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# PN/CAN LINK – SDO communication

SIMATIC S7

<https://support.industry.siemens.com/cs/ww/en/view/109751076>


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# 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.

 <b>DANGER</b>	<b>indicates that death or severe personal injury will result if proper precautions are not taken.</b>
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 <b>WARNING</b>	<b>indicates that death or severe personal injury may result if proper precautions are not taken.</b>
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 <b>CAUTION</b>	<b>indicates that minor personal injury can result if proper precautions are not taken.</b>
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<b>NOTICE</b>	<b>indicates that property damage can result if proper precautions are not taken.</b>
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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:

 <b>WARNING</b>	<b>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.</b>
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The present application example shows the SDO communication of the PN/CAN LINK. In the process the PN/CAN LINK as a manager accesses the entries of the Object Dictionary (OD) of a PN/CAN LINK configured as a slave.

The application example does not go into detail on the configuration of the PN/CAN LINK. The application examples "CANopen Manager" are provided to this purpose.

This application example is used to illustrate how individual OD entries can be written and read via the control system. The PN/CAN LINK via PROFINET provides multiple data records for the CANopen Manager module that the S7 user program can access with the acyclic PROFINET IO services RDREC (read data record) und WRREC (write data record). Such data records are not available at the configured CANopen slaves.

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### Note

For the configuration presented below, the associated example program is available for downloading at Internet links (Page 25).

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### Knowledge required

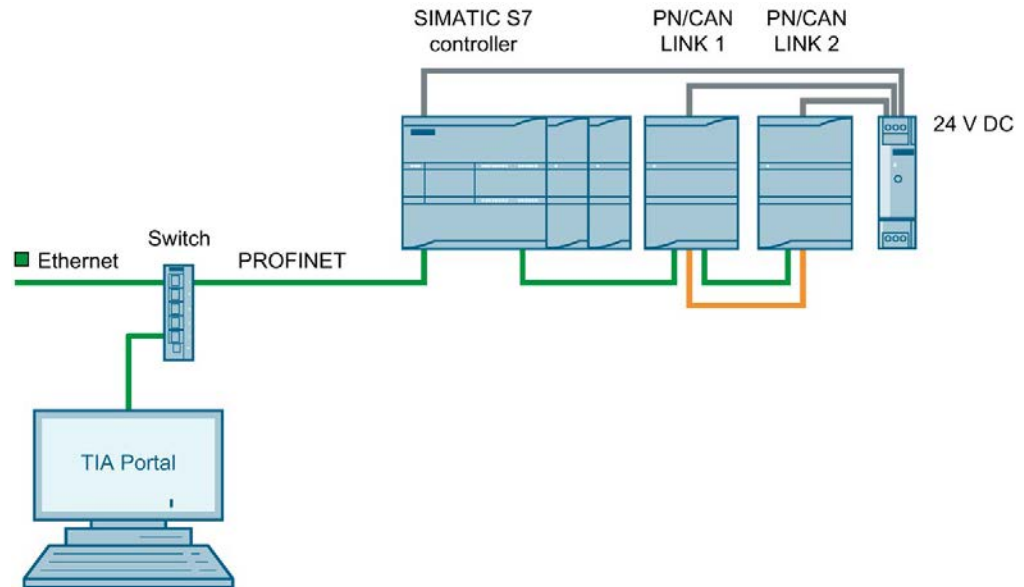
The following knowledge is required:

- 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

## Solution

### 2.1 System configuration

For the application example use the following configuration:



The PN/CAN LINKs are connected via PROFINET to the SIMATIC S7 control system. The PN/CAN LINKs are configured as follows:

- PN/CAN LINK 1 - in "CANopen Manager" mode
- PN/CAN LINK 2 - in "CANopen Slave" mode

The configuration takes place on a PC with installed TIA Portal.

## 2.2 Hardware and software components

The application example was created with the following components:

### Hardware components

Component	Number	Article number	Comment
SIMATIC S7 control system	1	6AG1215-1AG40-5XB0	CPU 1215C
PN/CAN LINK	2	6BK1620-0AA00-0AA0	12 V DC to 24 V DC supply voltage
Power supply SIPLUS S7-1200 PM 1207	1	6AG1332-1SH71-4AA0	For power supply of control system and PN/CAN LINK

### Software components

Component	Number	Article number	Comment
SIMATIC STEP 7 BASIC V15.1	1	6ES7822-0AA05-0YA5	–

### Example files and projects

File	Comment
109751076_network_transistions_pn_can_link_sdo_communication_en.pdf	The present document
SDO_Kommunikation.zip	The file contains: <ul style="list-style-type: none"> <li>• The present document</li> <li>• The TIA project of the application example</li> </ul>

