PN/CAN gateway, PROFINET/CANopen Master

Manual

Version 4 / 18.03.2020 | for firmware V1.06 and above

Link to newest version of manual

Notes

To download the latest version of this manual, please visit our website at www.helmholz.de.

We welcome all ideas and suggestions.

Revision Record

Version	Date	Change
1	12/16/2015	First version
2	8/16/2016	SDO communication flags explained in more detail; Various corrections arising from the system test PROFINET Certificate
3	1/24/2017	change of company name corrections for firmware V. 1.04 Master-Status errors added (7.1.2)
4	3/18/2020	Changes from firmware V1.06 Screenshots for TIA Portal WEEE Note inserted

Contents

1 General

This operating manual applies only to devices, assemblies, software, and services of Helmholz GmbH & Co. KG.

1.1 Target audience for this manual

This description is only intended for trained personnel qualified in control and automation engineering who are familiar with the applicable national standards. For installation, commissioning, and operation of the components, compliance with the instructions and explanations in this operating manual is essential.

WARNING

Configuration, execution, and operating errors can interfere with the proper operation of the PN/CAN gateways and result in personal injury, as well as material or environmental damage. Only suitably qualified personnel may operate the devices!

Qualified personnel must ensure that the application and use of the products described meet all the safety requirements, including all relevant laws, regulations, provisions, and standards.

1.2 Safety instructions

The safety instructions must be observed in order to prevent harm to living creatures, material goods, and the environment. The safety notes indicate possible hazards and provide information about how hazardous situations can be prevented.

1.3 Note symbols and signal words

HAZARD

If the hazard warning is ignored, there is an imminent danger to life and health of people from electrical voltage.

WARNING

If the hazard warning is ignored, there is a probable danger to life and health of people from electrical voltage.

CAUTION

If the hazard warning is ignored, people can be injured or harmed.

ATTENTION

Draws attention to sources of error that can damage equipment or the environment.

NOTE

Gives an indication for better understanding or preventing errors.

1.4 Intended use

The PN/CAN gateway connects CANopen devices in a PROFINET network. The PN/CAN gateway represents a full-fledged CANopen master.

All components are supplied with a factory hardware and software configuration. The user must carry out the hardware and software configuration for the conditions of use. Modifications to hardware or software configurations which are beyond the documented options are not permitted and nullify the liability of Helmholz GmbH & Co. KG.

The PN/CAN gateway may not be used as the only means for preventing hazardous situations on machinery and systems.

Problem-free and safe operation of the PN/CAN gateway presumes proper transport, storage, setup, assembly, installation, commissioning, operation, and maintenance.

The ambient conditions provided in the technical specifications must be adhered to.

The PV/CAN gateway has a protection rating of IP20 and must be installed in an electrical operating room or a control box/cabinet in order to protect it against environmental influences. To prevent unauthorized access, the doors of control boxes/cabinets must be closed and possibly locked during operation.

1.5 Improper use

WARNING

The consequences of improper use may include personal injuries of the user or third parties as well as property damage to the control system, the product, or the environment. Use the PN/CAN gateway only as intended!

1.6 Liability

The contents of this manual are subject to technical changes resulting from the continuous development of products of Helmholz GmbH & Co. KG. In the event that this manual contains technical or clerical errors, we reserve the right to make changes at any time without notice.

No claims for modification of delivered products can be asserted based on the information, illustrations, and descriptions in this documentation. Beyond the instructions contained in the operating manual, the applicable national and international standards and regulations must also be observed in any case.

1.6.1 Disclaimer of liability

Helmholz GmbH &Co. KG is not liable for damages if these were caused by use or application of products that was improper or not as intended.

Helmholz GmbH & Co. KG assumes no responsibility for any printing errors or other inaccuracies that may appear in the operating manual, unless there are serious errors about which Helmholz GmbH & Co. KG was already demonstrably aware.

Beyond the instructions contained in the operating manual, the applicable national and international standards and regulations must also be observed in any case.

Helmholz GmbH & CO. KG is not liable for damage caused by software that is running on the user's equipment which compromises, damages, or infects additional equipment or processes through the remote maintenance connection and which triggers or permits unwanted data transfer.

1.6.2 Warranty

Report any defects to the manufacturer immediately after discovery of the defect.

The warranty is not valid in case of:

- Failure to observe these operating instructions
- Use of the device that is not as intended
- Improper work on and with the device
- Operating errors
- Unauthorized modifications to the device

The agreements met upon contract conclusion under "General Terms and Conditions of Helmholz GmbH & Co. KG" apply.

1.7 Recycling / WEEE

The company Helmholz GmbH & Co. KG is registered as a manufacturer with the HELMHOLZ brand and the device type "Small devices of information and telecommunications technology for exclusive use in households other than private households" as well as the following registration data:

Helmholz GmbH & Co. KG,
Location / Headquarters: 91091 Großenseebach,
Address: Hannberger Weg 2,
Name of authorized representative: Carsten Bokholt,

Registration number: DE 44315750.

The electrical devices described in this document are to be recycled. According to Directive 2012/19 / EU on waste electrical and electronic equipment (WEEE), they must not be disposed of by municipal waste disposal companies.

2 System overview

2.1 General/area of application

The PN/CAN gateway integrates a CANopen network into a PROFINET network. It is a full-fledged CANopen master and enables the incorporation of the process and service data of CANopen slave devices into the IO area of a PROFINET CPU.

2.2 Properties des PN/CAN-Gateways CANopen

The PN/CAN gateway, PROFINET/CANopen Master has the following properties:

- PROFINET IO device as defined in IEC 61158-6-10

- Integrated two-port Ethernet switch

- Full-duplex transmission rate of 100 Mbps

- PROFINET Conformance Class C

- Media redundancy (MRP client)

- CANopen master as of CANopen® protocol according to DSP 301

- Up to 126 CANopen participants

- Up to 16 TPDOs / 16 RPDOs per slave

- Up to 1 Mbps CAN bit rate

- Heartbeat and node guarding

- SYNC object

- Configuration using GSDML file

- No handling blocks or parameterization software necessary

- 24 V DC power supply

- 3 LEDs, bi-color

- USB device interface for online diagnosis and firmware update

3 Installation

3.1 Access restriction

The modules are open operating equipment and must only be installed in electrical equipment rooms, cabinets, or housings.

Access to the electrical equipment rooms, cabinets, or housings must only be possible using a tool or key, and access should only be granted to trained or authorized personnel.

3.2 Electrical installation

Observe the regional safety regulations.

3.3 Protection against electrostatic discharges

To prevent damage through electrostatic discharges, the following safety measures are to be followed during assembly and service work:

- Never place components and modules directly on plastic items (such as polystyrene, PE film) or in their vicinity.

- Before starting work, touch the grounded housing to discharge static electricity.

- Only work with discharged tools.

- Do not touch components and assemblies on contacts.

3.4 Overcurrent protection

Overcurrent protection isn't necessary as the PN/CAN gateway transports no load current. The power supply of the PN/CAN gateway electronics is to be secured externally with a fuse of maximum 1 A (slow-blowing).

3.4.1 Operation

Operate the PN/CAN gateway only in flawless condition. The permissible operating conditions and performance limits must be adhered to.

Retrofits, changes, or modifications to the device are strictly forbidden.

The PN/CAN gateway is a piece of operating equipment intended for use in industrial plants. During operation, all covers on the unit and the installation must be closed in order to ensure protection against contact.

ATTENTION

Bus connections are interrupted when the PN/CAN gateway is switched off!

Before commencing with any kind of work on the PN/CAN gateway, ensure that no unpermitted disruptions of connected systems occur following interruption of the bus connections.

3.5　Installation position

The PN/CAN gateway can be installed in any position. The front plate must be accessible in order to plug in bus lines.

3.6　Minimum clearance

It is recommended to adhere to the minimum clearances specified when installing devices. Adhering to these minimum clearances will ensure that:

- The modules can be installed and removed without having to remove any other system components

- There will be enough space to make connections to all existing terminals and contacts using standard accessories

- There will be enough space for cable management systems (if needed)

4 Setup and wiring

4.1 EMC/safety/shielding

The PN/CAN gateway complies with EU Directive 2004/108/EC ("Electromagnetic Compatibility").

One effective way to protect against disturbances caused by electromagnetic interference is to shield electric cables, wires, and components.

> **ATTENTION**
>
> When setting up the system and routing the required cables, make sure to fully comply with all standards, regulations, and rules regarding shielding. Precisely observe the corresponding texts of the PROFIBUS user organization for setting up PROFINET and the setup guidelines of CANopen. All work must be done professionally!
> Shielding faults can result in serious malfunctions, including the system's failure.

