



Version

**2<sup>en</sup>**  
as of FW 1.02

## Quick Start Guide PN/CAN Gateway Layer 2

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# 1. Introduction

**Before getting started:**

Please observe the safety instructions for the product, which can be found in the manual. You can find the manual on the accompanying CD or it can be downloaded from the website [www.helmholz.de](http://www.helmholz.de) in the download area.

This document should present the initial commissioning of the PN/CAN Gateway with a simple CAN Device.

## 2. Preparation of the PN/CAN Gateway

### 2.1 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).

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.



Pin	SUB-D plug CAN-Bus
1	–
2	CAN Low
3	CAN GND
4	–
5	–
6	–
7	CAN High
8	–
9	–

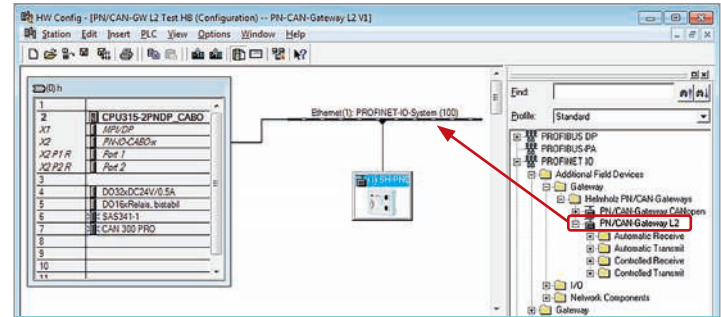
## 2.2 Install GSDML file

The GSDML file can be found on the accompanying CD or in the download area of the PN/CANGateway at [www.helmholz.com](http://www.helmholz.com).

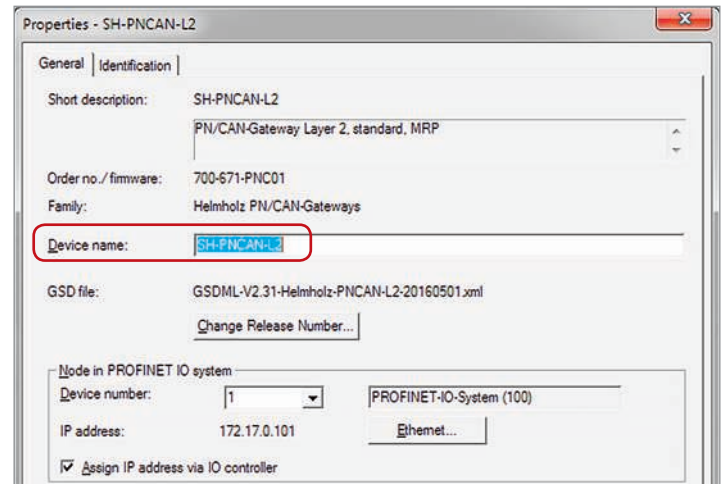
## 3. Configure PN/CAN Gateway

After installing the GSDML file, the PN/CAN Gateway Layer 2 can be found in the hardware catalog under „PROFINET IO -> Other field devices -> Gateway -> Helmholz PN/CAN Gateways“.

Add the „PN/CAN Gateway L2“ to the project and connect it with your PROFINET network.



By calling up the object properties, you can assign the PN/CAN Gateway a unique PROFINET name and check the IP address for plausibility.



## 4. PN/CAN Gateway settings

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

Set the CAN bit rate and the type of CAN identifier (11 bit or 29 bit). The importance of the additional parameters can be derived from the manual and have no relevance for standard applications.

The other „PN/CAN L2“ slot modules contain no parameters.

