TechTip: PLC data exchange with SIEMENS STEP 7 TIA Portal

Contents

1. Use

This TechTip contains additional information on the data exchange with the SIEMENS STEP 7 TIA Portal as a supplement to the TechTip "**TechTip-PLC-data-exchange**".

The data exchange takes place in the AutomationML AR APC format. You can find further information in the TechTip "**TechTip-PLC-data-exchange**", section "AutomationML AR APC".

Overview of the different versions of EPLAN Electric P8 and STEP 7 TIA Portal

Version		Remarks	Supported version of the AR APC
EPLAN Electric P8	STEP 7 TIA Portal		
2.7	14SP1	Initial creation of the AML interface	1.0.0
2.7 HF3		Roundtrip engineering optimized	1.0.0
	15	Change in the handling for bus adapters	1.0.0
2.8	15.1	Bus adapters are now replaced as independent PLC cards	1.0.0
2.9	16	AR APC 1.1.0 support, exchange of extension modules, exchange of the BaseUnits for ET 200SP	1.1.0
2022	17	AR APC 1.2.0 support, exchange of drive components, exchange of device-specific configuration values	1.2.0
2023	18	AR APC 1.3.0 support, exchange of symbolic addresses within user-defined data types (UDT)	1.3.0

Note:

The "Save GUID during the import" property has to be set for the round-trip engineering up to and including TIA Portal Version 15.1 (can be accessed under TIA Portal in the menu "Extras > Settings" in the "CAx" group).

In addition to the restriction in the AutomationML AR APC format, the following points, amongst others, are currently not supported:

- Exchange of accessories up to and including TIA Portal Version 15.1. Therefore export your data without accessories (setting can be accessed in the export dialog under "Options > Export accessories")
- With few exceptions HMI devices cannot be exchanged
- Packed addresses (for example at input / output cards with 2-bit data width)
- Symbolic addresses outside the process image.
  Here the data exchange via the SDF format can be used.
- Some connection point properties at analog modules (for example signal range)

- Redundant control systems (H-series)

Please refer to the online help system of the TIA Portal under the search term "Restrictions for CAx" for a detailed overview of all restrictions

2. SIEMENS STEP 7 TIA Portal

1. The **PLC type designation** corresponds to the Siemens order number as it is also specified in the hardware catalog of the PLC configuration program.

2. **Racks** are designated in ascending order with numerical values, beginning at "0". The CPU is always plugged at Rack "0".

3. The **Plug designation** is only exchanged at bus ports.

4. The **Start address** always has to be specified at input and output modules. If a module has an inputs and outputs, **Start address 2** is used for the outputs.

5. A PLC connection point (input / output) is exported correctly when

    a) A valid **PLC address** is specified.

    b) The **Data type** is filled.

    c) At the associated PLC box, the CPU: Name property is filled correctly.

6. The **Station ID** is specified at each module.

7. The **Station type** is entered

    a) at the module that represents the CPU.

    b) At each head station if no device description file is specified.

8. The **MasterSystemID** is specified at the bus master and has the following values:

    a) PROFIBUS: in the range of 1 to 99

    b) Ethernet-based bus systems: greater than or equal to 100.

9. For the identification of the address use "I" at inputs and "Q" at outputs, so that the identifications do not change during an import.

10. Siemens remembers the **DT**.

11. If both the **PLC type designation** as well as a device description file are specified, the **PLC type designation** is used for the data exchange.

12. The **Channel designation** is a numerical value equal to or greater than 0.

13. The **Function text** is transferred in several languages.

14. A head station is identified by itself being a **rack** that is not placed on any rack and at which either the **Bus coupler / head station** check box or the **CPU** check box is activated (see also TechTipp "**TechTip-PLC-data-exchange**", chapter "Head station").

15. The **PLC card is placed on head station** check box has to be activated for PLC cards that are placed on the head station, are integrated into it and are not adjoined next to the head station.

2.1. ET 200SP

1. If the ET 200SP station contains a CPU, no separate rack is configured. Instead the CPU itself is the Rack "0". All other fields for rack assignment remain empty.

2. You can find additional information on the PLC data exchange with an ET 200SP in the TechTip "**TechTip-Recommendation-for-PLC-items-with-base-and-pluggable-logic**".

2.1.1. Special feature IM155-6PN/3 HF

When using bus adapters in the IM155-6PN/3 HF head station, the following has to be observed: At the second adapter slot one of the two connection points is not used. In this case it is recommend to use a second part variant for the bus adapter (see also TechTipp "**TechTip-PLC-data-exchange**", chapter "Bus adapter"). Each part variant has the exact number of bus ports that are used for the respective slot / module.

