PSS u2 IO-Link Master with PROFINET Headmodul on a SIMATIC S7-1500

PILZ
THE SPIRIT OF SAFETY

Product

Type: PSS u2 I/O
Name: PSS u2 ES 4IOL 328770
Manufacturer: Pilz GmbH & Co. KG, Safe Automation

Document

Release Number: 01
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Important Note

This Application Note covers the functions of the PSS u2 IO-Link Master. In this document only the PSS u2-IO-Link Master with the PROFINET/PROFIsafe with the order number 328061 is described!

Application Note – 1005142_EN_01

Document Revision History

Release	Date	Changes	Chapter
01	2019-05-23	Creation	all

Validity of Application Note

This present Application Note is valid until a new version of the document is published.
This and other Application Notes can be downloaded in the latest version and for free from www.pilz.com.
For a simple search, use our content document (1002400) or the direct search function in the download area.

Exclusion of liability

We have taken great care in compiling our application note. It contains information about our company and our products. All statements are made in accordance with the current status of technology and to the best of our knowledge and belief.
While every effort has been made to ensure the information provided is accurate, we cannot accept liability for the accuracy and entirety of the information provided, except in the case of gross negligence. In particular, all information on applicable standards, safety-related classifications and time characteristics should be viewed as provisional. In particular it should be noted that statements do not have the legal quality of assurances or assured properties.
We are grateful for any feedback on the contents.

May 2019

Abbreviations

Abbreviation / term	Description	Source
AN	**A**pplication **N**ote	www.pilz.com > AN content (1002400)
PNOZ	Pilz E-STOP positive-guided (DE: **P**ilz **NO**T-AUS-**Z**wangsgeführt)	www.pilz.com > PNOZ
PSS	Programmable control system (DE: **P**rogrammierbares **S**teuerungs**s**ystem)	www.pilz.com > PSS
PSS u2	**PSS**universal, **2**nd generation	www.pilz.com > PSS u2
POU	**P**rogram **O**rganisation **U**nit	
NC	**N**ormally **C**losed	
NO	**N**ormally **O**pen	
PII	Process image of inputs	
PIO	Process image of outputs	
IODD	IO Device Description	
ST-Input/Output	Standard Input/Output	
TCI	Tool Calling Interface	

Definition of symbols

- Information that is particularly important is identified as follows:

CAUTION!

This refers to a hazard that can lead to a less serious or minor injury plus material damage, and also provides information on preventive measures that can be taken.

NOTICE

This describes a situation in which the product or devices could be damaged and also provides information on preventive measures that can be taken.
It also highlights areas within the text that are of particular importance.

INFORMATION

This gives advice on applications and provides information on special features.

Contents

1. Useful documentation

Reading the documentation listed below is necessary for understanding this Application Note. The availability of the indicated tools and safe handling are also presupposed with the user.

1.1. Documentation from Pilz GmbH & Co. KG

No.	Description	Item No. /Download
1	Pilz international homepage, download section	www.pilz.com > Support > Downloads
2	Software 'PASconfig', Online help Pilz international Webportal > Products and Solution > Controllers > PLC Controllers and I/O systems > I/O modules PSSuniversal 2 or the Head module under section "Software"	Products solutions > Controller > PLC controllers and I/O systems **328770** (Order number IO-Link Master) www.pilz.com > Download 328770
3	Operation manual PSS u2 ES 4IOL	1004880-EN-xx www.pilz.com > Download 1004880
4	System Description PSSuniversal 2	Not yet available.
5	Installation manual PSSuniversal 2	1004152-EN-xx www.pilz.com > Download 1004152
6	Operation manual PSS u2 P0 F/S PN Product modification PSS u2 P0 F/S PN GSD file under section "Device description file"	1003986-EN-xx www.pilz.com > Download 1003986 1004483-EN-xx www.pilz.com > Download 1004483 **328061** (Order number head module) www.pilz.com > Download 328061
7	Application Note ‚PSS u2 IO-Link Master with PROFINET Headmodul on a SIMATIC S7-1500'	1004479-EN-xx www.pilz.com > Download 1004479

1.2. Documentation from other sources of information

No.	Description	Item No. / Download
1	PI Portal (PROFIBUS and PROFINET International)	www.profinet.com
2	Siemens Homepage, Safety integrated	www.industry.siemens.com > Safety Integrated
3	Ifm TD2943	TD2943
4	Pepperl+Fuchs OMT100-R101-2EP-IO-V31	OMT100-R101-2EP-IO-V31
5	Pepperl+Fuchs OBR7500-R100-2EP-IO	OBR7500-R100-2EP-IO

2. Used hardware and software

2.1. Pilz products

No.	Descriptions	Order number	Version	Number
1	Hardware head module PSS u2 P0 F/S PN	328 061	02	1
2	Hardware electronic Module IO-Link Master with 4 IO-Link Ports PSS u2 ES 4IOL	328770	1	2
3	Hardware backplane 4 Slots PSS u2 B4	328810	-	1
4	Hardware terminal block 16-pin, 1 piece PSS u2 T 16	328850	-	2
5	Software PASconfig	-	3.01 Build 3	1

2.2. Third-party products

No.	Descriptions	Order number	Version	Number
1	Siemens Hardware PLC CPU 1518F-4 PN/DP	6ES7 518- 4FP00-0AB0	V1.8	1
2	Siemens TIA Portal	-	15.1	1
3	Siemens TIA Safety Advanced	-	15.1	1
4	IO-Link Device ifm TD2943	-	-	1
5	IO-Link Device Pepperl+Fuchs OTM100-R101-2EP-IO-V31	-	-	1
6	IO-Link Device Pepperl+Fuchs OBR7500-R100-2EP-IO	-	-	1

2.3. Structure of the application (schematic)

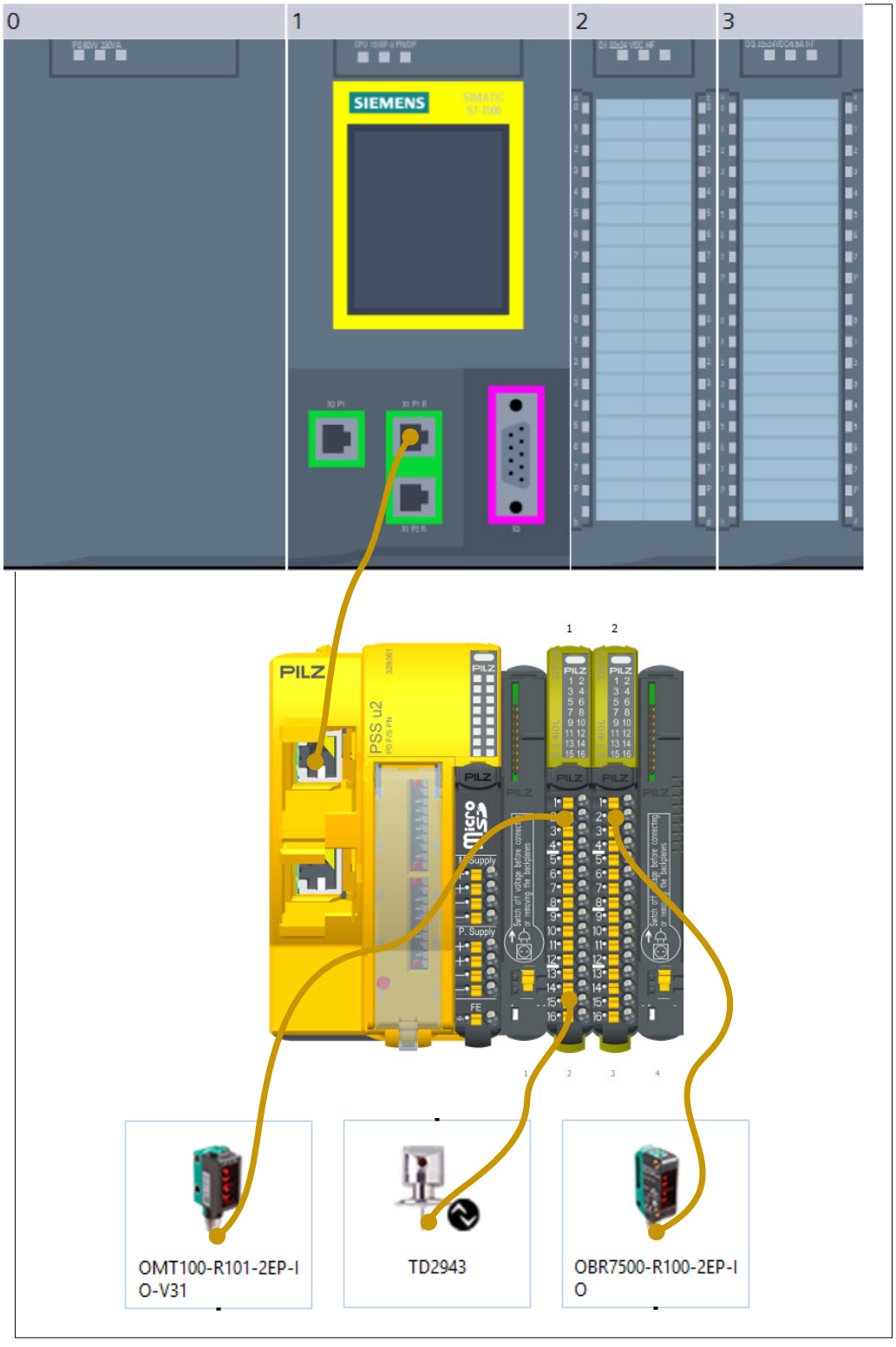


Figure 1: Application – Structure of the hardware (schematic)

3. Preface

This Application Note essentially describes the commissioning of an IO-Link master on the PSSuniversal 2 Remote I/O System on a current SIMATIC F-CPU. The settings required to configure the PROFINET/PROFIsafe head and to connect it to the Siemens PLC are not part of this Application Note. This is described in Application Note 1004479 "PSS u2 I/O PROFINET with PROFIsafe Profile on a SIMATIC S7-1500 with TIA Portal".
The essential procedure for a successful IO-Link basic configuration is described step by step, usually with screenshots.

NOTICE

- In the online help of PASconfig, the necessary steps as well as the possible settings are explained. This document does not replace the online help and the technical documentation.
- This document only describes the procedure for using the IO-Link module with order number 328770 on the remote I/O system PSS u2 and is not intended as technical documentation for the general use of the SIMATIC STEP 7 Professional for Siemens TIA Portal.

4. Application description

The aim is to show how an IO-Link communication can be established between the IO-Link master of the Remote I/O System PSS u2 and the IO-Link device.
Several IO-Link devices from different manufacturers are connected, configured and the data are exchanged with a Siemens PLC.
The representation of the individual IO-Link devices in the process image will be shown as well as the configuration of the IO-Link master on the Profinet controller using the supplied GSDML file.
The different operating modes, the use of IODD files and online functions such as error stack and comparison are also shown.

