Weidmüller

u-remote

Quick Start Guide for getting started with Profinet applications

Abstract:
The first steps in Profinet and PROFIsafe applications with Siemens TIA-Portal

Hardware reference

No.	Component name	Article No.	Hardware / Firmware version
Fieldbus couplers			
1	UR20-FBC-PN-IRT	1334880000	Discontinued
2	UR20-FBC-PN-IRT-V2	2566380000	
3	UR20-FBC-PN-IRT-ECO	2659680000	
UR20 - Profisafe modules			
4	UR20-4DI-4DO-PN-FSPS-V2	2464570000	
5	UR20-8DI-PN-FSPS-V2	2464590000	
UR20 – IO modules			
6	UR20-x	See description in corresponding chapter	

Software reference

No.	Software name	Article No.	Software version
1	SIEMENS TIA Portal		V 15 (was used to create this document)
2	Weidmüller CPD-Tool		V2

Contact
Weidmüller Interface GmbH & Co. KG
Klingenbergstraße 26
32758 Detmold, Germany
www.weidmueller.com

For any further support please contact your local sales representative:
https://www.weidmueller.com/countries

Content

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2 Accompanying documents

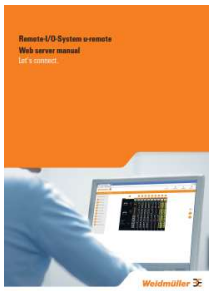
The following product related manuals for u-remote stations are available and can be downloaded in the support area or product catalogue on the Weidmüller website:

u-remote manual
Main manual for all ur20 fieldbus couplers and modules

English	Document No. 1432790000
German	Document No. 1432780000

IP20 modules for functional safety
Manual for all safety modules

English	Document No. 1484600000
German	Document No. 1484590000



Web server
Manual for using the webserver of all ur-20 devices

English	Document No. 2112220000
German	Document No. 2112210000

Communication module UR20-4COM-IO-LINK
Additional manual for the ur20 IO-Link module

English	Document No. 2547720000
German	Document No. 2547620000

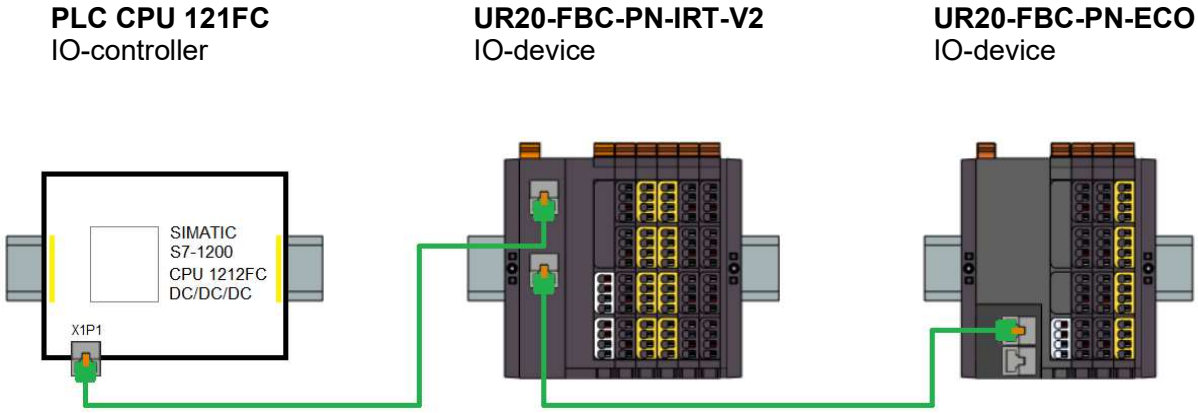
Further manuals, application notes and quick start guides can also be found in the support center.

3 Profinet basics

This chapter shall introduce how a simple Profinet works, and which steps are necessary to start with a simple application in Siemens TIA Portal.

3.1 The Profinet network

In general, all participants of a Profinet (**Pro**cess **Fi**eld **Net**) network are connected via Ethernet. A simple network consists of at least one IO-controller that controls one or more IO-devices:



Topology view of a Profinet network

To program the IO-controller and parameterize the IO-devices an IO-supervisor is necessary, this is typically an engineering tool like TIA Portal. When the IO-supervisor is connected to the network it is also possible to read diagnostic data.

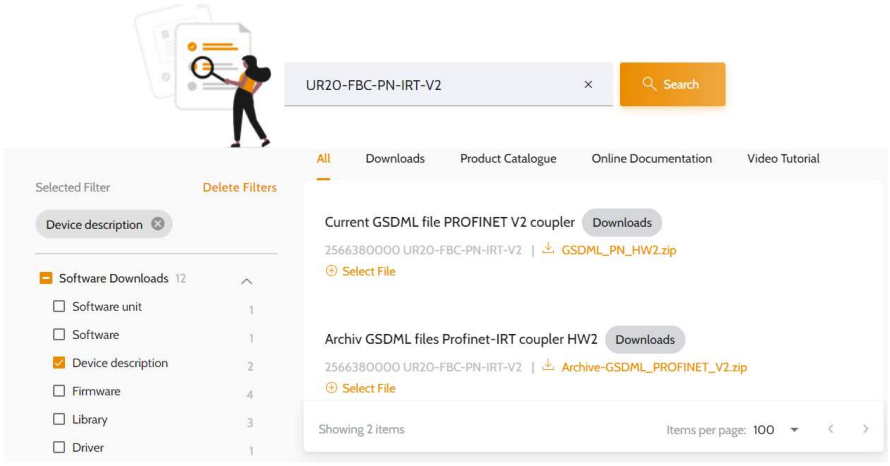
Most important points to make it possible for the PLC to communicate with the devices are:

1. **The PLC knows the device description**
   In Profinet networks always the IO-controller parameterizes all IO-devices during the initialization phase.
   This will also happen when parameters were set up at the webserver of the u-remote station, the parameters which shall be activated have to be chosen in the hardware configuration of the PLC project. To be able to set up these parameters the corresponding device description file must be installed (see chapter 3.2).

2. **The IO-device has a device name**
   The IO-controller will assign the IP-addresses of the IO-devices depending on their device name or by using the LLDP protocol for advertising their identity to neighboring IO-devices (see chapter 3.3- “3. Assign the device names to the physical hardware”).

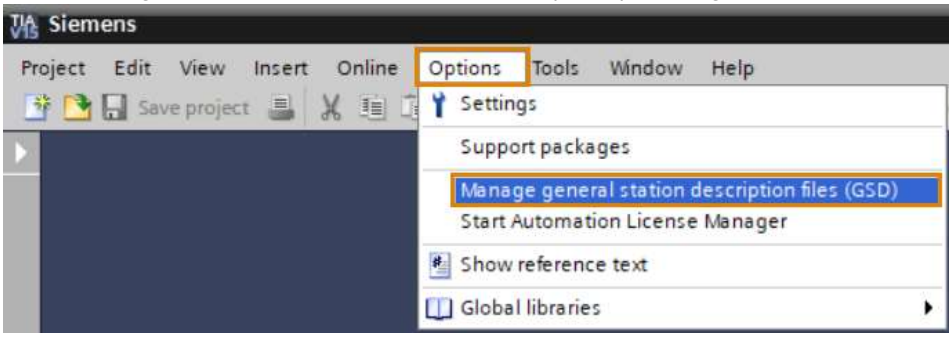
3.2 Installing the device description file in TIA Portal

1.) Download the device description file for Profinet fieldbus couplers. These files can easily be found in the support center by using one of the Profinet fieldbus couplers as keyword:

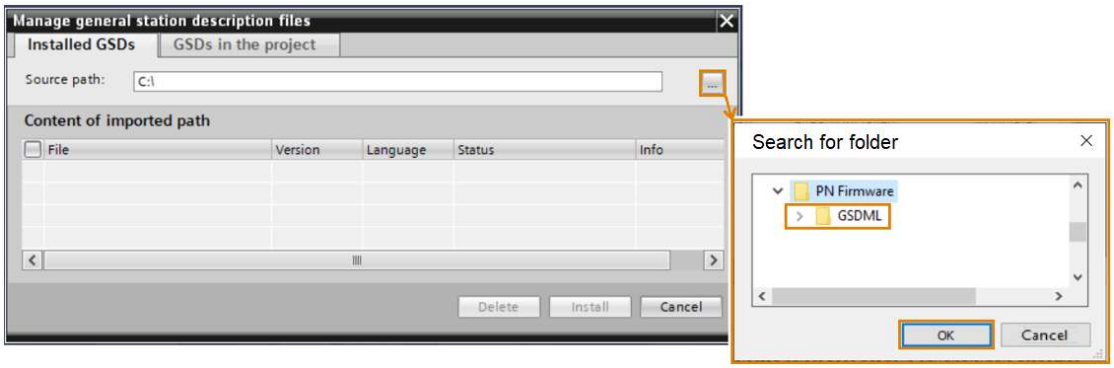


2.) Unzip the downloaded archive to a local folder.
Make sure that the GSDML file (*.xml) and image files (*.bmp) are extracted to the same folder.

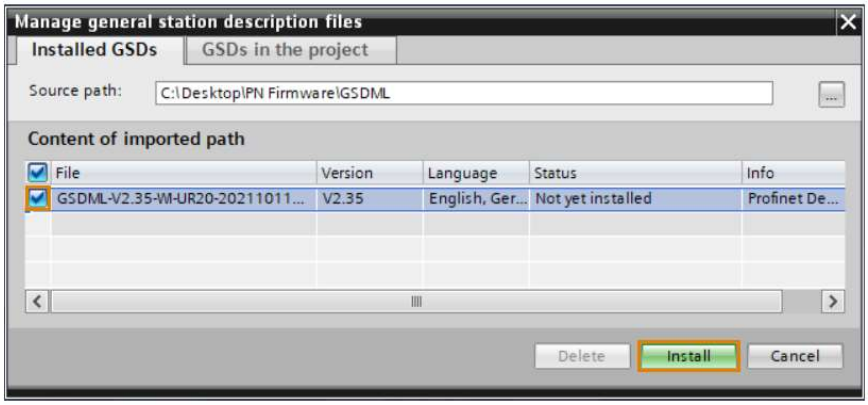
3.) Open the “general station description files” (GSD) manager in TIA Portal:



4.) Search for the local folder which contains the GSDML file:



5.) Use the checkbox to select the just added and “not yet installed” GSDML file and klick on “Install”:

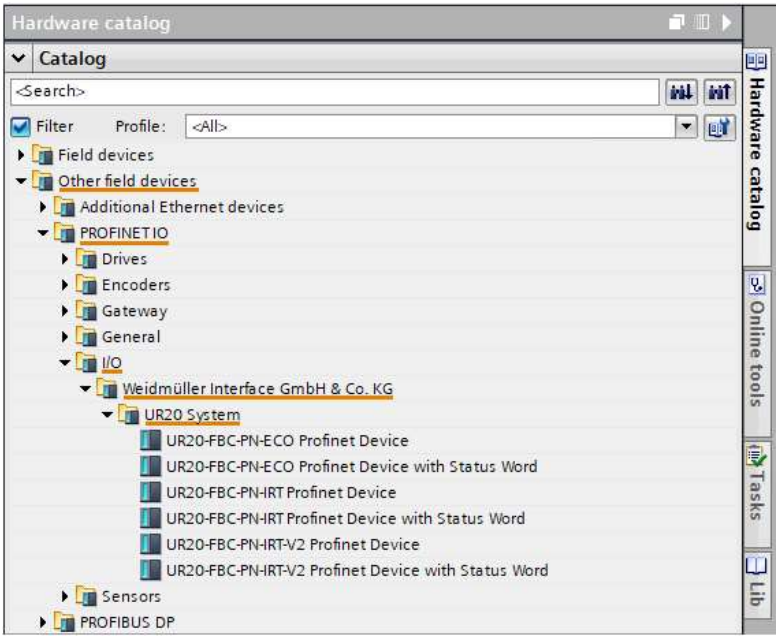


The name of the GSDML file has always the same structure:

GSDML-V2.35[GSDML schematic version]
-**WI**[manufacturer name: Weidmüller Interface]
-**UR20**[device family name: u-remote IP 20]
-**20211011**[date of release: October 11, 2021].**xml**

6.) Wait until the installation process has been completed successfully and close the description file manager. An update of the hardware catalogue will automatically be performed afterwards.

