remain off.

- **Check box Block Error passive alarm**

When you select this option, the error passive state of the CAN bus is not reported as an alarm in the diagnostic buffer. The error LED remains off.

(ISO 11898 CAN Layer 2 device: If one of the error counters is above 127, the device goes into the "Error Passive" state of the CAN bus. The next error is signaled by a "Passive Error Flag", which consists of 6 recessive bits. This signal does not destroy any other communication on the bus. The device is fully operational unless an error counter exceeds 255 and the device goes into the "Bus Off" state.)

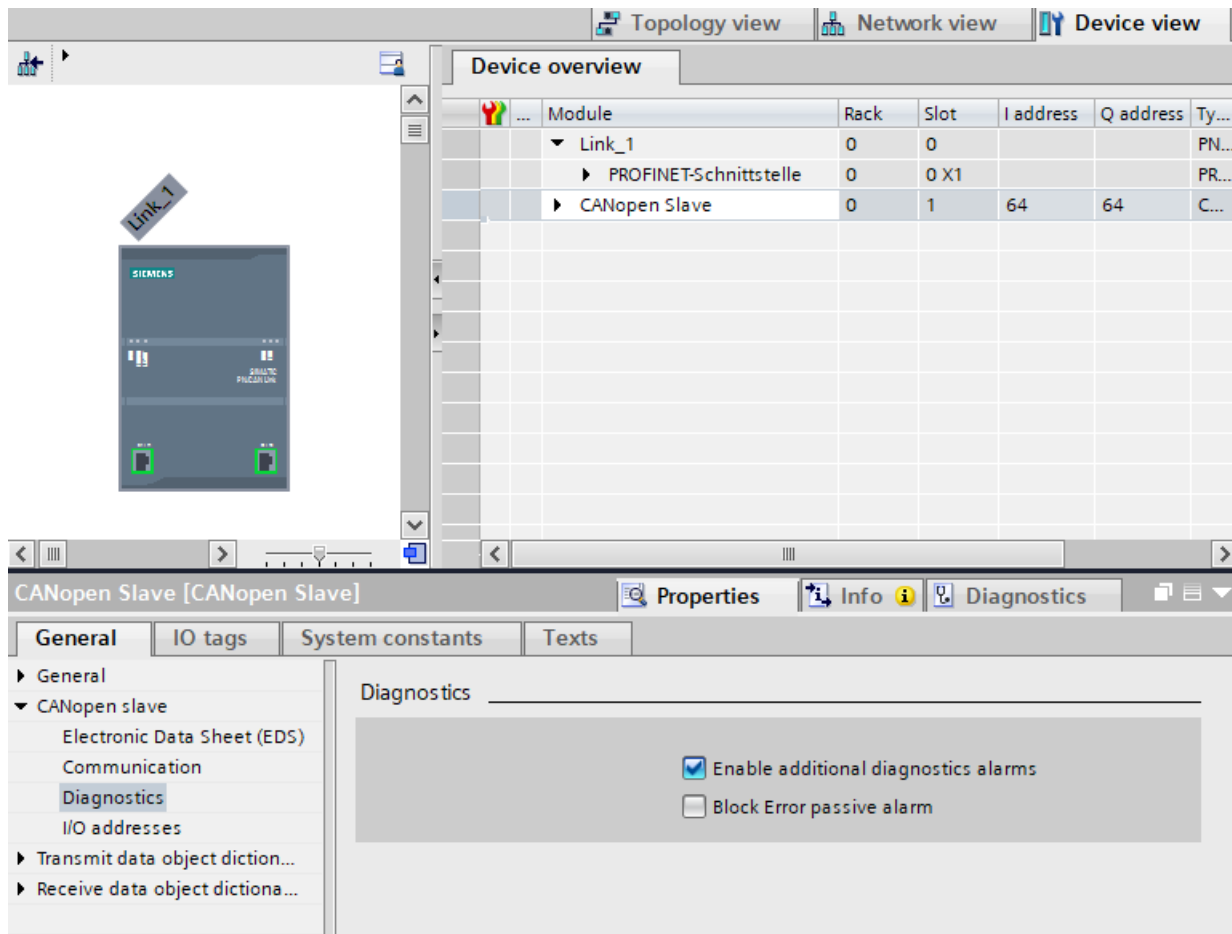


Figure 10-28 CANopen Slave diagnostics menu

Creating an OD entry for transmit data in the slave

Double-click "Transmit data object dictionary" ① in the HW catalog. A transmit data OD entry is placed as a submodule in the "CANopen Slave" module.

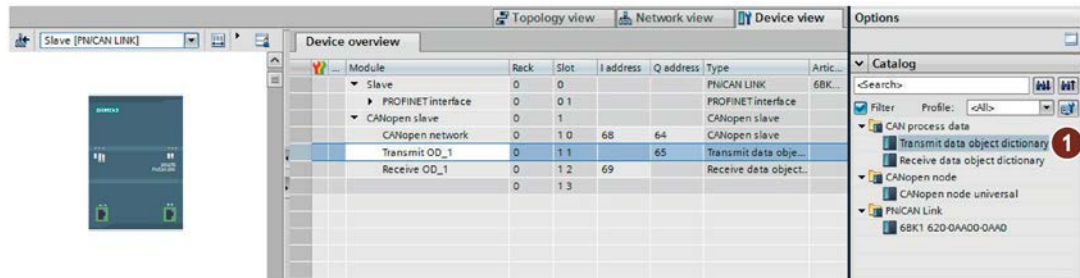


Figure 10-29 Creating a transmit data object dictionary

Defining a transmit data OD index and subindex

1. Select the transmit data object dictionary (OD) entry in the device overview with a mouse click.
2. Enter the OD index ① and the name for the created transmit data OD entry.

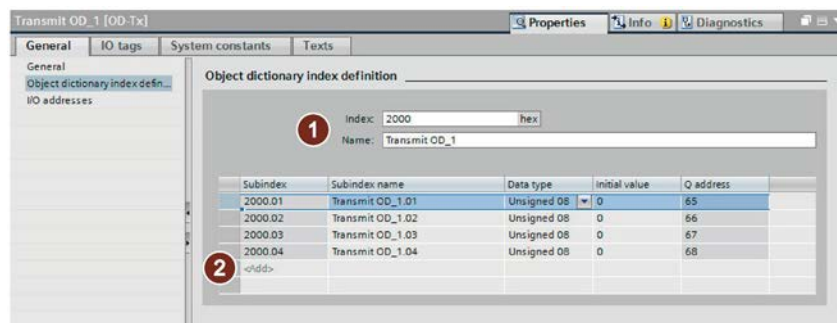


Figure 10-30 Object dictionary index definition

3. Create the subindices ② associated with the OD index.
To create additional subindex entries, double-click "Add".

Creating additional OD entries for transmit data in the slave

Repeat the above steps until all desired transmit data has been created in the OD of the slave.

Note

You can create a maximum of 100 OD entries.

This maximum number is independent of the distribution of entries between the transmit data OD and receive data OD.

Defining a receive data OD

The steps for defining and assigning the receive data ODs are analogous to those for transmit data ODs:

1. Create receive data object directory
2. Define receive OD index and subindex

Adapting I/O addresses

If necessary, you must adapt the I/O addresses assigned automatically by the TIA Portal. This is possible, for example, in the "Device overview" window. Here you can also find the I/O addresses used by the slots. In particular, the addresses assigned to slot 1, that is the "CANopen Slave" module, are important because the control and status information is exchanged with the S7 program via these addresses. It is important for startup of the PN/CAN LINK that the control information transmitted here from the S7 program is set correctly.

Checking data consistency

You can check the consistency of the assignments as well as the data types used with a compilation.

Exporting the EDS file

Set the number of desired process data objects.

Export the EDS file of the PN/CAN LINK. Click the "Export EDS file" button ① to open the corresponding file selection dialog.

Note

Define only as many process data objects (PDOs) as you actually need for transmissions. A large number of unnecessary PDOs can significantly slow down the processes in the TIA project when importing an EDS file into the CANopen Manager.