5. Hardware configuration

5.1. Used hardware

5.1.1. Pilz devices

- The used Pilz modules are listed in the table of the following link:
  - Chapter 2.1, Pilz products, Page 6
- The relevant important documents are named and linked here:
  - Chapter 1.1 Documentation from Pilz GmbH & Co. KG, Page 5

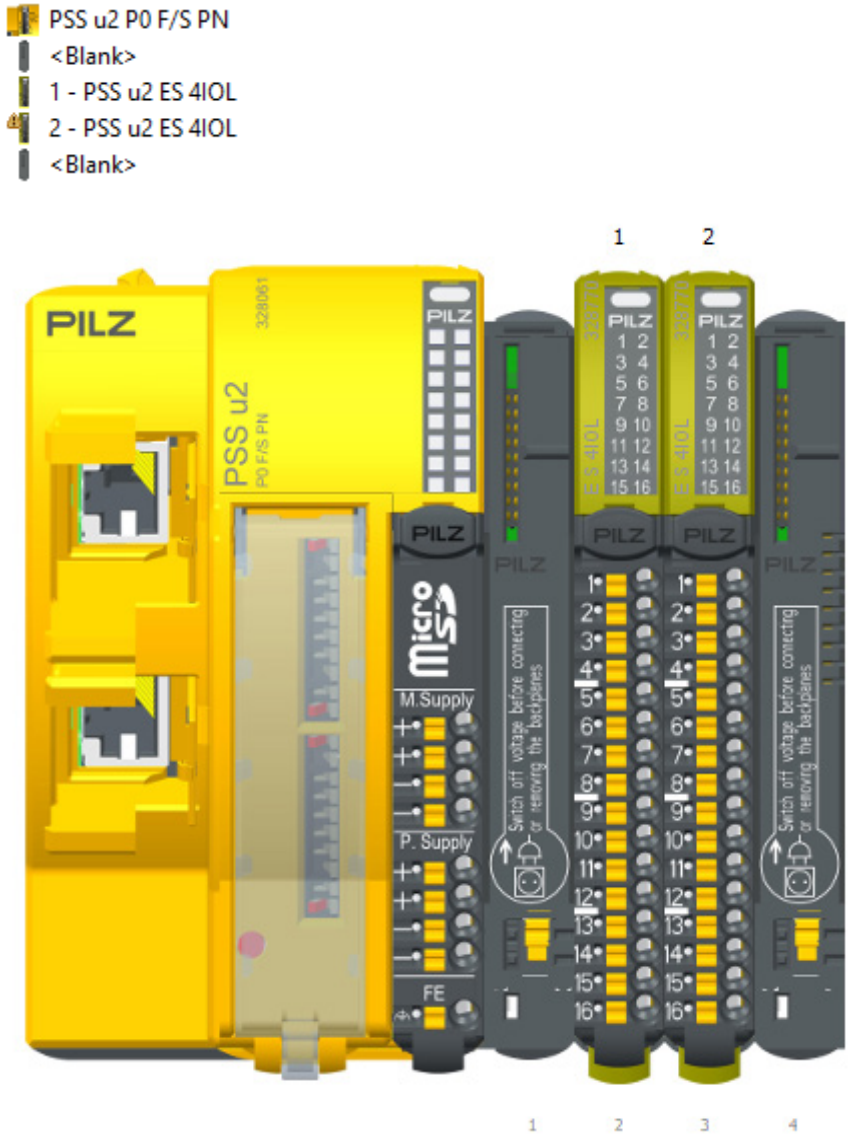


Figure 2: PSS u2 – Hardware » Overview of used modules

IMPORTANT

- The head module PSS u2 P0 F/S PN requires at least version 2.0 to support the IO-Link module.

5.1.2. Siemens devices

- The used SIMATIC devices are listed in the table of the following link:
  - Chapter 2.2, Third-party products, page 6
- The relevant important documents are named and linked here:
  - Chapter 1.2, Documentation from other sources of information, page 5

5.1.3. IO-Link devices

- The used IO-Link Devices devices are listed in the table of the following link:
  - Chapter 2.2, Third-party products, page 6
- The relevant important documents are named and linked here:
  - Chapter 1.2, Documentation from other sources of information, page 5

5.2. General Features of the IO-Link Master

- 4 IO-Link Ports
- Master according to IO-Link specification V1.1
- Port Class A and B (Class B with additional module)
- COM1,2,3
- Up to 32 bytes of input data and 32 bytes of output data per port
- Data Storage of the Device-Configuration in the Master
- Diagnostic with LEDs and Fehlerstack
- CQ Terminal can be operated in IO-Link mode, DI or DO

6. Wiring of the IO-Link Device

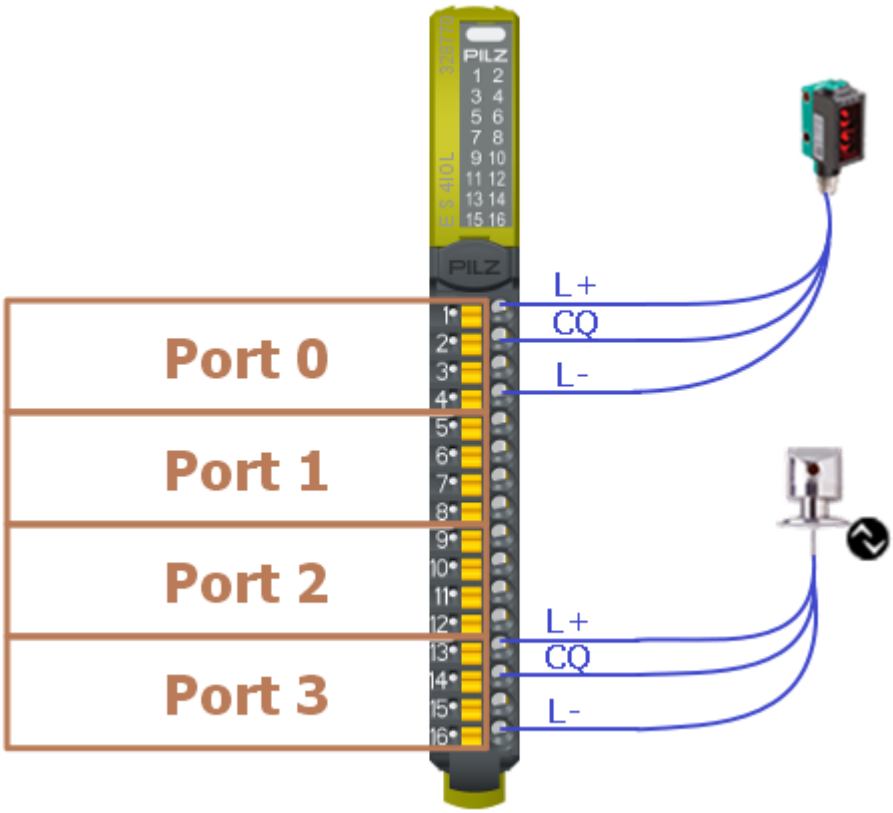


Figure 3: Wiring of the IO-Link devices

7. Configuration in SIMATIC TIA-Portal

7.1. Integrating PSS u2 devices

Precondition:

- The most recent GSDML file was imported.
  This can be downloaded from the Pilz homepage, see Chapter 1.1, Documentation from Pilz GmbH & Co. KG, page 5.
- PSS u2 P0 F/S PN Head has been set up (procedure is described in Application Note 1004479, see Chapter 1.1, Documentation from Pilz GmbH & Co. KG, page 5)

- Select the IO-Link modules in the hardware catalog and drag them to the same slots as in PASconfig.

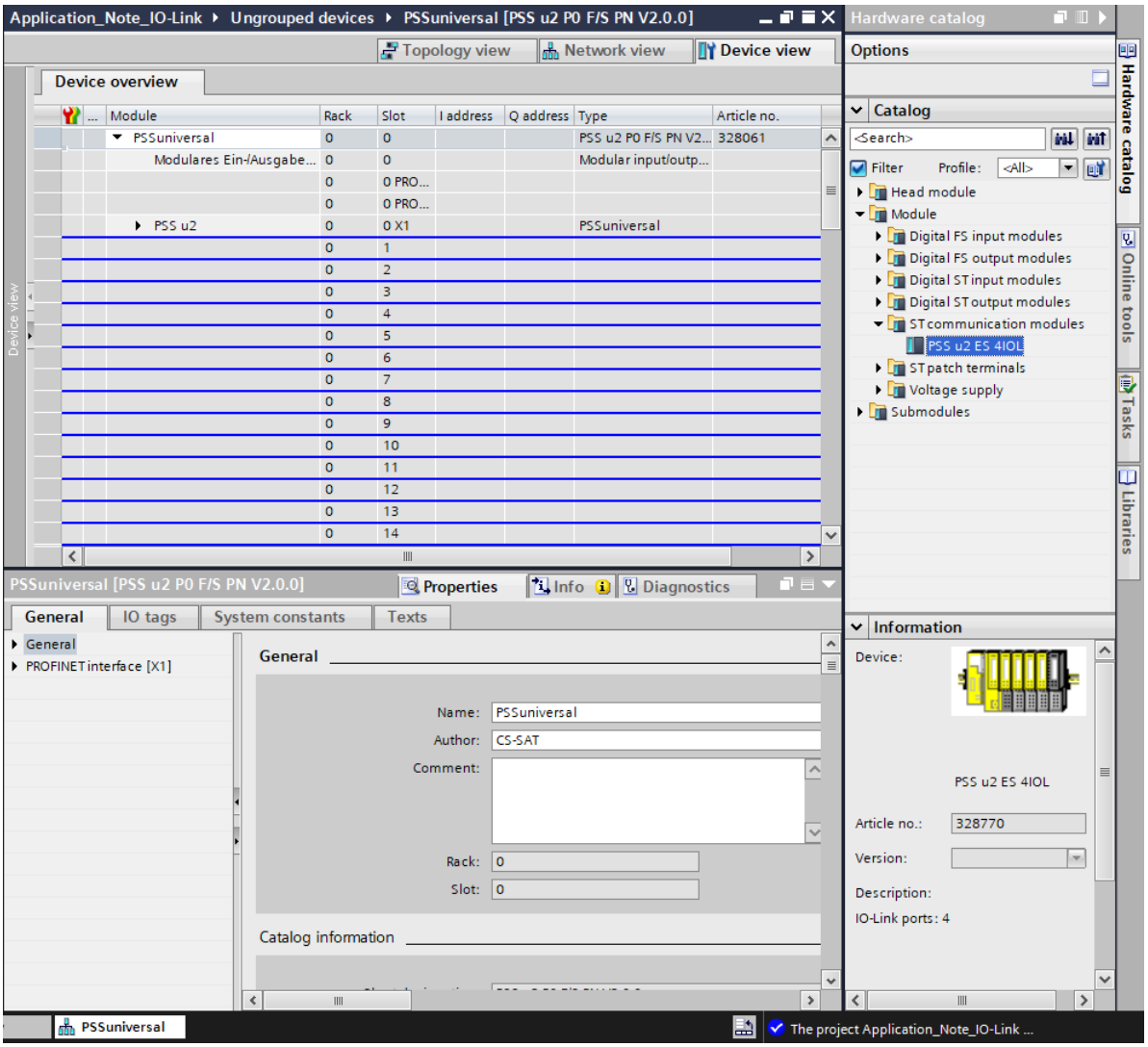


Figure 4: TIA Portal – Add PSS u2 IO-Link Master

- Select submodules with the corresponding data size. The data size must be identical to the one configured in PASconfig, see Figure 15: PASconfig – Process image IO-Link Master 1.

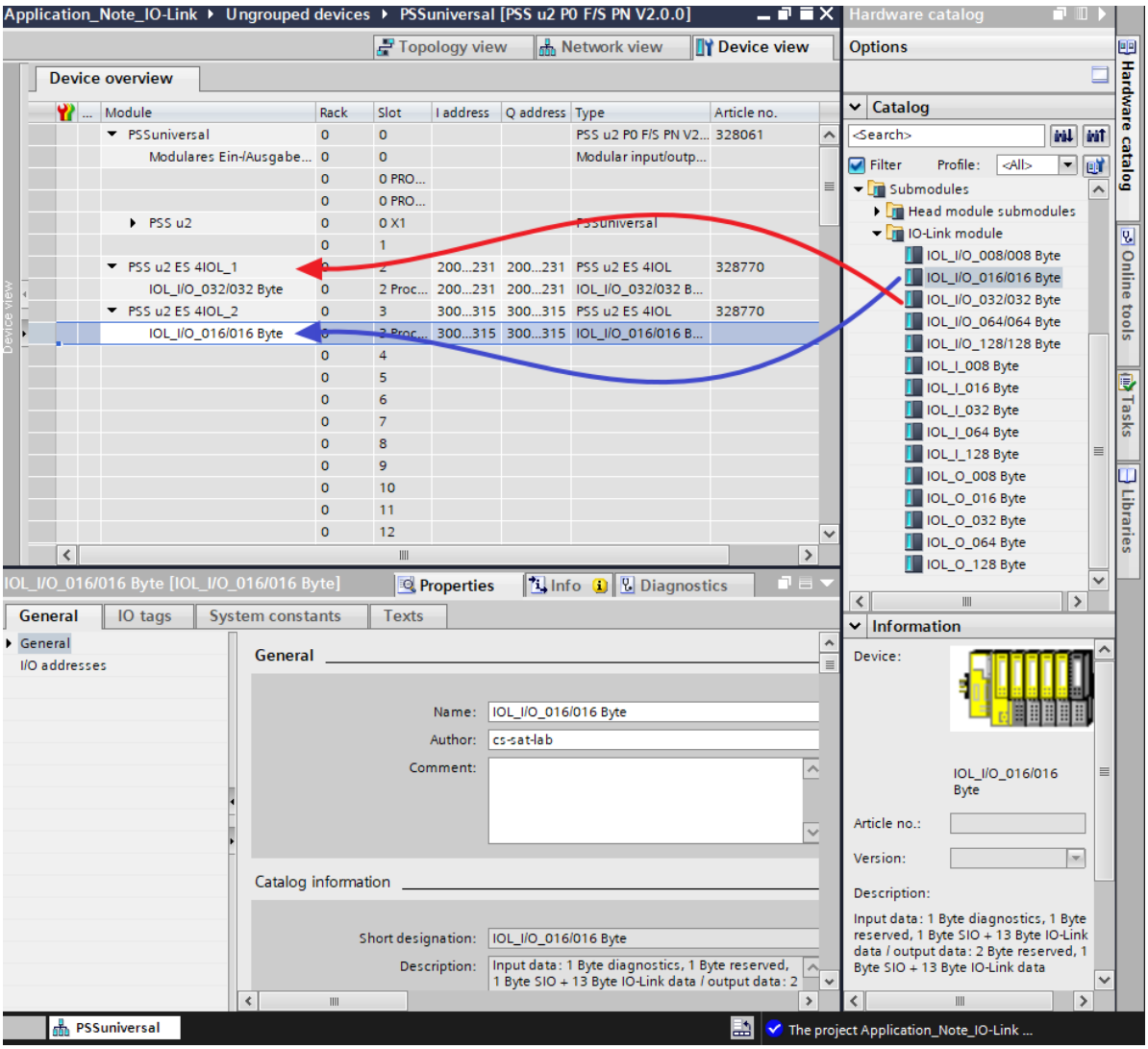


Figure 5: TIA Portal – Add PSS u2 IO-Link Master Submodules

7.2. TIA – Download the configuration to S7 F-CPU

- After closing the 'PASconfig' tool, the TIA project is saved first:

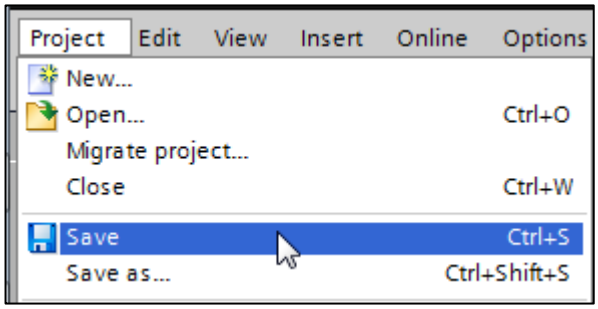


Figure 6: TIA – Download configuration » Save project (Part 1, Start)

- Now the F-CPU is selected in the project tree and the TIA project is compiled:

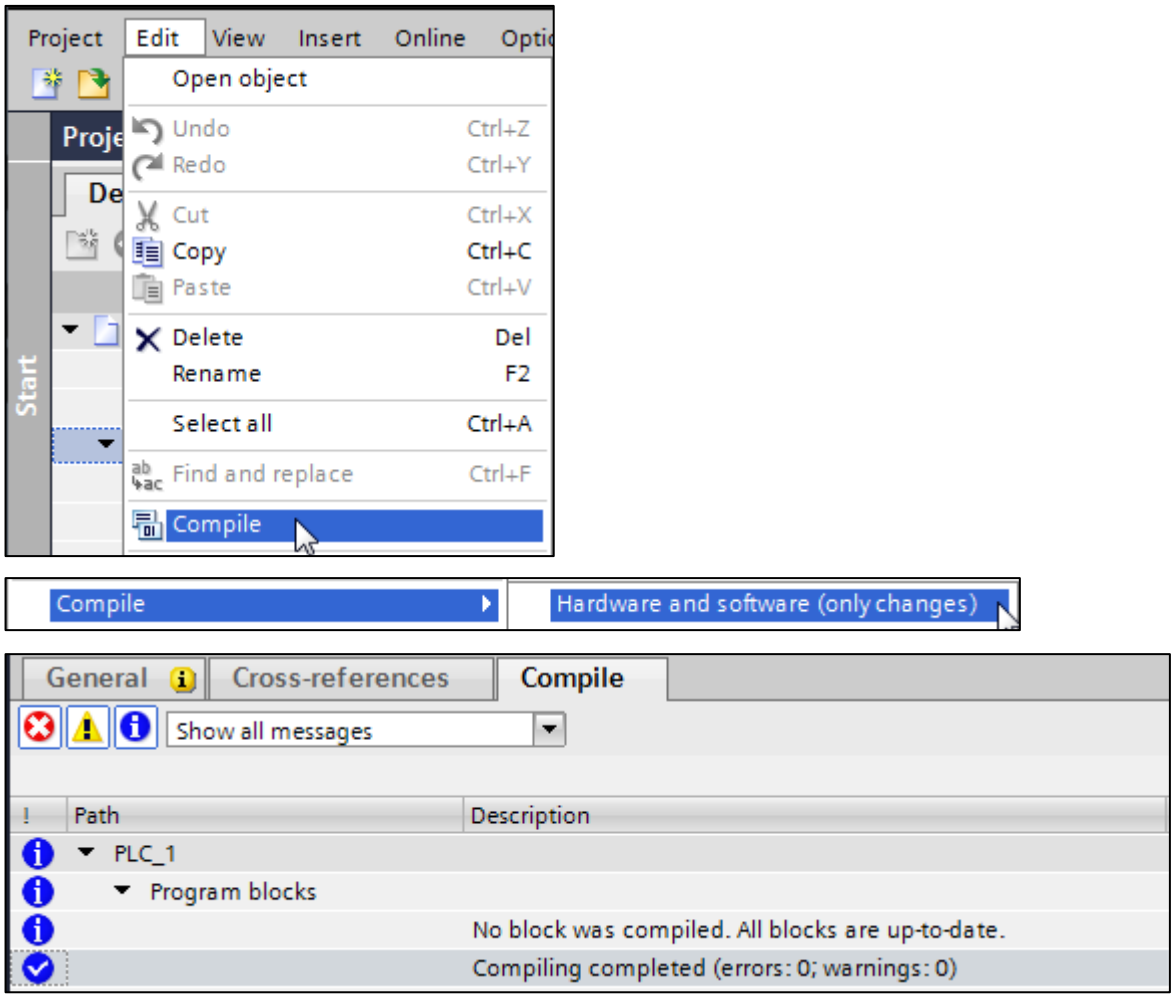


Figure 7: TIA – Download configuration » Compile project (Part 2)

- The TIA project is then loaded into the F-CPU:

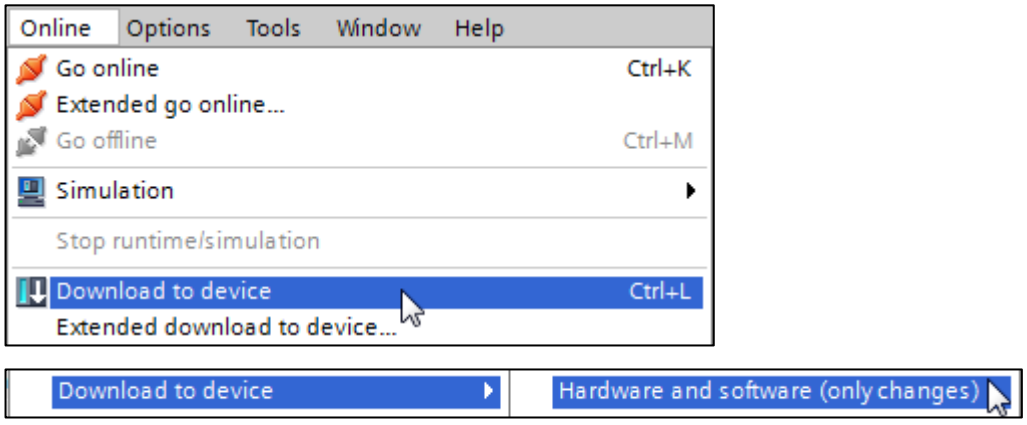


Figure 8: TIA – Download configuration » Download project to device (Part 3)

- The F-CPU can now be set to the operating mode "RUN".
  Now there should be no error messages in the PSS u2 system diagnostics:

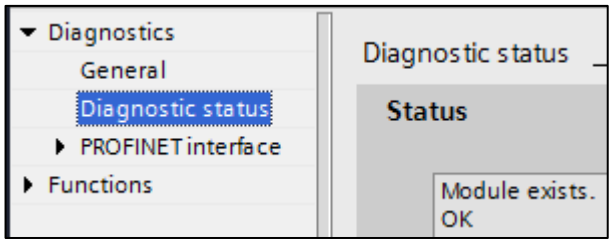


Figure 9: TIA – Download configuration » Check Diagnostic status (Part 4, Finalization)

- The error-free status of the two devices can be also recognized by their LEDs:

Figure 10: PSS u2 – Diagnostic status with error-free configuration

Figure 11: F-CPU – Diagnostic status with error-free configuration

8. IO-Link Configuration with PASconfig

8.1. Start of PASconfig via TIA device configuration

- Open the function “Devices & networks” in “Project tree”.
- Switch to “Device view” and select the device ‘PSSuniversal’.
- Right click on the device icon and select the function ‘Start device tool …’ using the access point ‘Configuration’:

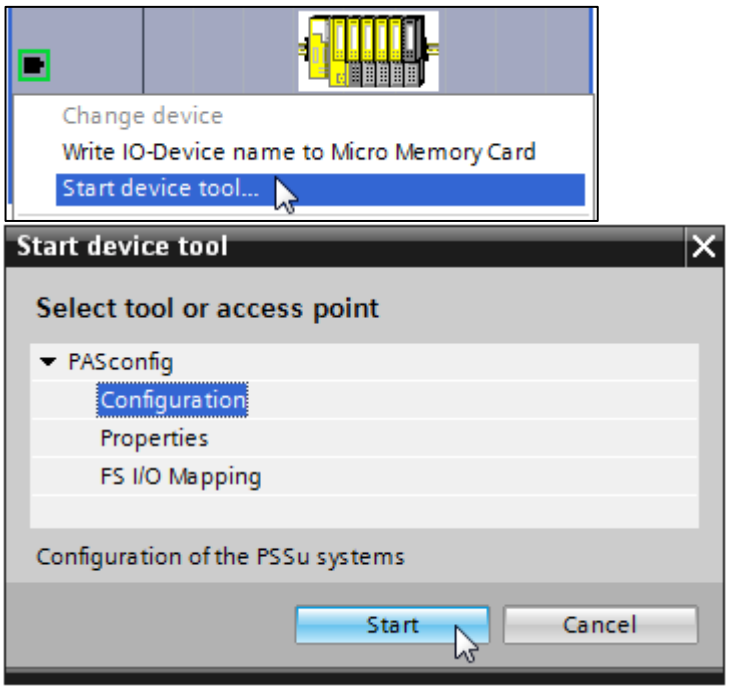


Figure 12: PASconfig – Start device tool from TIA (Access point “Configuration”)

8.2. PASconfig - Settings

- By calling PASconfig via the TCI interface the configured assembly is taken over.