Now the fieldbus couplers can be found in the following subfolders of the Hardware catalog:

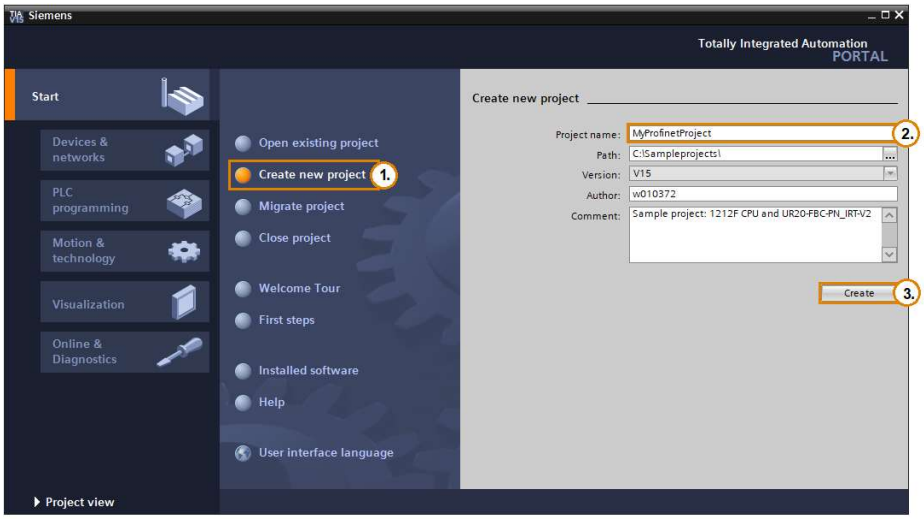


3.3 Create a new project in TIA Portal

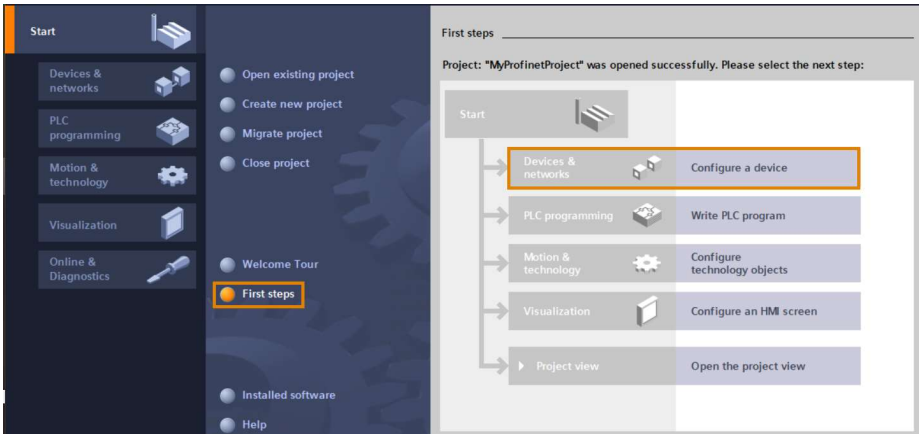
This chapter is intended to provide an introduction about the general use of Profinet devices which are manufactured by Weidmüller in TIA-Portal. The following 5 steps are necessary to start with your application:

Step 1	⇒	Step 2	⇒	Step 3	⇒	Step 4	⇒	Step 5
Create a new project		Setup the hardware configuration		Assign the device names		Download the project to the PLC		Assign the process data mapping

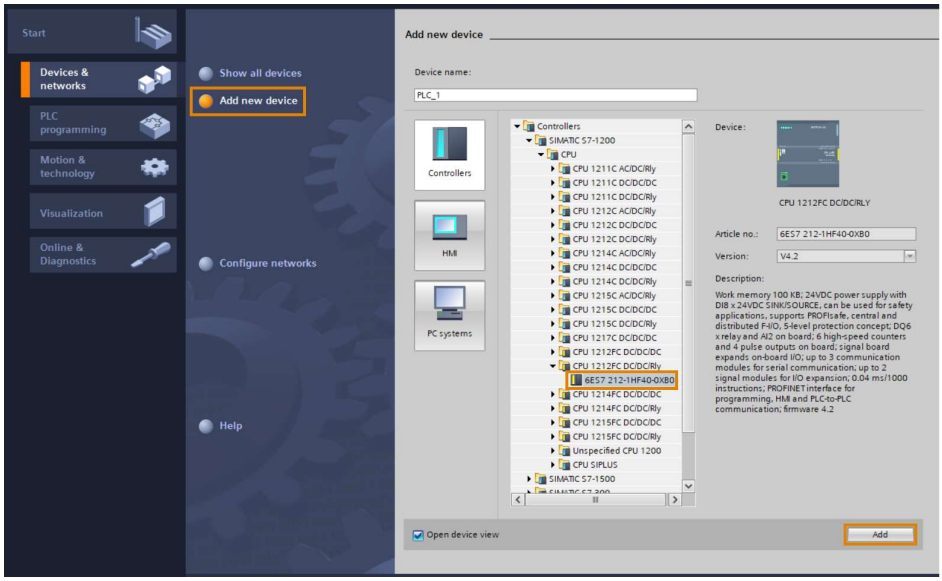
1. **Create a new project**
   As soon as TIA Portal was started the portal view will be displayed
   1. Click on “Create a new project”
   2. Enter a name for the project to be created
   3. Click on “Create”



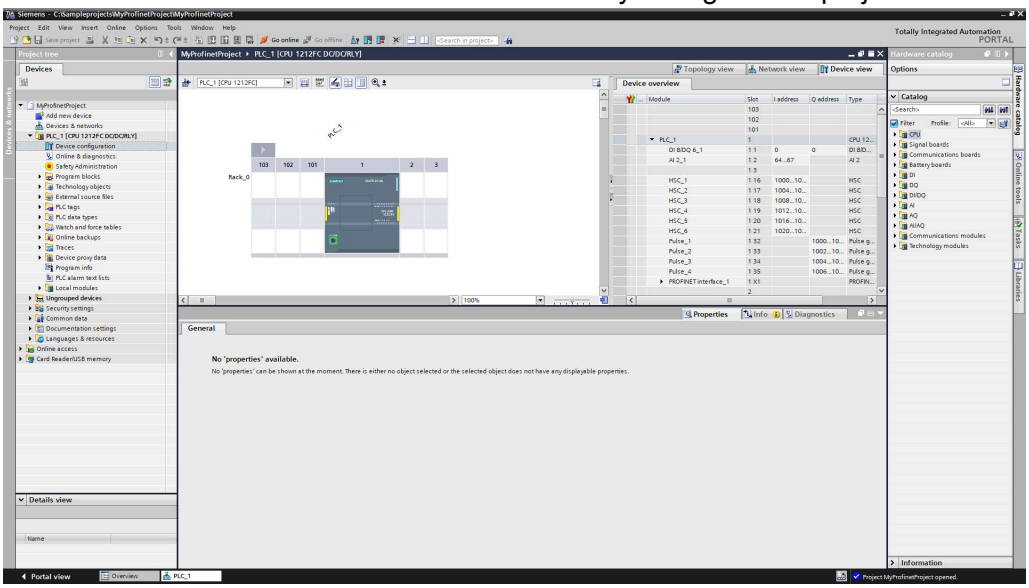
2. **Setup the hardware configuration**
   The “first steps” for the just created project are displayed, click on “configure a device”:



Choose “Add a new device” and select the CPU that is used in your application:



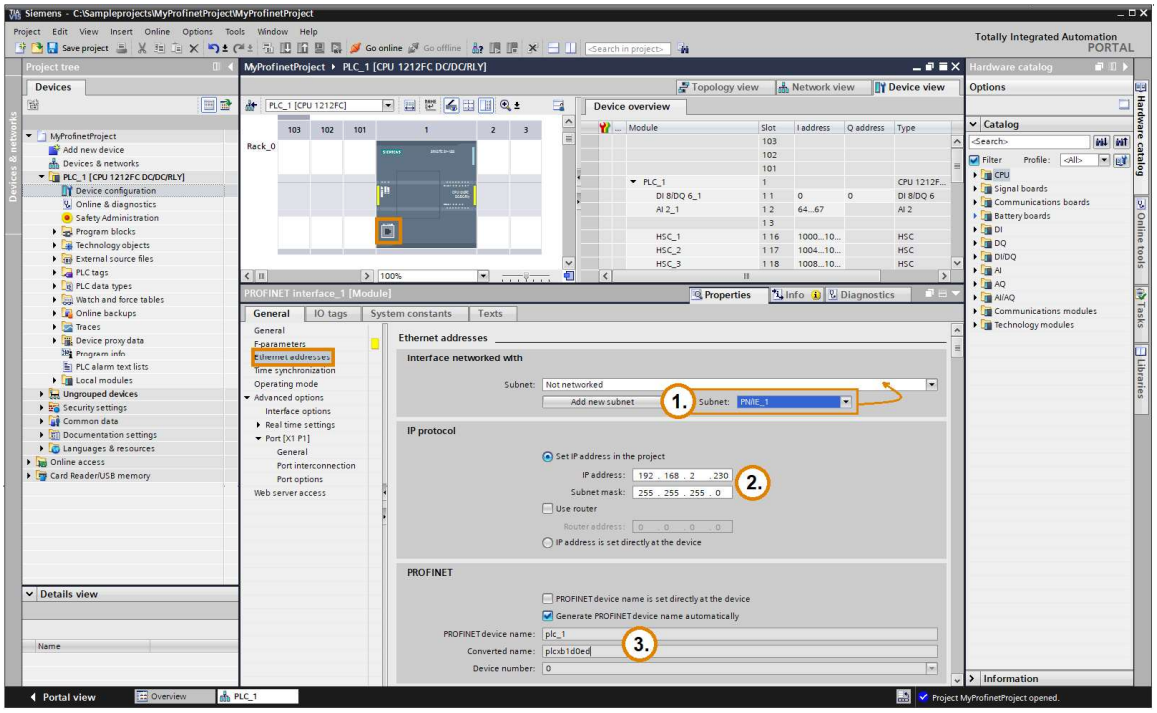
Click on “Add” and TIA Portal should automatically change to the project view:



Set up the network settings of the PLC

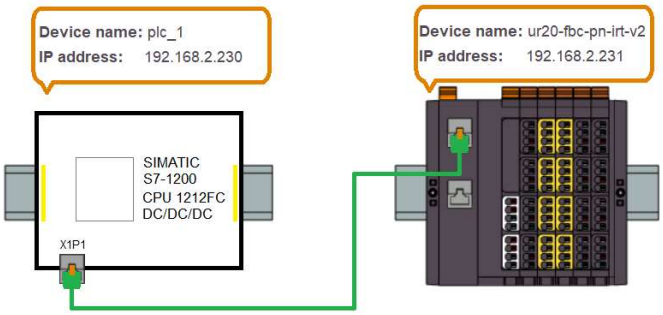
Click on the network interface in the “Device view”. Open the properties for the Ethernet addresses of the interface where the Profinet network shall be connected to:

1. Add a new subnet for the Profinet network (PN/IE)
2. Enter the IP address of the PLC and the corresponding subnet mask
3. Optional the device name of the PLC could also be changed



Set up a new Profinet device

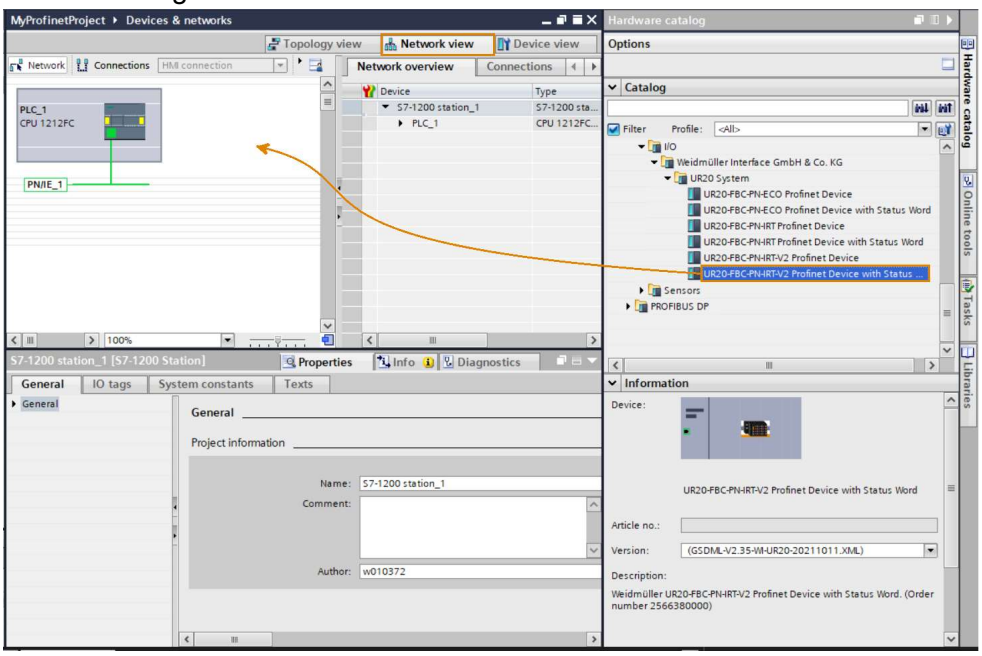
In this sample project a UR20-FBC-PN-IRT-V2 fieldbus coupler shall be connected. For further devices the same procedure must be repeated. The network settings that shall be used are shown in the network diagram below:



Network diagram of this sample project

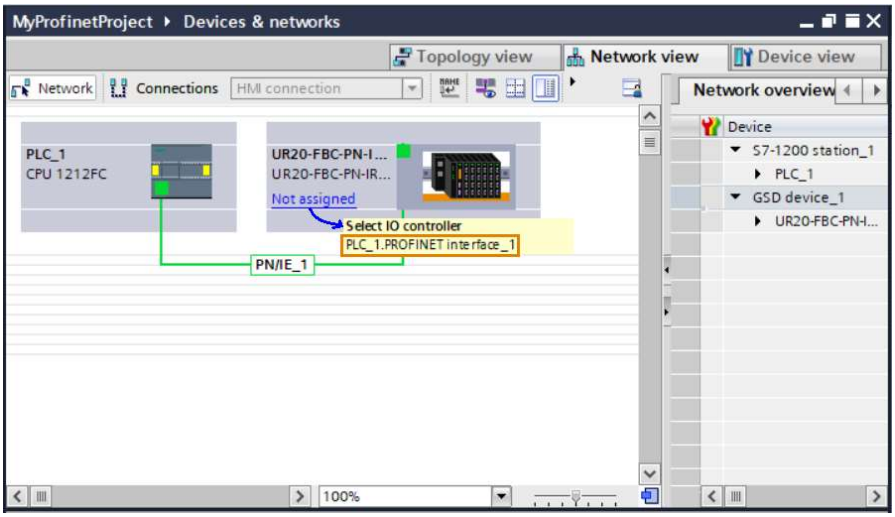
The ethernet interface of the PLC has already been configured in the step before, therefore the fieldbus coupler can simply be added.

Open the “Network view” and search for the fieldbus coupler in the device tree (see chapter 3.2). Move the device via drag and drop or double-click to the working area of the network configuration:



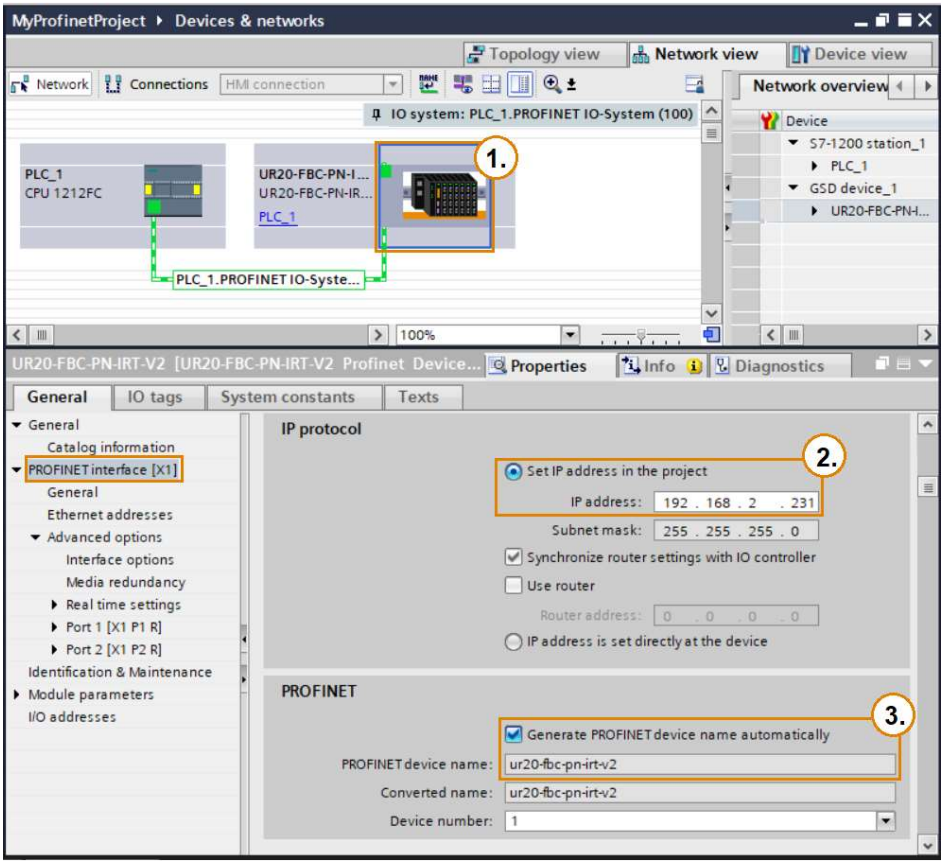
It is possible to use different versions of the device description file. The version that will be used in the project can be selected in the information field of the hardware catalogue.

In order that the devices communicate with each other the fieldbus coupler must be assigned to the related PLC, click on “Not assigned” and select the Profinet interface of PLC_1:



In the last step of this section the network settings of the fieldbus coupler must be adjusted.

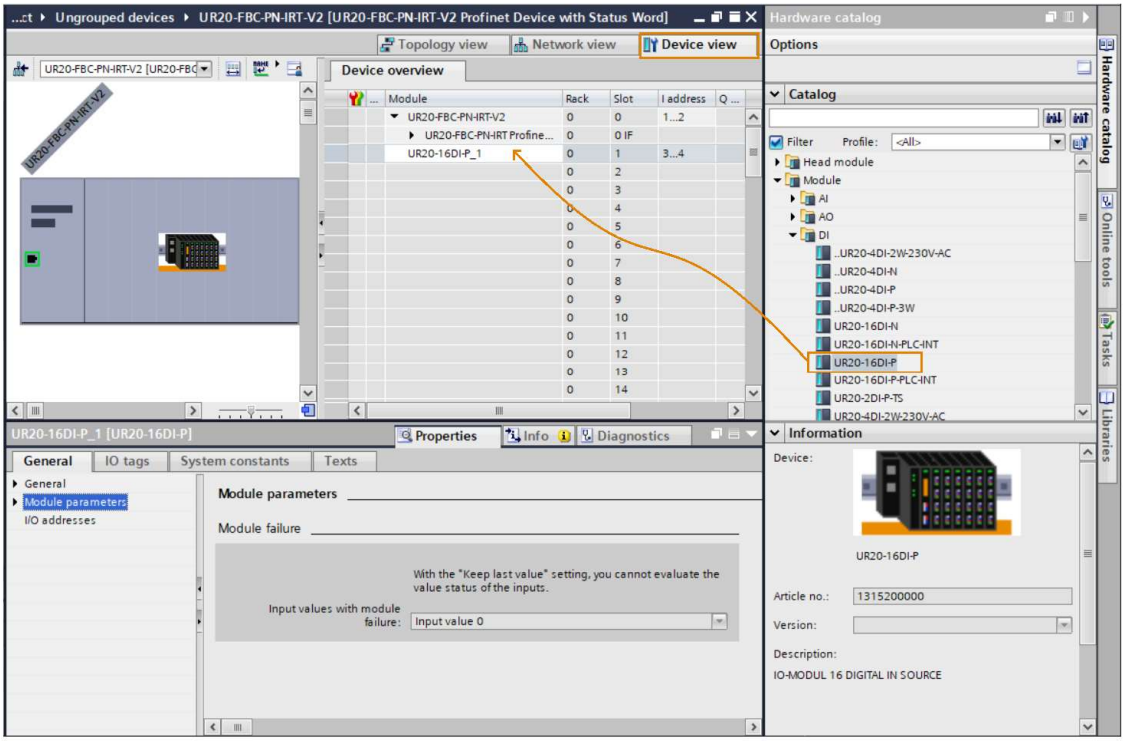
1.) Click on the symbol or change to “Device view” for the coupler:
Select “PROFINET interface [X1]
2.) If necessary, change the IP address which will be assigned by the PLC based on the device name
3.) For changing the device name disable the checkbox “Generate PROFINET device name automatically”. In this case the automatically generated name already matches with the that one from the network plan:



Now the network configuration of this project has been finished.

Add I/O modules to the hardware configuration

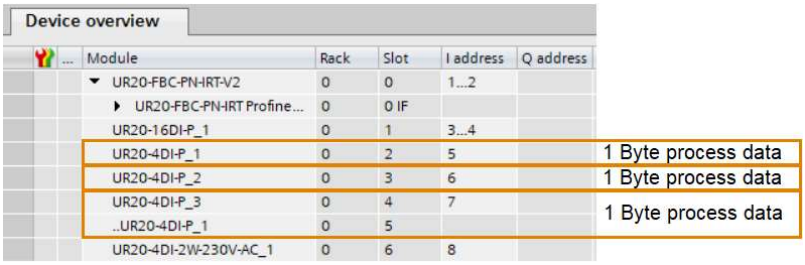
I/O modules can be added in the device view of each fieldbus coupler:



The module parameters can be changed in the properties of each module.