To ensure electromagnetic compatibility (EMC) in your control cabinets in electrically harsh environments, the following EMC rules are to be observed in the design:

- All metal parts of the cabinet are to be connected with each other over a large area with good conductivity (no paint on paint). Where necessary, use contact washers or serrated washers.

- The cabinet door must be connected to the ground straps (top, middle, bottom) over as short a distance as possible.

- Signal cables and power cables are to be laid separated spatially by a minimum distance of 20 cm from each in order to avoid coupling paths.

- Run signal lines only from one level into the cabinet if possible.

- Unshielded cables in the same circuit (outgoing and incoming conductors) must be twisted if possible.

- Contactors, relays, and solenoid valves in the closet, or in adjacent cabinets if applicable, must be provided with quenching combinations; e.g., with RC elements, varistors, diodes.

- Do not lay wires freely in the closet; instead, run them as closely as possible to the cabinet housing or mounting panels. This also applies to reserve cables. These must be grounded on at least one end, and it is better if they are grounded at both ends (additional shielding effect).

- Unnecessary line lengths should be avoided. Coupling capacitances and inductances are kept low this way.

- Analog signal lines and data lines must be shielded.

4.2 Wiring of the PN/CAN gateway

4.2.1 Voltage supply

The PN/CAN gateway is supplied with 24 V DC voltage via the 3-pin power supply plug.

4.2.2 CAN bus connection

Pin	CAN bus D-sub connector
1	-
2	CAN low
3	CAN GND
4	-
5	-
6	-
7	CAN high
8	-
9	-

NOTE

PN/CAN gateway contains no terminating resistor for the CAN bus!

4.2.3 PROFINET connection

Pin	Signal	RJ45 plug PROFINET	Color	Wire pair
1	TD+	Transmission data +	Yellow	1
2	TD-	Transmission data -	Orange	1
3	RD+	Receive data +	White	2
4	-	-	-	-
5	-	-	-	-
6	RD-	Receive data -	Blue	2
7	-	-	-	-
8	-	-	-	-

4.2.4 USB interface

The service USB interface is only required for the firmware update and for diagnoses in the event of support.

5 CAN bus

CAN bus (Control Area Network) is an international open fieldbus standard for building, manufacturing, and process automation applications. CAN bus communications are defined in standard ISO 11898-2.

5.1 Wiring a CAN Bus

A CAN bus cable requires at least three wires: CAN high, CAN low, and CAN ground. Only linear bus topologies are allowed, A terminating resistor of 120 ohms must be connected between CAN high and CAN low at both ends of the CAN bus cable. The PN/CAN gateway has no installed bus terminating resistor.

The maximum cable lengths will depend mainly on the bit rate being used.

Bit rate	Bus length	Bit time
1 Mbps	30 m	1 μs
800 kbps	50 m	1.25 μs
500 kbps	100 m	2 μs
250 kbps	250 m	4 μs
125 kbps	500 m	8 μs
50 kbps	1500 m	20 μs

The cable lengths specified above should only be used as reference values. The maximum cable length will also depend on the number of connected participants, on the use and the number of repeaters and on the cable type.

5.2 CAN bus plug

Helmholz offers a comprehensive range of CAN bus connectors that can be used with the PN/CAN gateway. All Helmholz CAN bus connectors come with a terminating resistor that can be switched on and off.

5.3 The CANopen protocol

The CANopen® protocol is a layer 7 (application layer) protocol based on the CAN bus. CAN bus layers 1 and 2 (physical layer and data link layer) are used by the CAN bus unchanged.

The service elements provided by the application layer make it possible to implement applications that are distributed throughout the network. CANopen communication profiles and standards are administered by the CIA (CAN in Automation e.V.). The standard DS 301 "CANopen application layer and communication profile" is relevant for the PN/CAN gateway. This is available at CAN in Automation's website (http://www.can-cia.org).

The CANopen standards assign a fixed definition to the 11-bit identifier and the 8 data bytes of a CAN bus frame. Each device in a CANopen network has a configurable node ID (module number, 1–127).

5.3.1 CANopen objects

Data exchange with a CANopen slave takes place either via established service data objects (SDOs) or freely configurable process data objects (PDOs).

Every CANopen slave has a fixed directory of SDOs (object directory) that are addressed with an index (16 bits) and a sub-index (8 bits).

Example: Index 0x1000 / sub-index 0 = "Device type", 32-bit unsigned

SDOs with a width of 8/16/32 bits can be read and written with one CANopen frame, Longer SDOs (e.g. strings) are transferred using multiple frames.

SDOs can be processed as soon as a CANopen slave is ready for operation. The "SDO request" and "SDO response" functions are available for SDOs. The object number (index and sub-index), the access mode and type are stored in the first four bytes of the CAN frame. The last four bytes of the CAN frame then contain the value for the SDO.

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Command specifier	16 SDO index		8 bit SDO sub-index	1-4 bytes of parameter data			

PDOs contain the operating values of a CANopen slave for cyclical process operations. Each CANopen slave can manage multiple PDOs (normally up to four transmission PDOs and four reception PDOs).

Each of these PDOs will have its own COB-ID. Any information of the CANopen slave can be mapped for reading and writing in the 8 data bytes. The values from the object dictionary (SDOs) are always the values mapped.

PDOs are automatically mapped at the startup by most CANopen slaves (default mapping). The assignment can generally be changed via defined SDOs when the device supports this.

5.3.2 CANopen functions

The CANopen functions are subdivided into the following basic types:

- SDO read and SDO write operations

- PDO read and PDO write operations

- Network management

- Emergency messages

The function code is stored in the upper four bits of the CAN identifier, which, together with the node ID, forms the communication object identifier, or COB-ID. CANopen normally uses CAN bus frames with 11-bit identifiers (CAN 2.0A).

COB identifier (COB-ID):

10	9	8	7	6	5	4	3	2	1	0
Function				Node ID						

Broadcast functions:

Function	Function code (binary)	Resulting COB-ID
NMT	0000	0_{hex}
SYNC	0001	80_{hex}
TIME STAMP	0010	100_{hex}

Node functions:

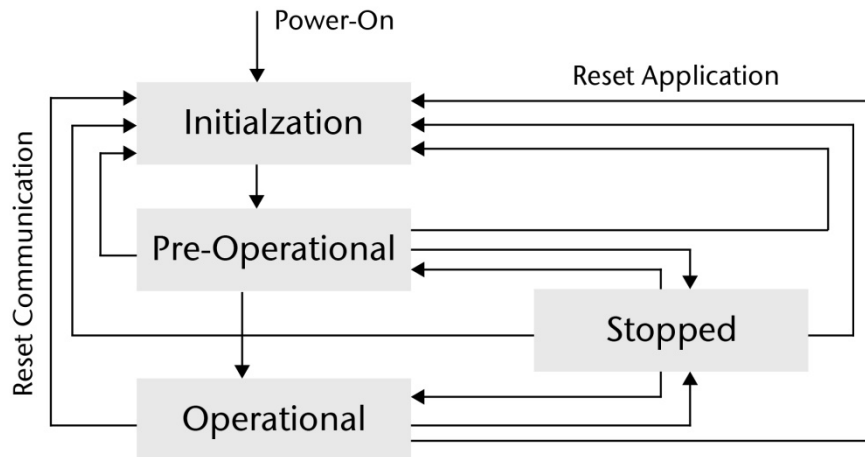| Function	Function code (binary)	Resulting COB-ID
EMERGENCY	0001	$81_{hex} - FF_{hex}$
TPDO1 (tx)	0011	$181_{hex} - 1FF_{hex}$
RPDO1 (rx)	0100	$201_{hex} - 27F_{hex}$
TPDO2 (tx)	0101	$281_{hex} - 2FF_{hex}$
RPDO2 (rx)	0110	$301_{hex} - 37F_{hex}$
TPDO3 (tx)	0111	$381_{hex} - 3FF_{hex}$
RPDO3 (rx)	1000	$401_{hex} - 47F_{hex}$
TPDO4 (tx)	1001	$481_{hex} - 4FF_{hex}$
RPDO4 (rx)	1010	$501_{hex} - 57F_{hex}$
SDO (tx)	1011	$581_{hex} - 5FF_{hex}$
SDO (rx)	1100	$601_{hex} - 67F_{hex}$
NMT error control	1110	$701_{hex} - 77F_{hex}$

"tx" = transmitted by the slave
"rx" = received by the slave

5.3.3 Network management

Network status (NMT states):

Each CANopen device can have various system states. After the device is switched on, an internal system initialization is carried out (hardware initialization, RAM test, setup of the basic objects). After successful initialization, a boot up frame [COB-ID: 700_{hex} + node ID / data (1 byte): 00_{hex}].