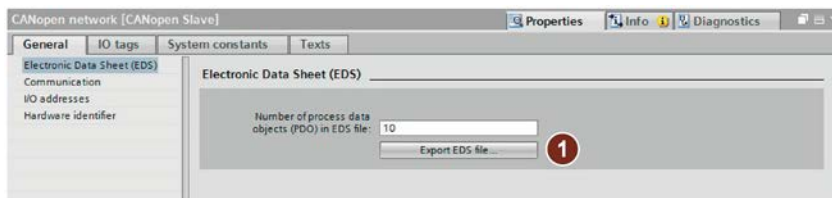


Figure 10-31 Exporting the EDS file

Allowing PN/CAN LINK to transition to "Operational" via the S7 user program

To enable the PN/CAN LINK to transition to "Operational" state and thus the transmission of data between the S7 controller and the PN/CAN LINK, you must set the control bit to "1" using the S7 user program. This control bit is cyclically transmitted from the S7 controller to the PN/CAN LINK as part of the IO data. However, the actual state transition must be triggered by the current NMT master.

10.3 Configuring CAN transparent

10.3.1 Overview

Configuring using HSP in the TIA Portal

The PN/CAN LINK is configured in the TIA Portal. The configuration for "CAN transparent" operating mode mainly consists of the following steps:

1. Import PN/CAN LINK HSP into the TIA Portal.
2. Drag PN/CAN LINK from the HW catalog to the project.
3. Set the PROFINET-specific parameters.
4. Set the "CAN transparent" operating mode.
5. Set the transmission rate.
6. Set the transmit/receive messages and transmit/receive proxies.
7. Check and compile the configuration.

10.3.2 Configuring in the TIA Portal

TIA Portal: Devices & networks

Follow these steps:

1. Select the PN/CAN LINK with its specific article number from the HW catalog ①.
2. Select the firmware version (V1.0 or V2.0) of the PN/CAN LINK. ② This step is only possible if the HSP_V17_0358_001_Link_PN_CAN_V2.0 is installed. The PN/CAN LINK appears in the "Devices & networks" window.

If the HSP_V17_0358_002_Link_PN_CAN_V2.0 is installed, you can also select the firmware version V2.1.

3. Connect the CPU and PN/CAN LINK by means of a PROFINET connection. CPU and PN/CAN LINK are connected in the "Devices & networks" window with a green PN line ③.
4. Assign the parameters of the PROFINET interface of the PN/CAN LINK ④ according to the configuration of your PROFINET network.

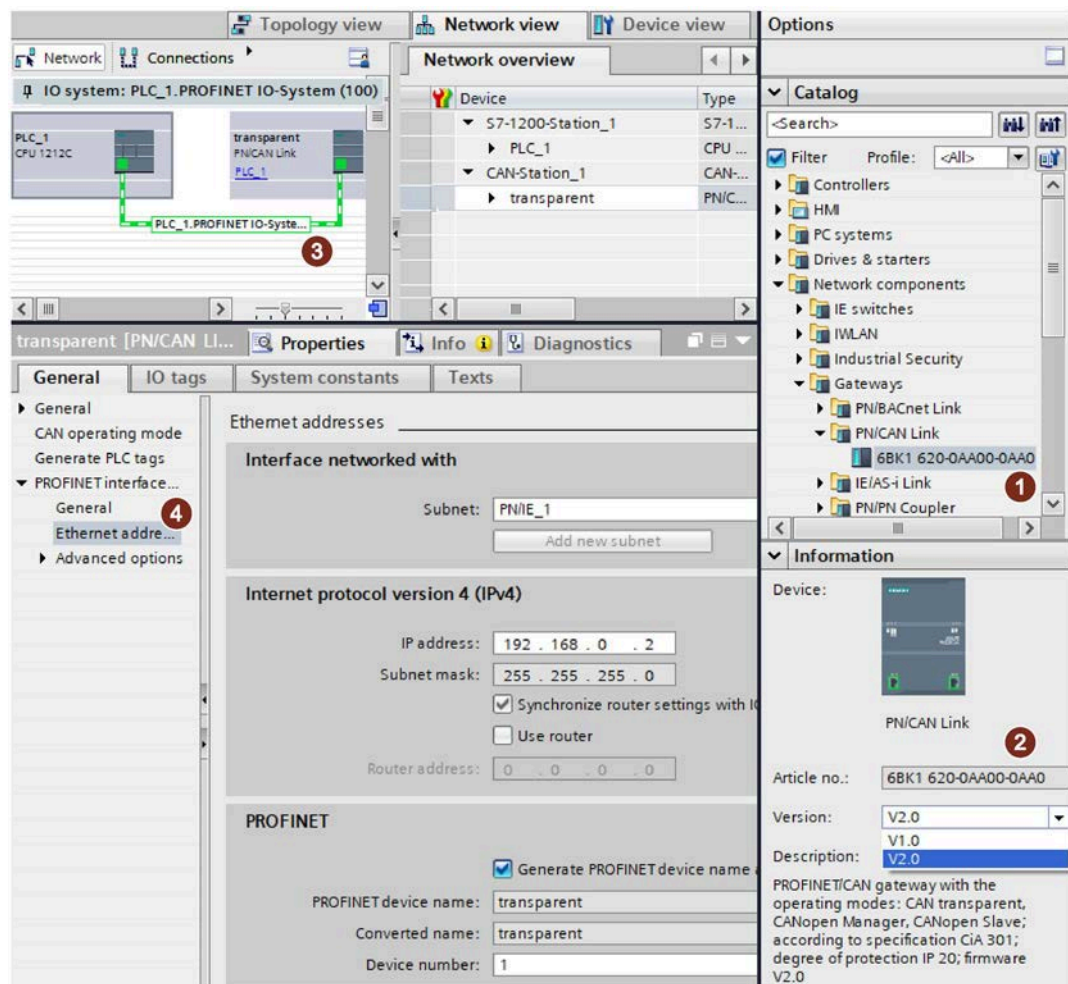


Figure 10-32 TIA Portal: Devices & networks

Selecting the CAN operating mode of the PN/CAN LINK

The CAN operating mode is selected using the "Set operating mode" drop-down list with the following selection options:

- CANopen Manager
- CANopen Slave
- CAN transparent

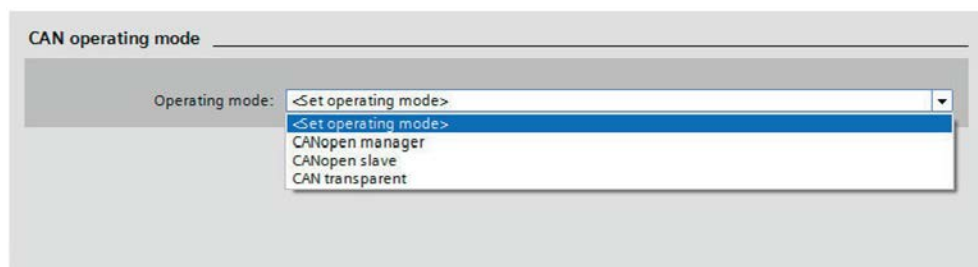


Figure 10-33 Selecting the CAN operating mode

1. Select the "CAN transparent" operating mode.
After selection of the operating mode the parameters associated with the selected mode can be set. All settings for the "CAN transparent" module of the PN/CAN LINK are made in slot 1.

Setting the communication parameters

Select the transmission rate for the communication.

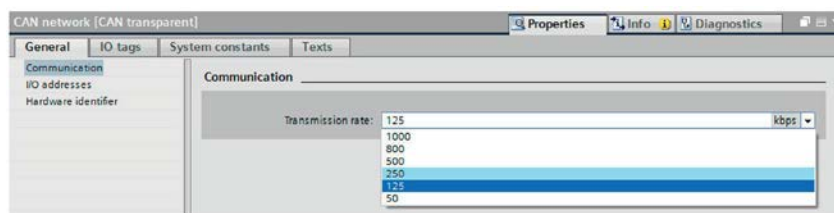


Figure 10-34 Transmission rate

Setting the diagnostic parameters

As of firmware version 2.0, you can select the new menu "Diagnostics", which contains two check boxes.