2.2. ET 200AL

All modules of an ET 200AL station are configured on the shared rack (rack 0).

2.2.1. Head station of the ET 200AL

The head station is on slot / module 0, all other PLC cards on slot / modules 2 to 17 and 19 to 34.

The head station contains two PLC subdevices that are treated as independent devices in TIA Portal. The device identification is carried out in EPLAN by means of the properties **PLC subdevice 1: PLC type designation** and **PLC subdevice 2: PLC type designation**.

Head station as PLC box

ID	Property	Value
20161	Configuration project	Not empty
20408	PLC station: ID	Not empty
20409	PLC station: Type	`ET200AL`
20416	PLC type designation	For example `6ES7 157-1AB00-0AB0`
20427	Rack	`0`
20411	Position (slot / module)	`0`
20164	Bus coupler / head station	☑
20521	PLC subdevice 1: Name	`ET_Con_1`
20533	PLC subdevice 1: Position (slot / module)	`1`
20607	PLC subdevice 1: PLC type designation	For example `6ES7 157-1AB00-0AB0#BUILTIN`
20522	PLC subdevice 2: Name	`ET_Con_2`
20543	PLC subdevice 2: Position (slot / module)	`18`
20582	PLC subdevice 2: PLC type designation	For example `6ES7 157-1AB00-0AB0#BUILTIN`

A part can be stored at this box.

Bus ports that connect the ET 200AL with the network also belong to this head station.

Settings at the bus ports of the ET 200AL head station using Ethernet as an example

20447	**Bus interface: Name**	X1
20406	**Plug designation**	P1 R or P2 R
20308	**Bus system**	Ethernet

The bus ports that connect the head station with the modules also belong to the head station. The bus ports are located on both PLC subdevices of the head station and are assigned to the PLC subdevices via the property **PLC subdevice: Index** .

Settings at the bus ports that connect the head station with the individual modules.

First connection point:

20406	**Plug designation**	X30
20308	**Bus system**	ET connection
20384	**PLC subdevice: Index**	1

Second connection point:

20406	**Plug designation**	X31
20308	**Bus system**	ET connection
20384	**PLC subdevice: Index**	2

2.2.2. Modules of the ET 200AL

Within the modules, TIA Portal does *not* treat PLC subdevices as independent devices.

Further PLC cards as boxes

ID	Property	Value
20161	**Configuration project**	Like at the head station
20408	**PLC station: ID**	Like at the head station
20409	**PLC station: Type**	`ET200AL`
20416	**PLC type designation**	Not empty
20410	**PLC card is placed on rack ID**	`0`
20411	**Position (slot / module)**	Not empty
20253 [1]	**CPU name [1]**	Not empty (see CPU name)

A part can be stored at these boxes.

The bus ports that connect the individual modules with each other also belong to the individual modules. The bus ports are located on the modules. The **PLC subdevices property: Index** is not used for the bus ports.

Settings at the bus ports for the connection of the ET 200 AL with each other

First connection point:

20406	**Plug designation**	`X30`
20308	**Bus system**	`ET connection`

Second connection point:

20406	**Plug designation**	`X31`
20308	**Bus system**	`ET connection`

2.2.3. Correcting the start addresses after a PLC data import

After a PLC data import the start addresses of the individual PLC cards have to be checked, a value of "-1" for the (new) export is not valid and must be corrected. The start address must either be empty or must have a value greater than / equal to "0".

Affected PLC cards can be determined in the PLC navigator with a filter. To this purpose select the **Start address of PLC card** property as the filter criterion:

Active	Negated	Criterion	Operator	Value
☑	☐	Start address of PLC card	=	-1

2.2.4. Power supply connection points X80 or X81

The voltage supply connection points (plug designation: X80 or X81) that connect the individual racks of the ET 200AL to each other are not contained in the exchange file. Therefore configure these as device connection points in EPLAN.