After this, the device is ready for operation and in the Pre-Operational state. Although the slave's parameters can be configured in this state (SDOs can be read and written), it will not transfer process data objects (PDOs).

With the NMT command "Operational" [COB-ID: 000_{hex} / data (2 bytes): 01_{hex} node ID], a CANopen device can be switched to the operational status. Once in the Operational state, the coupler's process data will be enabled (RPDO/TPDO communications will be running). The options available for making changes to SDOs may be limited.

With the NMT command "Pre-Operational" [COB-ID: 000_{hex} / data (2 bytes): 80_{hex} node ID], a CANopen device can be switched to the pre-operational status.

With the NMT command "Reset (Application)" [COB-ID: 000_{hex} / data (2 bytes): 81_{hex} node ID], a restart of a CANopen device is triggered.

With the NMT command "Reset Communication" [COB-ID: 000_{hex} / data (2 bytes): 82_{hex} node ID], the CANopen communication of the device is reset. The device is subsequently in the Pre-Operational state.

SYNC:

The SYNC frame is a periodic "Broadcast" frame and is a trigger for CANopen functions. The SYNC frame makes it possible to transfer input data in a synchronized manner and to activate output data simultaneously throughout the whole system. In order to ensure that the intervals at which the SYNC frame are sent are equally spaced, the frame has a high priority level. [COB-ID: 80_{hex}]

Node guarding:

Node guarding means that the master monitors the CANopen slaves with cyclically transmitted frames. Each CANopen slave must respond to the node guarding frame with a status frame.
[COB-ID: 700_{hex} + node ID / data: 1 byte with slave status]

Life guarding:

Life guarding means that each CANopen slave will monitor to make sure that the master continuously carries out the started node guarding within specific time limits. If the master's node guarding frame is not sent, the CANopen slave can detect this with the life guarding function and switch all its outputs to a safe state, for example. The node guarding and life guarding functions always run simultaneously.

Heartbeat:

Heartbeat monitoring works the same way as node guarding, with the exception that the CANopen master does not generate any request frames. Instead, the heartbeat frame is sent automatically by each node (producer heartbeat) and can be evaluated in the master (consumer heartbeat).
[COB-ID: 700_{hex} + node ID / data: 1 byte with slave status]

Emergency message:

If one of the CANopen slaves detects that something has gone wrong (e.g., life guarding times out), it will send an emergency message on the bus.
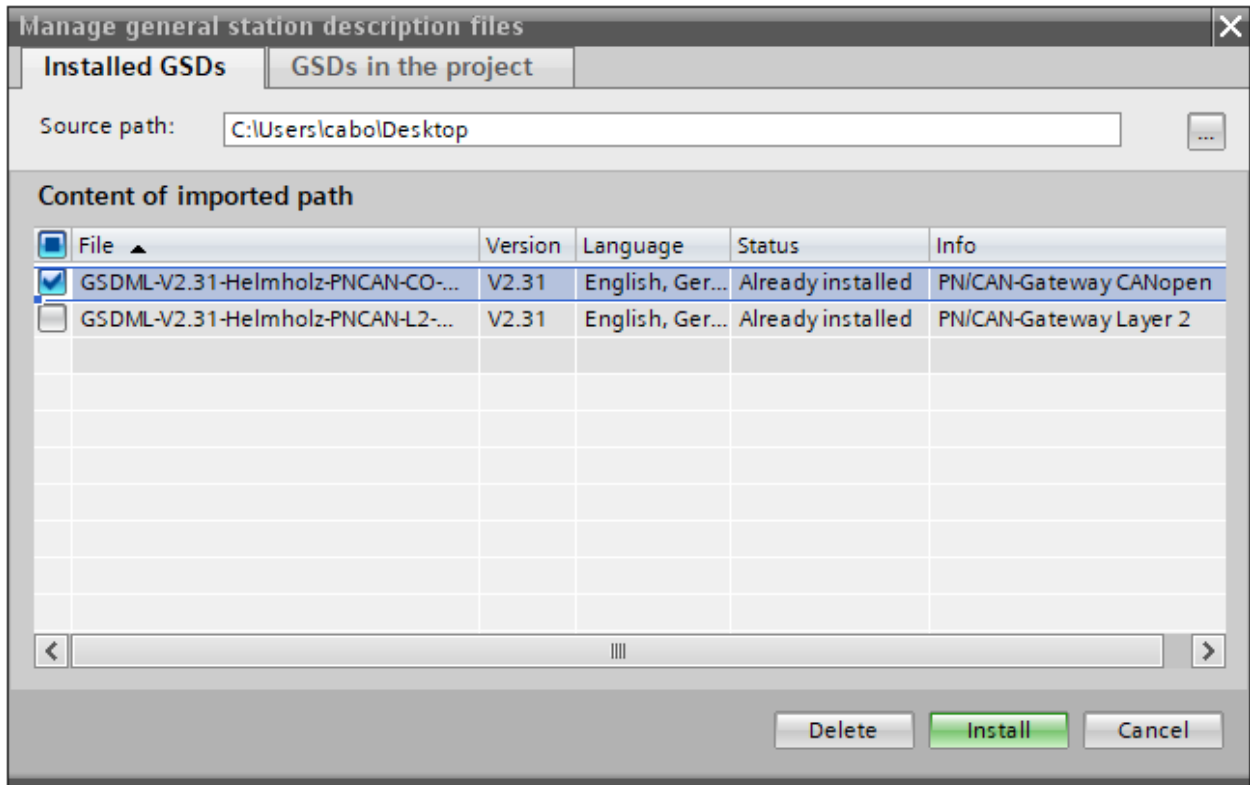[COB-ID: 80_{hex} + node ID / data: 8 bytes]

6 Setup and use

6.1 Install GSDML file

The GSDML file can be found in the download area of the PN/CAN gateway at www.helmholz.de.
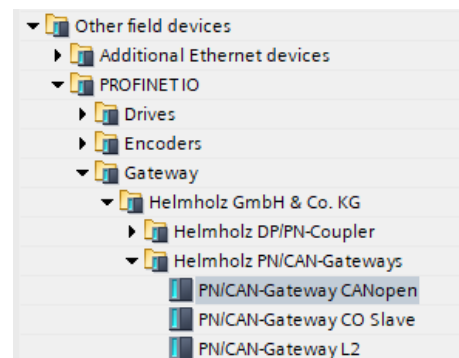
Install the GSDML-file in TIA-Portal in the menu "Options / Manage general station description files (GSD)".
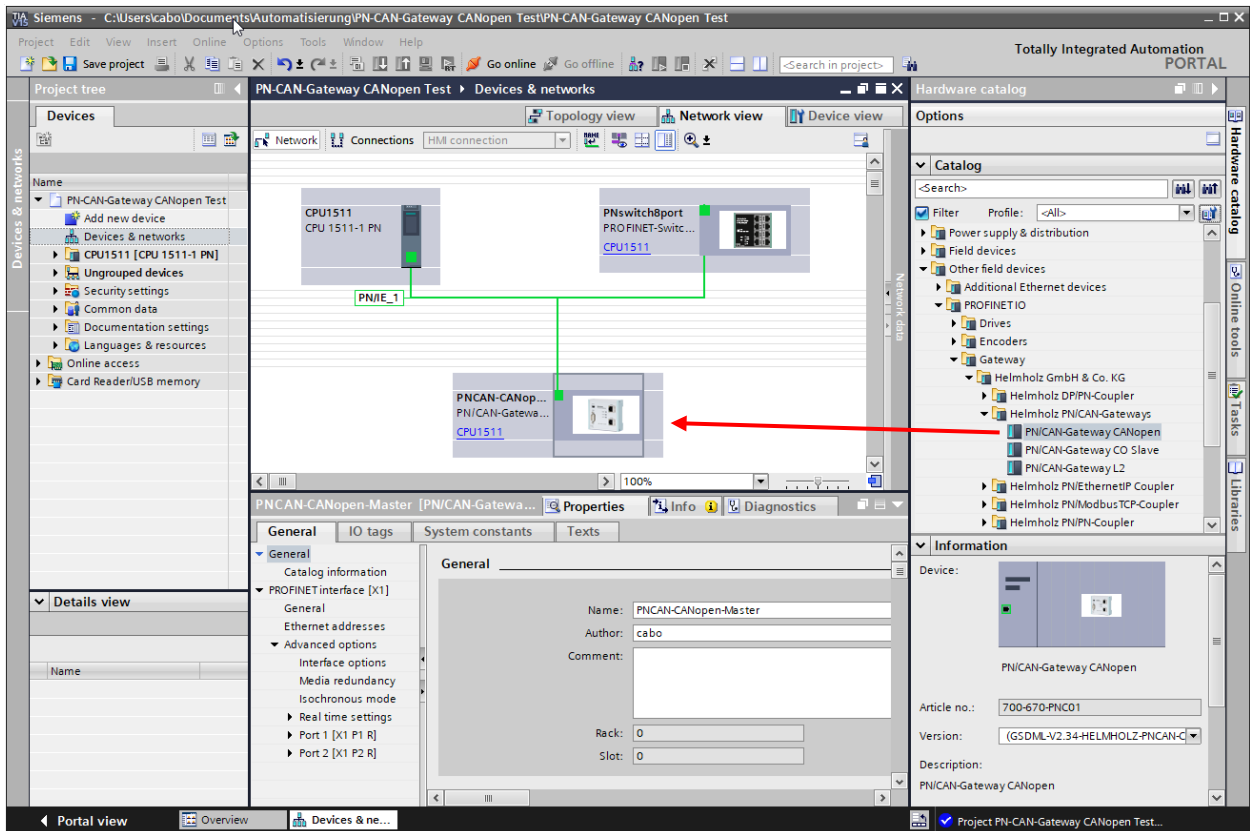

6.2 Configuring gateway

The PN/CAN gateway can be found in the hardware catalogue under " Other field devices → PROFINET IO → Gateway → Helmholz PN/CAN gateways".