- **Check box Enable additional diagnostics alarms**

When you disable this option, the device does not send diagnostic alarms related to the operating mode (CANopen Manager, CANopen Slave and CAN transparent). Both error LEDs remain off.

- **Check box Block Error passive alarm**

When you select this option, the error passive state of the CAN bus is not reported as an alarm in the diagnostic buffer. The error LED remains off.

(ISO 11898 CAN Layer 2 device: If one of the error counters is above 127, the device goes into the "Error Passive" state of the CAN bus. The next error is signaled by a "Passive Error Flag", which consists of 6 recessive bits. This signal does not destroy any other communication on the bus. The device is fully operational unless an error counter exceeds 255 and the device goes into the "Bus Off" state.)

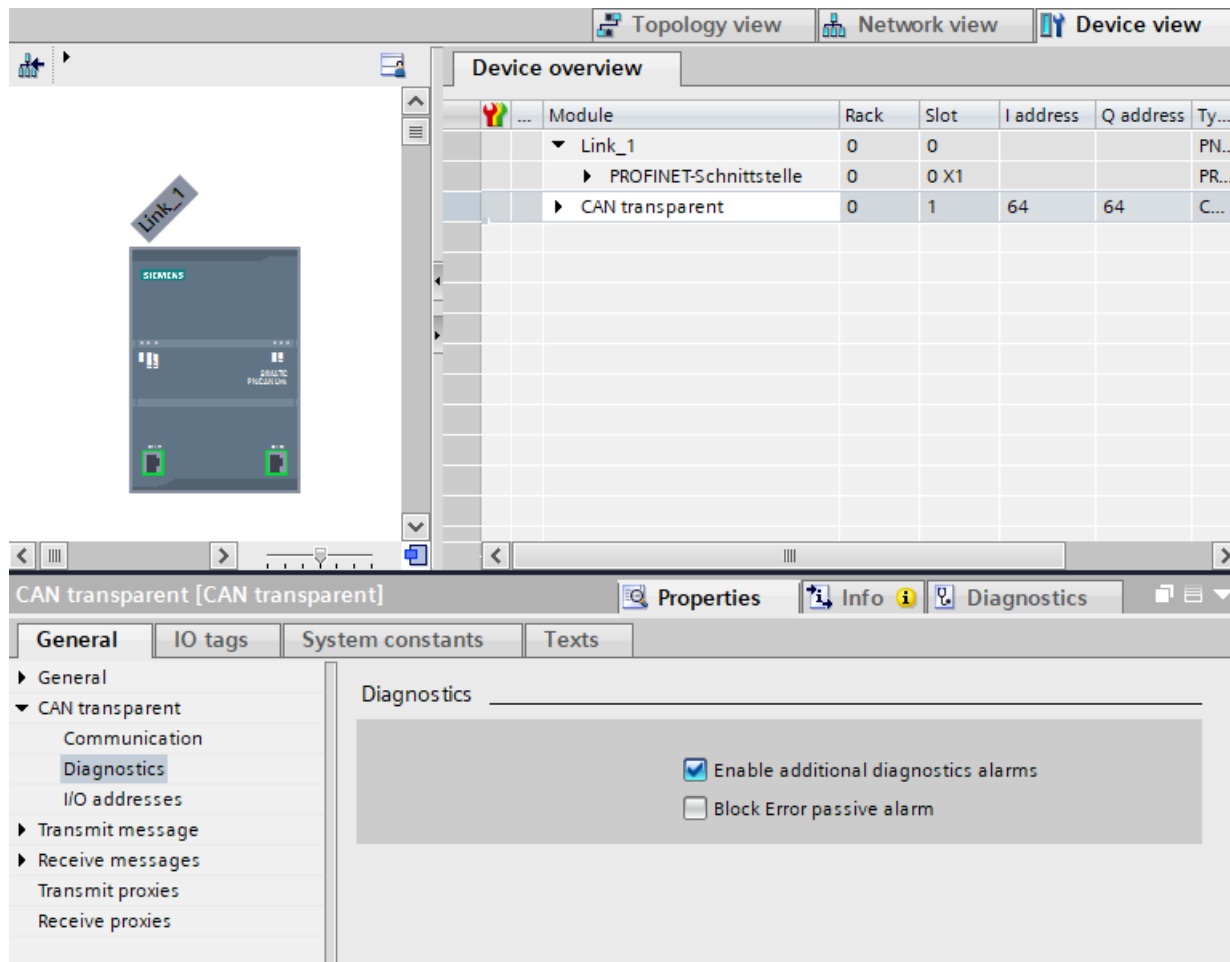


Figure 10-35 CAN Bus transparent diagnostics menu

Configuring transmit/receive messages

1. Double-click "Transmit message" or "Receive message" ① in the HW catalog. The corresponding message type is placed as a submodule in the "CAN transparent" module.
2. Select a send message entry or a receive message entry with the left mouse button in the device overview ②.
3. Create the necessary message definitions ③.

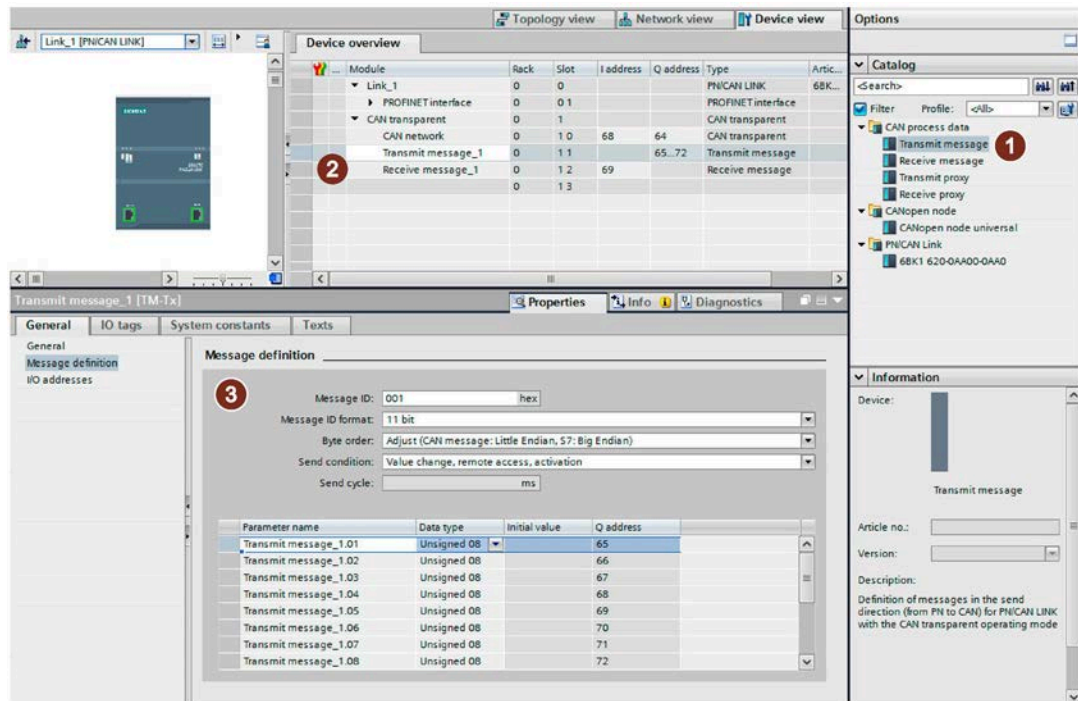


Figure 10-36 Transmit and receive messages

Creating and setting transmit proxies and receive proxies

1. Double-click "Transmit proxy" or "Receive proxy" ① in the HW Catalog. The corresponding proxy is placed as a submodule in the "CAN transparent" module.
2. For receive proxies you can specify the maximum number of messages to be stored by the receive buffer. You can define which messages are to be processed using a message filter ②.