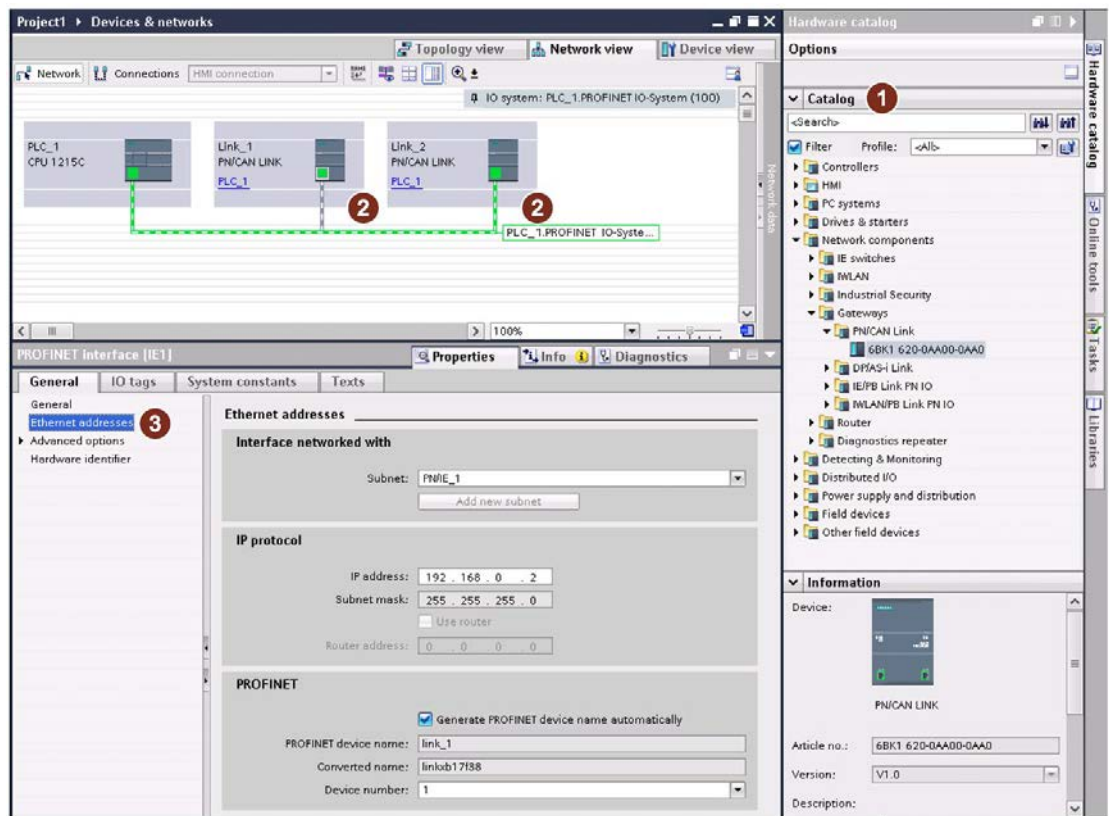
You will find the download link in the section "Internet links (Page 25)".

# Configuring / programming

## 3.1 General procedure

Proceed as follows:

1. Create a new project.
2. Switch the language of the user interface to English.
3. Click "Catalog" ① and insert the devices according to the section "Hardware and software components (Page 6)".
4. Connect the CPU and PN/CAN LINK by means of a PROFINET connection.  
CPU and PN/CAN LINKs are connected in the "Network view" window via PROFINET ②.
5. Configure the PROFINET interfaces ③ based on the conditions of your PROFINET network.

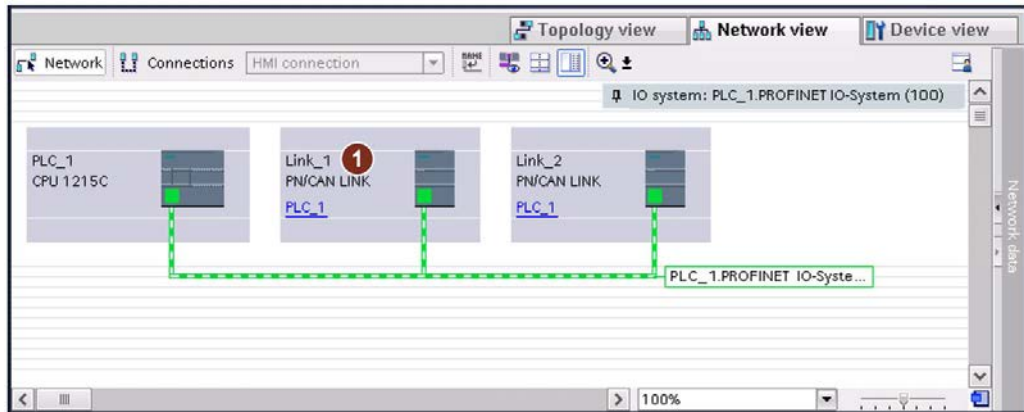


### 3.2 Configuring PN/CAN LINK

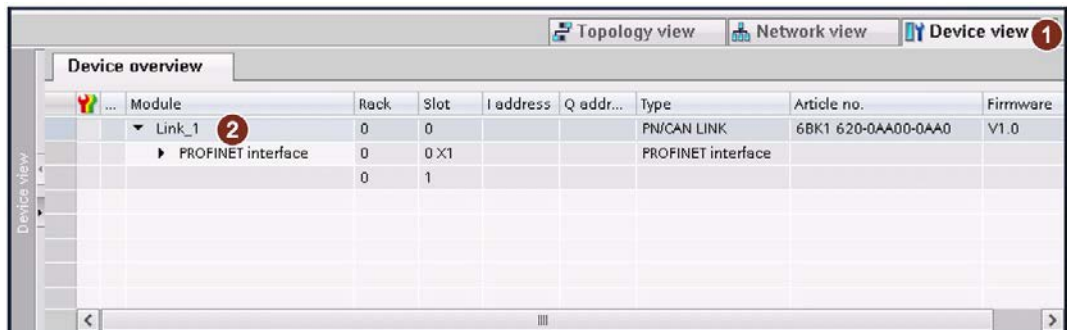
#### Configuring the mode

Proceed as follows:

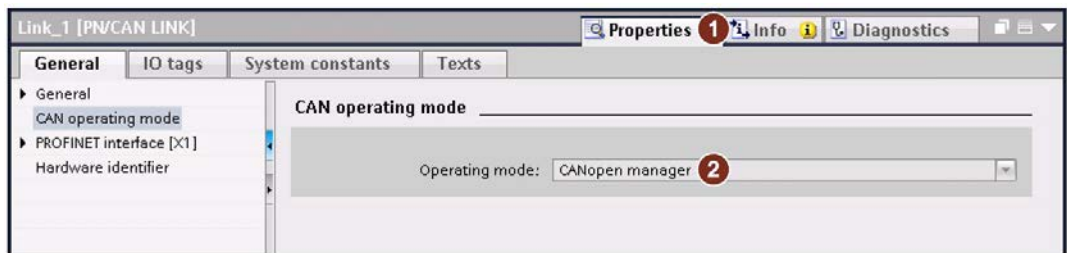
1. Change to the net view and select "Link\_1".



2. Change to "Device view" ① and select "Link\_1" ②



3. Select "Properties ① → General → CAN operating mode" and set operating mode "CANopen manager ②".



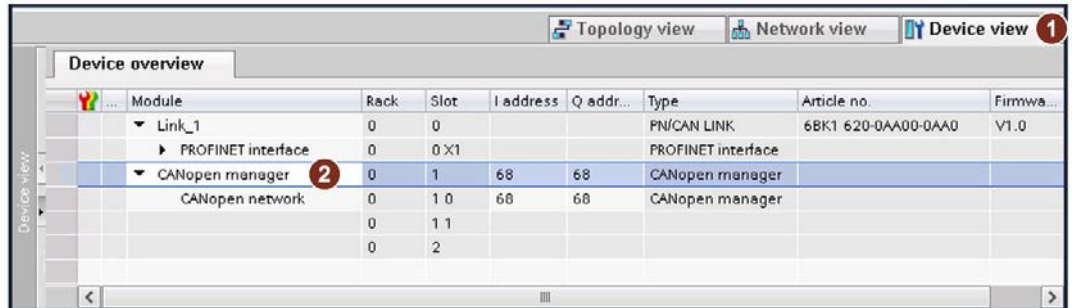
4. Repeat steps 1 to 3 for "Link\_2" and set the "CANopen slave" mode.



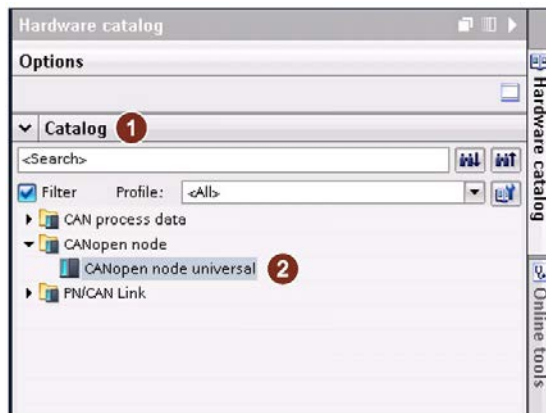
## Inserting CANopen nodes

Proceed as follows:

1. Select "Device view ① → Device overview → CANopen manager ②".

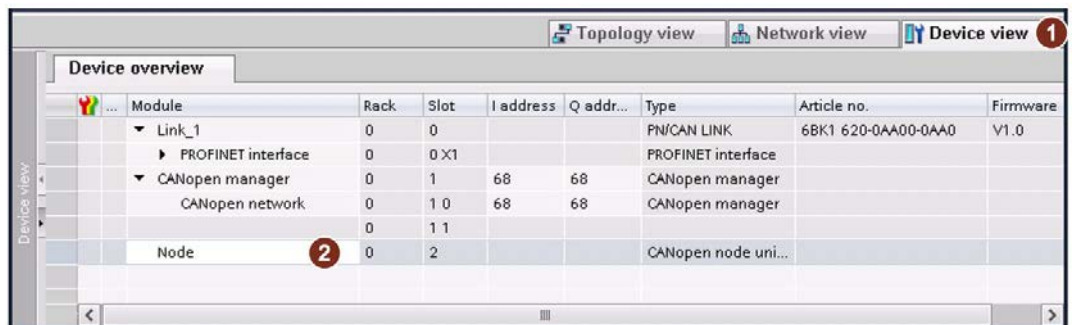


2. Select "Catalog ① → CANopen node".



3. Insert a "CANopen node universal" ② with a double click.

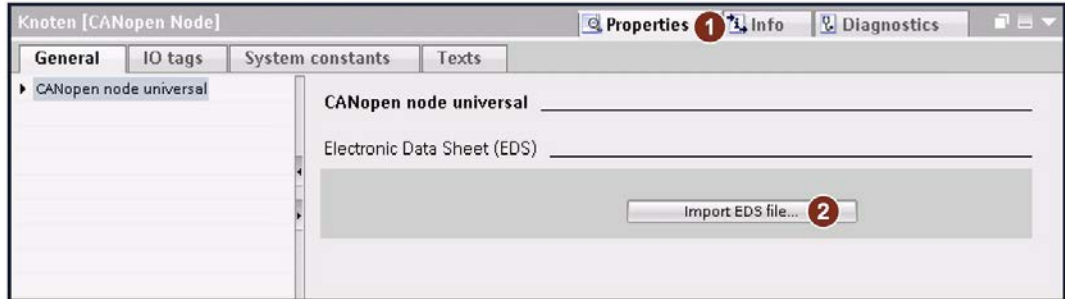
The CANopen node is inserted under "Device view ① → Device overview" as submodule ②.



