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Quick Start Guide
PN/CAN gateway CANopen®

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1. Safety instructions

Target audience

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. The specialist personnel is to ensure that the application or the use of the products described fulfills all safety requirements, including all applicable laws, regulations, provisions, and standards.

Intended use

The device has a protection rating of IP 20 (open type) 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. The consequences of improper use may include personal injury to the user or third parties, as well as property damage to the control system, the product, or the environment. Use the device only as intended!

Operation

Successful and safe operation of the device requires proper transport, storage, setup, assembly, installation, commissioning, operation, and maintenance. Operate the device only in flawless condition.

The permissible operating conditions and performance limits (technical data) must be adhered to. Retrofits, changes, or modifications to the device are strictly forbidden.

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2. Introduction

This document should present the initial commissioning of the PN/CAN gateway with a simple CANopen device. It is presumed that the CANopen device has already been basically configured (Node ID, device-specific parameters, PDO mapping, etc.).

SCAN QR CODE TO GET MANUAL

PN/CAN gateway Documentation

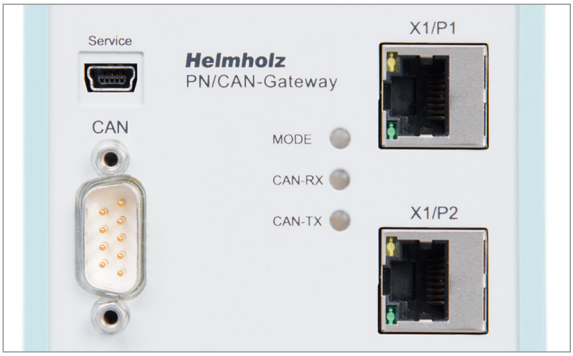
You can find the most current version of the documentation under **www.helmholz.de** or scan the QR code directly.

3. Preparation of the PN/CAN gateway

3.1 Connection

The PN/CAN gateway is supplied via the 3-pin connection plugs with 24 V DC voltage.

The CAN bus is connected to the “CAN” interface using a SUB-D plug (e.g. Helmholz CAN bus plug).



Pin	SUB-D plug CAN bus
1	–
2	CAN low
3	CAN GND
4	–
5	–
6	–
7	CAN high
8	–
9	–

The PROFINET line is connected to X1/P1 or X1/P2.

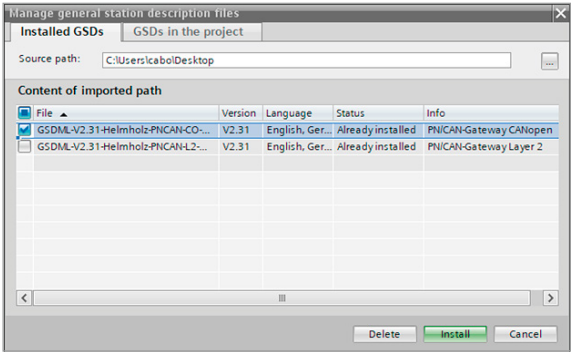
The service USB interface is required for the firmware update and for diagnoses in the event of support.

3.2 Install GSDML file

Please download the GSDML file (“GSDML-V2.31-Helmholz-PNCAN-CO-20170121.xml”) under **www.helmholz.de** or scan the QR code.