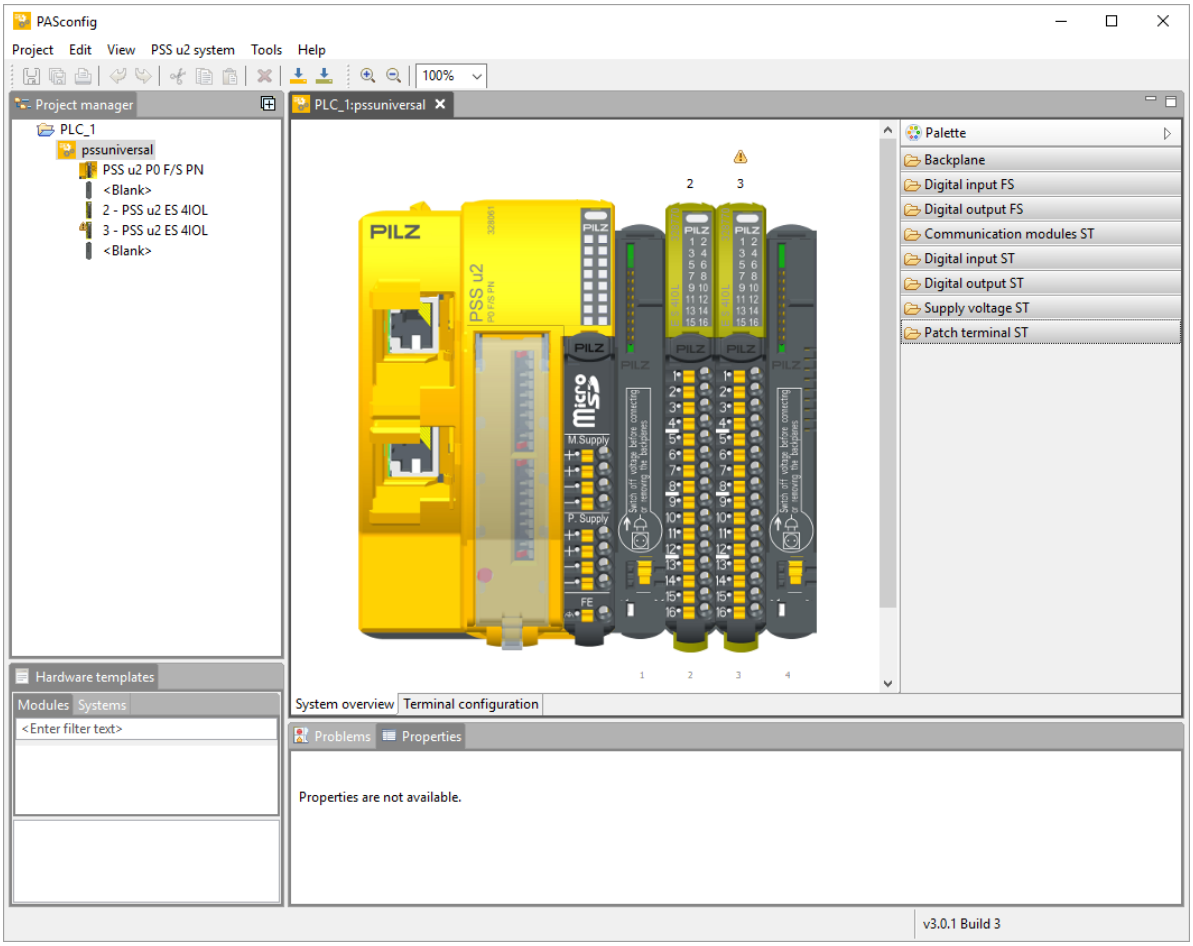


Figure 13: PASconfig – Assembly from TIA

- Choose in the properties an overall process image size that is sufficiently large for all IO-Link devices.

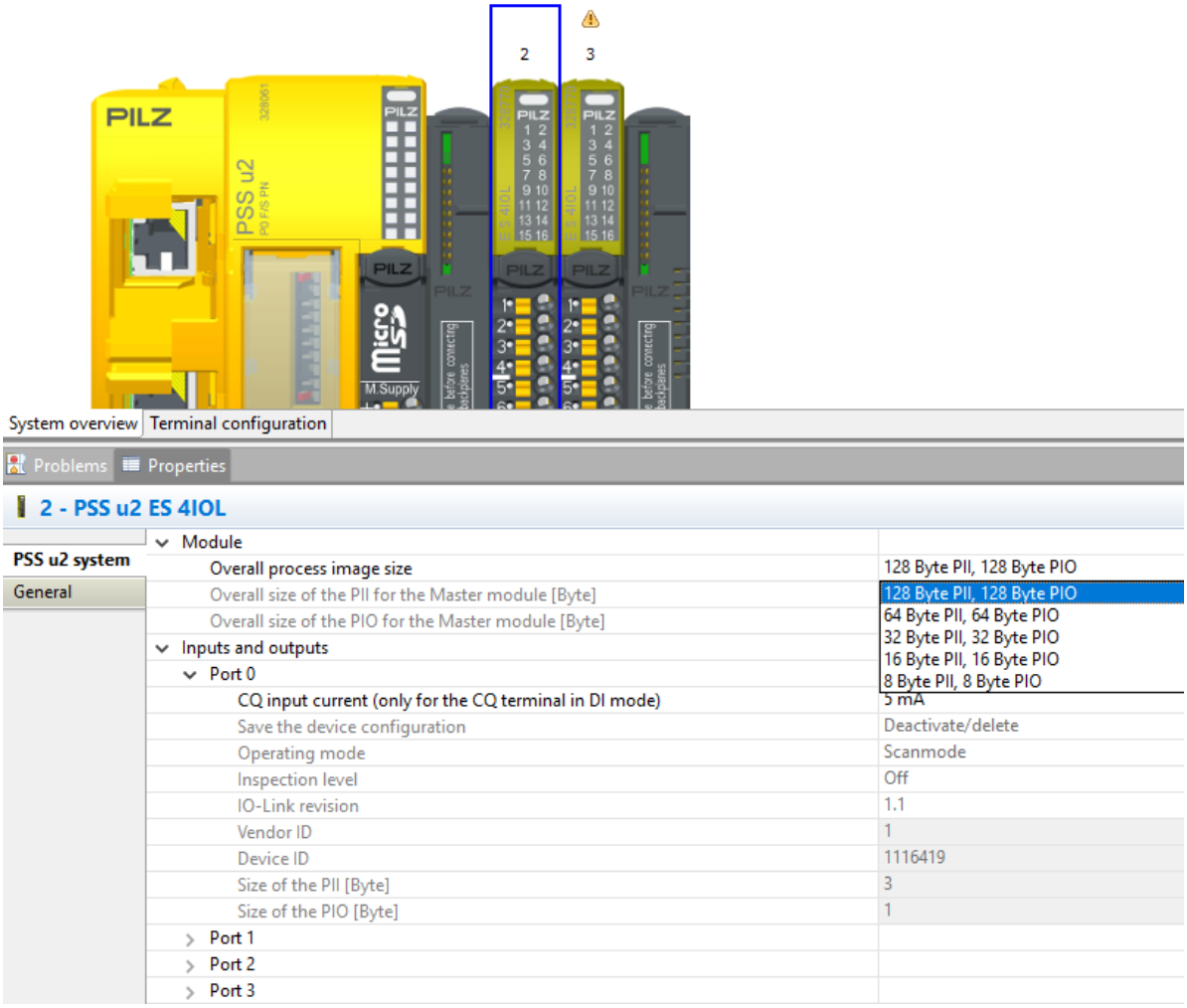


Figure 14: PASconfig – Setup the Process image size

- Setting the size of the process image per module

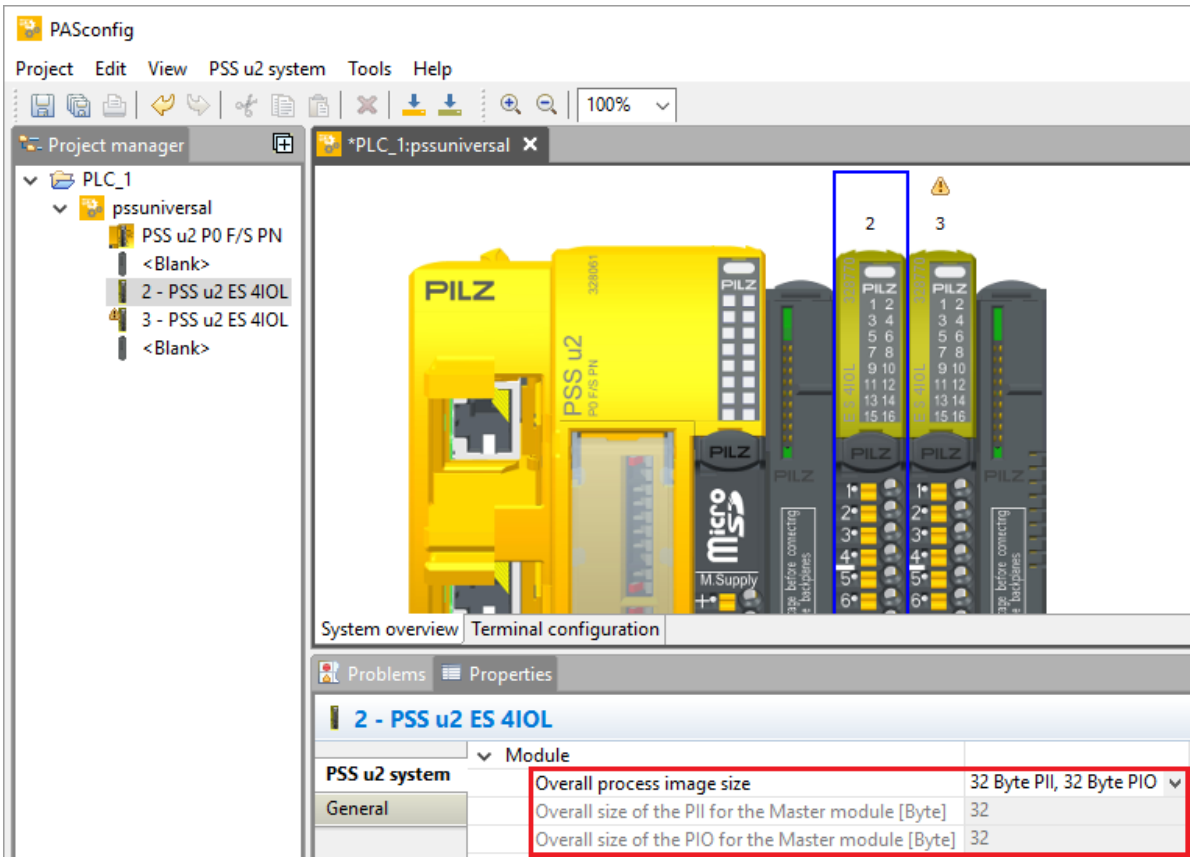


Figure 15: PASconfig – Process image IO-Link Master 1

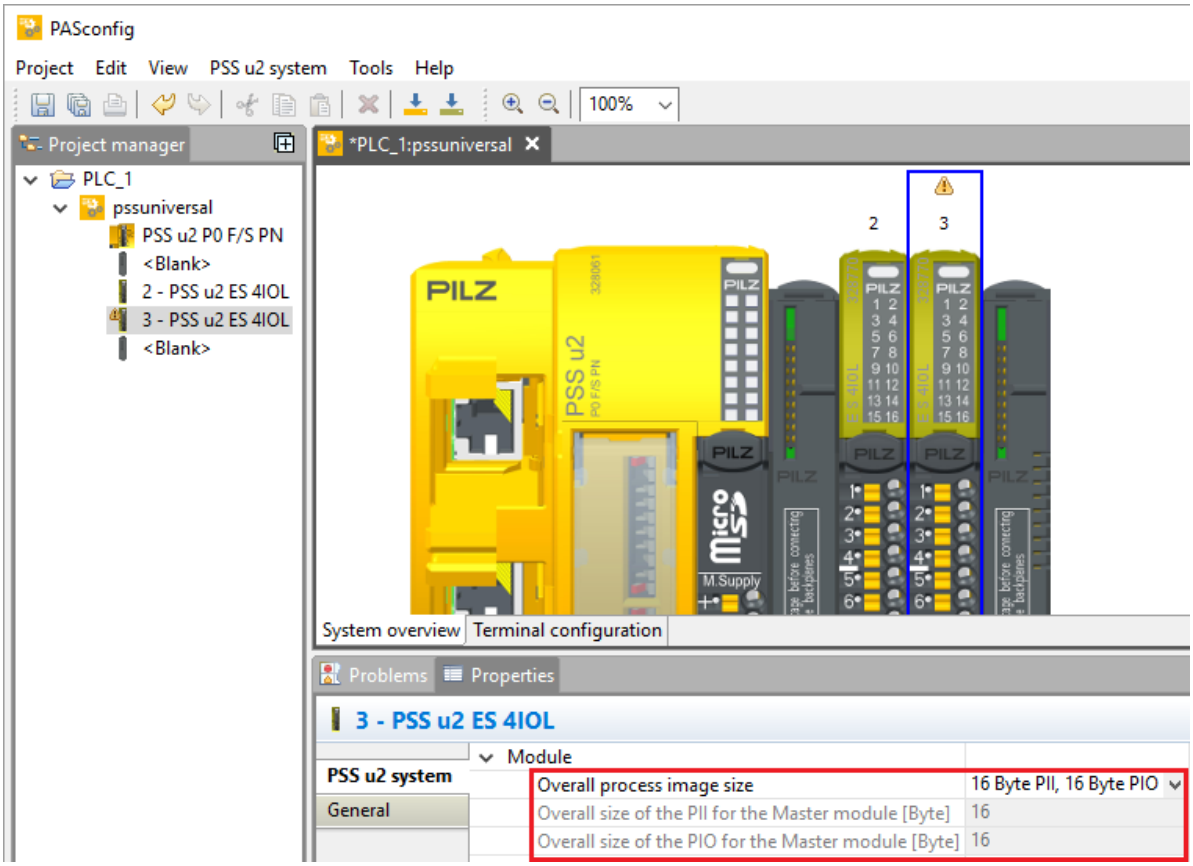


Figure 16: PASconfig – Process image IO-Link Master 2

INFORMATION

The process data size you select here must match the selected size in the GSDML. See Chapter 7.1, Figure 5: TIA Portal – Add PSS u2 IO-Link Master Submodules.