In addition to the various groups of modules there are some follower modules with three points at the beginning available:

These modules can be used to save process data bytes by using them combined with another module that also only uses a nibble of a process data byte, for example:



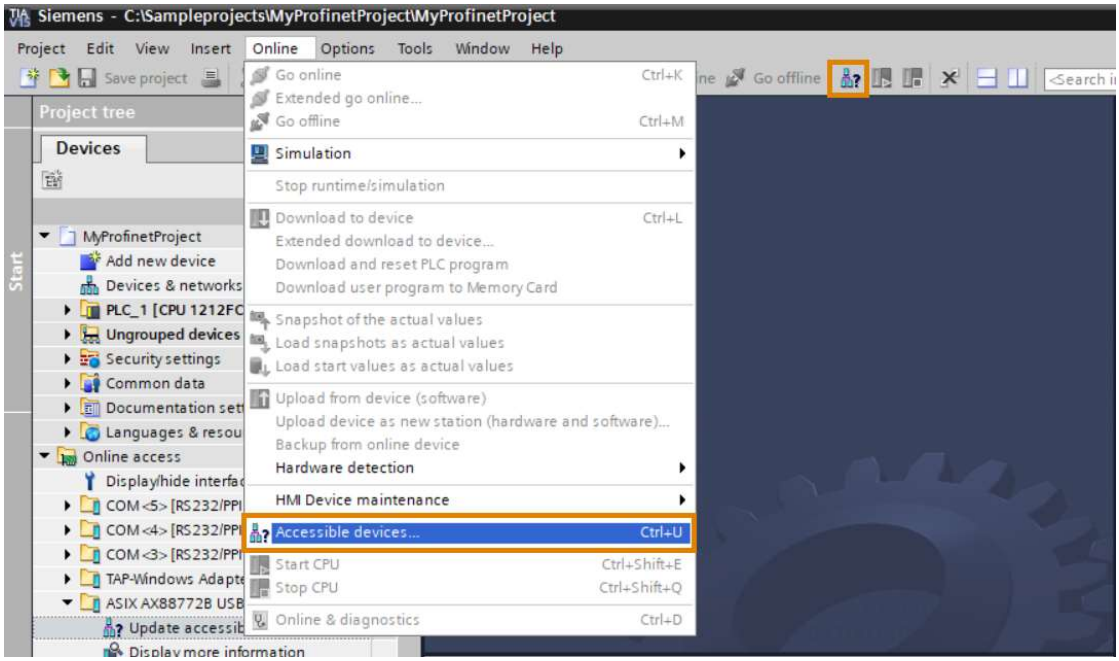
After having selected the modules in the same number and order like they are present in the physical hardware station the project is ready to be transferred to the PLC.

3. Assign the device names to the physical hardware

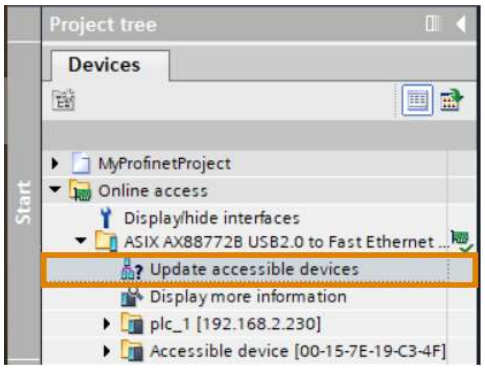
In delivery state normally the device name of Profinet fieldbus couplers is empty. For this reason, the device name which is configured in the hardware configuration of the project must be assigned manually.

Automatically assignment of the device names is also supported by activating LLDP mode in the properties of the PLC and the fieldbus coupler and linking the devices in the topology view.

To be able to assign the device names a connection between TIA Portal and the Profinet network must be present. For the first connection an automatic scan for all devices in the network can be executed by searching for “Accessible devices”:

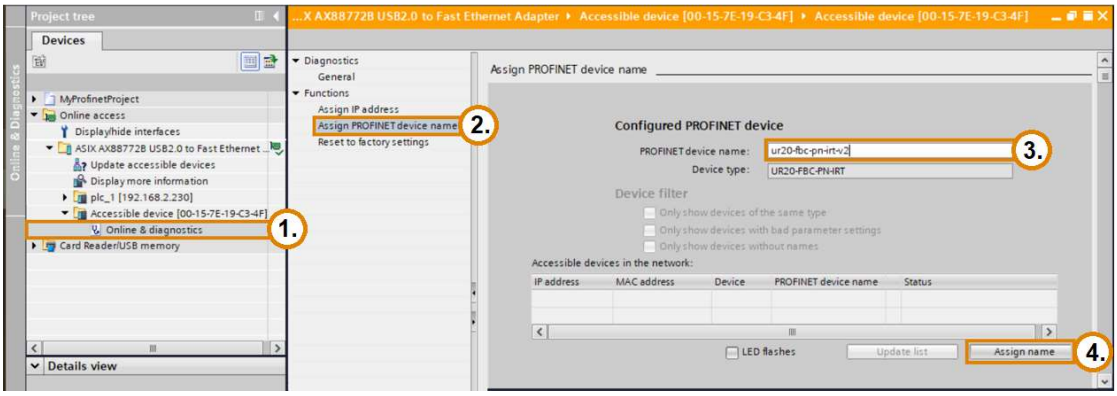


After the scan process has been finished this tool will create a list of all Profinet devices that were found in the network. By clicking on “Show “the “Online access” folder in the “Project tree” will be expanded. This can also be done directly and by clicking on “Update accessible devices…” the list will be updated:

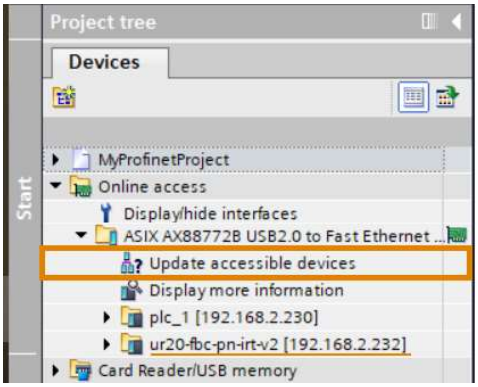


Each device is displayed by its own subfolder. All devices without an assigned device name will be displayed as “Accessible device” together with its MAC-address:

1. Expand the subfolder and click on “Online & diagnostics”
2. Choose the function “Assign PROFINET device name”
3. Enter the device name which is configured in the hardware configuration for this device
4. Click on “Assign name”

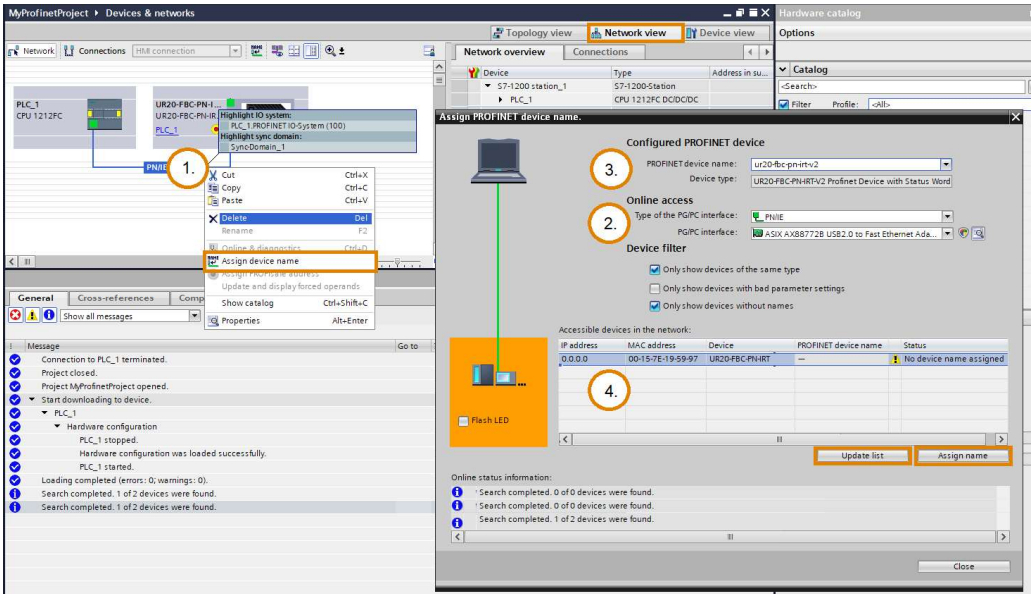


Go back to the “Project tree” and click on “Update accessible devices…” again to refresh the list, the subfolder should contain the device name now:



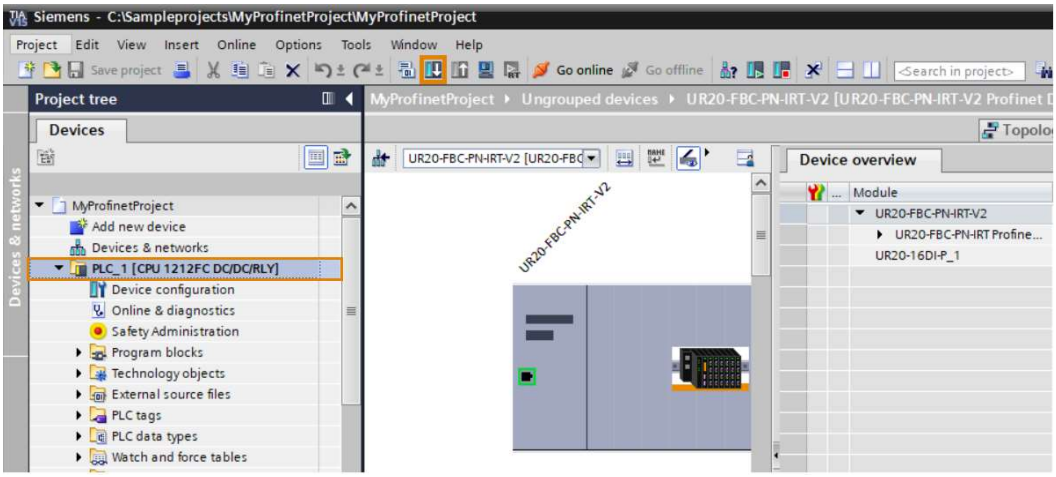
Alternatively, the device names can also be assigned in the “Network view”:

1. Right click on the PN-Network connection, select “Assign device name”
2. Choose the network interface
3. Select the device from the hardware configuration
4. Click on “Update list”, select the corresponding IO-device in the accessible device list and click on assign name