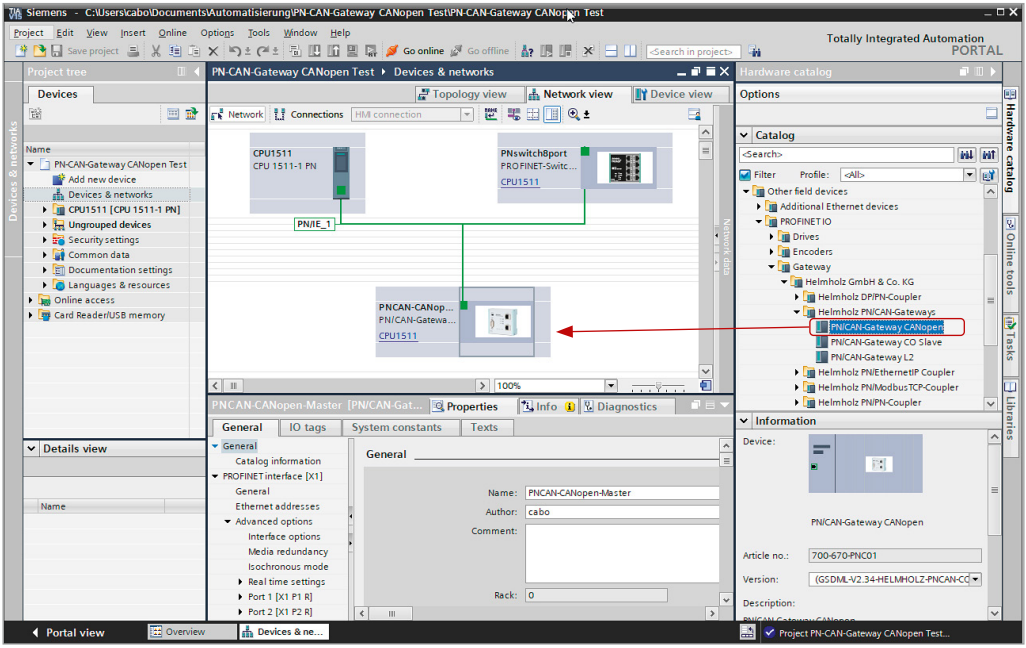
SCAN QR CODE TO GET GSDML

PN/CAN gateway GSDML file



4. Plan PN/CAN gateway

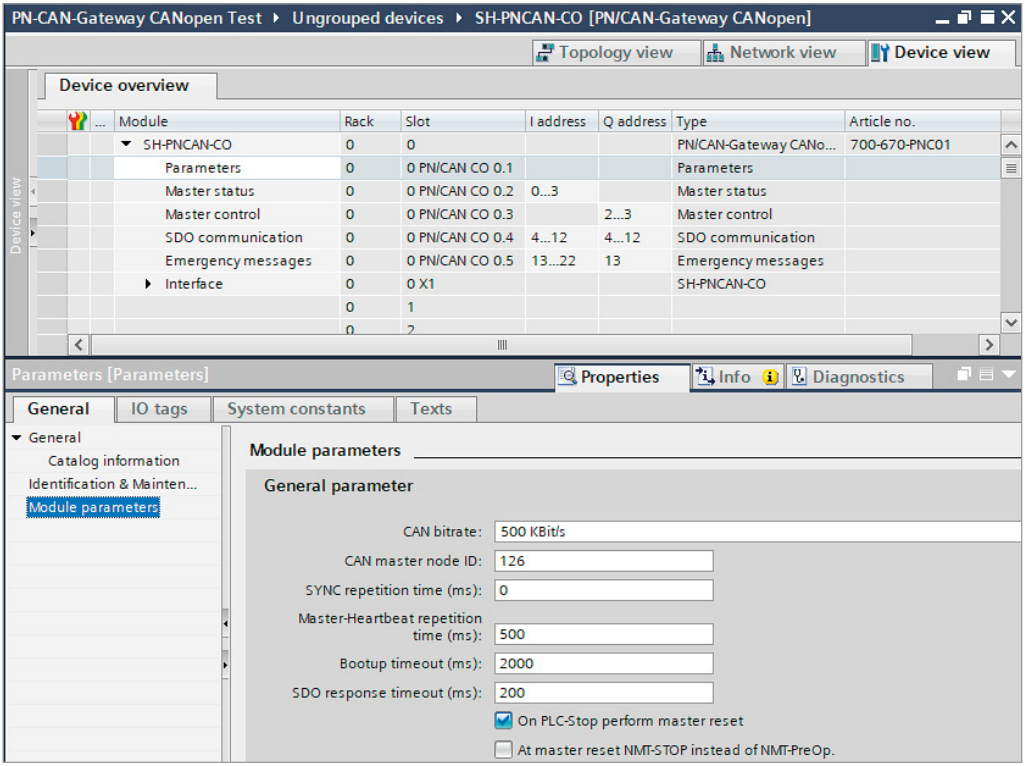
Following the GSDML installation, the PN/CAN gateway can be found in the hardware catalog under “Other field devices -> PROFINET IO -> Gateway -> Helmholz GmbH & Co. KG -> Helmholz PN/CAN-Gateway”.
Add the “PN/CAN-Gateway CANopen” device to the project and connect it with your PROFINET network.