### Importing the EDS file

Proceed as follows:

1. Select "Properties ① → General → CANopen node universal".

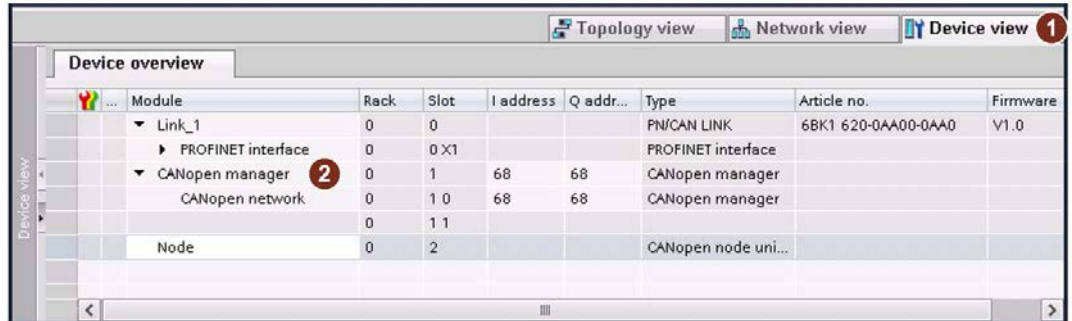


2. Click "Import EDS file" ②.  
The "Import EDS file" window is displayed.
3. Select the EDS file to import.
4. Confirm the import with "OK".

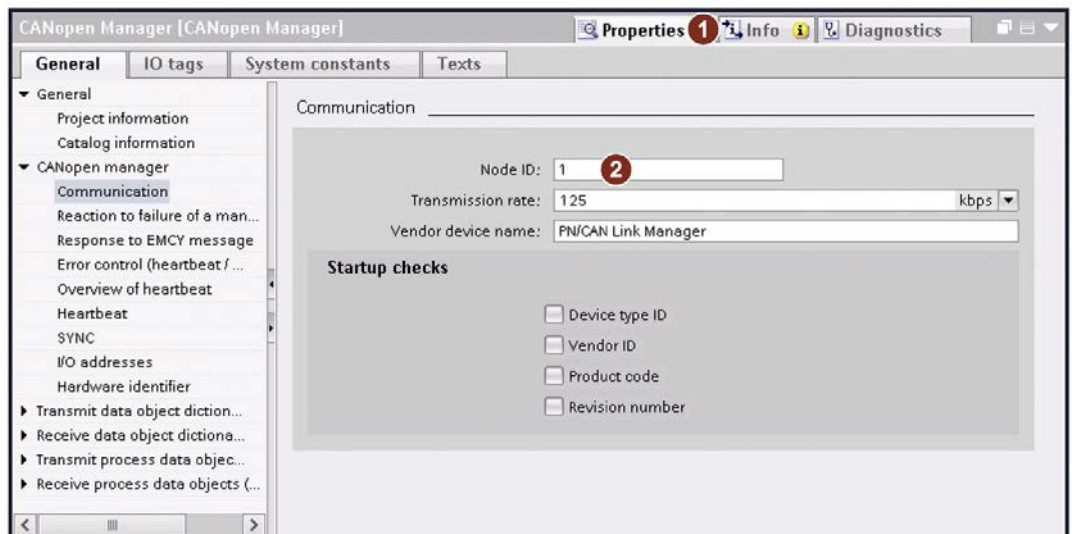
## Setting the node ID

Proceed as follows:

1. Select "Device view ① → Device overview → CANopen manager ②".



2. Select "Properties ① → General → CANopen manager → Communication".



3. Enter the following node IDs ②:
  - CANopen slave, "Node ID" 10
  - CANopen manager, "Node ID" 1

## Inserting a transmit OD and receive OD entry

The OD entries are required in order to transmit and receive user-defined data. No data is exchanged via the OD entries in this application example. At least one OD entry needs to be configured for successful compilation of the project.

Creation is effected in the device view of the respective PN/CAN LINK. Insert the corresponding modules for a transmit data and receive data OD entry from the HW catalog as a submodule into the respective PN/CAN LINK.

Proceed as follows:

1. Select "Hardware catalog ① → CAN process data ②".



2. Add the following object dictionary as a submodule by double-clicking:

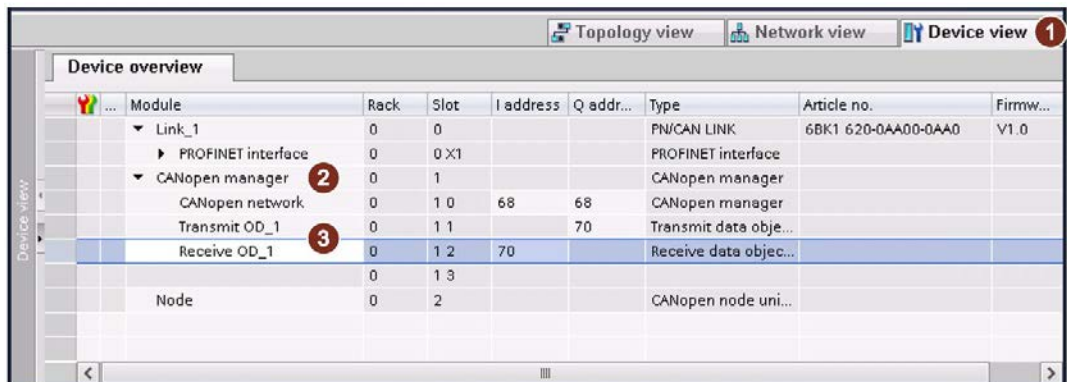
- Transmit data object dictionary

To transmit data, a transmit OD entry is required to which the transmitted data is written.