[1] SH-PN/CAN-L2						
Slot	Module	Order number	I Address	Q address	Diagnostic A...	Comment
0	SH-PN/CAN-L2	700-671-PNC01			2029*	
X1	Interface				2042*	
X1 P1 R	Port 1				2041*	
X1 P2 R	Port 2				2040*	
PN/CAN L2 0.1	Parameter				2029*	
PN/CAN L2 0.2	Steuerung und Status		0...5	4...5		
PN/CAN L2 0.3	Empfangskanal (Rx-FIFO)		6...20	6		
PN/CAN L2 0.4	Sendekanal (Tx-FIFO)		21...22	7...20		
1						
2						

Properties - Parameter	
General	Addresses
Identification	Parameters
Parameters	
Parameters	Value
General parameter	
CAN bitrate	500 KBit/s
CAN-Identifier type	11 Bit
Receive channel FIFO size	32
Receive channel filter mask (dec.)	0
Receive channel filter code (dec.)	0
Allow overwrite in receive channel	<input checked="" type="checkbox"/>
Transmit channel FIFO size	32
Repetition time (ms)	0
On PLC-Stop performs device reset	<input checked="" type="checkbox"/>

## 5. Adding CAN frame

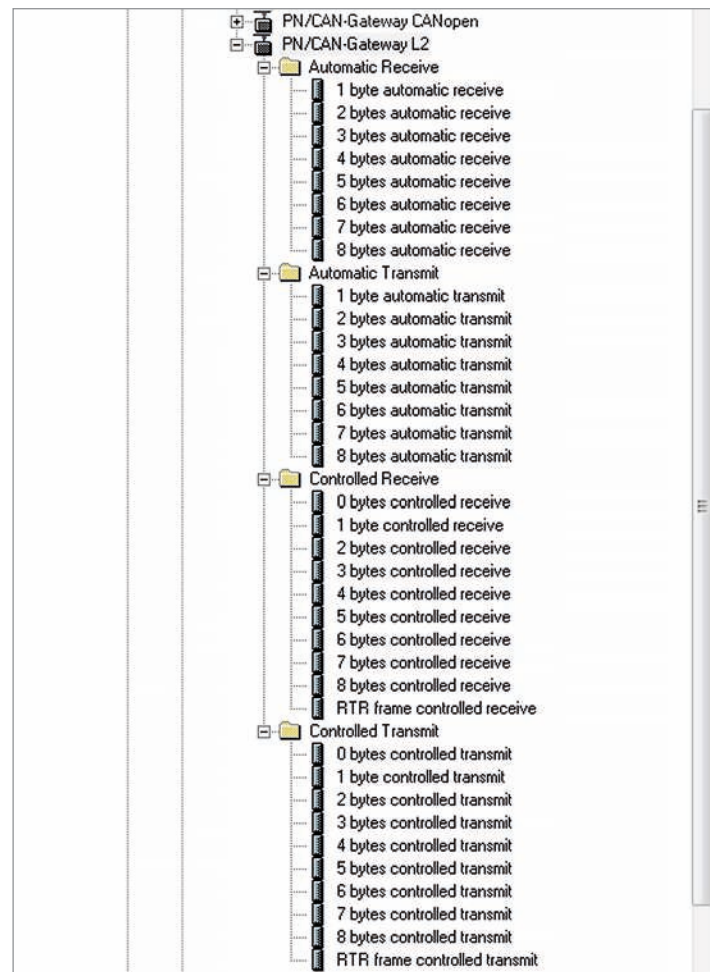
The PN/CAN Gateway Layer 2 can transmit and receive CAN frames with 1 to 8 bytes of data and any CAN-IDs. A module with the CAN identifier must be configured in the slots of the PN/CAN Gateway for each anticipated CAN frame and each CAN frame to be transmitted.

There are two types of CAN frames: **automatic receiving/transmission** and **controlled receiving/transmission**.

In the case of the **automatic reception** of CAN frames, the data of the most recently received CAN frame is always found in the input data. If a CAN frame with identical data is received several times, this can't be recognized in the PLC.

In the case of **automatic transmission** the CAN frame is transmitted as soon as something changes in the output data of the frame. Repeat transmission of the same data is thus not possible.

In the case of **controlled reception** and the **controlled transmission** of CAN frames, the PLC program has direct control over each telegram through control and status bits.