By calling up the properties, you can assign the PN/CAN gateway a unique PROFINET name and check the IP address assigned by the system for plausibility.

5. Configure PN/CAN gateway

The first slot entry after the ports is the slot for the CANopen master parameters.

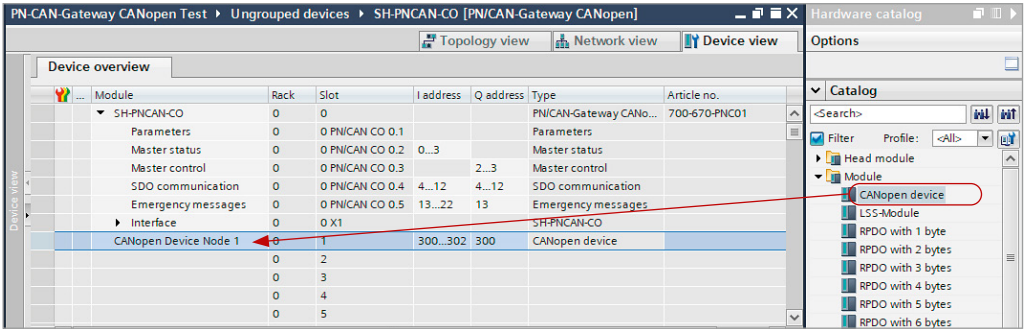


Set the **CAN bitrate** and the **CAN master node ID**. In some applications, a SYNC frame or heartbeat frame of the master is necessary for operation.

The other “PN/CAN CO” slot entries contain no parameters.

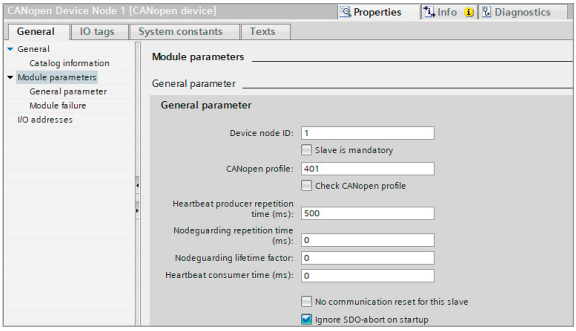
6. Add CANopen device

A “CANopen device” is a CANopen slave participant. An entry must be created for each CANopen slave.



7. Configure CANopen device

The node ID of the CANopen slave must be set absolutely correctly.