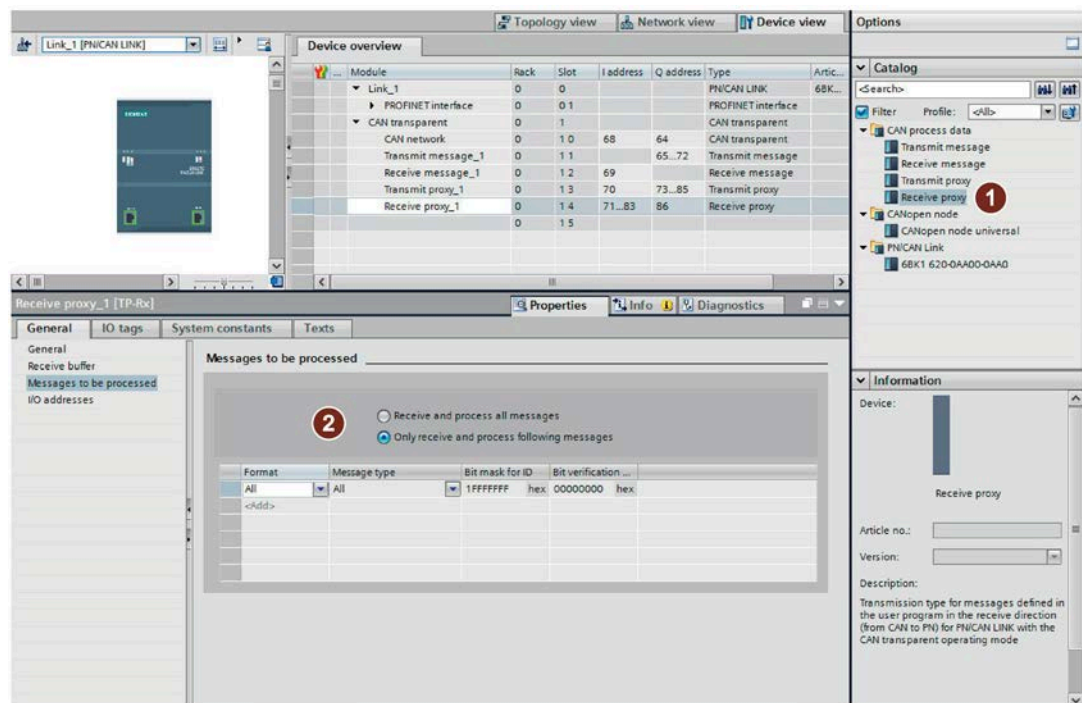


Figure 10-37 Transmit proxies and receive proxies

Adapting I/O addresses

If necessary, you must adapt the I/O addresses assigned automatically by the TIA Portal.

This is possible, for example, in the "Device overview" window. Here you can also find the I/O addresses used by the slots. The addresses assigned to slot 1, that is the "CAN transparent" module, are especially important because the control and status information is exchanged with the S7 program via these addresses. It is important for startup of the PN/CAN LINK that the control information transmitted here from the S7 program is set correctly.

Checking data consistency

You can check the consistency of the assignments for the receive data and transmit data as well as the data types used with a compilation.

Setting CAN communication to "ON" via S7 user program

To enable transmission of data between the S7 controller and the PN/CAN LINK, you must set a control bit to "1" via the S7 user program. This control bit is cyclically transmitted from the S7 controller to the PN/CAN LINK as part of the IO data.

10.4 Programming

10.4.1 PLC tags

PLC tags are automatically created by the HSP during configuration of the PN/CAN LINK in the TIA Portal; you can use these PLC tags in the S7 program to access the cyclic I/O image. This means the parts of the I/O image allocated to the PN/CAN LINK can be accessed from the S7 program using logical names. The use of explicit addresses is therefore not required in the S7 program.

Note

As of TIA Portal V15, it is possible to switch automatic tag generation for I/O objects on and off. Make sure that automatic tag generation is activated.

The setting option is available under "General > Generate PLC tags" after you have set the CAN operating mode.

Note

To improve the performance, switch off the "Automatic generation of PLC tags for I/O objects" when creating large configurations.

When configuration is complete, switch on the "Automatic generation of PLC tags for I/O objects" to generate the PLC tags.

Naming scheme of the created PLC tags

Table 10- 1 Naming scheme of the created PLC tags

Module/ submodule	IO data	Naming scheme	Data type	S7 address Mnemonics
CANopen Manager		Prefix: <LinkName>.<LinkModuleName>		
CANopen Slave				
	Status	<Prefix>.Status	Byte	%IB<ByteAdr>
	Control	<Prefix>.Control	Byte	%QB<ByteAdr>
	Transmit data object dictionary		Prefix: <LinkName>.<LinkModuleName>.<TransmitDataObjectDictionaryName>	
	Unsigned 08	<Prefix>.<Subindex name>	USInt	%QB<ByteAdr>
	Unsigned 16	<Prefix>.<Subindex name>	UInt	%QW<ByteAdr>
	Unsigned 32	<Prefix>.<Subindex name>	UDInt	%QD<ByteAdr>
	Unsigned 64 *	<Prefix>.<Subindex name>	ULInt	%Q<ByteAdr>.0
	Integer 08	<Prefix>.<Subindex name>	SInt	%QB<ByteAdr>
	Integer 16	<Prefix>.<Subindex name>	Int	%QW<ByteAdr>
	Integer 32	<Prefix>.<Subindex name>	DInt	%QD<ByteAdr>
	Integer 64 *	<Prefix>.<Subindex name>	LInt	%Q<ByteAdr>.0
	Real 32	<Prefix>.<Subindex name>	Real	%QD<ByteAdr>
	Real 64	<Prefix>.<Subindex name>	LReal	%Q<ByteAdr>.0
	Bool **	<Prefix>.<Subindex name>	Bool	%Q<ByteAdr>.0
	Receive data object dictionary		Prefix: <LinkName>.<LinkModuleName>.<ReceiveDataObjectDictionaryName>	
	Unsigned 08	<Prefix>.<Subindex name>	USInt	%IB<ByteAdr>
	Unsigned 16	<Prefix>.<Subindex name>	UInt	%IW<ByteAdr>
	Unsigned 32	<Prefix>.<Subindex name>	UDInt	%ID<ByteAdr>
	Unsigned 64 *	<Prefix>.<Subindex name>	ULInt	%I<ByteAdr>.0
	Integer 08	<Prefix>.<Subindex name>	SInt	%IB<ByteAdr>
	Integer 16	<Prefix>.<Subindex name>	Int	%IW<ByteAdr>
	Integer 32	<Prefix>.<Subindex name>	DInt	%ID<ByteAdr>
	Integer 64 *	<Prefix>.<Subindex name>	LInt	%I<ByteAdr>.0
	Real 32	<Prefix>.<Subindex name>	Real	%ID<ByteAdr>
	Real 64	<Prefix>.<Subindex name>	LReal	%I<ByteAdr>.0
	Bool **	<Prefix>.<Subindex name>	Bool	%I<ByteAdr>.0
CAN transparent		Prefix: <LinkName>.<LinkModuleName>		
	Status	<Prefix>.Status	Byte	%IB<ByteAdr>
	Control	<Prefix>.Control	Byte	%QB<ByteAdr>
	Transmit message		Prefix: <LinkName>.<LinkModuleName>.<TransmitMessageName>	
	Unsigned 08	<Prefix>.<Parameter name>	USInt	%QB<ByteAdr>
	Unsigned 16	<Prefix>.<Parameter name>	UInt	%QW<ByteAdr>
	Unsigned 32	<Prefix>.<Parameter name>	UDInt	%QD<ByteAdr>
	Unsigned 64 *	<Prefix>.<Parameter name>	ULInt	%Q<ByteAdr>.0
	Integer 08	<Prefix>.<Parameter name>	SInt	%QB<ByteAdr>
	Integer 16	<Prefix>.<Parameter name>	Int	%QW<ByteAdr>
	Integer 32	<Prefix>.<Parameter name>	DInt	%QD<ByteAdr>