8.3. Create IO-Link Configuration

8.3.1. Creating a new IO-Link configuration

- Call IO-Link Configurator with right mouse button on an IO-Link Master Module

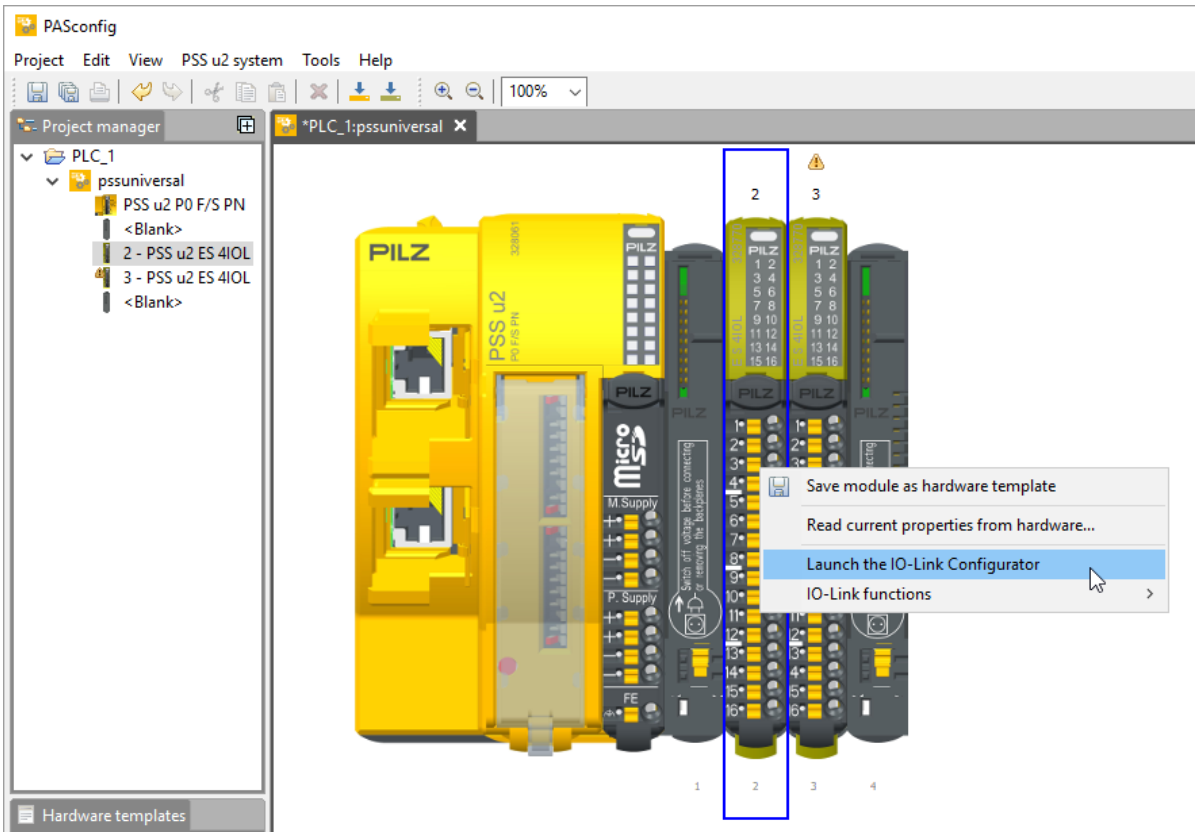


Figure 17: PASconfig – Start IO-Link Configurator

- Create new IO-Link project (upload only possible after all IODDs have been imported)

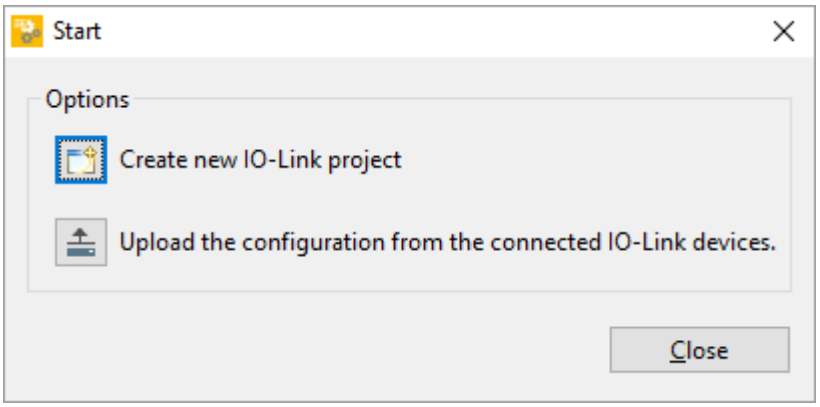


Figure 18: PASconfig – Create new IO-Link project

8.3.2. Import IODD

- To display and configure the IO-Link Devices with the correct parameters, an IODD file is required. This file must be imported into the IO-Link Configurator.
- IODD files can be downloaded from the respective manufacturer or from https://ioddfinder.io-link.com.

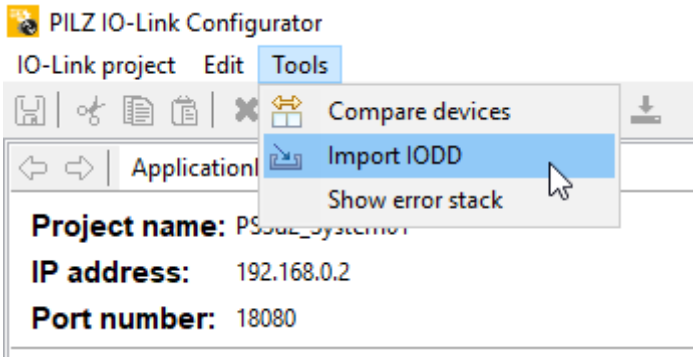


Figure 19: PASconfig – Import the required IODD files

- Select the required files
- It is also possible to select several files for import

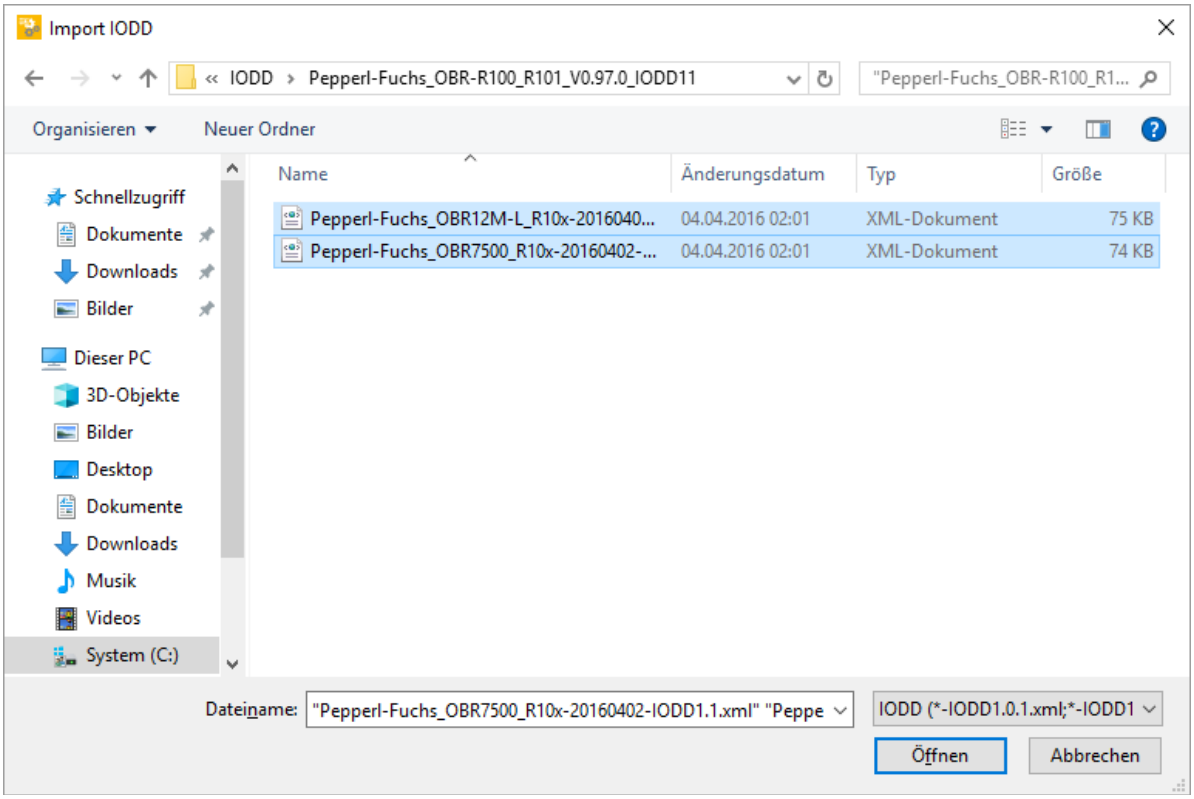


Figure 20: PASconfig – Selection of IODD files

After a successful import the imported IO-Link devices are available on the right side of the IODD catalog.

8.3.3. Setting the operating mode of the IO-Link Ports

The following operating modes can be set for each port:

- Port deactivated
  - A device connected to the port will not be detected. Terminal L+ is switched off.
- DI-Mode
  - The port is used as a digital ST input. The CQ terminal can be configured as an ST input for each port. The input current can also be configured for the ST inputs in DI mode.
- DO-Mode
  - The port is used as a digital ST output. The CQ terminal can be configured as an ST output for each port.
- Fixed Mode
  - The port is used in I/O-Link mode. When searching for connected devices, the master checks whether the configured manufacturer ID and device ID match the actual manufacturer ID and device ID on the connected device.
- Scanmode
  - The port is used in I/O-Link mode. When searching for connected devices, the master does not check whether the connected device matches the configured device.

The scan mode is recommended for the first commissioning of an IO-Link Device.
If you drag an IO-Link Device to a deactivated port, it is automatically set to
Scan mode changed.

- The setting will be applied after downloading the ST configuration.