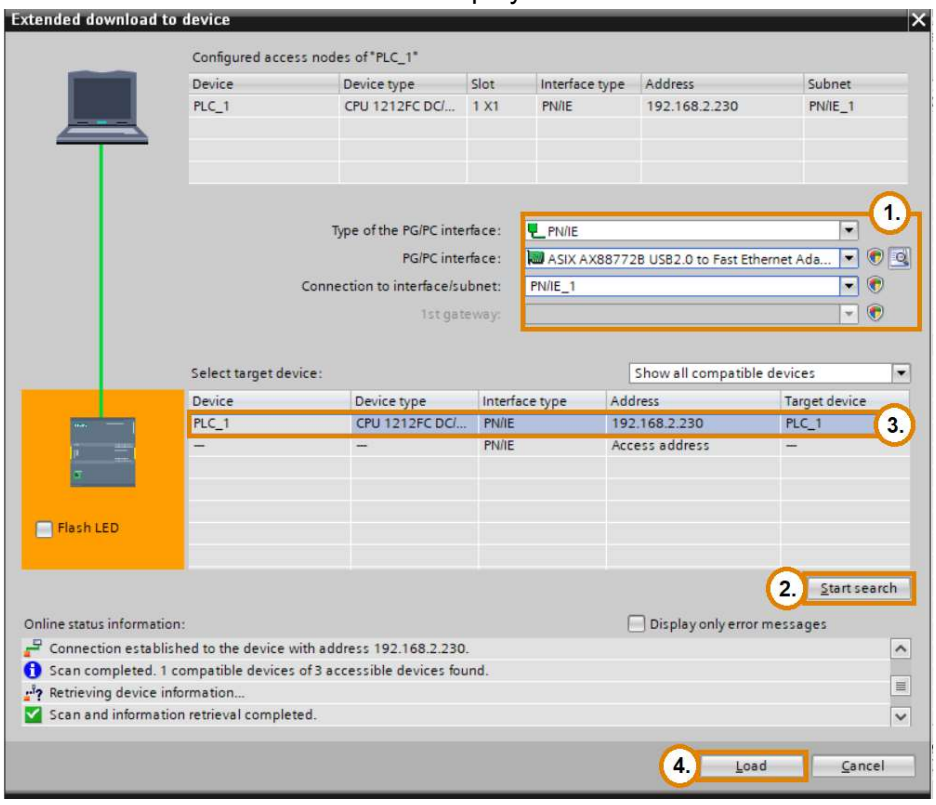
4. Download the project to the PLC

The complete project can be downloaded to the PLC now. Select the PLC in the device tree and click on the download button:

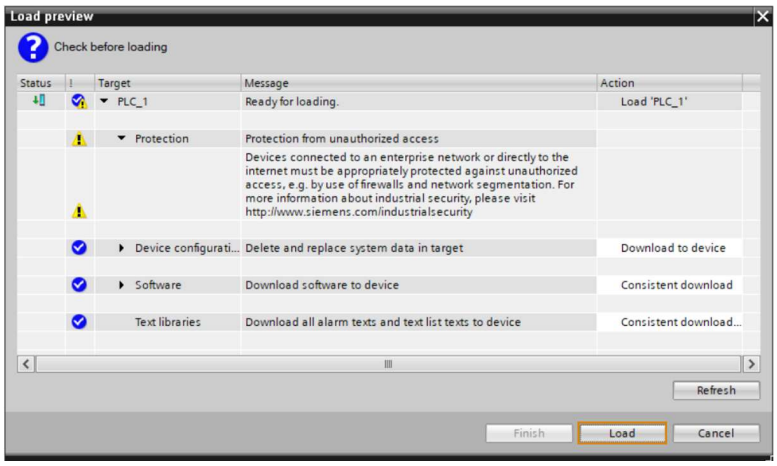


Configure the download process:

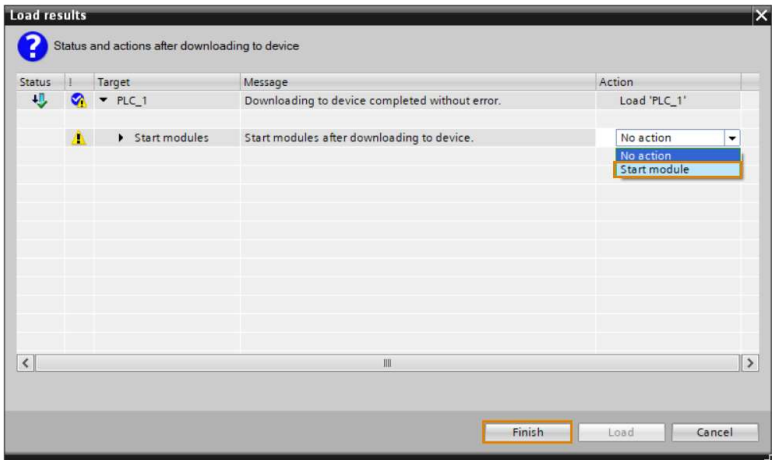
1. Select the interface that shall be used
2. Click on “Start search”
   the accessible devices will be scanned again, and all PLCs found are listed
3. Select the matching PLC as target device for the download
4. Click on “Load” and follow the displayed instructions



Check and select the actions in the “Load preview” and start the download by clicking on the “Load” button:

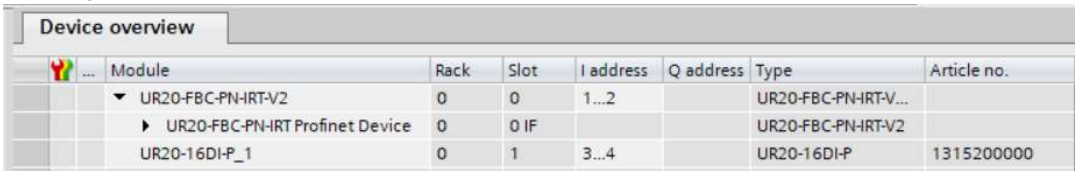


As soon as the download process has been finished successfully select “Start module” to change the operating state of the PLC in RUN mode and confirm this by clicking on the “Finish” button:



5. Assign the process data mapping

The logical addresses of the I/O data can be found in the device overview:



To be able to assign the I/O data, the u-remote manual should be used as a guide. The process data bytes are described in the individual chapters about the fieldbus couplers and modules, like in the following examples:

Status word of the fieldbus coupler

The Status word of the fieldbus coupler is only available if the corresponding coupler was selected from the hardware catalog.

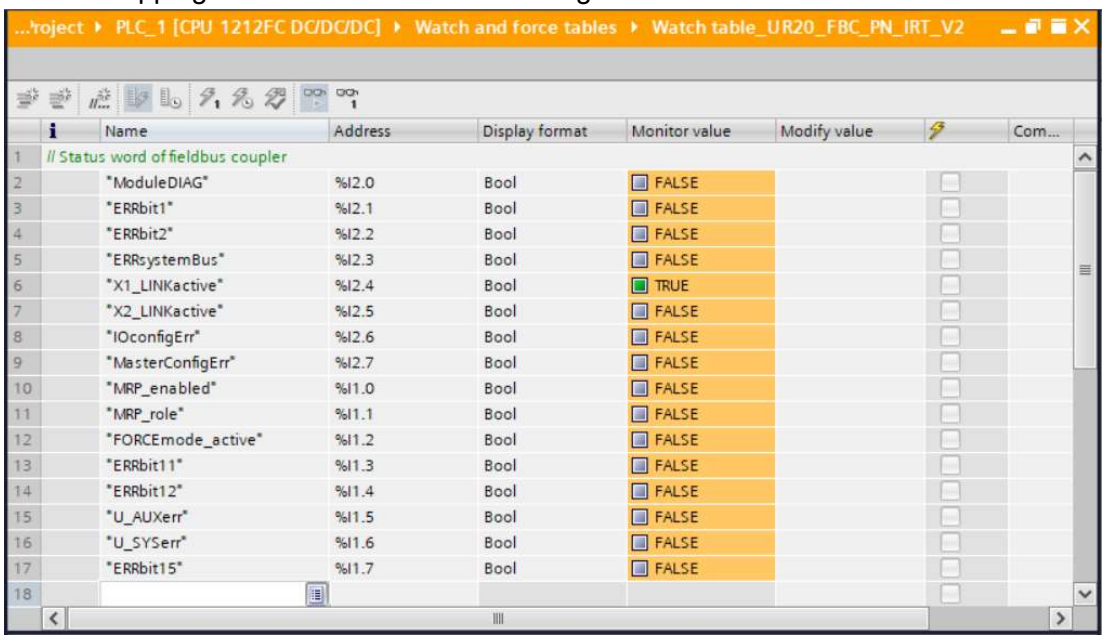
Together with the process data description from the u-remote manual the logical addresses of the project can be assigned:

Status word UR20-FBC-PN-IRT, UR20-FBC-PN-IRT-V2

Byte	Bit	Name	Logical address*
IB1	IX1.0	Summarized module diagnosis	%I2.0
	IX1.1	Errorbit 1	%I2.1
	IX1.2	Errorbit 2	%I2.2
	IX1.3	Systembus error	%I2.3
	IX1.4	Port 1 Link active	%I2.4
	IX1.5	Port 2 Link active	%I2.5
	IX1.6	I/O-Configuration error	%I2.6
	IX1.7	Master configuration error	%I2.7
IB0	IX0.0	MRP enabled	%I1.0
	IX0.1	MRP role	%I1.1
	IX0.2	Force mode active	%I1.2
	IX0.3	Errorbit 11	%I1.3
	IX0.4	Errorbit 12	%I1.4
	IX0.5	Voltage UOUT error	%I1.5
	IX0.6	Voltage UIN error	%I1.6
	IX0.7	Errorbit 15	%I1.7

* logical addresses of this sample project, see device overview

After the tags for the logical addresses have been created in the “PLC tags” of the project the I/O mapping could look like in the following watch and force table:



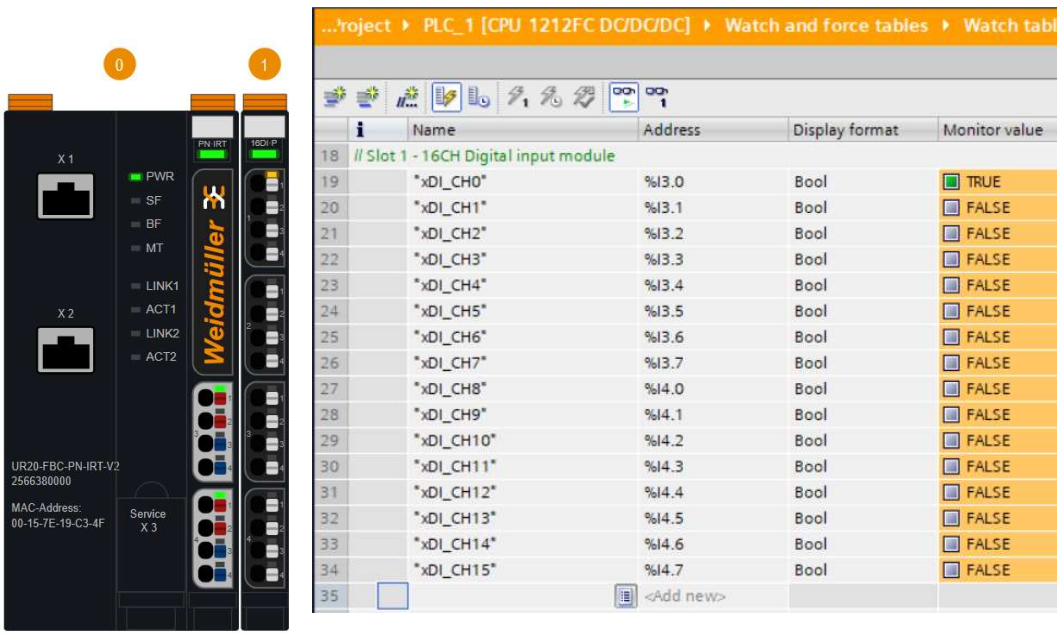
Process input data of UR20-16DI-P module in slot 1
The mapping of I/O modules can be done in the same way:

Process data inputs UR20-16DI-P

Byte	Bit	Description	Logical address*
IB0	IX0.0	DI 0	%I3.0
	IX0.1	DI 1	%I3.1
	IX0.2	DI 2	%I3.2
	IX0.3	DI 3	%I3.3
	IX0.4	DI 4	%I3.4
	IX0.5	DI 5	%I3.5
	IX0.6	DI 6	%I3.6
	IX0.7	DI 7	%I3.7
IB1	IX1.0	DI 8	%I4.0
	IX1.1	DI 9	%I4.1
	IX1.2	DI 10	%I4.2
	IX1.3	DI 11	%I4.3
	IX1.4	DI 12	%I4.4
	IX1.5	DI 13	%I4.5
	IX1.6	DI 14	%I4.6
	IX1.7	DI 15	%I4.7

* logical addresses of this sample project, see device overview

Applied to the logical addresses of the PLC the mapping can look like this:



4 PROFIsafe basics

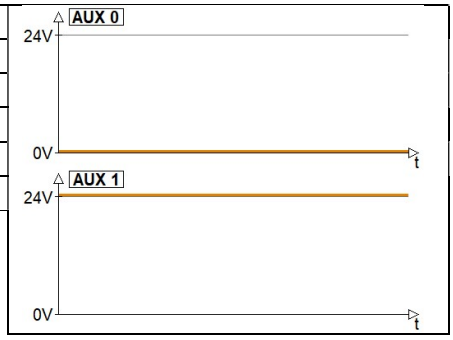
4.1 The physical hardware

This chapter is intended to summarise the most frequently asked questions about the hardware of Profisafe modules.