Add the "PN/CAN gateway CANopen" to the project and connect it with your PROFINET network.

By calling up the object properties, the PN/CAN gateway should be assigned a unique PROFINET name and the IP address be checked for plausibility.

The name of the configured device must later be assigned to the physical device (see Ch. 6.3).

6.2.1 Configure gateway master

The first slot entry "Parameter" contains the module parameters for the behavior of the CANopen master.

	...	Module	Rack	Slot	I address	Q address	Type	Article no.
		▼ SH-PNCAN-CO	0	0			PN/CAN-Gateway CANop...	700-670-PNC01
		Parameters	0	0 PN/CAN CO 0.1			Parameters	
		Master status	0	0 PN/CAN CO 0.2	0...3		Master status	
		Master control	0	0 PN/CAN CO 0.3		2...3	Master control	
		SDO communication	0	0 PN/CAN CO 0.4	4...12	4...12	SDO communication	
		Emergency messages	0	0 PN/CAN CO 0.5	13...22	13	Emergency messages	
		▶ Interface	0	0 X1			SH-PNCAN-CO	
			0	1				
			0	2				
			0	3				
			0	4				

Parameters [Parameters] — Properties / Info / Diagnostics

General | IO tags | System constants | Texts

▼ General
 Catalog information
 Identification & Mainten...
 Module parameters

Module parameters

General parameter

CAN bitrate:	500 KBit/s
CAN master node ID:	126
SYNC repetition time (ms):	0
Master-Heartbeat repetition time (ms):	500
Bootup timeout (ms):	2000
SDO response timeout (ms):	200

☑ On PLC-Stop perform master reset
☐ At master reset NMT-STOP instead of NMT-PreOp.

CAN bit rate: 10, 50, 100, 125, 250, 500, 800 Kbps and 1 Mbps are available as bit rates.

CAN master node ID: Node ID under which the PN/CAN gateway at the CAN bus is active.

In some applications, **a SYNC frame** is necessary for operation.

Cyclical **heartbeat frames** of the master for operation monitoring by the slaves are recommended.

Bootup timeout defines the waiting time in which the boot up message of a slave is expected following a reset. If the message doesn't arrive on time, the slave is marked as non-existent.

SDO response timeout: A response is expected from the slave for each SDO job. If the response is not provided within this configured period of time, the job is cancelled and an SDO abort error is reported to the PLC. An exception applies to the SDOs 0x1010 and 0x1011: These are fixed with a timeout of 2000ms.

In the case of PLC stop -> Master reset: If the PLC goes to stop and this option is chosen, the CAN bus is set to Pre-Operational or Stop and the master carries out an internal reset. The CAN bus is initialized again when the PLC restarts.

If this option is deactivated, no reaction takes place at the CAN bus for a PLC stop. This setting is useful when debugging is carried out in the PLC.
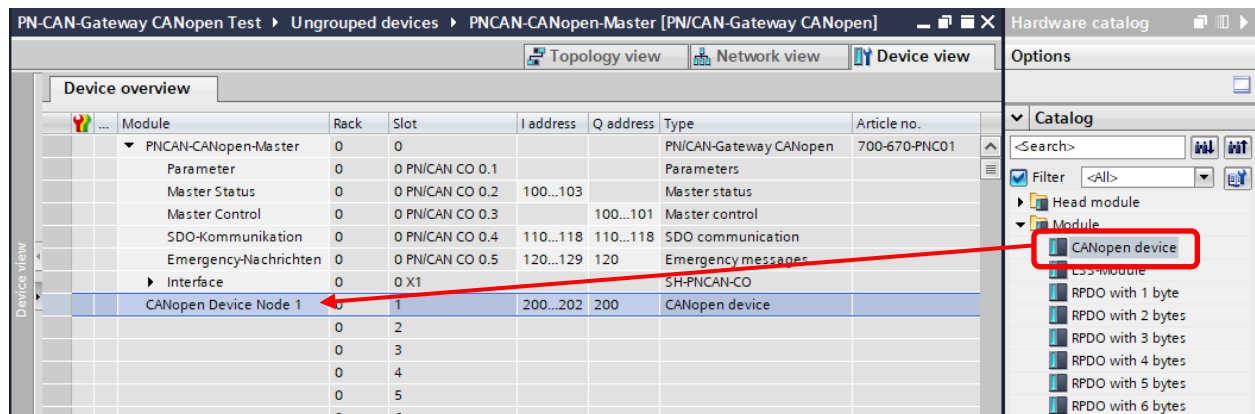
Note: If the PLC is restarted and the CAN bus is not stopped at stop, the CAN bus is stopped at the PLC start of the CAN bus and reinitialized.

In the case of master reset, NMT stop instead of NMT PreOp.: When the master carries out a reset (due to PLC stop, interruption of connection or user request), an "NMT Pre-Operational" is usually transmitted. With this option an NMT Stop is transmitted instead.
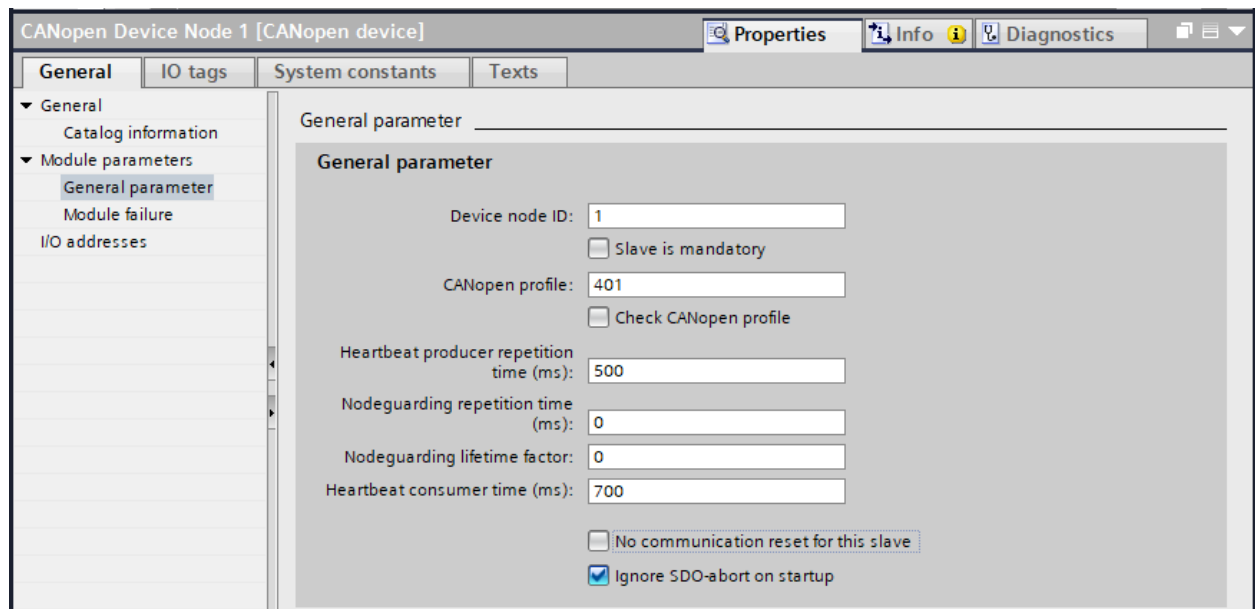
The other slot entries "Master Status", "Master Control", "SDO Communication" and "Emergency Messages" have no parameters.