- Receive data object dictionary

To receive data, a receive OD entry is required to which the received data is written.

In "Device view ① → CANopen manager ②", the submodules ③ are displayed.



## Switching to "Operational" operating state

Proceed as follows:

1. Create CPU variables for the control bits of the links:
  - For the CANopen Manager the Bits 0 and 2 of the output byte of the CANopen network submodule.
  - For the CANopen Slave Bit 0 of the same byte.

The CPU variables are necessary for the S7 connection. Additional information is available in the SIMATIC PN/CAN LINK operating instructions in the section "4.1.2.2 Control and status information". You will find the link to the document in the section "Internet links (Page 25)".

2. Compile and download the project.
3. After starting the CPU set all bits to 1, so that the links go to the "Operational" operating state.

You can find more detailed information in section "Checking and compiling a configuration in the TIA Portal (Page 22)".

## 3.3 SDO communication

For the SDO communication use the program blocks DoSdoRead and DoSdoWrite.

Reading out within the program blocks is effected via the acyclic services WRREC and RDREC of the S7 control system.

- First the WRREC is performed  
The SDO data of a node in the network is read or written.
- After that the RDREC is performed  
In the process the result of the PN/CAN LINK is collected.

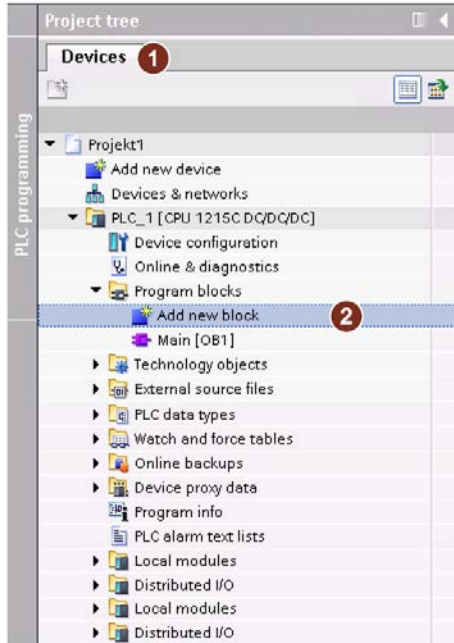
### 3.3.1 Function blocks and libraries

The following section described how to create a cyclic interrupt and the associated function block and to import it into the library. Create a cyclic interrupt that is called up every 100 ms.

#### Procedure

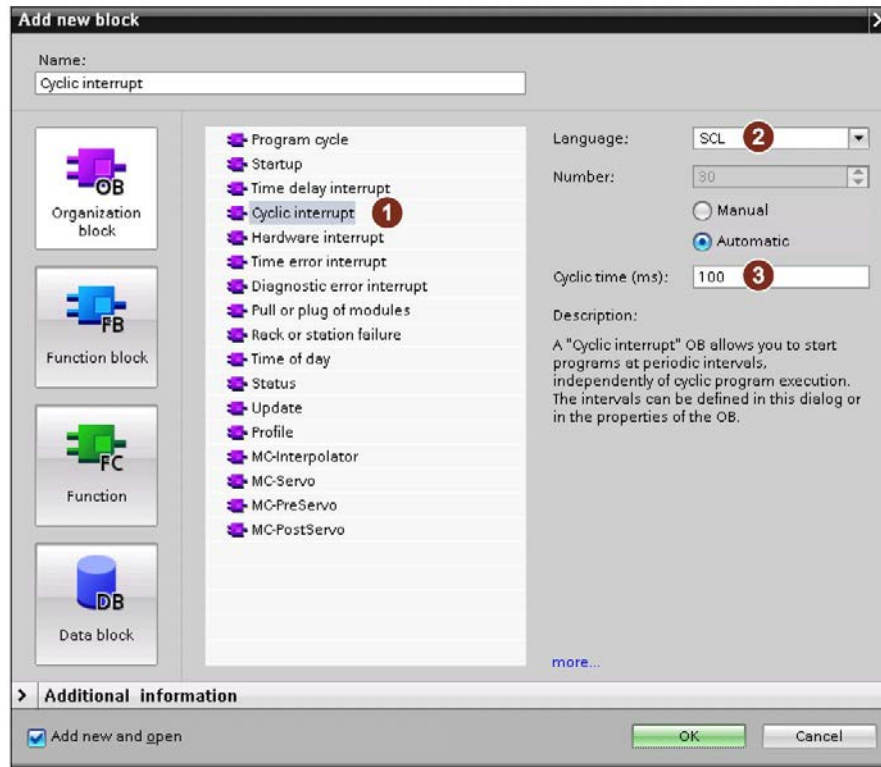
Proceed as follows:

1. Switch to the project navigation and click "Devices ① → PLC\_1 → Program blocks".



2. Double-click "Add new block" ②.

The following dialog window is displayed.



This interrupt calls up a function block that reads or writes data from or to Link\_2 via SDOs.

