

TechTip: PLC data exchange

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1. Use

The multiple entry of data is avoided through the PLC data exchange. This reduces the work load across departments and avoids typing errors. The configuration is accelerated overall and the planning quality is improved.

For the fundamental description of a property please refer to the current EPLAN help:

- [Terminals, Cables, Plugs, and PLC Information > PLC > Basics](#)
- [EPLAN Properties: Overview](#)

Further notes and specifications for individual properties can also be found in the TechTip "**TechTip-Overview-of-the-PLC-properties**".

With Version 2.7 of EPLAN Electric P8 numerous new check runs which help you in configuring the data exchange were implemented in the PLC field.

You can find details on the PLC data exchange with specific PLC configuration programs in separate TechTips.

2. Exchanged data

1. Hardware data
Rack structure with part information.
2. Symbol table (assignment list, table of variables or similar)
Contains the assignment of the symbolic address to a hardware address.
3. Network structure logical view (association of the devices to networks), not the exact cabling.

The PLC data exchange is based on a file that can be exchanged simply between the EPLAN designer and the PLC programmer. Data that an editing program does not find in the exchange file because the other editing program does not know them, are supplemented during importing. EPLAN supplements the further required data from the parts management.

PLC configuration programs and EPLAN are based on different points of view. EPLAN configures electrical engineering hardware details such as voltage supply, etc. PLC configuration programs have a logical view for the software programming.

Through the different views of the programs and the current developments on the hardware and software sector, the PLC data exchange cannot always cover all the requirements. This applies for example to passive items in the bus bundle and used field bus systems.

3. Recommended workflow in EPLAN

3.1. Physical rack layout

Begin with the rack layout on a single-line schematic page.
Use single-line PLC boxes as main functions.

Advantages:

1. The hardware data of the used devices is planned through the rack layout. All the main functions exist in the single-line representation. When this representation is copied, the parts entered there are copied as well.
2. Individual functions (I/O connection points, power supply, bus ports, etc.) can be placed via drag & drop from the PLC navigator.
3. The rack layout can be exchanged with PLC configuration programs.

The following properties must be filled at PLC cards that represent modules and / or racks:

ID	Property
20427	Rack at a rack
20410	PLC card is placed on rack ID at modules on a rack
20411	Position (slot / module) at modules on a rack. As a rule this field remains empty at racks or head stations.

EPLAN assumes that devices on the same rack are connected by means of a "backplane".
This is not configured separately.

Tip:

Use the "edit in table" function to achieve effective editing of the specifications. Special schemes are available here.

3.1.1. Head station

A **head station** is identified by being a rack and either has the **Bus coupler / head station** check box, is not placed on a rack, or the **CPU** check box is activated.

PLC cards which are directly placed on the head station or are integrated into it, are identified by the check box **PLC card is placed on head station**. For the corresponding position on the head station, the **Position (slot / module)** property is used.

For PLC cards that are adjoined next to the head station the **PLC card is placed on head station** check box remains deactivated. For the corresponding position next to the head station, the **Position (slot / module)** property is used.

The **PLC card is placed on head station** property is used during PLC data exchange in AutomationML format.

3.1.2. Extension racks

Extension racks have to be connected with the main rack via bus ports. Enter the configuration project that belongs to the PLC box, use the "Local-Bus: Extension" bus system at the bus port (see also chapter "[Connections between racks](#)"). Further properties are not required in the AutomationML format. Activate the **Ignore missing bus ID** check box at the bus port to suppress the error checking [004037](#).

3.1.3. Passive devices

Passive devices as well as devices that should not or cannot be exchanged with the PLC configuration program can be used for the configuration of the network structure.

1. Terminals, pins: To do so activate the **Net-connecting** check box on the **Symbol / function data** tab.
2. Passive switches, bus repeaters, and similar units:
 - a) When using a PLC box: The **PLC structure data** tab remains completely empty, no PLC-specific properties are required.
 - b) When using a black box: The settings for bus capable devices are not required and remain empty. Details on the individual properties can also be found in the TechTip "**TechTip-Overview-of-the-PLC-properties**", Chapter "Settings at bus-capable devices".
 - c) Bus ports are configured as "Network / Bus cable connection points, switch connection point". Since these bus ports are treated as busbar connection points, no specifications are required on the **Bus data** tab.