6.2.2   Add and configure CANopen device

For each CANopen slave participant (CANopen Device/CANopen Node), which is operated at the PN/CAN Gateway, a "CANopen Device" entry must be created in the slot list.

Under the properties of the CANopen Device entry the parameters of the CANopen Slave can be specified.

The **device node ID** of the CANopen slave must be set absolutely correctly and uniquely.

When the option **Slave is mandatory** (mandatory device) is selected, all CANopen participants on the CAN bus of the PN/CAN gateway are first switched to Operational when this device is present and configured. When this option is selected for several devices, all devices must first be Operational before the PN/CAN gateway goes Operational.

If such a slave isn't present, the start procedure is interrupted, and the CAN bus doesn't start (not set to Operational). If a mandatory slave fails, the master switches the entire CAN bus to a safe state.

CANopen profile
The profile of a slave is found in the lower 2 bytes of the SDO 1000. If the profile is indicated in the configuration and the **Check CANopen profile** option has been switched on, then the device at the CAN bus must also have this profile for initialization. The initialization is otherwise cancelled with an error.

Heartbeat producer repetition time
With the time set here, the heartbeat of the slave is transmitted when this is supported by the slave. The heartbeat frame is required by the master for the monitoring of the slave. Alternatively, the node guarding can also be used when this is supported.

Node guarding repetition time / Node guarding lifetime factor
Node guarding, like heartbeat, also serves the purpose of monitoring the slave and the master. It may not be configured simultaneously with the heartbeat.

Heartbeat consumer time
If a monitoring time is entered here, the heartbeat of the master is monitored with this time. If the heartbeat of the master doesn't occur (connection interruption, failure of the master), the slave can go to a safe state (depending upon configuration: Pre-Operational, Stop or no change of state).

It should be ensured that the monitoring time be somewhat longer than the master heartbeat time, as monitoring can be triggered prematurely in the case of transmission jitters of the master.

No communication reset for this slave
The slave is not additionally reset by an "NMT reset" when starting up or restarting. The slave is switched directly to Pre-Operational.

Ignore SDO-abort on startup
Several SDOs are described during the startup dependent upon the configuration of the slave. The startup procedure is cancelled when SDO aborts occur while writing (error responses). These SDO aborts are ignored with this option.

6.2.3 Minimum requirements of a CANopen slave

1. Slave transmits "NMT boot up" or another heartbeat message; can be switched off with the option **"no communication reset for this slave"**

2. SDO 1000 is answered

When the setting **"no communication reset for this slave"** is deactivated (default setting), an individual "NMT reset" is transmitted and a boot up frame must arrive within the boot up timeout; "NMT reset" is otherwise transmitted again.

If the **"no communication reset for this slave"** option is active, no "NMT reset" is transmitted and the receipt of "NMT boot up" is not waited for.

A response must come no later than by the 3rd reading of the SDO 1000, otherwise 3 times SDO 0x1000 are read again upon expiration of the boot up timeout.

6.2.4 Configure PDOs

TPDOs (transmit process data objects) are data sent by the CANopen slave to the PLC (input data from PLC view). RPDOs (receive process data objects) are sent by the PLC to the CANopen slave (output data from PLC view). The data size of the PDOs depends upon the data found in the PDO (PDO mapping) and can range between one and 8 bytes.

The sequence of the TPDO and RPDO entries in the configuration can be selected as desired. All TPDO and RPDO entries following a CANopen device entry belong precisely to this device.

Which PDOs of which sizes the connected CAN device contains can generally be determined in the manual of the respective CANopen slave or you can ask the manufacturer.

A maximum of 32 PDOs per slave can be configured; 16 TPDOs and 16 RPDOs.

NOTE

The mapping of the PDOs cannot be prescribed by the PN/CAN gateway configuration in the hardware configurator. If the default mapping is changed, the slave can be initialized to Pre-Operational and the mapping then be changed with the SDO frames.

Properties of the PDO entries:

PDO 1..16: With the specification of the PDO number (1..16), all necessary settings for the PDO are made automatically by the PN/CAN at the start. The default COB-ID of the slave is set, the transmission type and the inhibit time are set, and the PDO activated.

PDO COB-ID: It is also possible to define a device-specific COB-ID (PDO number must then be '0'). In this case it is presumed that all PDO settings have already been set in the CAN device in advance. The PN/CAN gateway will then not alter the PDO settings when starting up.

PDO TTYPE: Transmission type of the PDO as defined by the CANopen standard.
Only the TTYPEs 0 – 240 (synchronous), 254, and 255 (event-driven) are supported. The TTYPEs 241 to 253 should not be set.
When the TTYPEs 0 – 240 are used, the SYNC frame should be configured in the master configuration (see Ch. 6.2.1) when the SYNC signal is not generated by one of the slaves.

Inhibit time PDO: In order to prevent PDOs with rapidly changing data from overloading the CAN bus with frames, a minimum transmission pause can be indicated for each PDO. In the case of TPDOs, the time is written in the slave. In the case of RPDOs, the master considers the time when sending the frame. An Inhibit Time should only be use for asynchronous PDOs (TTYPE 254 or 255).

6.2.5 COB-IDs of the PDOs

When a PDO is configured with a PDO number 1-16, a suitable COB-ID from the following table is initialized.

Default COB-IDs for PDOs 1-4:

TPDO 1 = 180_{hex} + node ID	RPDO 1 = 200_{hex} + node ID
TPDO 2 = 280_{hex} + node ID	RPDO 2 = 300_{hex} + node ID
TPDO 3 = 380_{hex} + node ID	RPDO 3 = 400_{hex} + node ID
TPDO 4 = 480_{hex} + node ID	RPDO 4 = 500_{hex} + node ID

Expanded COB-IDs for PDOs 5-16:

TPDO 5 = 180_{hex} + node ID + 1	RPDO 1 = 200_{hex} + node ID + 1
TPDO 6 = 280_{hex} + node ID + 1	RPDO 2 = 300_{hex} + node ID + 1
TPDO 7 = 380_{hex} + node ID + 1	RPDO 3 = 400_{hex} + node ID + 1
TPDO 8 = 480_{hex} + node ID + 1	RPDO 4 = 500_{hex} + node ID + 1
TPDO 9 = 180_{hex} + node ID + 2	RPDO 9 = 200_{hex} + node ID + 2
TPDO 10 = 280_{hex} + node ID + 2	RPDO 10 = 300_{hex} + node ID + 2
TPDO 11 = 380_{hex} + node ID + 2	RPDO 11 = 400_{hex} + node ID + 2
TPDO 12 = 480_{hex} + node ID + 2	RPDO 12 = 500_{hex} + node ID + 2
TPDO 13 = 180_{hex} + node ID + 3	RPDO 13 = 200_{hex} + node ID + 3
TPDO 14 = 280_{hex} + node ID + 3	RPDO 14 = 300_{hex} + node ID + 3
TPDO 15 = 380_{hex} + node ID + 3	RPDO 15 = 400_{hex} + node ID + 3
TPDO 16 = 480_{hex} + node ID + 3	RPDO 16 = 500_{hex} + node ID + 3

ATTENTION

When the PDOs 5-16 are used, the COB-IDs of the following device addresses are used. An additional slave should have the node ID + 4 for the previous slave as an address.

It should be noted that, in the case of devices with node IDs as of 125 and the use of more than 4 PDOs, an overflow of the COB-IDs may occur.

6.2.6 Maximum extension of the PN/CAN gateway configuration

The maximum extension of a project configuration is limited by the following parameters:

- A maximum of 126 CANopen Slaves can be created

- A CANopen slave can have a maximum of 16 RPDOs and 16 TPDOs

- 512 slots are provided for the insertion of modules (CANopen Device, RPDO, TPDO)

- The PROFINET input data can be up to 1420 bytes long

- The PROFINET output data can be up to 1420 bytes long

The exceeding of the limits is either reported by the hardware configurator or by an error code at the master status of the PN/CAN gateway.

6.2.7 Detection and initialization of a slave

The master always attempts to find, to initialize and to bring configured slaves to the desired state (Pre-Operational or Operational depending upon the master state).