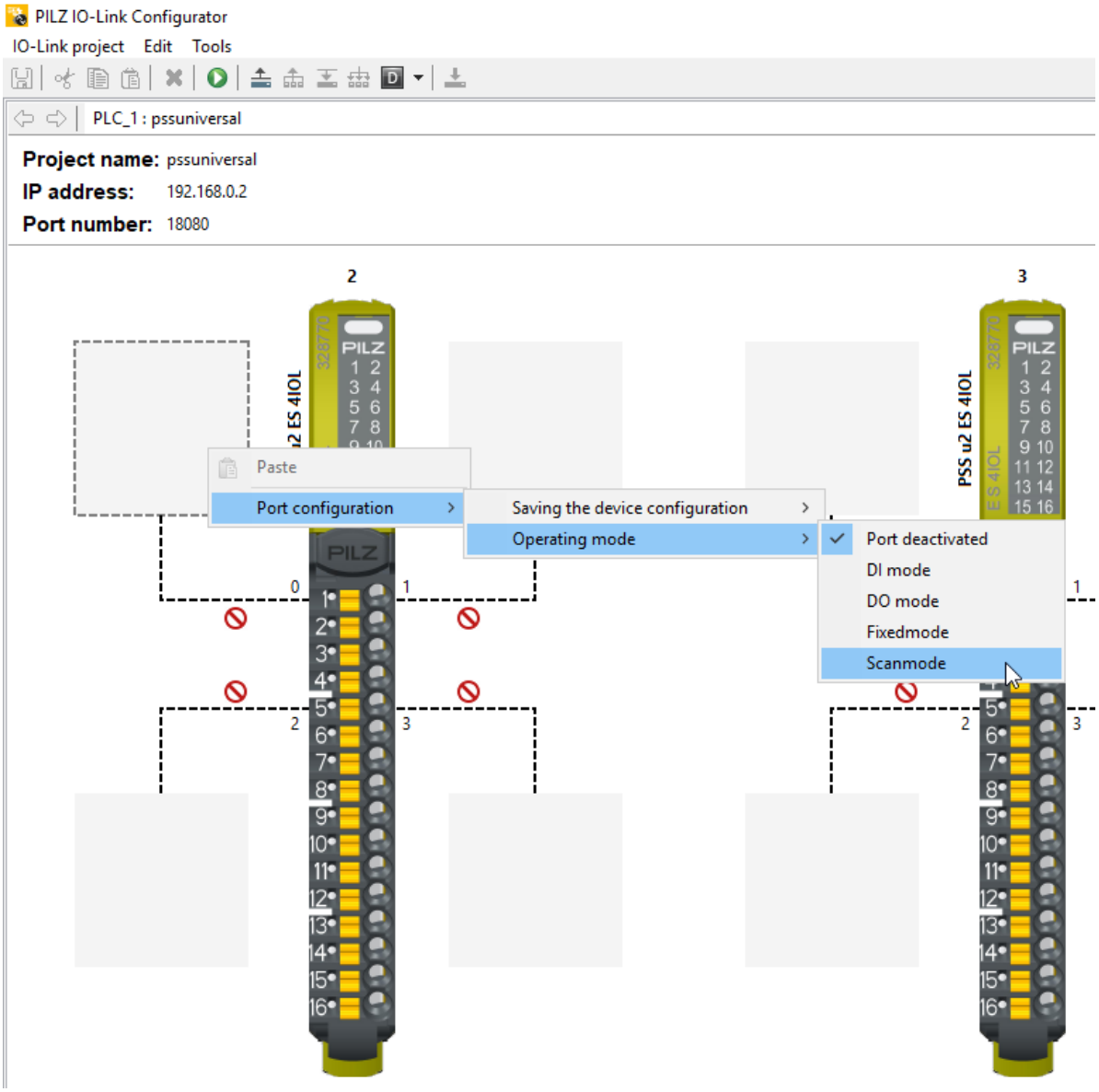


Figure 21: PASconfig – Port Configuration

8.4. Digital In-Output

- The CQ pin can be switched between DI, DO or IO-Link mode.
- The setting can be made per port
- The setting is applied after downloading the ST configuration.

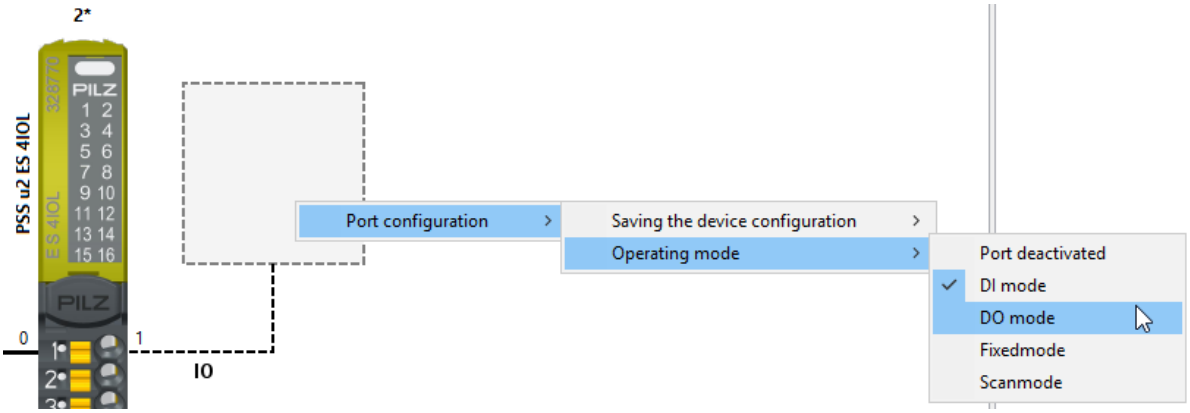


Figure 22: PASconfig – Digital In-Output

8.4.1. Create IO-Link Device

- Choose the IO-Link Device on the right from the catalog and drag and drop it to a free port.
- The setting is applied after downloading the ST configuration.

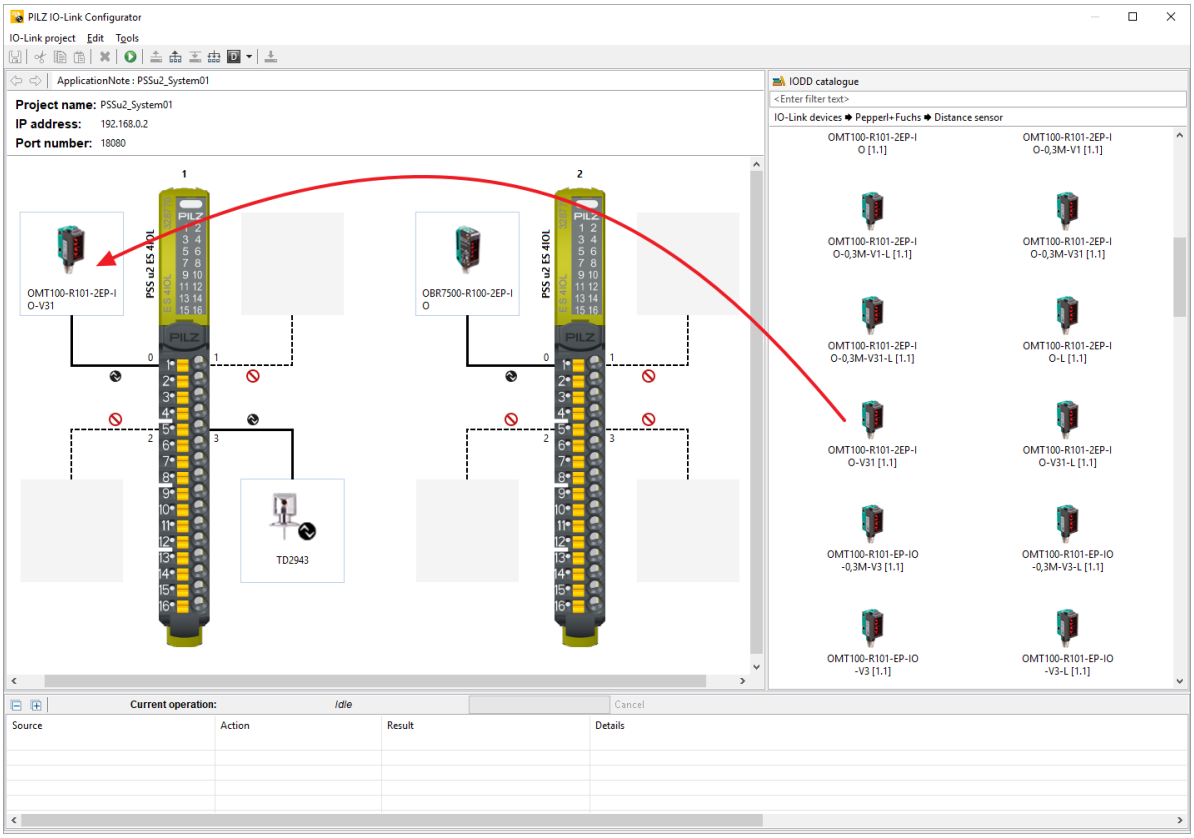


Figure 23: PASconfig – Create IO-Link Device

INFORMATION

After all IO-Link Devices have been created, a download must take place so that the power supply of the Devices is switched on.
The download is described in chapter 8.4.4, Download the configuration to PSS u2 system, page 28.

8.4.2. Configuring the IO-Link Device

The parameters can be configured offline or online. With an online configuration, the values displayed in the tabs for data and parameters match the values in the connected IO-Link device. If any changes are made, the values are applied to the IO-Link device immediately. With an offline configuration, the parameters are saved in the project and must be downloaded to the IO-Link devices.

8.4.2.1. Offline-Configuration

- Double-click on an IO-Link device to open the data and parameters for an IO-Link device.
- Switch to the Parameter tab.
- Set the parameters for the IO-Link device and save the IO-Link project.
- Click on the Download Button  to download the configuration for the selected port to the IO-Link device.

8.4.2.2. Online-Konfiguration

- Click on  to establish a connection to the IO-Link devices.
- Double-click on an IO-Link device to display the parameters from the IODD.
- Switch to the Parameter tab.
- Set the parameters for the IO-Link device.

INFORMATION

During online configuration, the entered / changed parameters are directly transferred to the Device.

8.4.3. Saving the Device Configuration (Device Storage)

The configured properties of a device can be saved in the master. The master can then write these to the new device when a device is exchanged.

- Deactivate/delete: In this mode, all data in the data memory is deleted and the data memory is deactivated.
- Upload: In this mode, the configuration is loaded from the device into the master. This setting can be used when devices already contain configured data and this data is to be applied to the master.
- Download: In this mode, the configuration saved in the master is written to the device. This setting can be used when a device needs to be exchanged.
- The setting is applied after downloading the ST configuration.

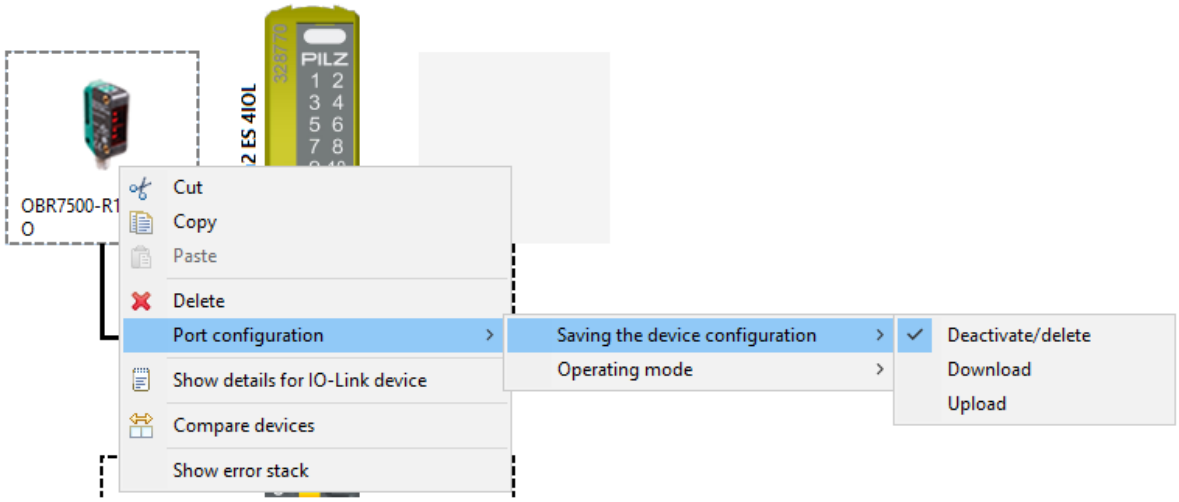


Figure 24: PASconfig – Port configuration

- Close the IO-Link Configurator

8.4.4. Download the configuration to PSS u2 system

- The configuration you just created must be saved.

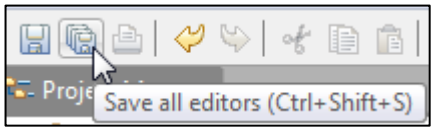


Figure 25: PASconfig – Save configuration » Save all editors

A password is required to transfer the FS configuration.
The default password is “**pssu**”.

- It can be changed via the menu item ‘PSS u2 System’ » ‘Change FS password ...’.