2.3. ET 200eco

The following PLC box has to be created for the configuration of an ET 200eco station:

Head station as PLC box

ID	Property	Value
20161	Configuration project	Not empty
20408	PLC station: ID	Not empty
20409	PLC station: Type	ET200eco
20427	Rack	0
20164	Bus coupler / head station	☑
20521	PLC subdevice 1: Name	8 DIO DC24V/1.3A 8xM12
20533	PLC subdevice 1: Position (slot / module)	1

When using with the specification of the PLC type designation:

20416	**PLC type designation**	For example `6ES7 147-6BG00-0AB0`
20607	**PLC subdevice 1: PLC type designation**	`6ES7 147-6BG00-0AB0#BUILTIN`

When using with the specification of the device description file:

20415	**Device description: File name**	For example `GSDML-V2.25-SIEMENS-ET200ECO-20100910.XML`
20381	**Device description: Index in file**	`DIM 12`
20606	**PLC subdevice 1: Device description: Index in file**	`DAP/DIM 12#BUILTIN`

The part is stored at this box.

All other PLC connection points belong to this head station.

Settings at the bus ports

ID	Property	Value
20447	**Bus interface: Name**	`X1` (for all bus ports)
20406	**Plug designation**	`Px R`, for all bus ports, whereby x = 1 ... Number of bus ports

Identify the first bus port as **Bus interface: Main bus port** and enter the relevant bus data here.

If PLC connection points can be either configured as inputs or as outputs, then you use the **PLC connection point, multi-function** function definition at these and set the direction (digital input or digital output) via the logic at the connection point.

2.4. PN/PN coupler

A PN/PN coupler is used to connect two Ethernet subnets with each other and exchange data. It is configured in EPLAN as a device with two PROFINET interfaces.

2.4.1. Integrated bus adapters

The "SIMATIC PN/PN Coupler" `6ES7 158-3AD01-0XA0` by Siemens contains the respective integrated bus adapter "BA 2XRJ45" as a firmly installed component for the two network interfaces. These integrated bus adapters must be configured as PLC subdevices in EPLAN.

To this purpose the properties at the main function are filled as follows:

ID	Property	Value
20161	Configuration project	Not empty
20408	PLC station: ID	Not empty
20409	PLC station: Type	`LINKS/PnPnCoupler`
20416	PLC type designation	`6ES7 158-3AD01-0XA0`
20427	Rack	`0`
20164	Bus coupler / head station	☑
20521	PLC subdevice 1: Name	`BA 2xRJ45`
20533	PLC subdevice 1: Position (slot / module)	`0`
20607	PLC subdevice 1: PLC type designation	`6ES7 158-3AD01-0XA0#BUILTIN`
20522	PLC subdevice 2: Name	`BA 2xRJ45`
20543	PLC subdevice 2: Position (slot / module)	`1`
20582	PLC subdevice 2: PLC type designation	`6ES7 158-3AD01-0XA0#BUILTIN`

The settings at the bus ports are to be carried out as follows:

First interface (PLC subdevice 1):

20447	**Bus interface: Name**	X1
20406	**Plug designation**	P1 R
20384	**PLC subdevice: Index**	1

Second interface (PLC subdevice 2):

20447	**Bus interface: Name**	X2
20406	**Plug designation**	P2 R
20384	**PLC subdevice: Index**	2

2.4.2. Pluggable bus adapters

Pluggable bus adapters are also covered in the TechTip "**TechTip-PLC-data-exchange**" in the section "Bus adapters". Supplementary information is available there.

The "SIMATIC PN/PN Coupler" 6ES7 158-3AD10-0XA0 by Siemens, for example, contains slots / modules for pluggable bus adapters, for example "BA 2XRJ45" 6ES7 193-6AR00-0AA0 for the two network interfaces.

The bus adapters are configured as follows:

Settings at the PLC box for the bus adapter

ID	Property	Value
20161	**Configuration project**	Not empty
20416	**PLC type designation**	e.g. 6ES7 193-6AR00-0AA0
20410	**PLC card is placed on rack ID**	Like head station
20411	**Position (slot / module)**	Not empty
20444	**PLC card is placed on head station**	☑

Settings at the bus ports

20447	**Bus interface: Name**	X1 or X2 (depending on the slot / module in the PN/PN coupler)
20406	**Plug designation**	Px R, for all bus ports, whereby x = 1 ... Number of bus ports, the method of counting is per adapter

2.4.3. PN/PN couplers that are identified via a device description

The Device identification of PLC devices takes place in the PLC configuration program, either via the PLC type designation (for manufacturer devices) or via the combination of **Device description: File name** and **Device description: Index in file**. Further information is available in the TechTip "**TechTip-Configuring-PLC-devices-with-device-description-files**".

While the proprietary PN/PN coupler is mapped fully in a configuration project, the external device for the data exchange with the STEP 7 TIA Portal in EPLAN must be divided onto two configuration projects. Each interface is assigned to a different configuration project.