Initialization process for a slave:

1. Trigger "NMT reset" for each slave or set slave to Pre-Operational
2. Wait for "NMT boot up" or another heartbeat or node guarding message
3. Read SDO 1000 "Device type" and check profile as required
4. Read SDO 1001
5. Write SDO 1017 "Producer heartbeat" (if configured)
   or SDO 100C/100D "Nodeguarding" (if configured)
6. Write SDO 1016 "Consumer heartbeat"
   (if master heartbeat monitoring has been configured)
7. Initialize all configured TPDOs
   (COB-ID, Activate PDO, Transmission Type, Inhibit Time)
8. Initialize all configured RPDOs
   (COB-ID, Activate PDO, Transmission Type, Inhibit Time)
9. Set slave to operational when NMT state control = 2 (Operational) has been selected

If user-defined SDOs still need to be described for the slave or the mapping needs to be changed, the gateway can be set by the PLC to the *Pre-Operational (1)* state in the first step
(see Ch. 7.1.1 "Master control"). The CANopen slave can then be configured as desired with the SDO commands (see Ch. 7.4 "SDO communication").
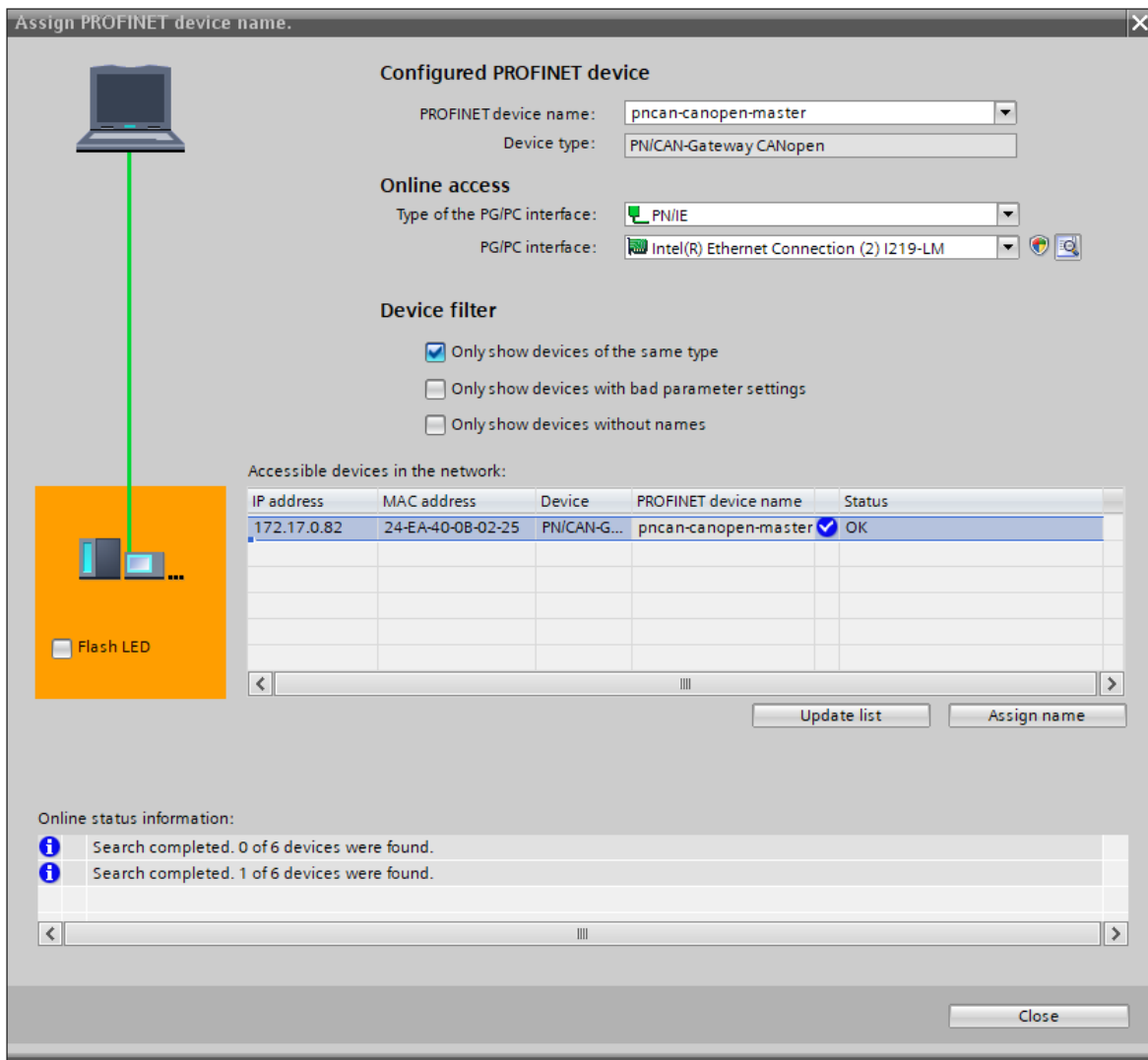
The gateway is only switched to the *Operational (2)* state subsequent to this.

6.3 Assign the PROFINET device-name

When the configuration of the PN/CAN gateway has been completed in the hardware configurator, it can be loaded into the PLC.

In order for the PN/CAN gateway to be found by the PROFINET controller, the PROFINET device name must be assigned to the PN/CAN gateway. To do this, use the "Assign device name" function, which you can access with the right mouse button or in the Online menu when the PN/CAN gateway is selected.

Use the "Refresh list" button to search the network for PROFINET stations. With "Assign Name" the PROFINET device name can be assigned to the device.

The clear identification of the PN/CAN gateway is ensured here by the MAC address of the device. The MAC address of the device is on the front of the PN/CAN gateway.

If the PN/CAN gateway has been assigned the correct PROFINET device name, it is recognized by the PLC and configured. When the configuration has run correctly, the blue "Mode" LED should blink.

To set the PROFINET name, the Helmholz IPSet Tool can also be used, which can be downloaded free of charge from the Helmholz website. Scan the following QR code to download IPSet Tool:

7 Programming in the PLC

7.1 Master control

No handling blocks for operation are required in the PLC. The control and status query of the PN/CAN gateway can be carried out directly via the I/O map. For more complex applications, sample programs for the TIA Portal are available on request.

7.1.1 Master control

The conduct of the PN/CAN gateway can be controlled with the two master control bytes in the initial map of the PLC.

Byte/bit	7	6	5	4	3	2	1	0
Out 0	-	-	-	-	-	-	-	-
Out 1	User reset	activate LSS mode	Clear emergency FIFO error	Send SYNC frame	*reserved*	Clear CAN Rx overflow error	**NMT state control**	

NMT state control: State control of the CANopen master

Boot up (0) = The CANopen master has been switched off. No CAN frames are being transmitted or received. If the state was previously *Operational (value 2)*, the CANopen slaves are stopped ("NMT Pre-Operational" or "NMT Stop" depending upon the configuration).

Pre-Operational (1) = If the previous state was 0, all CANopen slaves are initialized. The status 1 is subsequently displayed in the master state. If the previous state was *Operational (2)* or *Stop (3)*, only an "NMT Pre-Operational" is transmitted.

Operational (2) = If the previous status was 0, all CANopen slaves are initialized and "NMT Operational" subsequently transmitted. The PDO data is only exchanged in status 2. If the previous state was *Pre-Operational (1)* or *Stop (3)*, only an "NMT Operational" is transmitted.

Stop (3) = An NMT-Stop is transmitted to all slaves.

Clear CAN Rx Overflow Error:
Resetting of CAN Receive Overflow error displays.

Send SYNC frame:
When no cyclical SYNC frame has been configured at the CANopen master, a SYNC frame can be triggered by the program of the PLC as an alternative. A SYNC frame is transmitted for each increasing flank at the master control "Send SYNC frame" (byte, 1 bit 4). An acknowledgment of the transmitted SYNC frame is can be detected in the master status "SYNC transmitted" (byte 1, bit 4).

Clear Emergency FIFO-Error:
A FIFO Overflow display of the emergency message buffer can be reset with this bit.

Activate LSS mode:
The PN/CAN gateway is to be switched to the LSS operating mode. This is only permitted if the master is in the state 0 (bootup). Whether the gateway is in LSS mode can be read off bit 6 of byte 1 of the master status. See chapter 7.6 for more information about LSS.

User reset:
The PN/CAN gateway is reset by writing the value 0080_{hex} onto the master control value. An "NMT stop" is transmitted to the CAN bus and the PN/CAN gateway is re-initialized. The "Bit user reset requested" in the master status (byte 1, bit 7) shows the carried out reset. The bit "User reset" can now

be reset. The desired NMT state (1 or 2 in the NMT State Control) can subsequently be requested and the PN/CAN gateway initializes the bus again.

7.1.2 Master status

The master status consists of 4 input bytes.

Byte/bit	7	6	5	4	3	2	1	0
In 0	Gateway configured	-	-	-	-	-	-	-
In 1	User reset requested	LSS mode active	Emergency Lost	SYNC transmitted	No CAN connection	CAN RX-FIFO overflow	CAN bus error (Rx/Tx)	CAN bus offline
In 2	-	-	General error bits of the slave errors					
In 3	Master error				0	0	NMT state	

Gateway configured indicates that the PN/CAN gateway has been configured. The bit is also set for an incorrect configuration.