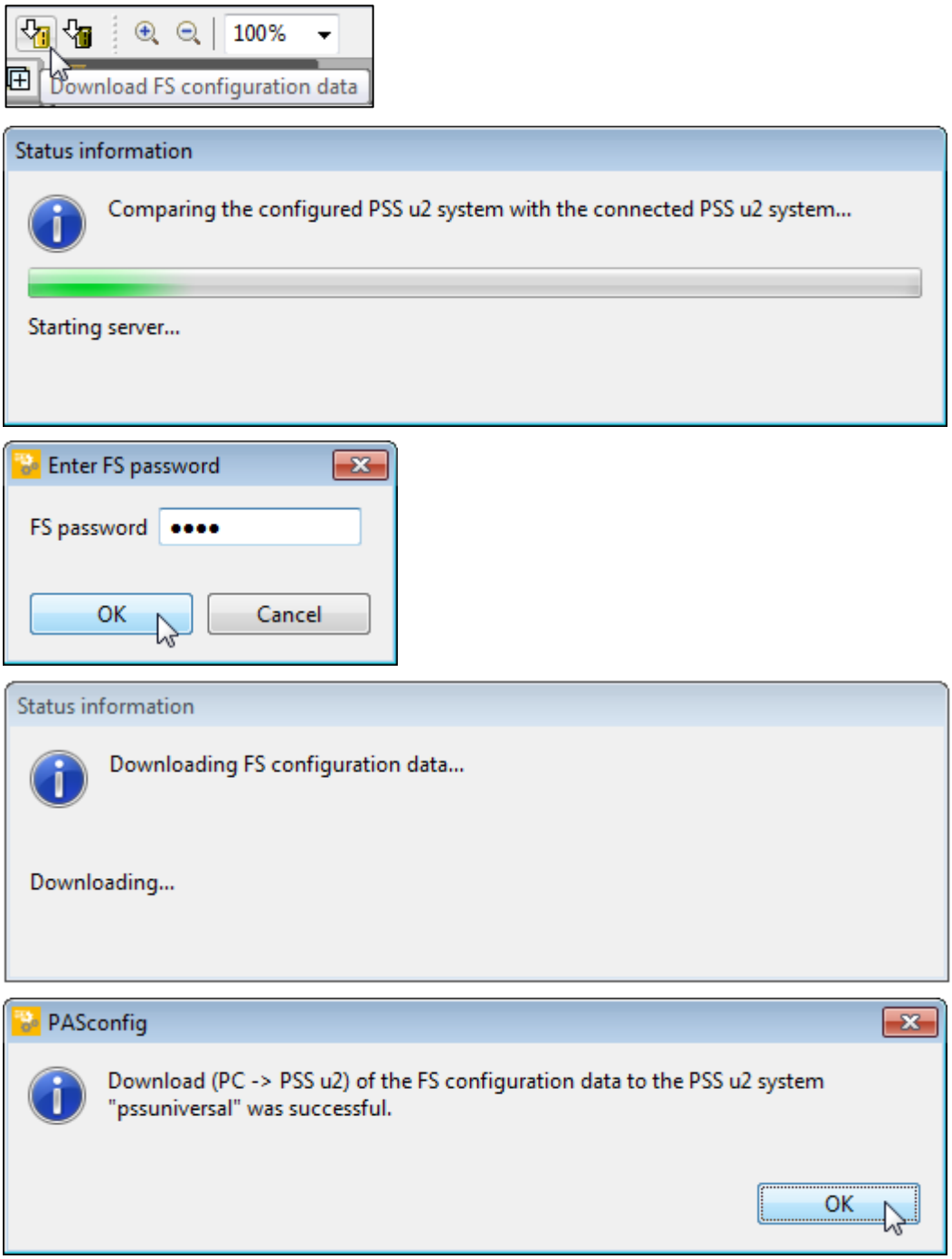


Figure 26: PASconfig – Download configuration » Download FS configuration data

If PSS u2 standard modules are used, the ST configuration must also be downloaded.

- In this case, the following dialog box should be confirmed with “Yes”.

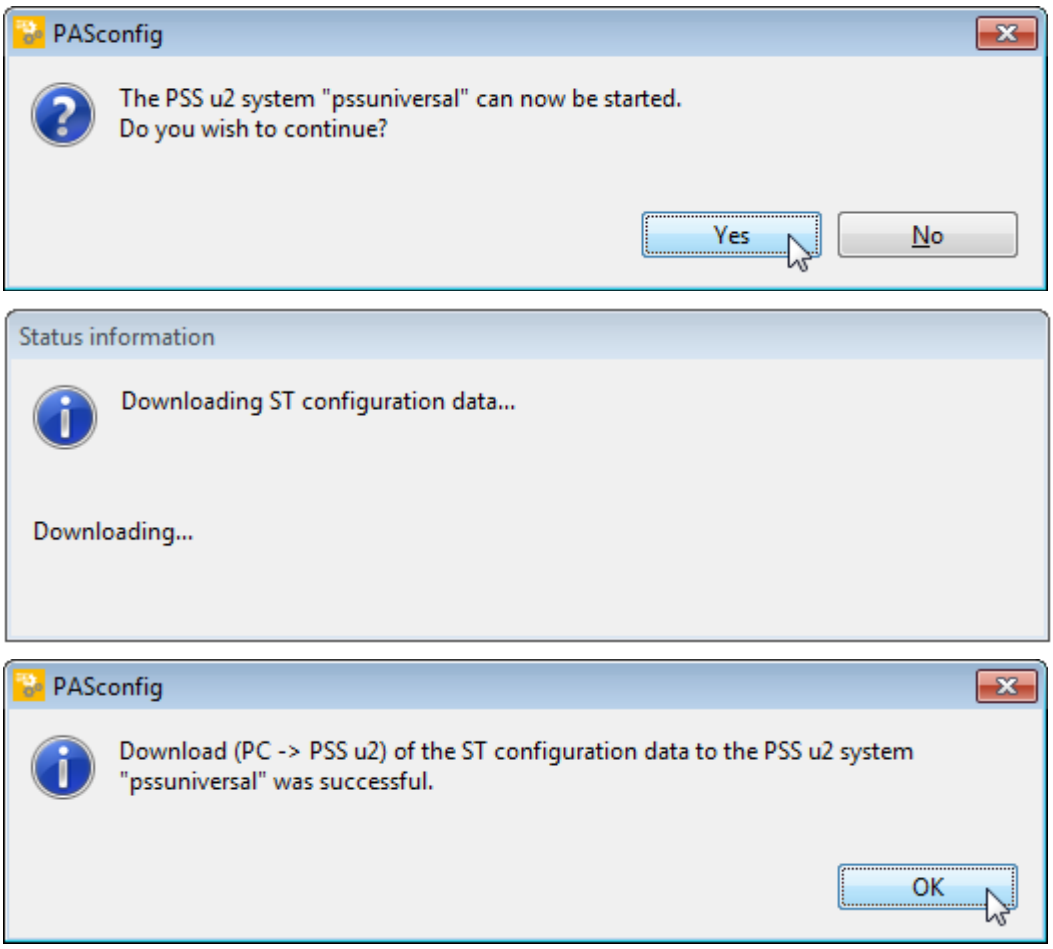


Figure 27: PASconfig – Download configuration » Download ST configuration data

- The PSS u2 system must now be restarted.

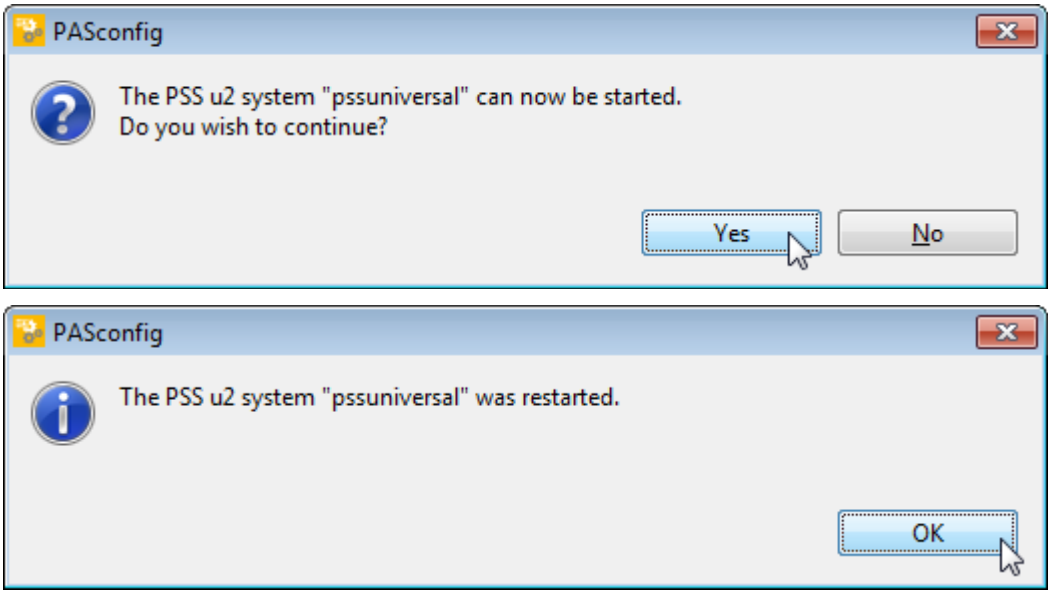


Figure 28: PASconfig – Download configuration » Restart PSS u2 system

INFORMATION

For a download, the IP address as well as the ProfiSAFE address must be set correctly in the connections. The basic configuration of the PSS u2 I/O system is described in Application Note 1004479.

8.5. Reading the configuration of the IO-Link Devices (Upload)

To avoid having to create the IO-Link Devices manually, an upload can be carried out.
Either one or all ports can be selected, the device type of the connected device as well as the parameters are read out.

- Upload of all IO-Link Ports
- Upload from a (marked) port

In order to find all IO-Link devices, all required IODD files must be imported first, see chapter 8.3.2, Import IODD, page 22.

8.6. Data structure of the process data

The size of the process data for the complete module can be set in PASconfig, see Figure 14: PASconfig – Setup the Process image size. The size per port is automatically configured depending on the configured IO-Link devices.
No process image data area is reserved for ports that are not in IO-Link mode.

In this example, ports 0 and 3 are in IO-Link mode, the IO-Link device on port 0 occupies 3 bytes in the PAE, the one on port 3 occupies 2 bytes. Ports 1 and 2 are deactivated, in the process image no data area is reserved for deactivated ports.

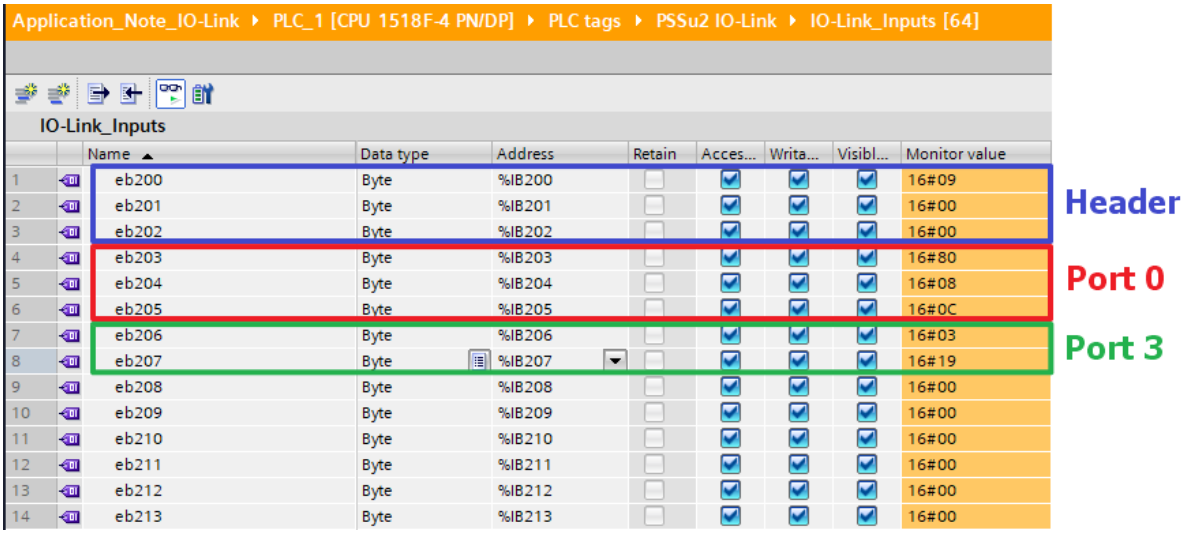


Figure 29: Data Structure Port 0 and 3 in IO-Link Mode

8.6.1. Header

Header in the process image of inputs

- The header in the PII contains:
  - Status of the process image
  - Process data from the "CQ" terminal, which is configured as a digital input in DI mode.