Module/ submodule	IO data	Naming scheme	Data type	S7 address Mnemonics
	Integer 64 *	<Prefix>.<Parameter name>	LInt	%Q<ByteAdr>.0
	Real 32	<Prefix>.<Parameter name>	Real	%QD<ByteAdr>
	Real 64	<Prefix>.<Parameter name>	LReal	%Q<ByteAdr>.0
	Bool **	<Prefix>.<Parameter name>	Bool	%Q<ByteAdr>.0
	Receive message	Prefix: <LinkName>.<LinkModuleName>.<ReceiveMessageName>		
	Unsigned 08	<Prefix>.<Parameter name>	USInt	%IB<ByteAdr>
	Unsigned 16	<Prefix>.<Parameter name>	UInt	%IW<ByteAdr>
	Unsigned 32	<Prefix>.<Parameter name>	UDInt	%ID<ByteAdr>
	Unsigned 64 *	<Prefix>.<Parameter name>	ULInt	%I<ByteAdr>.0
	Integer 08	<Prefix>.<Parameter name>	SInt	%IB<ByteAdr>
	Integer 16	<Prefix>.<Parameter name>	Int	%IW<ByteAdr>
	Integer 32	<Prefix>.<Parameter name>	DInt	%ID<ByteAdr>
	Integer 64 *	<Prefix>.<Parameter name>	LInt	%I<ByteAdr>.0
	Real 32	<Prefix>.<Parameter name>	Real	%ID<ByteAdr>
	Real 64	<Prefix>.<Parameter name>	LReal	%I<ByteAdr>.0
	Bool **	<Prefix>.<Parameter name>	Bool	%I<ByteAdr>.0

I/Q: Input/output bit address

IB/QB: Input/output byte address

ID/QD: Input/output double word address

* The S7-1200 controller does not support the data types LInt and ULInt, which means the generated tags cannot be used for the S7-1200.

** The "Bool" data type is only available as of firmware version PN/CAN LINK 2.0.

Diagnostics

11.1 Status LEDs

11.1.1 Operating state of the PN/CAN LINK / PROFINET diagnostics

Operating state of the PN/CAN LINK / PROFINET diagnostics

The LEDs for visualization of the PN/CAN LINK operating states and the PROFINET ports are located on the front of the housing (Design (Page 35)).

RUN LED	ERROR LED	MAINT LED ¹⁾	Operating state	Description
 On	 On	 On	Power-up test / Serious error	- For approximately 1 second: LED test during startup - Longer than 1 second: HW error detected during power-up test or other serious error
 Off	 Off	 Off	System run-up	System not completely booted yet but power-up test is complete.
 Flashes	 Off	 Off	Not connected to S7 controller	No "IO controller" connection (Application Relation) established or configuration not yet complete.
 On	x	 Off	Connected to S7 controller	"IO controller" connection (Application Relation) established and configuration complete.
x	 Flashes	 Off	Error state	"IO controller" connection (Application Relation) established and configuration complete, but an error has occurred: - Diagnostic message to the S7 controller is pending or - Incorrect configuration by the S7 controller Flashes for at least 3 seconds.

RUN LED	ERROR LED	MAINT LED ¹⁾	Operating state	Description
 Flashes	 Off	 Off	Firmware update	While the firmware is written to the flash memory.
 Flashes	 Flashes	 Off	LEDs are flashing (triggered by TIA Portal)	3-second intervals

1) The MAINT LED currently has no meaning.

x: LED state is irrelevant

During boot-up of the PN/CAN LINK and after connecting the power supply, the sequence is as follows:

1. The three LEDs light up briefly for about 1 second and then go dark again.
2. None of the LEDs light up for about 4 seconds.
3. The RUN LED starts flashing.
4. When the boot-up of the PN/CAN LINK is complete and the connection to the S7 controller is established, the RUN LED lights up.

Ethernet interface

LINK	Indicates whether there is a physical connection on the Ethernet level.
 On	Connection exists
 Off	No connection exists

Rx/Tx	Indicates whether a package is being sent or received
 On	PN/CAN LINK sends or receives a package
 Off	No package is sent or received

11.1.2 Connection status CAN bus in the two CANopen operating modes

Connection status CAN bus in the two CANopen operating modes

The PN/CAN LINK signals its state in "CANopen Manager" mode and in "CANopen Slave" mode with the CAN LEDs on the front of the housing (Design (Page 35)).

Table 11- 1 Behavior of the RUN LED

RUN LED	Meaning	Note
 Off	The PN/CAN LINK is in the initialization phase.	After switching on the device or after reset
 Flashes	The NMT state of the PN/CAN LINK is "Pre-Operational".	--
 One-time brief flashing	The NMT state of the PN/CAN LINK is "Stopped".	--
 On	The NMT state of the PN/CAN LINK is "Operational".	--

Table 11- 2 Behavior of the ERR LED

ERR LED	Meaning	Note
 Off	No error on the CANopen bus	--
 One-time brief flashing	At least one error counter in the CAN controller has reached its warning threshold.	--
 Two-time brief flashing	A heartbeat or node guarding error has occurred.	--
 On	The CAN controller is in "Bus-Off" state.	--

11.1.3 Connection status CAN bus in "CAN transparent" operating mode

Connection status of the CAN bus in "CAN transparent" operating mode

The PN/CAN LINK signals its state in "CAN transparent" operating mode with the fieldbus LEDs on the front of the housing (Design (Page 35)).

Table 11- 3 Behavior of the RUN LED

RUN LED	Meaning
 Off	PN/CAN LINK is off.
 On	PN/CAN LINK is in "ON" state.

Table 11- 4 Behavior of the ERR LED

ERR LED	Meaning
 Off	No error on the CAN bus
 One-time brief flashing	The CAN controller is in "Error passive" state.
 On	The CAN controller is in "Bus-Off" state.

11.2 Diagnostic messages to the S7 controller

11.2.1 Events that trigger a diagnostic message

Diagnostics

The PN/CAN LINK sends diagnostic information to the S7 controller with the usual PROFINET methods.

A distinction is made here between diagnostic messages that refer to the entire PN/CAN LINK and those that affect individual modules.

Many diagnostic messages are the result of error events and not error states. This is why they are withdrawn immediately once they have been signaled to the S7 controller ("Incoming" message and "Outgoing" message).

The tables below provide an overview of the following for the different operating modes of the PN/CAN LINK:

- Events that trigger a diagnostic message
- Events that cause a pending diagnostic message to be withdrawn
- The associated component

The diagnostic messages including description are listed in the section Diagnostic messages (Page 152). The descriptions also include instructions and information on error correction.

Diagnostic-relevant events in "CANopen Manager" operating mode

Table 11- 5 Diagnostic-relevant events in "CANopen Manager" operating mode

Event for triggering	Event for withdrawal	Reference	Additional information
Transition of the CAN controller to "Bus Off" state	CAN controller exits "Bus Off" state again	PN/CAN LINK	---
Transition of the CAN controller to "Error Passive" state	CAN controller exits "Error Passive" state again	PN/CAN LINK	---
Internal communication error	Diagnostic information was transmitted to the S7 controller via PROFINET	PN/CAN LINK	---
Buffer overflow when sending CAN packets	Diagnostic information was transmitted to the S7 controller via PROFINET	PN/CAN LINK	---

11.2 Diagnostic messages to the S7 controller

Event for triggering	Event for withdrawal	Reference	Additional information
Buffer overflow when receiving CAN packets	Diagnostic information was transmitted to the S7 controller via PROFINET	PN/CAN LINK	---
Receipt of PDO with incorrect length	Diagnostic information was transmitted to the S7 controller via PROFINET	PN/CAN LINK	COB ID of the PDO
Heartbeat / node guarding error	When the slave is available again and in the expected state	Corresponding slave module	---
Unexpected slave state	When the slave is in the expected state again	Corresponding slave module	---
Error during boot-up of a slave	When the slave was booted successfully	Corresponding slave module	Cause of error, if known
Receipt of an EMCY message	Diagnostic information was transmitted to the S7 controller via PROFINET	Corresponding slave module	Error codes of the EMCY message