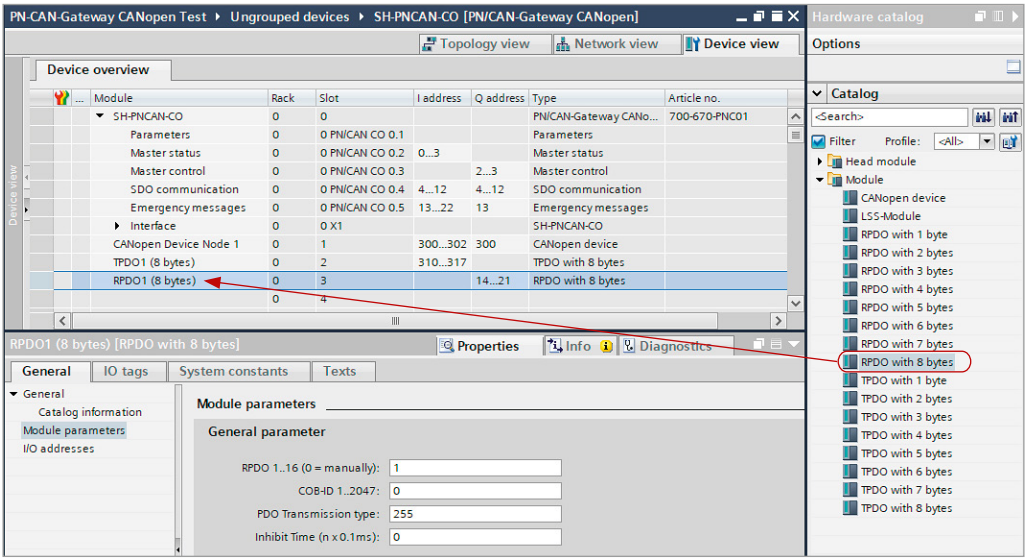


When the option **Slave is mandatory** (Mandatory Device) is selected, all CANopen participants on the CAN bus of the PN/CAN gateway are first switched to operational when this device is present and configured.

8. Add PDOs (process data objects)

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.

Which PDOs of which sizes the connected CAN device has can generally be determined in the manual of the respective CANopen slave.



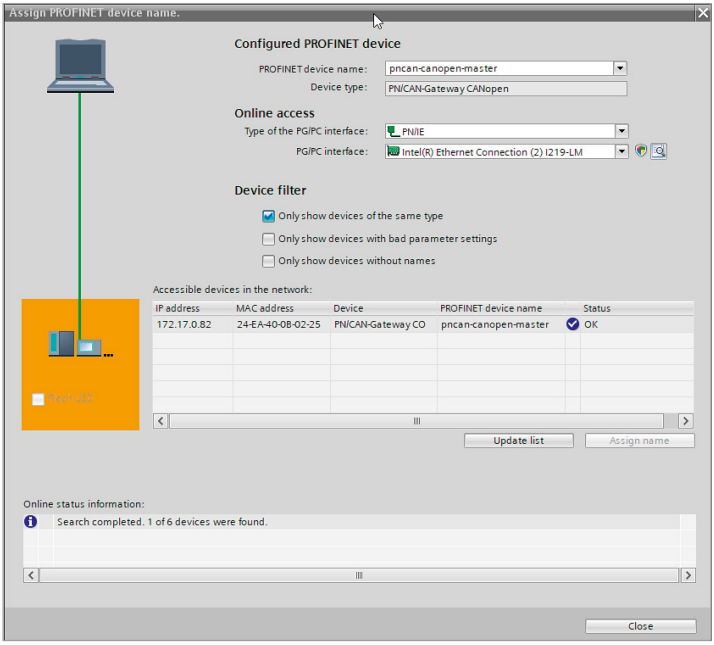
With the specification of the PDO number (1..16), all necessary settings for the PDO are made automatically by the PN/CAN at the start.

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. The PN/CAN gateway will then not alter the PDO settings when starting up.

9. Assign the PN/CAN gateway a PROFINET device name

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

In order that the PN/CAN gateway can be found by the PROFINET controller, the PROFINET device name must be assigned to the PN/CAN gateway. To this purpose, use the function “Assign device name”, which you can access in the Online menu with the right mouse button when the PN/CAN gateway is activated.



With the “Update list...” button, the network can be browsed for PROFINET participants.
The PROFINET device name can be assigned to the device with “Assign name”.

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

The Helmholz IPSet tool, which can be downloaded at no charge from the Helmholz website,
can also be used to set the PROFINET name.

If the PN/CAN gateway has been assigned the correct PROFINET name, it is recognized by the PLC and configured.
If configuration has taken place correctly, the PROFINET “BF” LED should be off.

Proceed as described above for both PROFINET networks.

SCAN QR CODE TO GET FIRMWARE

PN/CAN gateway IPSet

10. Programming in the PLC

No handling blocks for simple 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 area.
The value 2 must be written into the output word in “Master Control” for the start-up of the example project (“NMT-State Control”). Following the start up of the PN/CAN gateway and the initialization of the CANopen slave, the gateway in the 4th byte of the master status also reports 2 (“NMT state”, see below).

The CANopen system is operational and the I/O data of the slave can be read and written.