The network structure is exported in the AutomationML format. However, the port-specific interconnection is missing.

3.2. I/O interconnection

Place the I/O connection points with the associated sensors / actuators on multi-line schematic pages.

Use bitwise representation (meaning one macro per channel) with functional grouping of the devices.

Advantages:

1. Once macros have been created they can be used repeatedly for similar machine functions.
2. I/O connection points or channels can be placed via drag & drop from the PLC navigator or assigned.
3. You can check the assignment in the PLC navigator or on a PLC overview page.

3.3. Network structure

Connect the single-line bus ports of the modules via autoconnecting. Bus ports are by default net-connecting and signal-transmitting.

Advantages:

1. The network structure can be documented clearly by connecting the single-line bus ports.
2. The network structure can be exchanged with PLC configuration programs. The logical view (association of the devices to networks), is always exchanged. The export / import of the exact cabling depends on the bus system and the exchange format used.

The following properties have to be filled at the bus ports:

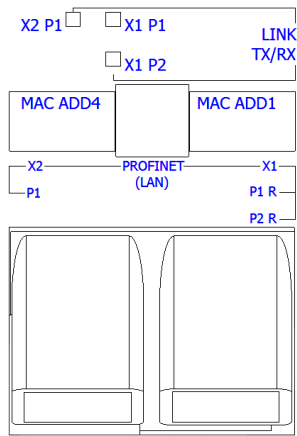
ID	Property
20406	Plug designation
20308	Bus system
20311	Physical network: Bus ID / item number
20413	Physical network: Name
20414	Logical network: Name
20447	Bus interface: Name at Ethernet-based bus systems

For the bus ports the **Plug designation** is identifying together with the **Bus interface: Name** property.

In Ethernet-based bus systems, associated bus ports are combined to a bus interface via the bus interface name. You can recognize this by the respective specifications in the manual or through labels on the PLC card.

You can find an exact overview of the properties to be filled for the PLC data exchange in AutomationML format in the chapter "[Settings for different bus systems](#)".

Example "6ES7516-3AN01-0AB0" of SIEMENS



This PLC card has three bus ports for Ethernet-based bus systems:

Connection point	Plug designation	Bus interface: Name
1	P1 R	X1
2	P2 R	X1
3	P1	X2

In the process the connection points 1 and 2 form a bus interface, connection point 3 forms a second bus interface.

Identify connection point 1 and connection point 3 as **Bus interface: Main bus port** and enter the relevant bus data here.

EPLAN treats the following bus systems equivalently during exporting / importing, because they have the same hardware topology (Ethernet-based bus systems):

- CC-Link IE
- CC-Link IE Control
- CC-Link IE Field
- CC-Link IE Field Basic
- EtherCAT
- Ethernet
- EtherNet/IP
- Modbus TCP
- Powerlink
- PROFINET
- SSCNET III
- SERCOS III
- VARAN

Special features of the bus systems "Local-Bus: Extension", "DRIVE-CLiQ", "PortToPort" and "ET connection"

- These bus systems do not form a network.
- For these bus systems only the connection between the bus ports is exported (port-specific interconnection).
- The property **Bus interface: Name** (ID 20447) must be identical at all associated bus ports of a device, an empty entry is permissible as well here.
- No bus address is required. The associated check run [004037](#) can be suppressed by activating the property **Ignore missing bus ID** (ID 20412) for this bus port.

Note:

A port-specific interconnection is only exported in the AutomationML format. If necessary, you can deactivate this setting in the [Settings: AutomationML export](#) dialog.

3.3.1. Connections between racks

Use the bus ports of the type "Network / bus cable connection point, general" for the connection of racks with each other. The "Local-Bus: Extension" bus system must be set at these bus ports.

In addition take into account the special features described in the previous section for the bus system "Local Bus: Extension".

3.3.2. Automatic connections between associated bus ports

Network / bus cable connection points of the type "Network / bus cable connection point, general" are considered as belonging together and are automatically connected to each other through an internal connection if they have the same DT, belong to the same bus system and have the same *bus interface name*. Enter further data, such as **Physical network: Bus ID / item number** only at the main bus port of the bus interface.

Note:

A "Network / bus cable connection point, general" with empty bus interface name cannot establish an internal connection to another "Network / bus cable connection point, general".

The check run [004040](#) can be used to find contradictory data.