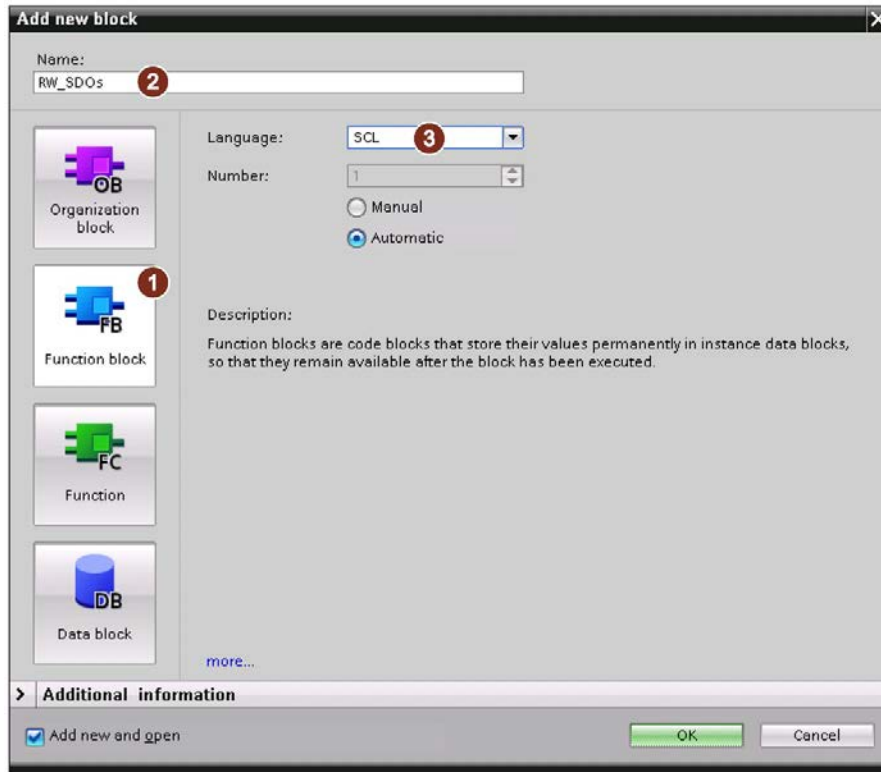
3. Click "Cyclic interrupt" ①.

The cyclic interrupt is used to change the transmit OD entry. The transmit OD entry is increased by the value "1" with each call.

4. Check if ② and ③ are set as seen in the figure.

5. Click "Function block" ①.

The following dialog window is displayed.

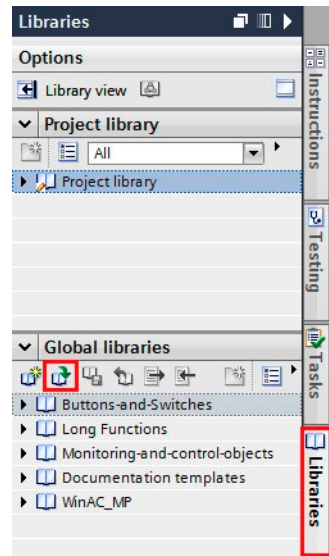


6. Change "Name" ② and "Language" ③ as specified.
7. Confirm your entries with OK.



8. The function blocks DoSdoRead and DoSdoWrite are called up in the function block RW\_SDO.

These can be imported as a library. The library is included in the ZIP file in accordance with section "Internet links (Page 25)".



9. To ensure that the RW\_SDOs function block is called in the interrupt, drag-and-drop the function block into the interrupt.

A data block is then created. The interrupt changes as follows:

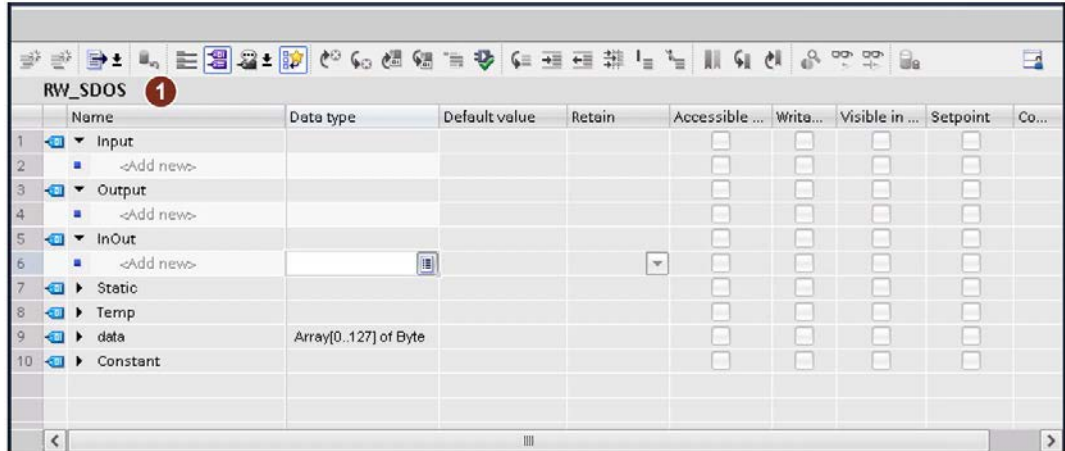
IF...	CASE... OF...	FOR... TO DO...	WHILE... DO...	(*...*)	REGION.
					1 "RW_SDOs_DB" ();
					2