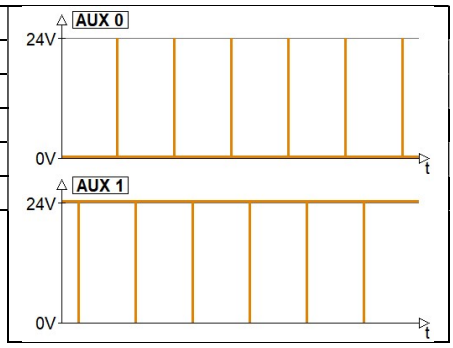
AUX characteristics for P- or N switching inputs
Depending on the selected parameter the auxiliary voltage at the input channel has different levels:

Module parameter for auxiliary outputs at digital input channels of UR20-xx-PN-FSPS-V2

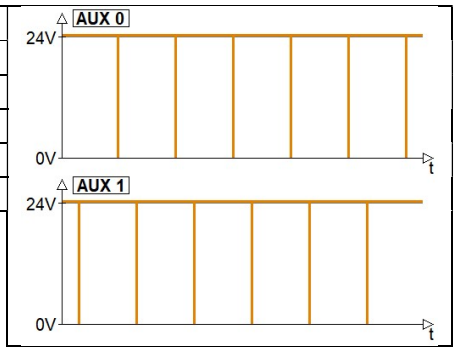
Channel	Parameter		AUX - Signal
CH 0: [AUX 0]		Input delay:	3ms
		Test pulse:	**internal**
		Input polarity:	**N-switching**
CH 1: [AUX 1]		Input delay:	3ms
		Test pulse:	**internal**
CH0/1:	Input dual channel mode:		dual channel equivalent



Channel	Parameter		AUX - Signal
CH 0: [AUX 0]		Input delay:	3ms
		Test pulse:	**from AUX 0**
		Input polarity:	**N-switching**
CH 1: [AUX 1]		Input delay:	3ms
		Test pulse:	**from AUX 1**
CH0/1:	Input dual channel mode:		dual channel equivalent

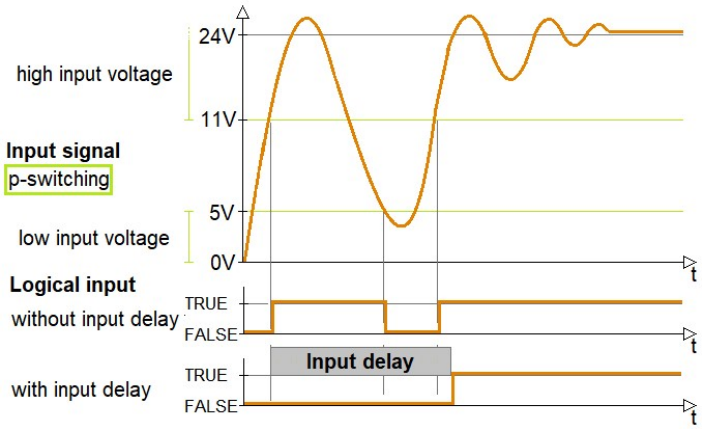


Channel	Parameter		AUX - Signal
CH 0: [AUX 0]		Input delay:	3ms
		Test pulse:	**from AUX 0**
		Input polarity:	**P-switching**
CH 1: [AUX 1]		Input delay:	3ms
		Test pulse:	**from AUX 1**
CH0/1:	Input dual channel mode:		dual channel equivalent



Input delay (single and dual channel mode)

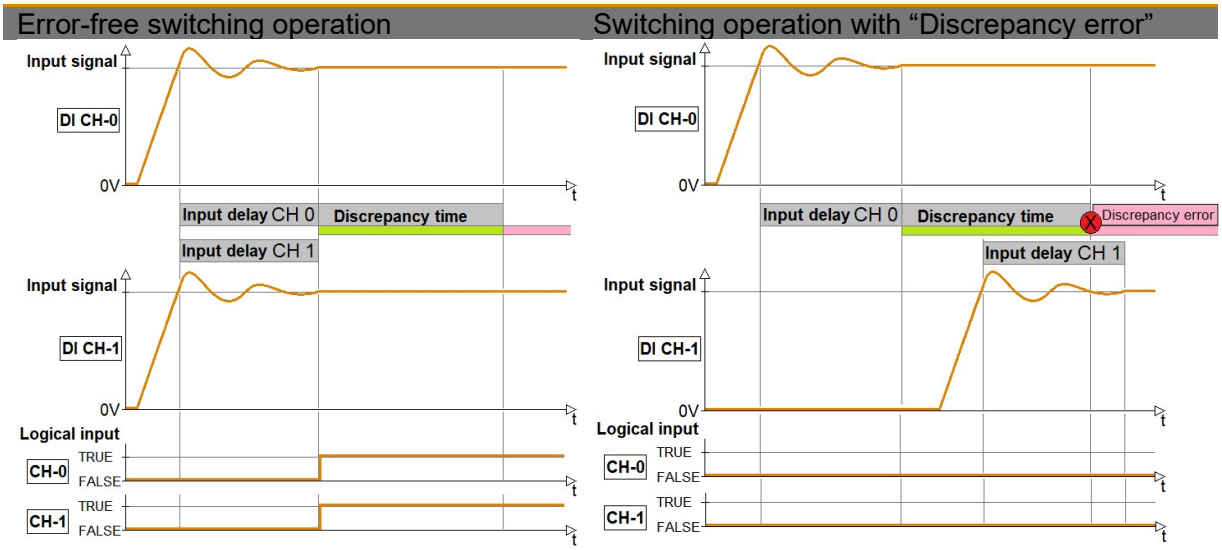
Every time when a switch is actuated the contacts in the switch are bouncing for a while. For this reason, the input signal is changing several times. To prevent that the logical input signal also toggles this parameter can be used to configure a time that shall be waited before the logical signal changes its logical state to true. The minimum required length of the input delay that must be configured depends on how long it takes before the input signal becomes stable:



Discrepancy time (only in dual channel mode)

After a valid signal change was detected on one of the related channels the module expects a signal change on the other channel within configured discrepancy time. A missing or delayed signal change will cause a discrepancy error:

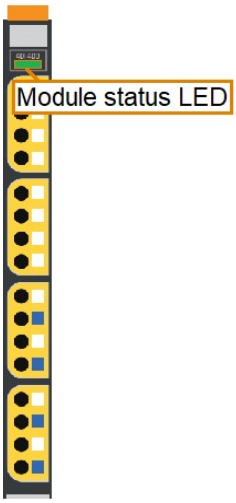
Signals at digital input channels of UR20-xx-PN-FSPS-V2 in dual channel mode



Equivalent (only in dual channel mode)
Both connected switching elements are the same type (NO+NO or NC+NC), this causes that the signal change on one channel is equivalent to the other channel.

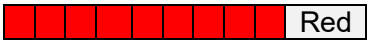
Antivalent (only in dual channel mode)
The connected switching elements are always different types (NO+NC), this causes that the signal change on one channel is antivalent to the other channel.

An error occurred – how to solve it….



The module status LED indicates the current state of the module as a collective message. This can be helpful to find out in which state the module is without having access to the diagnostic monitor of TIA Portal:

Communication on system bus

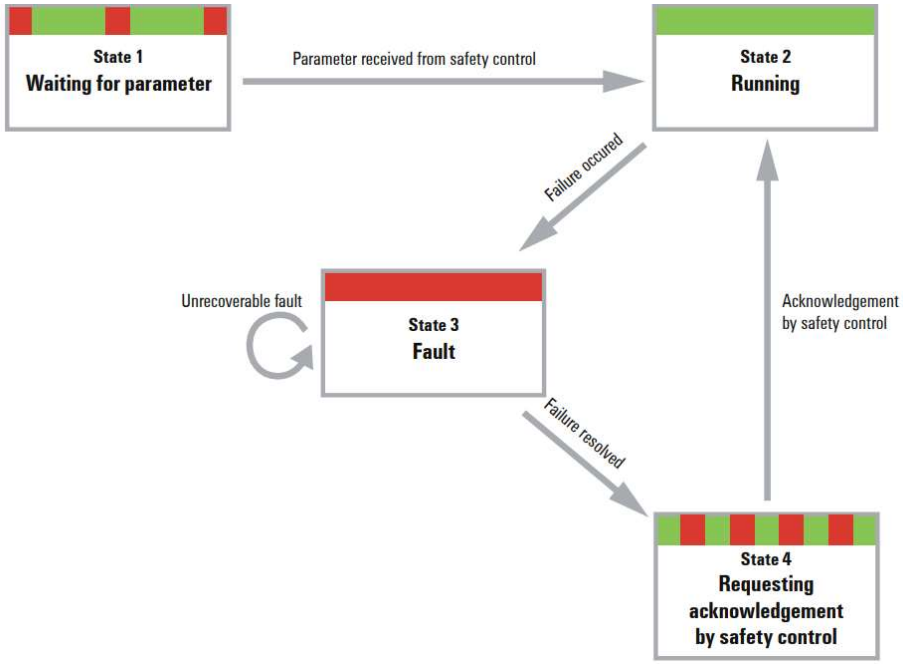


Collective error diagnostic

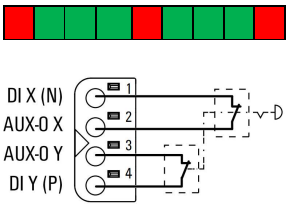
Module is waiting for parameters

Module is waiting for acknowledgement by safety control

The corresponding transition diagram which describes the dependencies between the different states can also be found in the “IP20 modules for functional safety” manual:

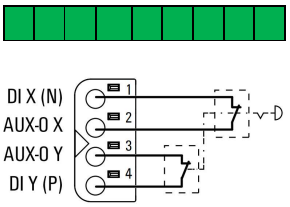


To get more familiar with the indicated diagnoses the following example describes the process beginning with powering on the system followed by a discrepancy error:



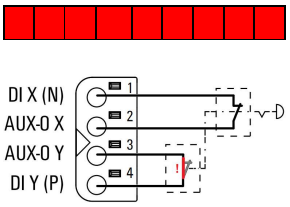
Power on the PLC and u-remote station

The module is waiting for parameters from the safety PLC.