Diagnostic-relevant events in "CANopen Slave" operating mode

Table 11- 6 Diagnostic-relevant events in "CANopen Slave" operating mode

Event for triggering	Event for withdrawal	Reference	Additional information
Transition of the CAN controller to "Bus Off" state	CAN controller exits "Bus Off" state again	PN/CAN LINK	---
Transition of the CAN controller to "Error Passive" state	CAN controller exits "Error Passive" state again	PN/CAN LINK	---
Internal communication error	Diagnostic information was transmitted to the S7 controller via PROFINET	PN/CAN LINK	---
Buffer overflow when sending CAN packets	Diagnostic information was transmitted to the S7 controller via PROFINET	PN/CAN LINK	---
Buffer overflow when receiving CAN packets	Diagnostic information was transmitted to the S7 controller via PROFINET	PN/CAN LINK	---
Receipt of PDO with incorrect length	Diagnostic information was transmitted to the S7 controller via PROFINET	PN/CAN LINK	COB ID of the PDO
Heartbeat / node guarding error	Diagnostic information was transmitted to the S7 controller via PROFINET	PN/CAN LINK	ID of failed node

Diagnostic-relevant events in "CAN transparent" mode

Table 11- 7 Diagnostic-relevant events in "CAN transparent" mode

Event for triggering	Event for withdrawal	Reference
Transition of the CAN controller to "Bus Off" state	CAN controller exits "Bus Off" state again	PN/CAN LINK
Transition of the CAN controller to "Error Passive" state	CAN controller exits "Error Passive" state again	PN/CAN LINK
Internal communication error	Diagnostic information was transmitted to the S7 controller via PROFINET	PN/CAN LINK
Buffer overflow when sending CAN packets	Diagnostic information was transmitted to the S7 controller via PROFINET	PN/CAN LINK
Buffer overflow when receiving CAN packets	Diagnostic information was transmitted to the S7 controller via PROFINET	PN/CAN LINK
Receipt of a CAN packet with incorrect length	Diagnostic information was transmitted to the S7 controller via PROFINET	Corresponding input module

11.2.2 Diagnostic messages

Diagnostics

Mode	Module / submodule for which the diagnostic information is signaled	Channel diagnostics error	Cause of error and possible solution
Manager, Slave, Transparent	CANopen Manager CANopen Slave CAN transparent	CAN bus cannot be reached ("Bus Off" state)	CAN messages can no longer be sent or received. Check for errors in the hardware installation (e.g. terminating resistor, etc.) or communication settings (e.g. transmission rate, etc.).
Manager, Slave, Transparent	CANopen Manager CANopen Slave CAN transparent	CAN bus in the "Error Passive" state	In this state, the device can no longer initiate repetition of defective CAN messages. Check for errors in the hardware installation (e.g. terminating resistor, etc.) or communication settings (e.g. transmission rate, etc.). The error may also occur if no other devices are connected to the CAN bus.
Manager, Slave, Transparent	CANopen Manager CANopen Slave CAN transparent	Overflow of the CAN receive buffer	Received CAN messages were lost. Reduce the CAN transmission rate, increase the PROFINET cycle time or reduce the PROFINET IO data to be transmitted.
Manager, Slave, Transparent	CANopen Manager CANopen Slave CAN transparent	Overflow of the CAN transmit buffer	CAN messages to be sent could not be sent and were discarded. This is caused by too much CAN communication traffic or when other problems occurred in the CAN communication ("Bus Off" or "Error Passive" state). If neither "Bus Off" nor "Error Passive" state exists, try reducing the amount of communication traffic or increasing the CAN bit rate.
Manager, Slave	CANopen Manager CANopen Slave	Received PDO with COB ID {1:x} has incorrect length	The received PDO with COB ID {1:x} has a different length than the configured length and is therefore discarded. Correct the PDO configuration.
Slave	CANopen Slave	Error control (heartbeat) signals an error - for node {1:d}	No heartbeat message was received from node {1:d} in the specified time. The error response configured in OD 0x1029 is executed. Check whether the node {1:d} has failed and whether the monitoring time is correctly configured.
Slave	CANopen Slave	Error control (node guarding) signals an error	No node guarding request was received from the manager within the specified time. The error response configured in OD 0x1029 is executed. Check whether the master has failed and whether the monitoring time is correctly configured.
Manager, Slave, Transparent	CANopen Manager CANopen Slave CAN transparent	Hardware fault detected: - ({1:x}).	Hardware faults were detected when switching on the module. The module must be replaced.

Mode	Module / submodule for which the diagnostic information is signaled	Channel diagnostics error	Cause of error and possible solution
Manager, Slave, Transparent	CANopen Manager CANopen Slave CAN transparent	Internal communication error detected.	Received and sent CAN messages may have been lost. Check for communication problems caused by EMI. If these can be excluded, there may be a hardware fault and the module must be replaced.
Manager	Node	Error control (heartbeat or node guarding) signals an error	No heartbeat message has been received from the node within the specified time or the node has not responded to a node guarding request within the set monitoring time. If the message occurred during startup, the start procedure is repeated for all nodes. In all other cases the reaction configured under "Reaction to failure of node" is executed.
Manager	Node	Error control (heartbeat or node guarding) in unexpected status	The node signals an unexpected network status (NMT status). Signaled NMT status {1:x}. If the message occurred during startup, the start procedure is repeated for all nodes. In all other cases the reaction configured under "Reaction to failure of node" is executed.
Manager	Node	Error when starting: Group message	Errors were detected when starting the node. Details are output in one or more additional diagnostic messages. Depending on the "Node is mandatory on the network" setting, the node is restarted or all nodes are restarted.
Manager	Node	Error when starting: Node is not responding	The node has not responded to a request (OD 1000) for 30 seconds. Check whether the node is correctly connected to the CAN bus and that it is not in "Stopped" state. The start operation is continued.
Manager	Node	Error when starting - Error {1:x}	-
Manager	Node	Error when starting - No response of the error control (heartbeat or node guarding)	During startup no heartbeat or node guarding message was received from this node within the specified time.
Manager	Node	Error when starting - Different device type ID (OD 1000)	The device type ID ({1:x}) of the node differs from the configured device type ID. Check whether the correct device is connected and the right EDS file was loaded. If the device type ID is 0, the ID could not be read by the device.
Manager	Node	Error when starting - Different Manufacturer ID (OD 1018.1)	The Manufacturer ID ({1:x}) of the node differs from the configured Manufacturer ID. Check whether the correct device is connected and the right EDS file was loaded. If the Manufacturer ID is 0, the ID could not be read by the device.

11.2 Diagnostic messages to the S7 controller

Mode	Module / submodule for which the diagnostic information is signaled	Channel diagnostics error	Cause of error and possible solution
Manager	Node	Error when starting - Different product code (OD 1018.2)	The product code ({1:x}) of the node differs from the configured product code. Check whether the correct device is connected and the right EDS file was loaded. If the product code is 0, the code could not be read by the device.
Manager	Node	Error when starting - Different version number (OD 1018.3)	The version number ({1:d},{2:d}) of the node differs from the configured version number. Check whether the correct device is connected and the right EDS file was loaded. If the version number is 0, it could not be read by the device.
Manager	Node	Error when starting - Writing of the OD {1:x}:{2:x} was rejected by the node.	An "SDO abort" message was received. The exact cause can be determined using a CAN bus analyzer.
Manager	Node	Error when starting - Writing of the OD {1:x}:{2:x} failed.	A timeout has occurred during writing of the values of OD {1:x}:{2:x}.
Manager	Node	EMCY message with error code {1:x} was received. Error tab: {2:x}	Note: If too many EMCY messages are received in too short a time, not all messages are displayed in the diagnostic message.
Transparent	Rx message	Received CAN message with ID {1:x} has incorrect length.	The received CAN message with {1:x} has a different length than the configured length and is therefore discarded. Correct the configured length.
Manager, Slave, Transparent	PROFINET interface	Internal software error - ({1:x}).	An internal error was detected and is now being signaled after restart of the module. The error message disappears when you restart the module again.

Maintenance and service

12.1 Replacing the PN/CAN LINK

Below you will find a description of the basic steps required for replacing the PN/CAN LINK.

Note

Use of the PN/CAN LINK V2.0 (firmware version 2.0) as a replacement for a device with firmware V1.0

It is not possible to use a device with firmware V2.0 as a replacement for a device with firmware V1.0. To bypass this restriction, you must update the firmware of the PN/CAN LINK that you want to use as a replacement to version V2.1 or downgrade it to version V1.0.