This results in the following restrictions:

- The device is divided into multiple devices. In this case it is advisable to work with a subcounter or subordinate DT. (For further information refer to the online help system in the section "Structure of the Device Tag".)
- Each of the devices divided in this way has its own part. Please note that such a part only represents one part of the device and cannot be ordered in this way. (During the output into a bill of materials such parts should be filtered so that the device is not listed several times there. For further information please refer to the online help system in the section "Part assemblies parts list".)

The properties at the main functions (for the interfaces) are filled as follows:

ID	Property	Value
20161	**Configuration project**	Not empty
20408	**PLC station: ID**	Not empty
20415	**Device description: File name**	For example `GSDML-V2.34-SIEMENS-PNPNIOC-20180626.XML`
20381	**Device description: Index in file**	For example `DAP X1 V4.2` for the first configuration project and `DAP X2 V4.2` for the second configuration project
20427	**Rack**	`0`
20164	**Bus coupler / head station**	☑
20521	**PLC subdevice 1: Name**	Not empty
20533	**PLC subdevice 1: Position (slot / module)**	`1`
20607	**PLC subdevice 1: Device description: Index in file**	For example `DAP/DAP X1 V4.2#BUILTIN` for the first configuration project and `DAP/DAP X2 V4.2#BUILTIN` for the second configuration project

The settings at the bus ports are to be filled as follows:

ID	Property	Value
20447	**Bus interface: Name**	`Xn` (whereby `n` stands for the number of the interface. This means for the first interface `X1` and for the second interface `X2`.)
20406	**Plug designation**	`Px R`, for all bus ports, whereby x = 1 ... Number of bus ports

Identify the first bus port as **Bus interface: Main bus port** and enter the relevant bus data here.

2.5. Passive devices in Ethernet-based networks

It is possible to configure passive devices as an "EthernetDevice" so that the port-specific interconnection within an Ethernet-based network is exchanged during the PLC data exchange of passive devices (switches, bus repeaters or similar, see also TechTip "**TechTip-PLC-data-exchange**" Section "Passive devices"). These devices have a specified number of bus connection points that are all configured as "Network / bus cable connection point, general" (also see TechTipp "**TechTip-PLC-data-exchange**", chapter "Automatic connections between connected bus ports").

EthernetDevice as head station

ID	Property	Value
20161	Configuration project	Not empty
20408	PLC station: ID	Not empty
20427	Rack	`0`
20411	Position (slot / module)	`1`
20409	PLC station: Type	`EthernetDevice`
20416	PLC type designation	`System:DeviceItem.EthernetDevice.Portx`, whereby x corresponds to the number of bus ports
20164	Bus coupler / head station	☑

Settings at the bus ports

ID	Property	Value
20447	Bus interface: Name	`X1` (for all bus ports)
20406	Plug designation	`Px`, for all bus ports, whereby x = 1 ... Number of bus ports

Identify the first bus port as **Bus interface: Main bus port** and enter the relevant bus data here.

Passive devices in Ethernet-based networks cannot be assigned to any logical network. Therefore the properties **Logical network: Name** and **MasterSystemID** must remain empty and the property **Logical network: Bus port is master** must be deactivated.

3. Differences between STEP 7 TIA Portal and STEP 7 Classic

The following overview shows which properties are used differently with STEP 7 TIA Portal and STEP 7 Classic during a PLC data exchange.

The data input in EPLAN can be effected:

A = in the parts data

M = in the macro

P = in the project

We recommend entering the data preferably in the parts data and / or in the macros.

Note:

In most cases it is possible to use the same parts database for both the PLC data exchange with STEP 7 TIA Portal as well as with STEP 7 Classic.

The main difference consists of the values for the **Channel designation** (ID 20428). The other properties have additional values for the TIA Portal. PLC cards with these new / additional values can as a rule not be exchanged with STEP 7 Classic since these PLC cards are unknown there and are not supported.
The property **Device description: Index in file** (ID 20381) is not used for the exchange with STEP 7 Classic and is not considered there.

If necessary, you can create part variants in the EPLAN parts management.