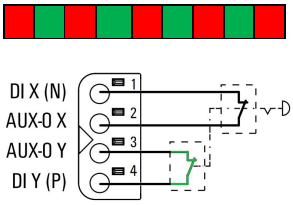
PLC is in run and data exchange has been started

Valid parameters were received from the safety PLC and no error was detected.



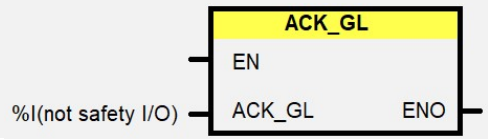
Emergency push button operated with a defect switching element

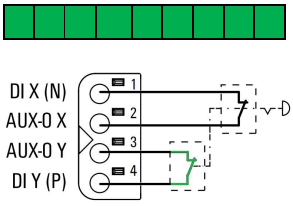
Within the configured discrepancy time a signal change was only detected on one of the two input channels. This causes that the complete module changes to “fault state”.
As long as the module is in this state the error cannot be acknowledged from the safety PLC!



Switching element was exchanged – ready to be reintegrated

As soon as a valid signal change has been detected the module is waiting for an acknowledge from the safety PLC.
A global acknowledge can be triggered in the safety program by using the basic function block “ACK_GL”:





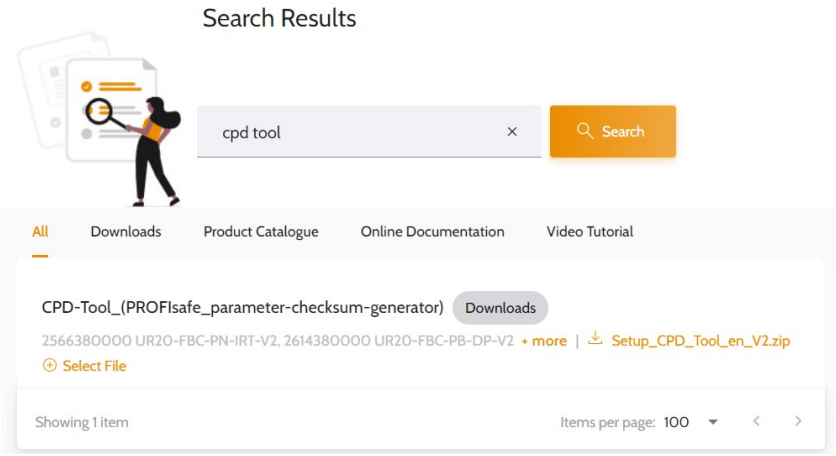
Global acknowledge was send by PLC

After having received the acknowledge the module changes back to the normal operating mode.

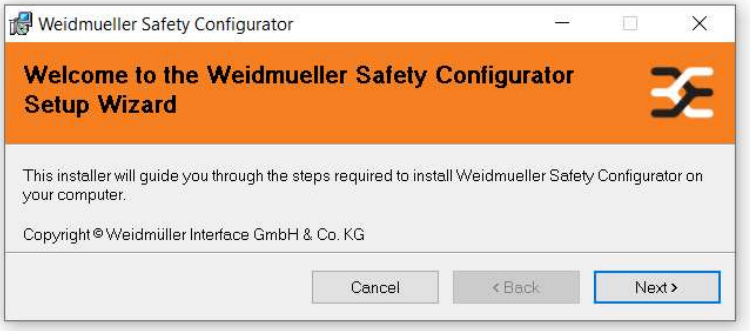
4.2 Installing the PROFIsafe parameter checksum generator

Before PROFIsafe modules can be used in TIA Portal and other engineering tools it is mandatory to install an additional product related tool to be able to calculate the check sum corresponding to the selected module parameters.

For all PROFIsafe modules manufactured by Weidmüller the “CPD-Tool” must be used which can be downloaded from the support center:



1) Unzip the downloaded archive “Setup_CPD_Tool_en_xx.zip”
2) Start the installation with the extracted “setup.exe” and follow the instructions

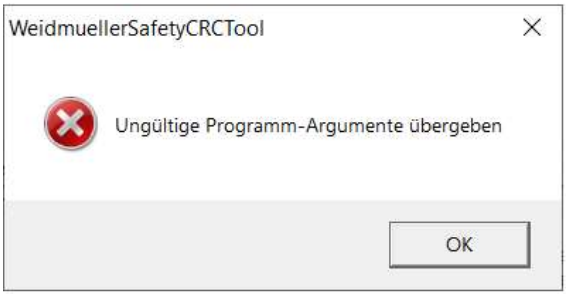


As soon as the has been finished successful the “CPD-Tool” can be executed from the engineering tool (see chapter 3.3)

4.3 Using the “CPD-Tool” without engineering tool

A shortcut to execute the “CPD-Tool” will also be available in Windows Start menu:

In default configuration an error will occur when the tool is not started within an engineering tool, because the expected data package which contains the selected module parameters from the hardware configuration of the project are missing:



Error: Invalid program arguments received

In case that a device tool cannot be started from the engineering tool it is also possible to execute it from Windows directly by changing the following value in the configuration file:

- Go to **C:\ProgramData\Weidmueller\Safety Configurator** (hidden folder)
- Open **WeidmuellerSafetyCRCTool.ini** with a text editor
- Change the value for **EditModeEnabled=0** to **1**:

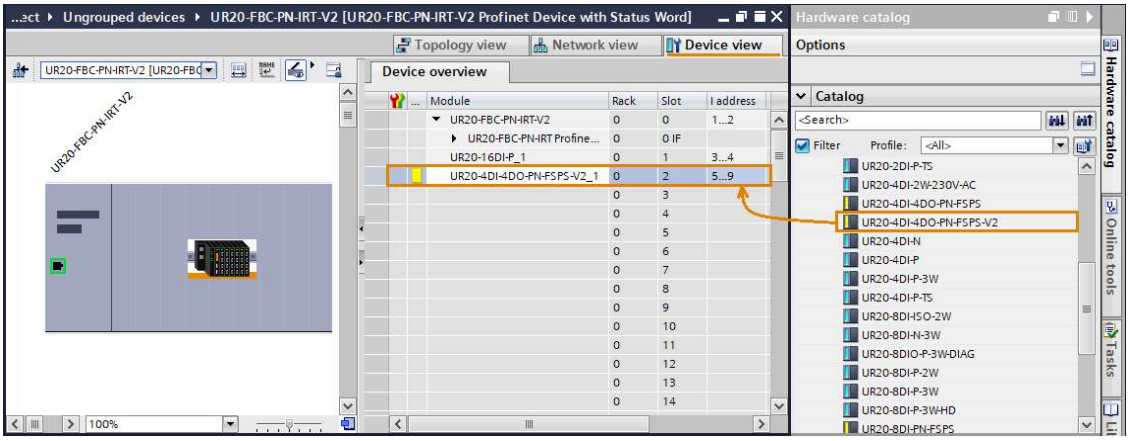
```
[COMMON]
CloseCommitDialog=0
CrcDisplayFormat=0
DebugTpf=1
EditEnabled=1
[…]
```

Now the module and its parameters have to be select manually before the corresponding checksum can be calculated.

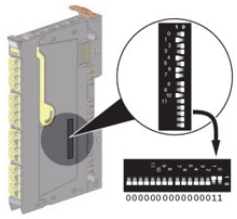
4.4 Using PROFIsafe modules in TIA Portal

Precondition to begin with this chapter is that the u-remote fieldbus coupler is already setup in the hardware configuration (chapter 3.3) and the PROFIsafe parameter checksum generator is installed (chapter 4.2).

1. **Add a FSPS module to the hardware configuration**
   Like all other modules the FSPS modules can be added to the u-remote station in the device view. In this example the UR20-4-DI-4DO-PN-FSPS-V2 module is used:



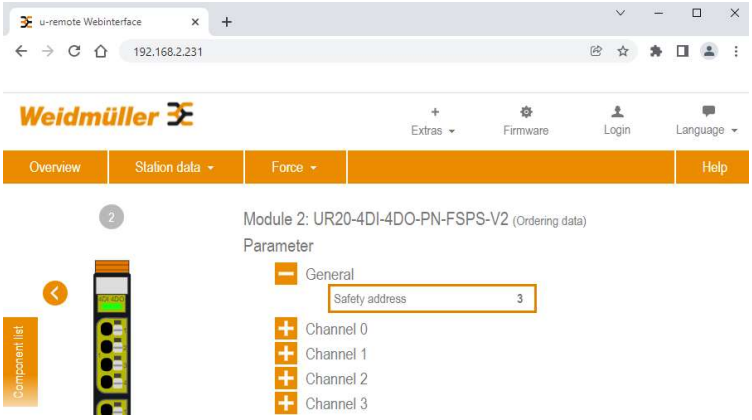
2. **Set a safety address at the module**



On each FSPS module a unique safety address has to be set as a binary value by using the DIP switches on the electronic unit. In this example the safety address **3** shall be configured:

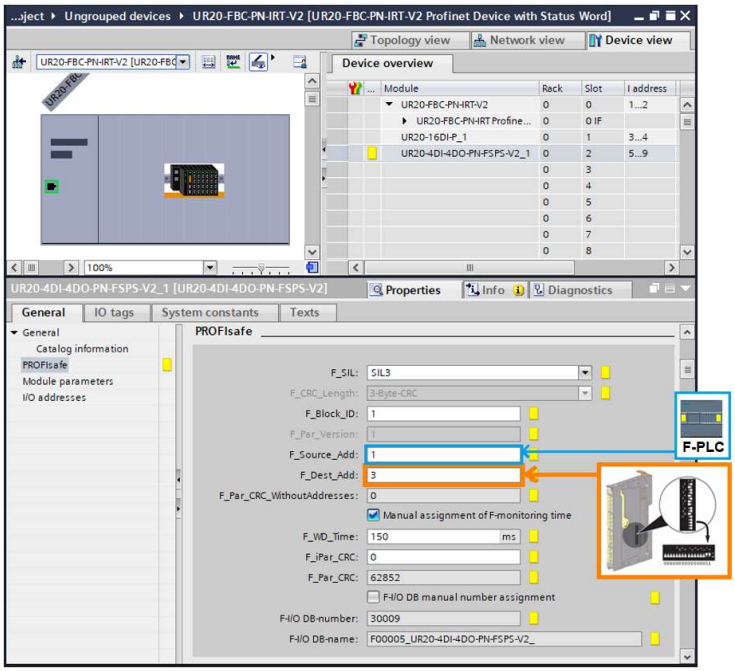
Decimal value:		2048	1024	512	256	128	64	32	16	8	4	2	1
DIP-switch	No.	11	10	9	8	7	6	5	4	3	2	1	0
	Value	0	0	0	0	0	0	0	0	0	0	**1**	**1**

The configured safety address is also displayed in the webserver of the fieldbus coupler below the general parameter information of the module:



3. Configure the safety addresses in the hardware configuration

Go to the device view and open the PROFIsafe parameters of the module:



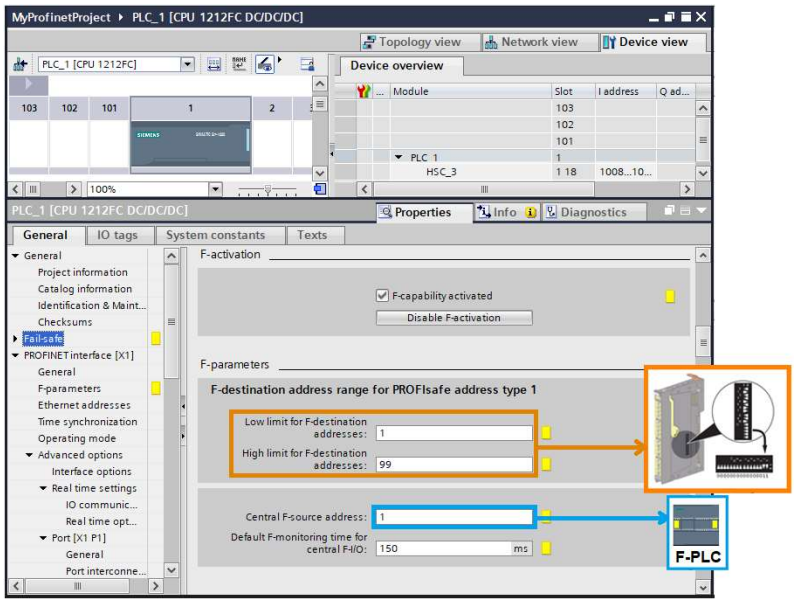
F_Dest_Add:

The safety address which was set on the electronic unit in step 2 has to be set for the F-destination address.