During the firmware update/firmware downgrade take the device functionality of the respective version (see version overview) (Page 15) into account.

Preparations

De-energize the S7 configuration including PN/CAN LINK.

Replacing the device

Follow these steps:

1. Disconnect the 24 V power supply cables and the functional ground from the screw terminal.
2. Remove the PROFINET connector and CAN connector.
3. Disassembling the device from the DIN rail. Proceed in the reverse order to that described in section Installing (Page 89).
4. Installing and connecting the new device

Note

The PROFINET device name and IP address of the new device must match those previously used. Otherwise, the device will not be detected.

Commissioning the device once again

1. Switch on the power supply for the S7 configuration and the PN/CAN LINK.

The configuration data are downloaded automatically from the higher-level S7 CPU.

The Step 7 program switches the PN/CAN LINK to "Operational" state by setting the control bits to "ON".

12.2 Recycling and disposal

The PN/CAN LINK can be recycled due to its environmentally friendly components.

NOTICE
For environmentally friendly recycling and disposal of your old equipment, contact a certified electronic waste disposal company and dispose of the equipment according to the applicable regulations in your country.

There is no provision for returning the device to Siemens.

For further questions regarding disposal and recycling, please contact your local Siemens contact. You will find the contact details in our database on the Internet (https://w3.siemens.com/aspa_app/).

Technical specifications

13.1 Technical specifications

Technical specifications PN/CAN LINK

Article number	6BK1620-0AA00-0AA0
General information	
Product type designation	PN/CAN Link
Firmware version	
• FW update possible	Yes
Vendor identification (VendorID)	ID 03 00 00 53h acc. to CiA
Product function	
• I&M data	Yes; I&M0 to I&M3
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	STEP 7 V14 or higher
Installation type/mounting	
Mounting	DIN rail, wall mounting, portrait mounting
Mounting position	any
Recommended mounting position	Horizontal
Rail mounting	Yes
Control cabinet installation	Yes
Supply voltage	
Type of supply voltage	DC
Rated value (DC)	24 V
permissible range, lower limit (DC)	20.4 V
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes
Overvoltage protection	Yes
Short-circuit protection	Yes
Mains buffering	
• Mains/voltage failure stored energy time	10 ms
Input current	
Current consumption (rated value)	0.09 A
Current consumption, max.	0.11 A
Power loss	
Power loss, typ.	2.2 W
Interfaces	
Interfaces/bus type	2x Ethernet (RJ45), 1x Sub-D (9-pin)
Supports protocol for PROFINET IO	
• automatic detection of transmission rate	No

13.1 Technical specifications

Article number	6BK1620-0AA00-0AA0
Transmission rate, max.	100 Mbit/s
Number of RJ45 ports	2
Number of FC (FastConnect) connections	2
PROFINET functions	
Assignment of the IP address, supported	Yes
Assignment of the device name, supported	Yes
1. Interface	
Interface type	CAN according to CiA 303-1
Isolated	Yes; 500 V AC or 707 V DC
Interface types	
Number of ports	1
Design of the connection	9-pin sub D socket
CAN	
CAN operating modes	CAN Standard CAN 2.0A/B; CANopen Manager / Slave acc. to CiA
Specification acc. to CiA	CiA 301 & CiA 302
Transmission rate, min.	50 kbit/s
Transmission rate, max.	1 000 kbit/s
Number of slaves, max.	126
Number of SDOs in parallel	16; Parallel
Number of PDOs	512; Send / receive
Services	
Node/life-guarding	Yes
Heartbeat	Yes
SYNC	Yes
2. Interface	
Interface type	PROFINET
Isolated	Yes; 1 500 V AC or 2 250 V DC
Interface types	
RJ 45 (Ethernet)	Yes
Number of ports	2
integrated switch	Yes
Protocols	
PROFINET IO Device	Yes
Interrupts/diagnostics/status information	
Status indicator	Yes
Alarms	Yes
Diagnostics function	Yes

Article number	6BK1620-0AA00-0AA0
Diagnostics indication LED	
• RUN LED	Yes
• ERROR LED	Yes
• MAINT LED	Yes
• LINK LED	Yes
• RX/TX LED	Yes
Potential separation	
Potential separation exists	Yes
Degree and class of protection	
IP degree of protection	IP20
Standards, approvals, certificates	
CE mark	Yes
UL approval	Yes
cULus	Yes
RCM (formerly C-TICK)	Yes
KC approval	Yes
EAC (formerly Gost-R)	Yes
PNO certificate	Yes
RoHS conformity	Yes
Marine approval	
• Germanischer Lloyd (GL)	Yes
• American Bureau of Shipping (ABS)	Yes
• Bureau Veritas (BV)	Yes
• Lloyds Register of Shipping (LRS)	Yes
• Nippon Kaiji Kyokai (Class NK)	Yes
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-25 °C
• horizontal installation, max.	60 °C
• vertical installation, min.	-25 °C
• vertical installation, max.	55 °C
• ceiling installation, min.	-25 °C
• ceiling installation, max.	45 °C
• floor installation, min.	-25 °C
• floor installation, max.	45 °C
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	85 °C

13.1 Technical specifications

Article number	6BK1620-0AA00-0AA0
Relative humidity	
• Operation, max.	95 %
Software	
Runtime software	
Target system	
– ET 200SP	Yes
– Open Controller	Yes
– S7-1200	Yes
– S7-1500	Yes
Dimensions	
Width	70 mm
Height	112 mm
Depth	75 mm
Weights	
Weight, approx.	212 g

13.2 Dimension drawing

Dimension drawings of the PN/CAN LINK

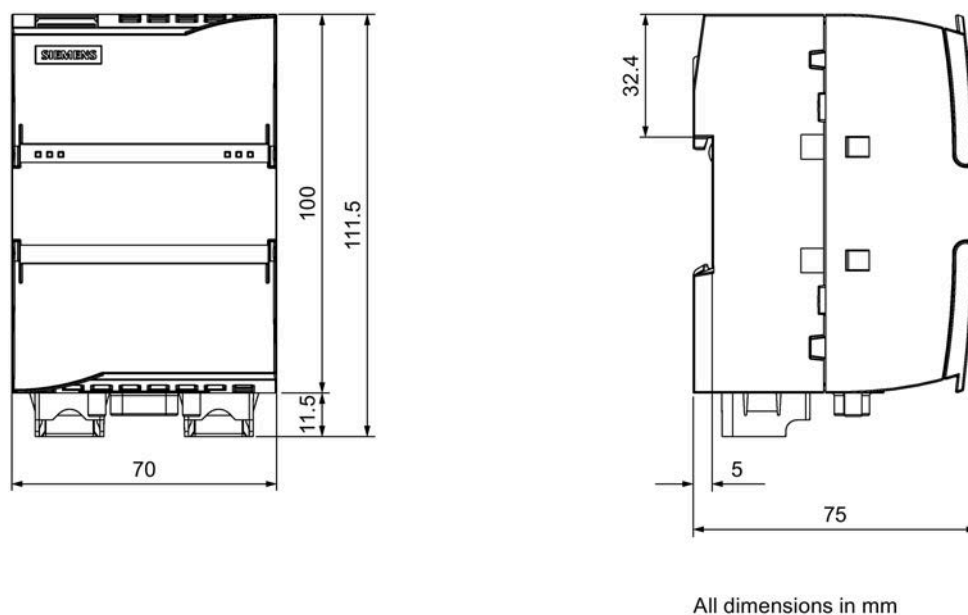


Figure 13-1 Dimension drawing PN/CAN LINK

Appendix

A.1 Certificates and approvals

Note

Approvals are only valid when marked on the product

The specified approvals apply only when the corresponding mark is printed on the product. You can check which of the following approvals have been granted for your product by the markings on the type plate.

CE marking

The SIMATIC PN/CAN LINK device conforms to the requirements and safety objectives of the EC Directives listed below.

EMC Directive 2014/30/EU

The product is designed for operation in residential and industrial areas.

EMC requirements:

Field of application	Noise emission requirements	Interference immunity requirements
Residential area	EN 61000-6-3	--
Industrial area	EN 61000-6-4	EN 61000-6-2

The product meets these requirements if you adhere to the installation guidelines and safety instructions included in these operating instructions and in the system manual of the S7-1200 automation system during installation and operation.