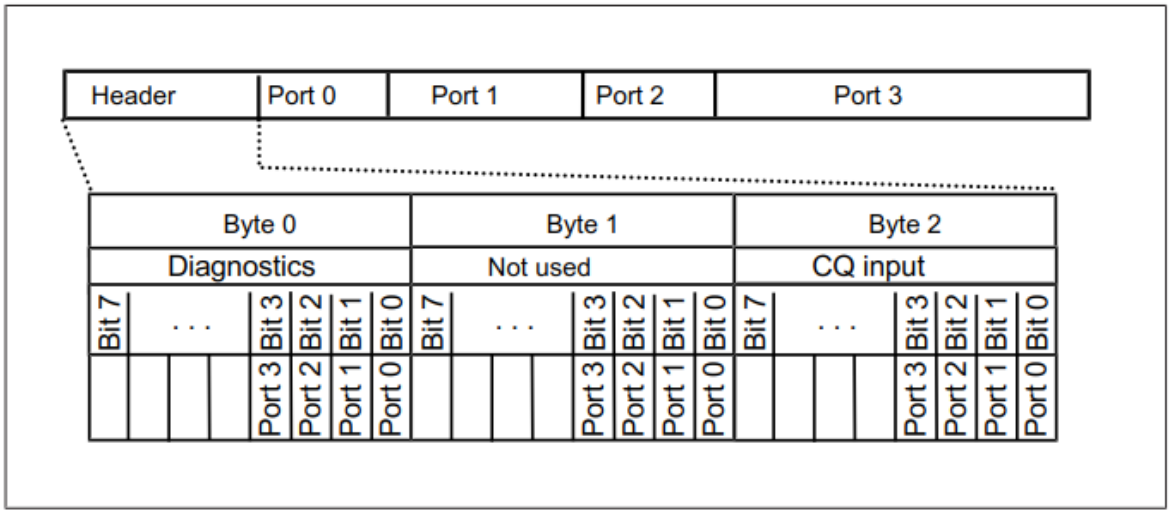


Fig.: Header in the process image of inputs

Legend

Diagnostics	"0": The port's process data is invalid.
	"1": There is an IO-Link connection to the device.
CQ input	"0": There is a "0" signal at the configurable CQ input (terminal 2,6,10,14).
	"1": There is a "1" signal at the configurable CQ input (terminal 2,6,10,14).

Figure 30: Header in PII

Header in the process image of outputs

- The header in the PIO contains process data from the "CQ" terminal, which is configured as a digital output in DO mode.

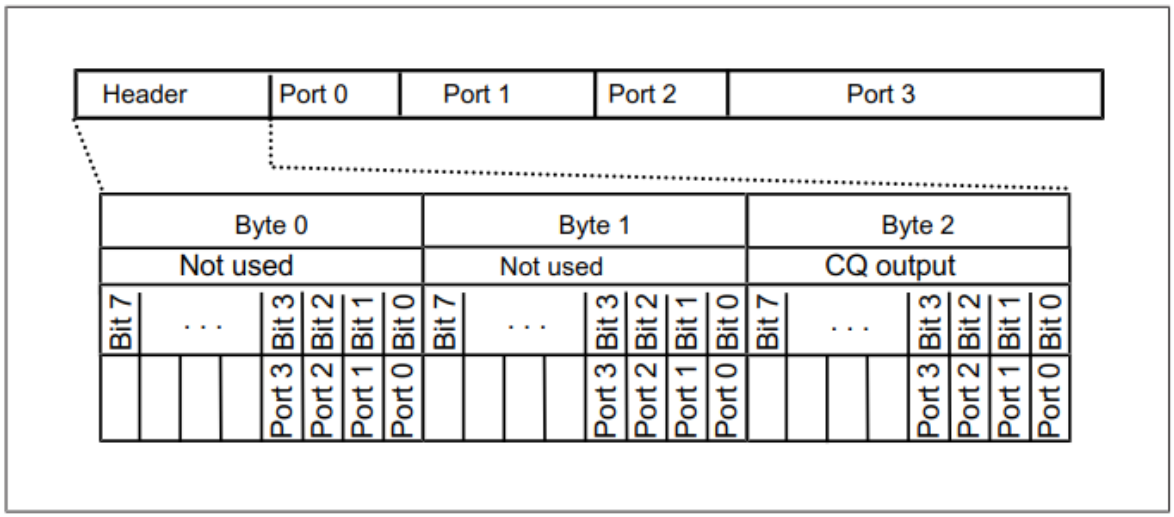


Fig.: Header in the process image of outputs

Legend

CQ output	"0": A "0" signal is output at the configurable CQ output (terminal 2,6,10,14).
	"1": A "1" signal is output at the configurable CQ output (terminal 2,6,10,14).

Figure 31: Header in PIO

9. Online functions

9.1. Compare Online/Offline

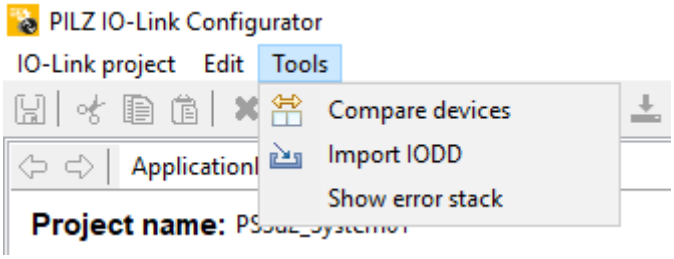
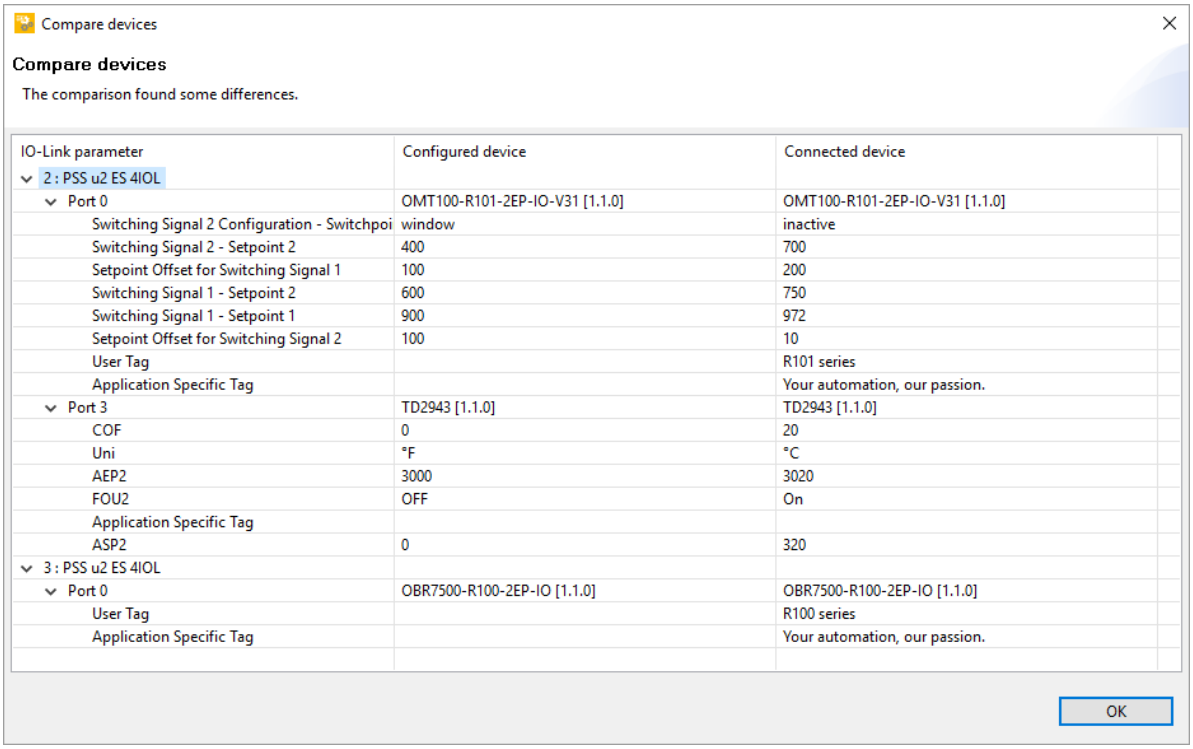


Figure 32: PASconfig – Compare devices

- Differences between the configured and connected Devices and parameters are displayed in a table.



IO-Link parameter	Configured device	Connected device
2 : PSS u2 ES 4IOL		
Port 0	OMT100-R101-2EP-IO-V31 [1.1.0]	OMT100-R101-2EP-IO-V31 [1.1.0]
Switching Signal 2 Configuration - Switchpoi	window	inactive
Switching Signal 2 - Setpoint 2	400	700
Setpoint Offset for Switching Signal 1	100	200
Switching Signal 1 - Setpoint 2	600	750
Switching Signal 1 - Setpoint 1	900	972
Setpoint Offset for Switching Signal 2	100	10
User Tag		R101 series
Application Specific Tag		Your automation, our passion.
Port 3	TD2943 [1.1.0]	TD2943 [1.1.0]
COF	0	20
Uni	°F	°C
AEP2	3000	3020
FOU2	OFF	On
Application Specific Tag		
ASP2	0	320
3 : PSS u2 ES 4IOL		
Port 0	OBR7500-R100-2EP-IO [1.1.0]	OBR7500-R100-2EP-IO [1.1.0]
User Tag		R100 series
Application Specific Tag		Your automation, our passion.

Figure 33: PASconfig – Compare Systems - Differences

9.2. Errorstack

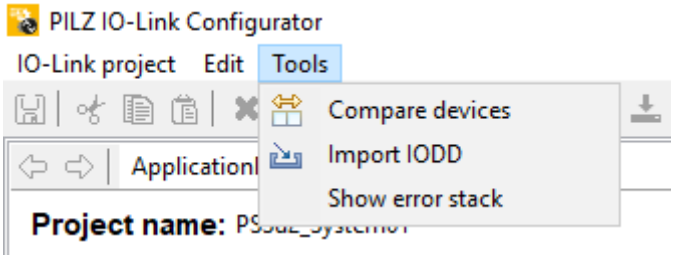


Figure 34: PASconfig – Show error stack

- Errors of the IO-Link Master and Devices are displayed in the error stack.

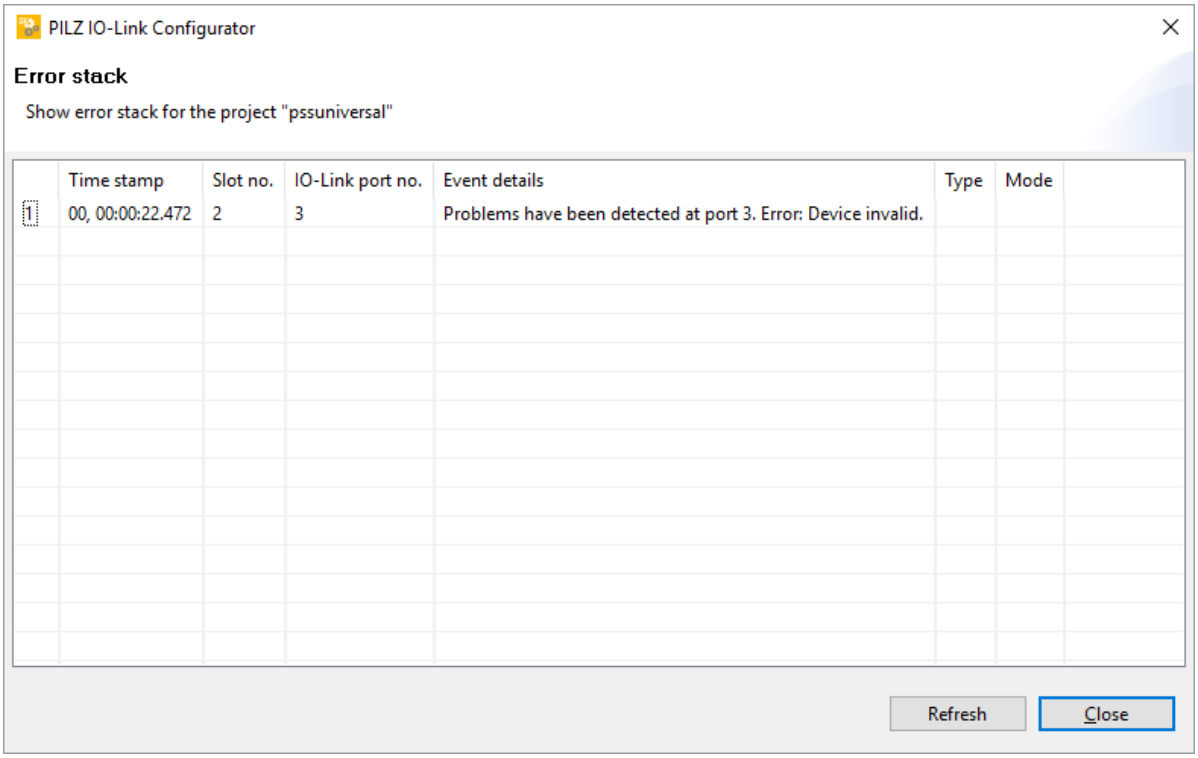


Figure 35: PASconfig – Errorstack

10. Table of figures

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