## 5.1 Automatically receiving CAN frames

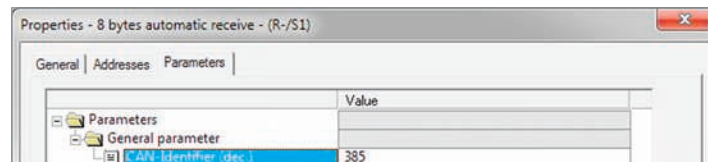
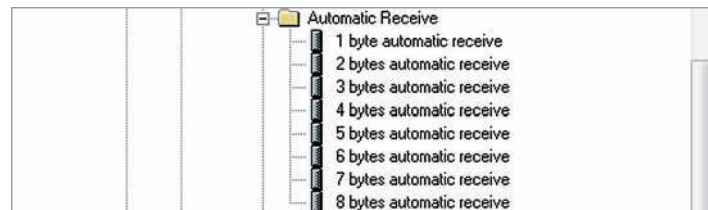
In the case of the automatic reception of CAN frames, the data of the most recently received CAN frame is always found in the input data.

Each configured CAN frame has a unique CAN identifier. If two reception objects with the same CAN identifier are being configured, that results in a configuration error.

A CAN frame always has a fixed data length. In the case of automatic reception, CAN frames with a fixed data length of 1 to 8 bytes can be configured.

If a CAN frame is received that has the correct CAN identifier but a false data length, the frame is rejected and the data is not forwarded to the PLC!

CAN frames with differing data lengths can be processed with the receiving channel (Rx-FIFO).



The screenshot shows the HW Config software interface for a rack. The title bar indicates '(1) SH-PN/CAN-L2'. The table below lists the modules in the rack:

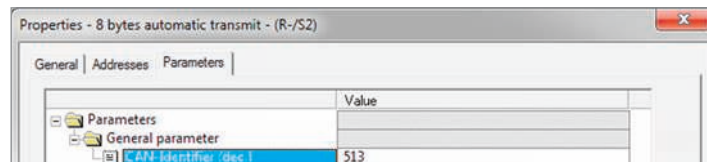
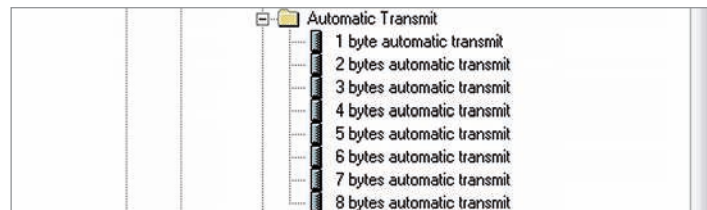
Slot	Module	Order number	I Address	Q address	Diagnostic A...	Comment
0	SH-PN/CAN-L2	700-671-PNC01			2039*	
X1	Interface				2042*	
X1 P1 R	Port 1				2041*	
X1 P2 R	Port 2				2040*	
PN/CAN L2 0.1	Parameter				2039*	
PN/CAN L2 0.2	Steuerung und Status		0...5	4...5		
PN/CAN L2 0.3	Eingangskanal (Rx-FIFO)		6...20	6		
PN/CAN L2 0.4	Sendekanal (Tx-FIFO)		21...22	7...20		
1	8 bytes automatic receive		23...30			
2						
3						

## 5.2 Automatically transmitting CAN frames

In the case of automatic transmission of a CAN frame, a frame is always sent to the CAN bus when the output data of the module changes.

Each configured CAN frame has a unique CAN identifier. If two transmission objects with the same CAN identifier are being configured, that results in a configuration error.

In the case of automatic transmission, CAN frames with a fixed data length of 1 to 8 bytes can be configured. The transmission of CAN frames with a variety of data lengths can be carried out with the transmission channel (Tx-FIFO).