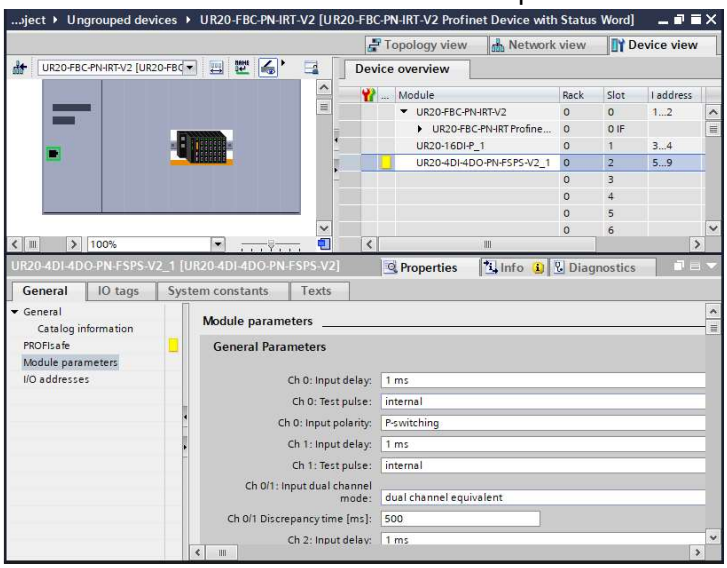
F_Source_Add:

The “Central F-source address” of the corresponding F-PLC

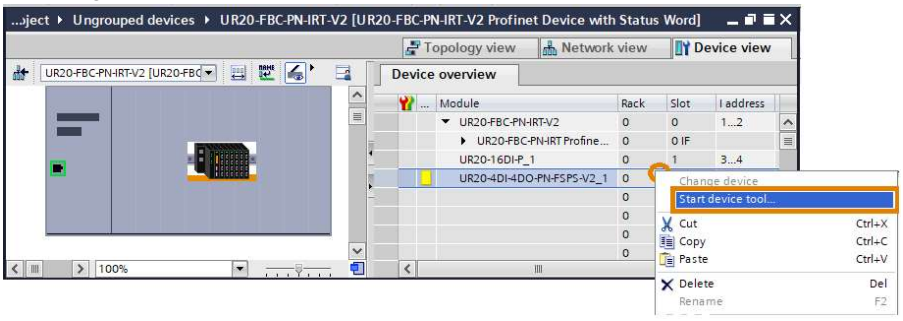
The valid addresses can be found in the “Failsafe” parameters of the PLC:



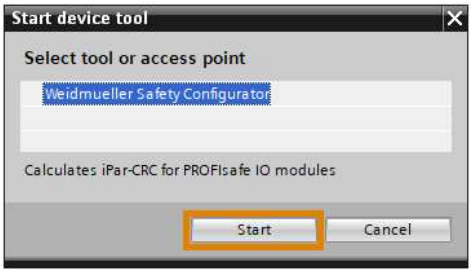
4. **Choose module parameter**
   Choose the module and channel related parameter of this module:



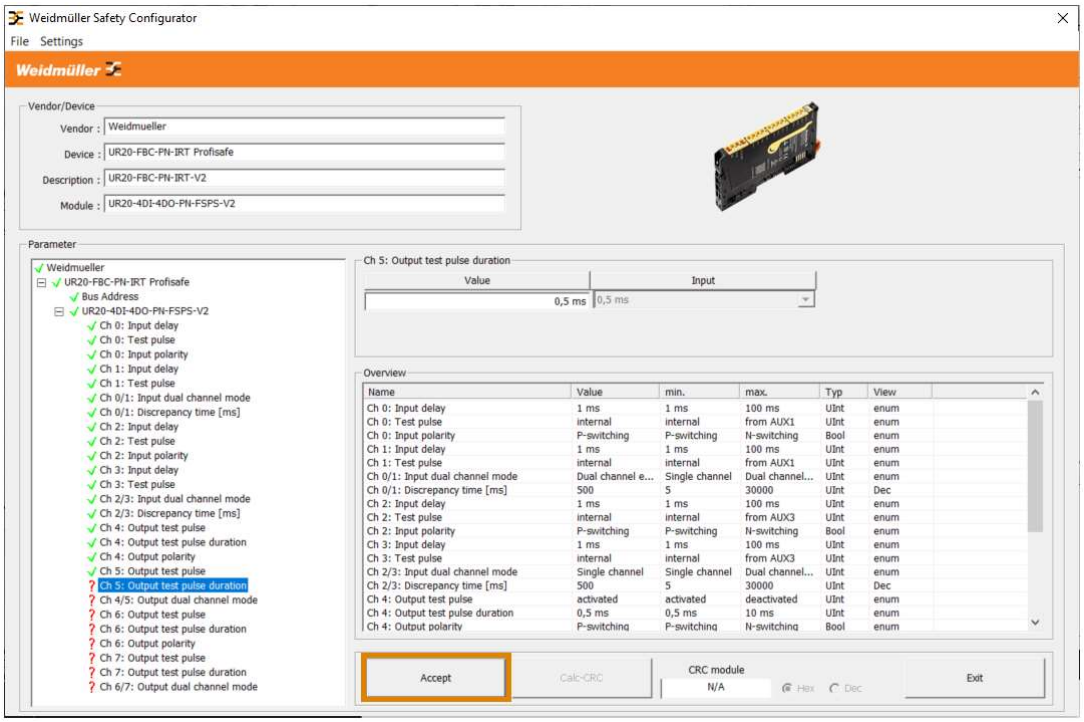
5. **Calculate the checksum for module parameters**
   As soon as the module parameters are selected a checksum must be calculated.
   Click right on the module in the device overview and select “Start device tool…”:



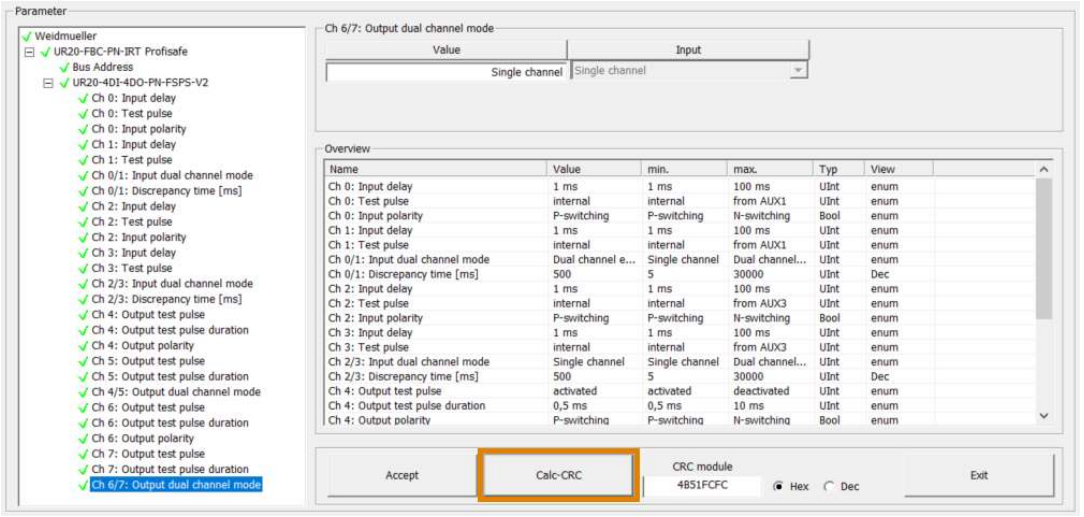
   Select the “Weidmüller Safety Configurator” and click on “Start”:



Confirm each value for the module parameters by clicking on “Accept”:

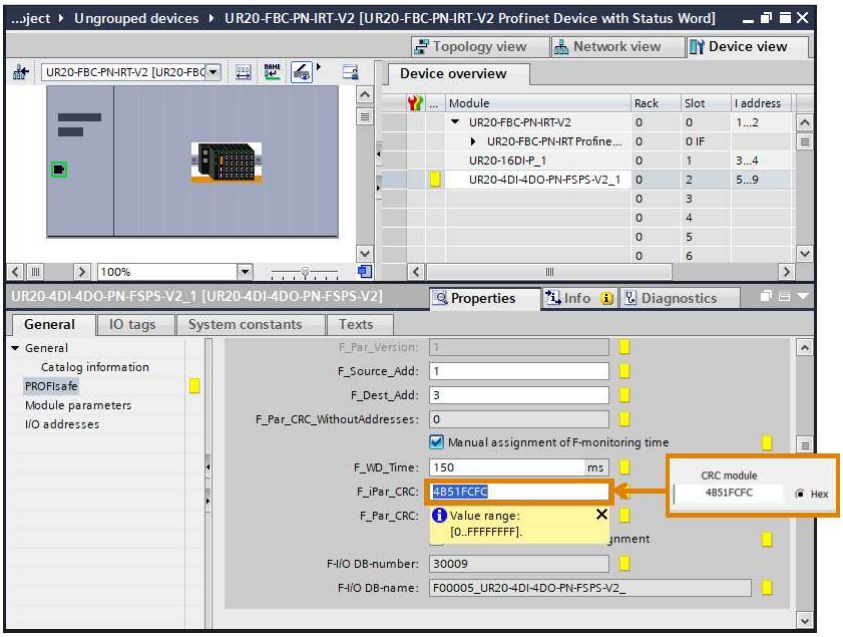


As soon as all values are confirmed the checksum can be calculated:



Copy the displayed checksum (in hex) and close the checksum generator.

Open the PROFIsafe parameters of the module and enter the checksum to individual device parameter checksum “F_iPAR_CRC”:



Now the hardware configuration has been finished and can be downloaded to the PLC.

Watch and force tables

Before live values of PROFIsafe modules are displayed in “Watch and force tables” it is mandatory to use minimum one I/O address of the module in the safety program. Otherwise, the process data will not be exchanged and the input values are always 0x00.