PLC connection point:

ID	Property	Usage in		Data input		
		TIA	Classic	A	M	P
20384	PLC subdevice: Index	✓	-	x	x	x
20428	Channel designation *1	✓	✓	x	x	x
20610	Symbolic address: Group *2	✓	-	-	-	x
20618	Symbolic address: UDT (name) *3	✓	-	-	-	x
20619	Symbolic address: UDT (data type) *3	✓	-	-	-	x

*1 Different values in STEP 7 TIA Portal and STEP 7 Classic:

20428	Channel designation
STEP 7 Classic	*Inputs are specified with "Inx", outputs with "Outx", whereby x is a consecutive* value equal to or greater than 0.
STEP 7 TIA Portal	*(Numerical) value equal to or greater than 0*

*2 Exchange as of AutomationML AR APC Version 1.1.0

*3 Exchange as of AutomationML AR APC Version 1.3.0

PLC bus port:

ID	Property	Usage in		Data input		
		TIA	Classic	A	M	P
20448	Bus interface: Main bus port	✓	-	-	x	x
20447	Bus interface: Name	✓	-	x	x	x
20386	Physical network: Bus ID / item number 2	✓	-	-	-	x
20313	Data transfer rate	-	✓	-	x	x
20289	Integrated module	-	✓	-	x	x
20312	Subslot	✓	✓	-	x	x
20308	Bus system *1	✓	✓	x	x	x
20446	Subnet mask	✓	-	-	x	x
20613	Standard gateway *3	✓	-	-	x	x
20309	DNS/PROFINET device name *3	✓	-	-	x	x

*1 Different values in STEP 7 TIA Portal and STEP 7 Classic:

20308	Bus system
STEP 7 Classic	*MPI bus, PROFIBUS, Ethernet or PROFINET*
STEP 7 TIA Portal	*MPI bus, PROFIBUS, Ethernet or PROFINET*[*4], *ASi*

[*3] Exchange as of AutomationML AR APC Version 1.2.0

[*4] Exchange as of TIA V17

PLC card:

ID	Property	Usage in		Data input		
		TIA	Classic	A	M	P
20437	PLC card name	✓	-	-	-	x
20164	Bus coupler / head station	✓	-	x	x	x
20381	Device description: Index in file	✓	-	x	x	x
20521 foll.	PLC subdevice x: Name	✓	-	x	x	x
20533 foll.	PLC subdevice x: Position (slot / module)	✓	-	x	x	x
20454, 20382, 20392 foll. 20452 foll.	PLC subdevice x: Start address (inputs)	✓	-	-	-	x
20455 foll., 20478 foll., 20515 foll.	PLC subdevice x: Start address (outputs)	✓	-	-	-	x
20607, 20582 foll.	PLC subdevice x: PLC type designation	✓	-	x	x	x
20606, 20593 foll.	PLC subdevice x: Device description: Index in file	✓	-	x	x	x
20417	Object description	-	✓	x	x	x
20432, 20299	Address range (SIEMENS STEP 7 Classic), Address range 2 (SIEMENS STEP 7 Classic)	-	✓	x	x	x
20289	Integrated module	✓	✓	-	x	x
20444	PLC card is placed on head station	✓	-	x	x	x
20312	Subslot	-	✓	-	x	x

ID	Property	Usage in		Data input		
		TIA	Classic	A	M	P
20439	Safety address: Target *2	✓	-	-	-	x
20615	Safety address: Source *2	✓	-	-	-	x
20616	Safety address: Upper value *2	✓	-	-	-	x *4
20617	Safety address: Lower value *2	✓	-	-	-	x *4
20409	PLC station: Type *1	✓	✓	x	x	x
20580	PLC device: TemplateIdentifier *3	✓	-	x	x	x
20614	PLC station: TemplateIdentifier *3	✓	-	-	x	x
20576	Drive *3	✓	-	-	x	x

*1 Different values in STEP 7 TIA Portal and STEP 7 Classic:

20409	PLC station type
STEP 7 Classic	*S7300, S7400, S7400H, PC_BASED, HMI_BASED*
STEP 7 TIA Portal	*S7300, S7400, S71200, S71500, ET200AL, PC, ET200ecoPN, ET200SP, ET200ISP, ET200M, ET200S, ET200Pro, ASi, S7mEC, Scalance/X200IRT, among other things*

*2 Exchange as of AutomationML AR APC Version 1.1.0

*3 Exchange as of AutomationML AR APC Version 1.2.0

*4 Values in EPLAN are write-protected and are only filled via the PLC data exchange

Tip:

In the TIA Portal the **Device description: Index in file** property is visible in the "Type Identifier" field of the hardware catalog if it is enabled via the setting "Activate display of the type identifier for devices and modules" (can be accessed in the menu "Extras > Settings" in the group "Hardware configuration > Information on product support").