General approvals

The current approvals for the PN/CAN LINK are listed in the Siemens Mall.

Declaration of Conformity

The EC Declaration of Conformity is kept available for the responsible authorities in accordance with the above-mentioned EC Directive at the following address:

SIEMENS AG
DF FA SE
BRESLAUER STR. 5
90766 FUERTH
GERMANY

Other applied standards

- IEC 61131-2 / DIN EN 61131-2 Programmable controllers
- IEC 61010-1 / EN 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use.

A.2 Contact address

Contact address

SIEMENS AG
DF FA SE
Breslauer Strasse 5
90766 FÜRTH
GERMANY

A.3 Licenses

Use of open source software (OSS)

Open-source software is used in the SIMATIC PN/CAN LINK product in unchanged form or in a form changed by us. License conditions and sources that have to be published are included on the CD supplied with the product.

Sources under the GNU General Public License are provided to you free of charge on request. Use the communication channels specified under Technical Support (Page 165) to do this.

A.4 Service & Support

A.4.1 Technical Support

Technical Support

You can contact the Technical Support experts in Germany at the following number:

- Phone: + 49 (0) 911 895 7222
- The contact data for Technical Support in other countries can be found in the Siemens contact database (https://w3.siemens.com/aspa_app/).

A.4.2 Siemens Industry Online Support

Siemens Industry Online Support

You can find various services at the Support homepage (<https://support.industry.siemens.com/cs/us/en/>) on the Internet.

There you will find the following information, for example:

- The correct documents for you via product-related search functions
- Online support request form
- Your local representative
- A forum for global information exchange by users and specialists
- Our newsletter containing up-to-date information on your products

A.4.3 Online catalog and ordering system

Online catalog and ordering system

The online catalog and the online ordering system can be found on the Industry Mall homepage (<https://mall.industry.siemens.com/>).

Glossary

AR (Application Relation)

S7 connection for data exchange in PROFINET

CAN (Controller Area network)

CAN is a serial bus system and belongs to the fieldbus family.

CAN node

Synonym for CAN device

CAN transparent

CAN transparent is an operating mode of the PN CAN LINK which enables transmission and reception of CAN messages from the S7 automation program.

All CANopen functions are disabled in "CAN transparent" mode.

CANopen

CANopen is a communication protocol based on CAN which is mainly used in automation technology and for networking within complex devices.

CANopen Manager

If the PN/CAN LINK is operated as "CANopen Manager", it takes over the following functions in CANopen:

- NMT Master: The PN/CAN LINK controls the NMT state of the other CAN devices and executes the boot-up procedure according to the CiA standard CiA 302 Part 2.
- Configuration Manager: The PN/CAN LINK configures the CANopen slaves during the boot-up procedure by means of SDO write access.

CiA (CAN in Automation)

International users' and manufacturers' group for the distribution and standardization of CAN

Consumer

The receiver of messages is referred to as consumer in a CAN network.

EDS (Electronic Data Sheet)

The electronic data sheet describes the functionality of a device in standardized form.

FE (functional grounding)

Low-impedance connection to ground potential

HSP (Hardware Support Package)

The Support Packages enable the configuration of modules that are not included in the hardware catalog of the TIA Portal installation.

NMT (Network Management)

Network management object. This object is responsible for the network boot-up behavior and controls the state machine of the PN/CAN LINK.

NMT Master

see CANopen Manager

OD (Object Dictionary)

The object dictionary enables access to all data types used by the device, to the communication parameters as well as the process data and configuration parameters.

OSS (Open Source Software)

Open Source Software (OSS) is software that meets the definition of the Open Source Initiative (OSI), for example, that this software is subject to one of the Open Source Software licenses recognized by OSI.

PN (PROFINET)

PROFINET (Process Field Network) is the open Industrial Ethernet standard of the PROFIBUS User Organization for automation.

Process data object

see PDO

Producer

The sender of messages is referred to as producer in a CAN network.

Receive PDO

A process data object (PDO) that is received by a CANopen device.

RoHs (Restriction of certain Hazardous Substances)

EU Directive 2011/65/EU restricts the use of certain hazardous substances in electrical and electronic devices.

RTR (Remote Transmit Request)

This mechanism enables a CANopen device to request another CANopen device to transmit data.

SDO (Service Data Object)

SDO is a specification for a framework for uniform data access to all entries in the CANopen object dictionary.

SIMATIC Controller

The SIMATIC Controllers are available as Basic, Advanced, Distributed and Software controllers. The Basic Controller S7-1200 for small to medium-sized applications, the Advanced Controller S7-1500 for medium-sized and complex applications, the Distributed Controller ET 200SP for distributed applications and the Software Controller S7-1500 for PC-based applications.

SYNC

Synchronization object SYNC messages synchronize the communication on the CANopen bus.

TIA (Totally Integrated Automation)

The TIA Portal offers complete access to the entire digitalized automation - from digital planning over integrated engineering all the way to transparent operation.

Transmit-PDO

A process data object (PDO) that is sent by a CANopen device.

Index

2

24 V DC connection, 35

A

Acyclic communication, 34

Approvals, 163, 163

B

Basic knowledge

Documentation, 7

C

Cable routing, 92

Cables

Requirements, 92

CAN bus

Connecting, 98

CAN connection, 35

CAN connection

Pin assignment, 98

CAN network, 98

Return, 98

CAN transparent, 69

CANopen Manager, 48

CE marking, 163

Commissioning, 99

Hardware, 99

Configuration, 34

Configuration Manager, 48

Connecting

24 V DC power supply, 94

CAN bus, 98

Functional ground, 96

PROFINET, 96

Connector pin assignment

Terminals for the 24 DC power supply, 94

Consumer, 66

Contact person for the database, 156

Control panel, 90

Control panel mounting, 89

Controller information, 63

D

Declaration of Conformity, 163

Delivery

Unpacking, 87

Device

Replacing, 155

Device description file, 34

Disposal, 156

Documentation

Basic knowledge, 7

History, 8

Purpose, 7

Target group, 7

E

EMC interferences, 96

ERROR LED, 145

Ethernet cable, 96

Ethernet interface, 146

F

FE terminal, 96

Functional ground, 94, 96

G

Gateway, 31, 34

Grounding, 92

H

Hardware catalog, 99

Heartbeat, 57, 66

History

Documentation, 8

HSP, 34, 69, 127, 136

I

Installation

- Ambient conditions, 85
- Device dimensions, 85
- Minimum spacing, 85
- Mounting position, 85
- Notes, 85

L

- License conditions, 164

M

- MAINT LED, 145

Mounting

- Control panel, 89
- Standard mounting rail, 89

N

- Nameplate, 35
- Network management function, 48
- NMT Master, 48
- NMT slave, 127
- Node guarding, 66
- Node Guarding, 57
- Notes
 - Installation, 85

O

- Open-source software, 164
- Operating mode, 69
- Operating state, 145

P

PN/CAN LINK

- Design, 35

PN/CAN LINK states

- Operational, 49
- Pre-Operational, 49
- Stopped, 49

- Power supply, 34, 94

- Producer, 66

PROFINET, 34

- Connecting, 96

- PROFINET diagnostics, 145

Purpose

- Documentation, 7

R

- Receiver, 66

- Recycling, 156

Requirements

- Cables, 92

- Reset acknowledgment bit, 64

- Reset bit, 63

- Retaining collar, 96

- RUN LED, 145

S

Safety information

- General, 11

- Working on the device, 12, 91

- Scope of delivery, 87

- Sender, 66

- Shielding, 93

SIMATIC

- Trademark, 8

- Standard mounting rail, 89

- State model, 48

- CANopen Manager, 48

- Status information, 64

- Status LEDs, 35

- System components, 34

- System configuration, 34

T

- Target group, 7

- Documentation, 7

- Technical Support, 165

- TIA Portal, 35, 99, 127

- TIA Portal

- TIA Portal

- Trademark

- SIMATIC!, 8

W

- Wiring guidelines, 91