### 3.3.2 Writing SDO parameters

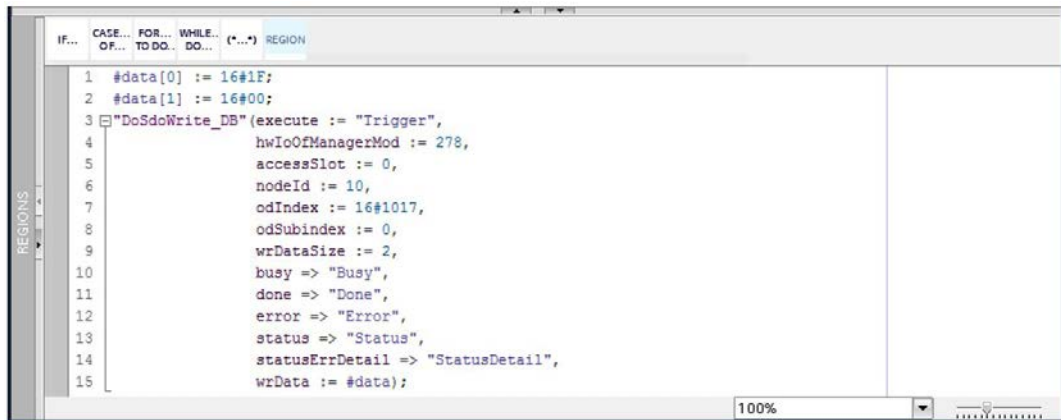
#### Procedure

Proceed as follows:

1. Drag the function block "RW\_SDOs" ① into the interrupt.
2. Confirm the creation of the associated data block.



#### Parameter description "DoSdoWrite\_DB"



The parameters of the example are described below.

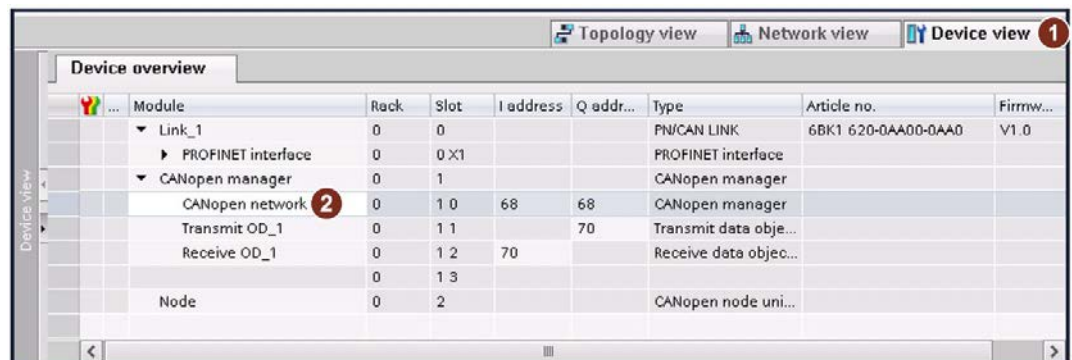
Parameter	Description
execute	Determines whether the block is executed (TRUE/FALSE). With this parameter the value of the CPU variable "Trigger" that points to a free output address is transferred. This CPU variable is required because the block is not executed again until "Execute" is reset from 1 to 0. This allows the execution of the block simply by triggering it via a watch table.
hwloOfManagerMod	Hardware ID of the CANopen Manager This is located in the "Device overview" and is marked in the following figure.
accessSlot	Channel through which the acyclic service is performed. 16 channels with the numbers 0 to 15 are available.
nodeId	Node ID of the node, whose SDO information is to be written.
odIndex	Object Dictionary Index that is to be written - in this example the Producer Heartbeat Time (Index 0x1017).
odSubindex	Sub index that is to be written - in this example the value "0".
wrDataSize	Quantity in bytes of the data to be written, with a maximum of 128.

## Displaying the Hardware identifier

The following figure shows at which point in the HSP the "Hardware identifier" that is required for the parameter "hwloOfManagerMod" is required.

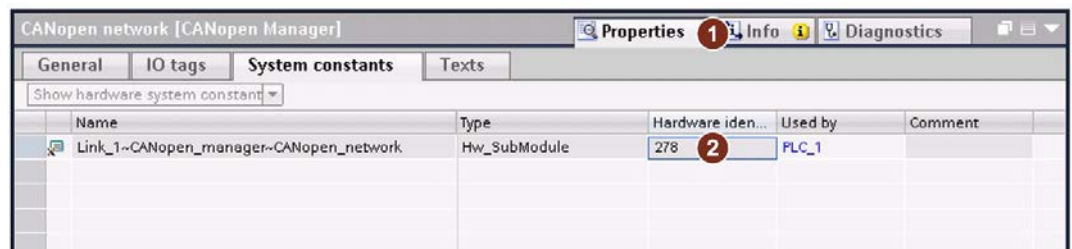
Proceed as follows:

1. In the network view, double-click "Link\_1".
2. Select "Device view ① → Device overview → CANopen network ②".



3. Select "Properties ① → System constants".

The "Hardware identifier" is displayed at ②.



**PLC variables for the watch table**

The following parameters are output values. These are written by the function block into the parameters. These parameters are PLC variables that can be made visible in a watch table.

Parameter	Description
busy	Shows whether the acyclic service is still busy.
done	Shows whether the acyclic service is finished.
error	Shows if an error occurred.
status	Shows the status of the acyclic service. This is displayed when an error occurs in the SDO communication during the RDREC. The meaning of the individual status codes can be found in the SIMATIC PN/CAN LINK operating instructions in the section "4.1.2.3 Acyclic data exchange between controller and PN/CAN LINK". You will find the link to the document in the section "Internet links (Page 25)".
statusErrDetail	Shows the error code: <ul style="list-style-type: none"> <li>• CAN-specific code  The error occurs for example if the transferred CAN parameters are not correct. The meaning of the individual status codes can be found in the SIMATIC PN/CAN LINK operating instructions in the section "4.1.2.3 Acyclic data exchange between controller and PN/CAN LINK". You will find the link to the document in the section "Internet links (Page 25)".</li> <li>• PROFINET error  The error occurs if the WRREC/RDREC already fails. You can read up on the meaning of the PROFINET error code in the help of the TIA Portal under WRREC or RDREC.</li> </ul> <p><b>Note</b> A CAN-specific error code that is not described in the operating instructions can also be entered here. This is due to the fact that the SDO communication has not functioned (see "Status"). If "Status" is not 0, the error code is specified in the CiA301 norm.</p>
wrData	The data to be written in the format "Little Endian" where the most significant bit is located at the highest address.