10.1 Master control (2 bytes outputs)

Byte/bit	7	6	5	4	3	2	1	0
Out 0	–	–	–	–	–	–	–	–
Out 1	User reset	Activate LSS mode	Delete emergency FIFO error	Send SYNC frame	Reserved	Delete CAN RX overflow error	**NMT-State Control**	

The NMT-State Control bits are used for the status control of the CANopen network.

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 set to Pre-Operational or Stop status.

1 = If the previous status 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.

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.

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

10.2 Master status (4 bytes inputs)

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**	

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

0 = The master is switched off. No CAN frames are being transmitted or received.

1 = The master is found at the end of the slave configuration (Pre-Operational), all mandatory slaves are configured and in Pre-Operational state

2 = The master is in the Operational state, all mandatory slaves are in Operational.

Slaves that are not in the operational state are automatically booted up to the Operational state as soon as they can be addressed.

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

10.3 CAN node status (3 bytes inputs)

The status of the slave can be read from the input data of the CAN device entry.

Byte/bit	7	6	5	4	3	2	1	0
In 0	Restart Slave active	Resend RPDOs done	CANopen profile false	Slave is sending false TPDO length	Slave not answering	SDO abort or profile false	Slave time-out/lost	False configu-ration
In 1	SDO 1001 value of the slave							
In 2	Configuration error (see manual)				0	0	**Slave state**	

The two slave state bits show the status of the CANopen master:

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

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

2 = Slave is in Operational state

3 = Slave is in Stop state

10.4 PDO data

The PDO data is found as inputs (TPDOs) or as outputs (RPDOs) directly in the IO process image.

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

When changed values are written to the outputs, RPDO frames are sent to the corresponding CANopen slave.

10.5 SDO communication

SDO communication with the slaves can take place following the initialization phase of the PN/CAN gateway both in the Pre-Operational and Operational modes.

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

Details on the programming of the SDO communication channel of the PN/CAN gateway can be found in the manual.

10.6 Emergency messages

Emergency messages from the slaves are always received by the PN/CAN gateway and forwarded to the PLC. The PN/CAN gateway itself doesn't react actively to the emergency messages.

Details on the programming of the emergency message channel of the PN/CAN gateway can be found in the manual.

11. LED status information

MODE	
Off	No power supply or device defective
Blue on	PN/CAN gateway is correctly configured via PROFINET and all CANopen slaves are in Operational
Flashing blue	PN/CAN gateway is correctly configured via PROFINET and at least one CANopen slave is in Pre-Operational or Stop, or the gateway has not yet been started.
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 receiver PN/CAN gateway is not yet configured No connection
CAN-TX	
Flashing green	CAN frames are being transmitted
Red	Transmission not possible (e.g. false Baud rate, CAN bus disrupted) or the PN/CAN gateway has not yet been configured No connection

12. Technical data

Order no.	700-670-PNC01
PROFINET interface	
- Protocol	PROFINET IO device as per IEC 61158-6-10
- Transmission rate	100 Mbps full duplex
- I/O image size	1440 bytes
- Connection	2 x RJ45, integrated switch
- Features	Media Redundancy Protocol (MRP), automatic addressing / topology detection (LLDP, DCP), diagnosis alarm, PROFINET conformance class C
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 1.5 kV
Voltage supply	24 V DC; 18 – 28 V DC
Current draw	Max. 250 mA
Dimensions (D x W x H)	35 mm x 83 mm x 72 mm
Weight	Approx. 160 g
Certifications	CE
Protection rating	IP 20
Permissible ambient temperature	0 °C to 60 °C
Transport and storage temperature	-20 °C to 80 °C

Note:

We have checked the contents of this Quick Start Guide for harmonization with the hardware and software described. However, we assume no liability for any existing differences, as these cannot be fully ruled out.

The information in this Quick Start Guide is, however, updated on a regular basis. When using your purchased products, please make sure to use the latest version
of the Quick Start Guide, which can be viewed and downloaded on the Internet from www.helmholz.de.

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Helmholz GmbH & Co. KG | Hannberger Weg 2 | 91091 Großenseebach | Germany
Phone +49 9135 7380-0 | Fax +49 9135 7380-110 | info@helmholz.de | www.helmholz.com