Note:

During a PLC data exchange in *AutomationML format* bus ports within the same bus system and the same physical network (property **Physical network: Name**) are considered as being connected to each other even if their DTs differ. This is, however, not evident during net tracking. The check run [004104](#) reports such bus ports as not being connected to each other. This message can be ignored if the network structure was consciously configured like this due to the physical conditions.

It is mandatory that the following properties be filled at the PLC bus port:

ID	Property
20161	Configuration project *
20006	DT
20406	Plug designation
20308	Bus system
20447	Bus interface: Name **

*: Can also be empty during the data export in AutomationML format. In this case the configuration project from the associated PLC box is applied.

** : Must always be filled for Ethernet-based bus systems, for other bus systems only if automatic connections are to be generated between general network / bus cable connection points.

The check run 004040 outputs a message if one of the following properties is different:

ID	Property
20413	Physical network: Name
20414	Logical network: Name
20310	Logical network: Bus port is master
20311	Physical network: Bus ID / item number
20386	Physical network: Bus ID / item number 2
20309	DNS/PROFINET device name
20313	Data transfer rate
20289	Integrated module
20334	MasterSystemID
20312	Subslot

ID	Property
20186	Marked for deletion
20446	Subnet mask

A check is carried out if the property to be checked is not empty at the second bus port.

If the property to be checked is empty at the first bus port and is filled at the second bus port, a message is also output.

4. Export from EPLAN

Before the export from EPLAN:

1. Check the project by means of the check runs from the 004 range. EPLAN makes schemes available to you here that you use or adjust according to your requirements.
2. Delete the data not required at the auxiliary function (**Project > Organize > Compress > Settings > Remove project data > Remove PLC structure data at PLC auxiliary functions**).
3. For optimal PLC data exchange, always configure *all I/O connection points and bus ports* of a device, even if nothing is connected to them.

4.1. Hardware data

1. The EPLAN export references a **configuration project** that is specified at all the associated PLC boxes and bus ports.
2. The bus ports are represented in single-line and are connected with each other. During the PLC data exchange in the AutomationML format, multi-line representations and bus ports connected to each other are also taken into consideration.
3. A device is identified with the **CPU** property (check box is activated). The full **CPU name** in the form [Configuration project].[Station ID].[CPU identifier] must be unique project-wide.

4. The [device identification](#) is effected by means of
 - a) the **PLC type designation** property or
 - b) a device description file (e.g. GSD / GSDML / EDS file, property **Device description: File name** property) and the **Object description** or
 - c) a device description file (e.g. GSD / GSDML / EDS file, property **Device description: File name property**) and the **Device description: Index in the file** at the data exchange in AutomationML format.

The **PLC type designation** as a rule corresponds to the order number in the hardware catalog of the respective PLC configuration program. The exact spelling is important.

Each PLC card can only have **one** device identification. A combination of several parts by entering several PLC type designations, device description files or indexes is not supported.

PLC connection points of the following categories are not exchanged:

- General
- 2 connection points
- Power supply
- Card power supply.

4.2. Assignment list

A PLC connection point (input / output) existing in a assignment list (symbol table) is exported if the following conditions are fulfilled:

1. Only PLC connection points with the following function definitions are exchanged:
 - a. PLC connection point, DI
 - b. PLC connection point, DO
 - c. PLC connection point, AI
 - d. PLC connection point, AO
 - e. PLC connection point, multi-function with the type of signal
 - Digital input
 - Digital output
 - Analog input
 - Analog output

(Exception: PLC standard exchange format, all PLC connection points are exchanged here)

2. A PLC connection point, multi-function is treated with its logic like the corresponding I/O connection. For example
PLC connection point, multi-function, type of signal digital input corresponds to *PLC connection point, DI*
3. A CPU exists in a configuration project.
4. The **symbolic address** is specified. The symbolic address must be unique within a CPU.
5. The **Data type** (Boolean, byte, etc.) is specified.
6. The associated PLC box is assigned to a CPU by specifying the [CPU: Name](#) property. The correct and complete specification of the CPU name at the PLC box is required so that the assignment list (designation in the AutomationML format: "TagTable") can be completely exported.

5. Import in EPLAN

During importing EPLAN supplements item data such as inputs / outputs from the parts data.