### 3.3.3 Reading SDO parameters

The DoSdoRead function block is required in order to read SDO parameters.

#### Procedure

Proceed as follows:

1. Extend the function block used for writing RW\_SDOs by the reading of an object as follows:

```

17 ▢ "DoSdoRead_DB" (execute:="Trigger",
18     hwIoOfManagerMod:=278,
19     accessSlot := 1,
20     nodeId:=10,
21     odIndex:=16#1018,
22     odSubindex:=16#04,
23     maxDataSize:=4,
24     busy->"Busy",
25     done->"Done",
26     error->"Error",
27     status->"Status",
28     statusErrDetail->"StatusDetail",
29     numBytesRead->"BytesRead",
30     rdData:=#recData);
31 "SerialNumber" := #recData[0] OR BYTE_TO_UDINT(IN := #recData[1]) * 256 OR BYTE_TO_UDINT(IN := #recData[2]) * 256 * 256;
32

```

The parameters of the example are described in the following section.

#### Parameter description

Parameter	Description
execute, hwIoOfManagerMod, accessSlot, nodeId, odIndex, odSubindex	See section Writing SDO parameters (Page 18)
maxDataSize	The maximum number of data which is to be read in bytes. A maximum of 128 Bytes is possible.
busy, done, error, status, statusErrDetail	See section Writing SDO parameters (Page 18)
numBytesRead	Actual number of read bytes. A CPU variable was created for this purpose to check the value in a watch table.
rdData	The read data in the format "Little Endian" where the most significant bit is located at the highest address.  In the current example the serial number of the PN/CAN LINK Link_2 is read out via the specified index/sub-index. The serial number has a length of 4 bytes. The serial number is created in the last line of the single byte in the return array.

### 3.4 Checking and compiling a configuration in the TIA Portal

#### 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. There 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. The control and status information is exchanged with the S7 program via the slot.

It is important for startup of the PN/CAN LINK that the transmitted control information from the S7 program is set correctly.

#### Checking the 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. Corresponding messages are output in the process.

#### PLC and PN/CAN LINK connection status

The correct behavior is displayed after the successful downloading of the application example:

Component	LED	Status	Operating state
PLC	RUN	■	Green, On
PN/CAN Link 1 (CANopen manager)	PN RUN	■	Green, On
PN/CAN Link 1 (CANopen manager)	CAN RUN	⦿	Green, flashing for "Preoperational" operating state
PN/CAN Link 2 (CANopen slave)	PN RUN	■	Green, On
PN/CAN Link 2 (CANopen slave)	CAN RUN	⦿	Green, flashing for "Preoperational" operating state

The display changes after you have set the following bits:

- CANopen manager bit 0 and 2 to TRUE
- CANopen slave bit 0 to TRUE

Component	LED	Status	Operating state
PLC	RUN	■	Green, On
PN/CAN Link 1 (CANopen manager)	PN RUN	■	Green, On
PN/CAN Link 1 (CANopen manager)	CAN RUN	■	Green, on for "Operational" operating state
PN/CAN Link 2 (CANopen slave)	PN RUN	■	Green, On
PN/CAN Link 2 (CANopen slave)	CAN RUN	■	Green, on for "Operational" operating state





## Appendix

### A.1 Internet links

No.	Topic
1	Entry ( <a href="https://support.industry.siemens.com/cs/products?search=109751076&amp;mf=ps&amp;o=DefaultRankingDesc&amp;lc=de-WW">https://support.industry.siemens.com/cs/products?search=109751076&amp;mf=ps&amp;o=DefaultRankingDesc&amp;lc=de-WW</a> )
2	SIMATIC gateways SIMATIC PN/CAN LINK ( <a href="https://support.industry.siemens.com/cs/document/109746744/simatic-network-transitions-simatic-pn-can-link?dti=0&amp;lc=en-US">https://support.industry.siemens.com/cs/document/109746744/simatic-network-transitions-simatic-pn-can-link?dti=0&amp;lc=en-US</a> )
3	Industry Online Support ( <a href="https://support.industry.siemens.com/cs/start?lc=en-WW">https://support.industry.siemens.com/cs/start?lc=en-WW</a> )
4	Mall ( <a href="https://mall.industry.siemens.com/mall/en/WW/Catalog/Products/10140445?activeTab=ProductInformation&amp;tree=CatalogTree">https://mall.industry.siemens.com/mall/en/WW/Catalog/Products/10140445?activeTab=ProductInformation&amp;tree=CatalogTree</a> )
5	Industrial communication ( <a href="http://w3.siemens.com/mcms/automation/en/industrial-communications/Pages/Default.aspx">http://w3.siemens.com/mcms/automation/en/industrial-communications/Pages/Default.aspx</a> )
6	Contact person for the database ( <a href="http://w3.siemens.com/aspa_app/">http://w3.siemens.com/aspa_app/</a> )

### A.2 History

Edition	Comment
02/2018	First edition

### A.3 List of abbreviations

CAN	Controller Area Network
CPU	Central Processor Unit
I/O	Input/output
OD	Object dictionary
PN	PROFINET
SDO	Service Data Object