NMT state indicates the current status of the CANopen master. Principally an attempt is made to assume the state called for in the **NMT State Control**. However, this can be prevented by the absence of slaves configured as mandatory (necessary).

Boot up (0) = The master has been switched off. No CAN frames are being transmitted or received.

Pre-Operational (1) = The master is found at the end of the slave configuration; at least all mandatory slaves are initialized and in Pre-Operational.

Operational (2) = The master is in the Operational state; all mandatory slaves are in Operational.

Stop (3) = The master is in the Stop state; all accessible slaves have been brought to the Stop state.

Continuous attempts are made to find missing slaves by reading the SDO 1000. Slaves that have been newly detected at the CAN bus are automatically initialized and switched to the state wished by the **NMT State**.

Master error:
Error 1: Sync request not possible, as bus load is too great to be able to send all PDOs
Error 3: COB-ID assigned twice
Error 4: internal memory error
Error 5: no devices configured
Error 6: PDO instead of device in slot 1
Error 7: too many PDOs configured at one slave
Error 8: Node guarding and heartbeat are configured parallel on at least one slave
Error 11: Slave Node-ID used twice
Error 12: Slave Node-ID and Master-Node-ID are equal
Error 13: RPDO COB-ID and TPDO COB-ID are equal
Error 14: RPDO or TPDO COB-IDs used twice
Error 15: COB-ID used twice (general)

Collective error bits of the slave errors: "Or"-ing of all CANopen slave error bits (see Ch. 7.2.1, Byte 0 of the device status)

Emergency Lost: The bit indicates the overflow of the emergency message buffer.

LSS Mode active: The PN/CAN-Gateway is in LSS mode (see Ch. 7.6)

User reset requested: User reset request (master control, byte 0, bit 7) has been detected and NMT Reset transmitted to the CAN bus.

No CAN connection: There is no recognizable CAN network (no participants, open termination resistors)

CAN RX-FIFO Overflow: Overflow of the Rx-FIFO in the CAN controller

CAN bus error (Rx/Tx): The bit indicates if the CAN Rx or Tx error counter is not equal to 0.

CAN bus offline: The CAN controller is offline

7.2 CANopen device

3 bytes of input data with the status information of the slave exist for each configured CANopen slave and one output byte for slave control.

7.2.1 CANopen Device Status

Byte/bit	7	6	5	4	3	2	1	0
In 0	Restart of slave active	Resend RPDOs	CANopen profile false	Slave transmitting false TPDO length	Slave not answering	SDO abort	Slave timeout	Incorrect configuration
In 1	SDO 1001 value of the slave							
In 2	Configuration error				0	0	Slave state	

Slave state:

0 =   Slave is still in the boot up, not present or cannot be addressed

1 =   Slave has been initialized, node guarding or heartbeat are running, and it is in the Pre-Operational state

2 =   Slave is in Operational state

3 =   Slave is in Stop state

Configuration error:
The CANopen slave device cannot start up as there is an error in the configuration. Possible causes are duplicate COB-IDs of the PDOs, or heartbeat and node guarding are configured parallel. The bit can only be deleted by transmitting a correct configuration.

Error 3: A COB-ID has been issued twice to the PDOs
Error 7: more than 16 TPDOs or 16 RPDOs configured
Error 8: Node guarding and heartbeat configured parallel

Slave timeout:
Failure of slave monitoring (node guarding or heartbeat).

SDO abort:
Initialization is interrupted when an SDO abort occurs during initialization of the slave by the master. If the Ignore SDO error option has been selected (see Ch. 6.2.2), the error is ignored at this point and the initialization continues.

Slave not answering:
Neither a boot up message nor a response to the reading of the SDO 0x1000 has been received. The initialization of the slave cannot be continued.

CANopen profile false:

The profile read from the SDO 1000 does not correspond to the planned profile. The initialization of the slave cannot be continued.

SDO 1001:
The SDO 1001 "Error Index" is read by the slave and the state entered here.

7.2.2 CANopen Device Control

Byte/bit	7	6	5	4	3	2	1	0
Out 0	Restart Slave	Resend all RPDOs	-	-	-	-	-	-

Restart Slave:

The CANopen slave is restarted and initialized.

Depending upon the global parameter "No communication-Transmit reset" (see Ch. 6.2.2), an NMT reset or only an NMT Pre-Operational command will initially be transmitted to the slave device before it is reinitialized.

Resend all RPDOs:

The RPDOs are normally only transmitted when a value in the initial map of the PN/CAN gateway has been changed. With this bit it is possible to have unchanged data sent again.

7.3 PDO data

The PDO data is found as inputs (TPDOs) or as outputs (RPDOs) directly in the process map. Each PDO entry in the hardware configuration has input and output bytes in accordance with the size of the PDO data (1-8 bytes).

The inputs always show the last received data of the TPDO.

When changed values are written onto the outputs, RPDO frames are sent to the corresponding CANopen slave. Depending upon the transmission type (TTYPE) of the PDO, immediately (event-driven) or directly after the SYNC frame (SYNC).

7.4 SDO communication

SDO communication with the slaves can take place following the initialization phase of the PN/CAN gateway both in the Pre-Operational (NMT state = 1) and Operational (NMT state = 2).

Only one SDO job can be carried out at a time. Both the reading and writing of SDOs is possible.

Byte/bit	7	6	5	4	3	2	1	0
In 0 "Status"	1 = Job in progress	Job type: 0 = read 1 = write	1 = Job completed	1 = Job completed with errors	-	-	SDO size: 1 = BYTE (8 bit) 2 = WORD (16 bit) 3 = DWORD (32 bit)	
In 1								
In 2								
In 3		Receive data of the SDO transmission						
In 4								
In 5								
In 6								
In 7		SDO abort code for incorrect job						
In 8								

Byte/bit	7	6	5	4	3	2	1	0
Out 0 "Control"	0 -> 1 Start job	Job type: 0 = read 1 = write	-	-	-	-	SDO size: 0 = Reading job 1 = Write BYTE (8 bit) 2 = Write WORD (16 bit) 3 = Write DWORD (32 bit)	
Out 1	Node ID of the slave							
Out 2	SDO index							
Out 3								
Out 4	SDO sub-index							
Out 5								
Out 6	Transmission data for SDO job							
Out 7								
Out 8								

All data/values must be written in Big Endian (highest address first) in the IO area.

7.4.1 SDO transmission example

...	Module	Rack	Slot	I address	Q address	Type	Article no.
	▼ PNCAN-CANopen-Master	0	0			PN/CAN-Gateway CANopen	700-670-PNC01
	Parameter	0	0 PN/CAN CO 0.1			Parameters	
	Master Status	0	0 PN/CAN CO 0.2	100...103		Master status	
	Master Control	0	0 PN/CAN CO 0.3		100...101	Master control	
	SDO-Kommunikation	0	0 PN/CAN CO 0.4	110...118	110...118	SDO communication	
	Emergency-Nachrichten	0	0 PN/CAN CO 0.5	120...129	120	Emergency messages	
	▶ Interface	0	0 X1			SH-PNCAN-CO	

In hardware configuration represented above, the SDO communication area is configured to the IO addresses 110 to 118:

EB 110: SDO status
ED 111: SDO receive data
ED 115: SDO abort code
AB 110: SDO control
AB 111: Node ID of the SDO slave
AW 112: SDO index
AB 114: SDO sub-index
AD 115: SDO transmission data

Process for an SDO reading job:

1. Describe node ID, SDO index and SDO sub-index (AB 111, AW 112, AB 114)
2. Set SDO size to 0 (AB 110, bits 1+2 = 0)
3. Set "Job type" to 0 (read) (AB 110, bit 6 = 0)
4. Set "Start job" (AB 110, bit 7 = 1)
5. Wait for SDO status "Job completed" (EB 110, bit 5 = 1?)
6. "Job completed without errors" (EB 110, bit 4) = 0 ? → Copy receive data
7. "Job completed with errors" (EB 110, bit 4) = 1 ? → Evaluate abort code
8. Reset "Start job" (AB 110, bit 7 = 0)
9. Wait until EB 110 = 0

Process for an SDO writing job:

1. Describe node ID, SDO index and SDO sub-index (AB 111, AW 112, AB 114)
2. Write value (AD 115, 4 bytes)
3. Set SDO size (AB 110, bits 1+2)
4. Set "Job type" to 1 (write) (AB 110, bit 6 = 1)
5. Set "Start job" (AB 110, bit 7 = 1)
6. Wait for SDO status "Job completed" (EB 110, bit 5) = 1 ?
7. "Job completed with errors" (EB 110, bit 4) = 1 ? → Evaluate abort code
8. Reset "Start job" (AB 110, bit 7 = 0)
9. Wait until EB 110 = 0

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NOTE

Ask support for the example of handling blocks for the SDO communication.