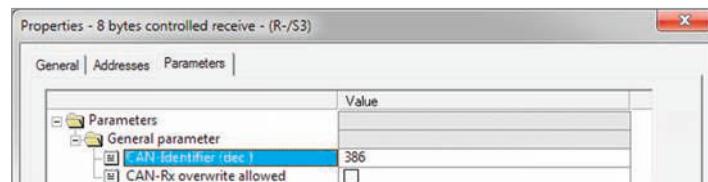
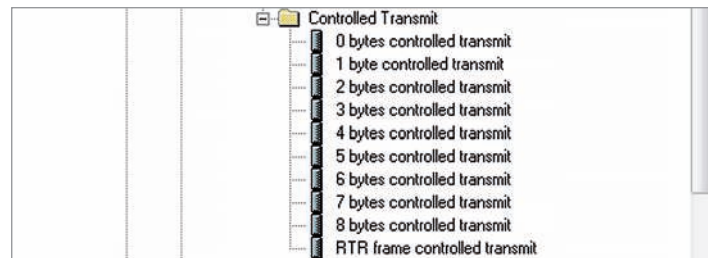
### 5.3 Controlled receiving of CAN frames

In the case of the controlled reception of CAN frames, the reception of each frame must be acknowledged in the PLC program.

In the case of controlled reception, CAN frames with a fixed data length of 0 to 8 bytes can be configured. An RTR frame can also be received.

If a CAN frame is received that has the correct CAN identifier but a false data length, the frame is rejected and the data is not forwarded to the PLC!

If two reception objects with the same CAN identifier are being configured, that results in a configuration error.

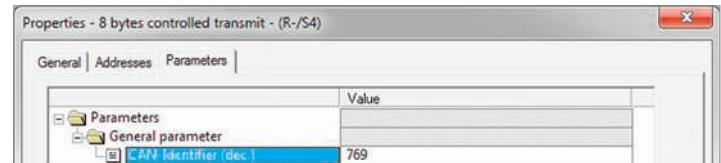
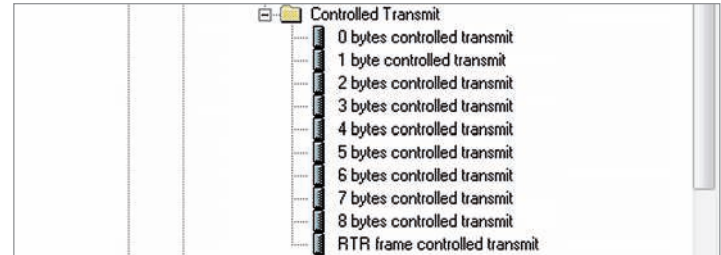


## 5.4 Controlled transmission of CAN frames

In the case of controlled transmission of a CAN frame, the PLC can directly trigger the transmission of a CAN frame through a control bit, irrespective of whether the transmission data has changed.

In the case of controlled transmission, CAN frames with a fixed data length of 0 to 8 bytes can be configured. An RTR frame can also be transmitted.

If two reception objects with the same CAN identifier are being configured, that results in a configuration error.



## 6. Assign the PN/CAN Gateway a PROFINET 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 that the PN/CAN Gateway can be found on the PROFINET by the PROFINET master (controller), the PROFINET name and possibly the IP address must be set.

To this purpose the function „Edit Ethernet Node“ is used in the SIMATIC<sup>1</sup> manager.

With the „Browse...“ button, the network can be browsed for PROFINET devices.

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

**Important:** *The assigned name must agree with the name defined in the hardware configurator.*

If the PN/CAN Gateway contains the correct PROFINET name, it is recognized by the PLC and configured.

When the configuration has run correctly, the blue „Mode“ LED should blink.

Edit Ethernet Node

Ethernet node

Nodes accessible online

MAC address: 24-EA-40-08-82-55 Browse...