7.5 Emergency messages

Emergency messages from the slaves are always received by the PN/CAN gateway and made available to the PLC. The PN/CAN gateway does not itself react actively to the emergency messages. The messages must be evaluated by the application program.

Byte/bit	7	6	5	4	3	2	1	0
In 0	Emergency message indication							
In 1	Emergency node ID							
In 2	Emergency message data (8 bytes)							
In 3								
In 4								
In 5								
In 6								
In 7								
In 8								
In 9								

Byte/bit	7	6	5	4	3	2	1	0
Out 0	Emergency message acknowledge							

Emergency message indication is set to 0 during the startup or following a master reset. The PLC program must also set the emergency message acknowledge entry to 0.

If an emergency message is received, emergency message indication is set higher (+ 1) and the message is available in the input area (Node ID + 8 bytes message data).

When additional messages are received by the PN/CAN gateway, these are stored in an internal FIFO.

In order to receive the next emergency message, the PLC must also increase the byte emergency message acknowledge and write to the same value currently displayed for emergency message indication.

An overflow of the emergency message indication takes place at 255 and a jump directly to 1 once again takes place. By writing a 0 into the "Emergency Message Acknowledge", the entire emergency messages buffer can be deleted.

The PN/CAN gateway can buffer up to 32 emergency messages. If the emergency message buffer overflows, this is shown in the master status in the bit "Emergency lost" (see Ch. 7.1.2). The oldest message is discarded.

The error display can be reset in the master control with the bit Clear emergency FIFO error (see Ch. 7.1.1).

7.6 Layer Setting Service (LSS)

The PN/CAN makes it possible to carry out LSS functions on the CAN bus (as of firmware version 1.04). With the LSS protocol, the node ID and the Baud rate of CANopen slave participants, among other things, can be set, insofar as this support the LSS protocol.

Details on the LSS protocol are described in the "CiA® 305 Draft Standard Proposal - Layer setting services (LSS) and protocols" or can be found in the manual of the slave.

LSS mode and CANopen mode exclude one another mutually. LSS can only be used in the bootup status of the gateway.

In order to be able to transmit and receive LSS frames, the "LSS module" must be plugged into slot 1 in the hardware configuration of the PN/CAN gateway.

The LSS module has as its only parameter the timeout time for responding to LSS requests:

In order to carry out the LSS functions on the CAN bus, these must be programmed in the PLC. To this purpose, the LSS module makes available the following command interface in the IO map.

LSS control:

Byte / Bit	7	6	5	4	3	2	1	0
Out 0	LSS control							
	Set LSS Baud rate*	Set LSS Baud rate: 0: 10 Kbit; 1: 50 Kbit; 2: 100 Kbit; 3: 125 Kbit; 4: 250 Kbit; 5: 500 Kbit; 6: 800 Kbit; 7: 1 Mbit			Set Baud rate from configuration*	-	Transmit LSS-frame with response	Transmit LSS frame without response
Out 1	LSS command (see CiA DSP 305 "command specifier")							
Out 2	Transmission data for the LSS frame (7 Bytes)							
Out 3								
Out 4								
Out 5								
Out 6								
Out 7								
Out 8								

* Only one of the two Baud rate options can be chosen; the respective other option must then be 0.

LSS-Status:

Byte / Bit	7	6	5	4	3	2	1	0
In 0	LSS status							
	LSS Baud rate is active	currently active Baud rate: 0: 10 Kbit; 1: 50 Kbit; 2: 100 Kbit; 3: 125 Kbit; 4: 250 Kbit; 5: 500 Kbit; 6: 800 Kbit; 7: 1 Mbit			Baud rate from configuration is active	Timeout: no response received	LSS-frame with response processed	LSS frame trans-mitted
In 1	LSS command (see CiA DSP 305 "command specifier")							
In 2	Received data of the LSS frame (7 Bytes)							
In 3								
In 4								
In 5								
In 6								
In 7								
In 8								

Transmit LSS-frame without response: An LSS frame is transmitted without a response frame being expected. The 0 bit in the LSS status shows that the frame has been transmitted. The 0 bit can then be reset in LSS control.

Transmit LSS-frame with response: An LSS frame is transmitted and a response from the LSS slave is waited for. When an LSS response has been received or when the configured timeout has expired, the bit 1 is set in the LSS status. Bit 2 is also set for a timeout.

In the LSS protocol, the COB IDs 7E5hex (LSS master transmitting) and 7E4hex (LSS slave responding) are used.

NOTE

Ask support for the example of handling blocks for the LSS functions.

7.7 PROFINET diagnosis alarm

The PN/CAN gateway supports the following diagnosis alarms:

18   Configuration error

19   SDO 0x1001 in the same is no longer equal to 0 *

20   Configuration error at the slave (e.g. same PDO numbers)

23   Alarm for master transition due to missing mandatory slave *

24   Slave has node guarding or heartbeat failure *

30   CAN bus error (RX overflow, bus error, bus off event) *

* these alarms can be locked through configuration *(in progress)*

8   LED-based diagnosis

MODE	
Off	No power supply or device defective
Blue on	PN/CAN gateway is correctly configured via PROFINET & all CANopen slaves are in Operational state
Flashing blue	PN/CAN gateway is correctly configured via PROFINET & at least one CANopen slave is in Pre-Operational or Stop state
Red on	No connection with PROFINET controller (PLC)
Flashing red	Connection with the PROFINET controller (PLC) exists, but a configuration error exists
CAN RX	
Flashing green	CAN frame is received without errors
Red	CAN bus error in the recipient PN/CAN gateway hasn't been configured yet No connection
CAN TX	
Flashing green	CAN frames are being transmitted
Red	Transmission not possible (e.g. false Baud rate, CAN bus disrupted) PN/CAN gateway has not yet been configured No connection

9   PROFINET Certificate

Certificate

PROFIBUS Nutzerorganisation e.V. grants to

Systeme Helmholz GmbH
Hannberger Weg 2, 91091 Grossenseebach, Germany

the Certificate No: **Z11459** for the PROFINET IO Device:

Model Name:	**PN/CAN-Gateway CANopen**
Revision:	**SW/FW: 1; HW: 1-1**
Identnumber:	**0x021B; 0x0100**
GSD:	**GSDML-V2.31-Helmholz-PNCAN-CO-20160401.xml**
DAP:	**DAP1, 0x00000003**

This certificate confirms that the product has successfully passed the certification tests with the following scope:

☑	PNIO_Version	V2.31
☑	Conformance Class	C
☑	Application Class	Isochronous
☑	Netload Class	III
☑	PNIO_Tester_Version	V 2.32.2.4437
☑	Tester	an testlabs, Prague, Czech Republic PN000-187

This certificate is granted according to the document:
"Framework for testing and certification of PROFIBUS and PROFINET products".
For all products that are placed in circulation by August 05, 2019 the certificate is valid for life.

(Official in Charge)

Board of PROFIBUS Nutzerorganisation e. V.

(Karsten Schneider)

(K.-P. Lindner)

10 Technical data

Order no.	700-670-PNC01
Name	PN/CAN gateway, PROFINET/CANopen Master
PROFINET interface	
Protocol	PROFINET IO device as defined in IEC 61158-6-10
Transmission rate	100 Mbps full duplex
I/O image size	1440 bytes
Connection	2x RJ45, integrated switch
Features	PROFINET Conformance Class C, Media redundancy (MRP client), Automatic addressing, Topology detection (LLDP, DCP), Diagnosis alarms
CAN interface	
Type	ISO/DIN 11898-2 CAN High-speed physical layer
Connection	9-pin D-sub male connector
Protocol	CANopen® master as defined in DSP301 V4.2
Baud rate	50, 100, 125, 250, 500, 800, 1000 kbps
Number of slaves	126
TPDOs/RPDOs per slave	16 / 16
USB interface	
Protocol	Full-speed USB 2.0 device
Connection	Mini-USB
Electrically isolated from USB	Yes; insulation 15 kV
Voltage supply	24 V DC, 18–28 V DC
Current draw	Max. 250mA
Dimensions (D x W x H)	35,5 x 83,5 x 76 mm
Weight	Approx. 160 g
Certifications	CE, PROFINET certification
Noise immunity	DIN EN 61000-6-2 "EMC Immunity"
Interference emission	DIN EN 61000-6-4 "EMC Emission"
Vibration and shock resistance	DIN EN 60068-2-6:2008 "Vibration" DIN EN 60068-2-27:2010 "Shock"
Protection rating	IP 20
Relative humidity	95% without condensation
Installation position	Any
Permissible ambient temperature	0° C to 60° C
Transport and storage temperature	-20° C to 80° C