Set IP configuration

☒ Use IP parameters

IP address: Gateway

Subnet mask: ☒ Do not use router

☐ Use router Address: 172.17.0.102

☐ Obtain IP address from a DHCP server

Identified by

☒ Client ID ☐ MAC address ☐ Device name

Client ID:

Assign IP Configuration

Assign device name

Device name: SH-PNCAN-L2 Assign Name

## 7. 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 map.

In order to start up the example project, the value 3 must be written into the „Control“ output word in order to switch to normal operation.

### 7.1 Control (2 bytes outputs)

The mode bits are used for the status control of the PN/CAN Gateway.

**INIT (0)** = CAN controller is at the bus, no frames are transmitted, received frames are discarded; outputs/inputs are set to zero; FIFOs are deleted.

The INIT (0) status is automatically active in the event of a PROFINET network cancellation or stoppage of the PLC.

**PASSIV (1)** = CAN Controller is at the bus; received frames are discarded, no frames are transmitted; error counters are transmitted to the PLC; FIFOs are maintained and can be operated; Rx-FIFO can be read until it is empty; Tx-FIFO can be described, but no frames are transmitted; controlled transmission modules can be operated; data from automatic receiver modules remain frozen

**RX-Only (2)** = Only the CAN reception is processed. No CAN frames are transmitted.

**RX-TX (3)** = Normal operation with transmitter and receiver.

*Note: In order to switch to normal operation, it is permitted to switch directly from mode 0 to mode 3. All necessary initializations (mode 1) will thereby take place automatically.*

Byte/Bit	7	6	5	4	3	2	1	0
Out 0	–	Reset	–	–	–	–	–	–
Out 1	–	–	–	–	–	–	Mode	

## 7.2 Status (6 bytes inputs)

Byte/Bit	7	6	5	4	3	2	1	0		
In 0	1= Gateway ready	1 = Reset carried out	–	–	–	–	–	–		
In 1	Error code for configuration errors				-	-	Mode State			
In 2	CAN receive error counter									
In 3	CAN transmit error counter									
In 4+5	First slot with configuration error									

The two mode state bits show the status of the PN/CAN Gateway. Principally, an attempt is made to occupy the status required in the mode of the control word. However, this can be prevented by configuration errors.

**INIT (0)** = CAN controller is at the bus, no frames are transmitted, received frames are discarded; outputs/inputs are set to zero; FIFOs are deleted.

**PASSIV (1)** = CAN controller is at the bus; received frames are discarded, no frames are transmitted; error counters are transmitted to the PLC; FIFOs are maintained and can be operated; Rx-FIFO can be read until it is empty; Tx-FIFO can be described, but no frames are transmitted; data from automatic receiver modules remain frozen.

**RX-Only (2)** = Only the CAN reception is processed. No CAN frames are transmitted.

**RX-TX (3)** = Normal operation with transmitter and receiver.

### Error code for configuration errors

- 1: Pluggable objects: Dual CAN-ID assignment
- 3: Reception channel FIFO: Filter mask and filter code results in too many filter entries (max. 16)
- 4: Filter table CAN hardware filter is full
- 5: General configuration errors
- 6: The firmware doesn't support a configured module -> Firmware update required

### First slot with configuration error

In connection with the error code for configuration errors, this value indicates the plug point of the first module with a configuration error.

**CAN receive error counter:** Error counter of the CAN controller

**CAN transmit error counter:** Error counter of the CAN controller

### 7.3 Controlled receiving of CAN frames

In the PLC, every controlled reception object has a status and a control byte in addition to the CAN data:

Byte/Bit	7	6	5	4	3	2	1	0
In 0	–	–	–	–	–	–	1 = Overrun	Indication toggle bit of new frame
In 1–n	CAN frame data depending upon the selected frame length (0 - 8 bytes)							

Byte/Bit	7	6	5	4	3	2	1	0
Out 0	–	–	–	–	–	–	Overrun-Reset	Acknowledge toggle bit of new frame

The indication and the acknowledge bit for the reception of new CAN frames are always toggled:

- Indication bit = Acknowledge bit -> no new frame received
- Indication bit  $\neq$  Acknowledge bit -> a new frame has been received

In order to be able to receive the next frame, the acknowledge bit must simply set equally to the indication bit.

## 7.4 Controlled transmission of CAN frames

In the PLC, every controlled transmission object has a status and a control byte in addition to the CAN data:

Byte/Bit	7	6	5	4	3	2	1	0
In 0	–	–	–	–	–	–	–	Transmit Acknowledge

Byte/Bit	7	6	5	4	3	2	1	0
Out 0	–	–	–	–	–	–	–	Request transmit
Out 1–n	CAN frame data depending upon the selected frame length (0 - 8 bytes)							

The request and the acknowledge bit for the transmission of CAN frames are always toggled:

- Request bit  $\neq$  Acknowledge bit -> Transmit frame
- Request bit = Acknowledge bit -> Don't transmit frame

## 7.5 Reception channel (Rx-FIFO)

The reception channel FIFO object can be used for the reception of a range of CAN frames that can also have differing data lengths. The PN/CAN Gateway hereby also provides a FIFO buffer with adjustable size.

Details on the use of the reception channel can be found in the manual of the PN/CAN Gateway.

## 7.6 Transmission channel (Tx-FIFO)

Any number of CAN frames can be sent with the transmission channel FIFO. Both the CAN identifier and the data length can be selected as desired. It is also possible to transmit CAN frames with identifiers that have already been configured as automatic or controlled modules.

Details on the use of the transmission channel can be found in the manual of the PN/CAN Gateway.

## 8. LED status information

MODE	
Off	No power supply or device defective
Blue on	PN/CAN Gateway is correctly configured via PROFINET Mode 3: Transmitting and receiving active
Flashing blue	PN/CAN Gateway is correctly configured via PROFINET Mode 0, 1 or 2
Flashing red	No connection with PROFINET controller (PLC) or a configuration error exists
CAN-RX	
Flashing green	CAN frame is received without errors
Red	CAN bus error in the recipient or PN/CAN Gateway hasn't been configured yet
CAN-TX	
Flashing green	CAN frames are being transmitted
Rot	Transmission not possible (e.g. false Baud rate, CAN bus disrupted) or PN/CAN Gateway has not yet been configured



## 9. Technical data

<b>Order no.</b>	700-671-PNC01
<b>PROFINET Interface</b>	
- Protocol	PROFINET IO as defined in IEC 61158-6-10
- Transmission rate	100 Mbit/s full duplex
- I/O image size	1440 bytes
- Number of configurable slots	512
- Connection	2 x RJ45, integrated switch
- Features	Media Redundancy Protocol (MRP), automatic addressing / topology detection (LLDP, DCP), diagnosis alarm
<b>CAN interface</b>	
- Type	ISO/DIN 11898-2 CAN High Speed physical Layer
- Connection	9-pin D-sub male connector
- Protocol	CAN Layer 2 with 11-Bit or 29-Bit identifier
- Baud rate	50, 100, 125, 250, 500, 800, 1000 kbps
<b>USB interface</b>	
- Protocol	USB 2.0 Device, Full Speed
- Connection	Mini-USB
- Electrically isolated from USB	Yes; Isolation 1.5 kV
Voltage supply	DC 24 V, 18 - 28 V DC
Current draw	Max. 250 mA
Dimensions (D x W x H)	35 x 84 x 76 mm
Weight	Approx. 160 g
Certifications	CE
Protection ratings	IP 20
Permissible ambient temperature	0 °C to +60 °C
Transport and storage temperature	-20 °C to +80 °C



## Notes

#### **Note**

*The contents of this Quick Start Guide have been checked by us so as to ensure that they match 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 this Quick Start Guide, which can be viewed and downloaded on the Internet at [www.helmholz.com](http://www.helmholz.com).*

*Our customers are important to us. We are pleased to receive suggestions for improvement and new impulses.*

*1) SIMATIC is a registered trademark of Siemens AG.*