1. The [device identification](#) is effected by means of
 - a) the **PLC type designation** property or
 - b) a GSD / GSDML / EDS file (**Device description: File name** property) and the **Object description** or
 - c) a GSD / GSDML / EDS file (**Device description: File name** property) and the **Device description: Index in file** at the data exchange in AutomationML format.
2. If items with placeholder characters (such as "*" and "?") are found in the PLC type designation in the parts database during an import into EPLAN, the first suitable part is used (PLC configuration programs do not always differentiate between parts that are equivalent electrotechnically).
3. If multiple parts with the same **PLC type designation** are found during the import in EPLAN, the first of those parts with the matching **Object description** (in as far as this import file is available) is assigned. If no part has a matching object description, the first found part is assigned.
4. If no appropriate part is found, a simple PLC box is created.

In these cases messages are output so that the imported devices can be checked subsequently.

Device and PLC connection points that are available in the project but not in the import file, have the **Marked for deletion** property assigned during import. These objects can be filtered in the PLC navigator and subsequently be edited. Deactivate this property after the check or editing.

6. Recommendation for preparation of the master data

EPLAN recommends prepared macros for standardization. In many cases you can obtain the parts and part macros from the EPLAN Data Portal. It is nevertheless possible that a used PLC card is not available there. In this case you have to create the required parts and macros yourself.

The TechTip "**TechTip-Preparation-of-master-data-for-PLC-data-exchange**" is available as an aid. It contains additional information on editing parts data and the creation of macros.

7. AutomationML

Details on the individual properties can be found in the TechTip "**TechTip-Overview-of-the-PLC-properties**".

Free symbolic addresses (which are not assigned to any PLC connection point) can be exported and imported in AutomationML format via the PLC data exchange. After the import of an AutomationML file, the free symbolic addresses existing there are available in EPLAN.

Exporting in the AutomationML format can be carried out either in the AML version 1.0.0 or in the AML version 1.1.0.

New features in the export format of AML version 1.1.0:

- Longer device tags can now be replaced thanks to extensions in the AML file.
- An improved exchange of free symbolic addresses is now possible through extensions in the assignment list.
- The assignment of the PLC cards to your CPUs is now replaced. This way you can restore the association of the PLC card to "its" CPU during the data exchange.
- The bus systems "DRIVE-CLiQ", "PortToPort" and "ET connection" are now correctly replaced with port-specific interconnection.
- The connections between racks are now exchanged with port-specific interconnection.
- Safety addresses at the bus systems are now exchanged.
- You can now replace the manufacturer name at the devices. In EPLAN the manufacturer name is saved in the part reference data.

The following sections contain information about the bus systems and special features of different devices.

7.1. Settings for different bus systems

The following table provides an overview of the properties relevant for the PLC data exchange in the AutomationML format. Which properties at the bus ports must be filled (x), should be filled or are optional (o) depends on the bus system being used.

ID	Property	Bus system				
		Ethernet-based	PROFIBUS DP	ASI	DRIVE-CLiQ PortToPort ET connection Local-Bus: Extension	All others
20161	Configuration project	o ^{*1}	o ^{*1}	o ^{*1}	o ^{*1}	o ^{*1}
20308	Bus system	x	x	x	x	x
20406	Plug designation	x	x	x	x	x
20447	Bus interface: Name	x				
20448	Bus interface: Main bus port	o				
20413	Physical network: Name	o	o	o		o
20311	Physical network: Bus ID / item number	o	o	o		o
20386	Physical network: Bus ID / item number 2			o ^{*2}		
20446	Subnet mask	o				
20414	Logical network: Name	o	o			
20310	Logical network: Bus port is master	o	o			
20412	Ignore missing bus ID				o ^{*3}	

*1: Only required if the value deviates from that of the associated PLC box.

*2: Can be filled if it is an ASI dual device.

*3: Can be activated to ignore bus ports that do not require a bus address during the execution of the [004037](#) error checking.

Non-identified fields are not required for the PLC data exchange. If the optional fields (o) are left empty, the import to the PLC configuration program is possible but post-processing is required.

Note:

The properties [Logical network: Name](#) and **Logical network: Bus port is master** specify the affiliation of a station to a DP master or IO controller.

Within an IO system, there is always a master that is designated through the check box **Logical network: Bus port is master**.

7.2. PC station

1. The PC is a separate station and is configured as Rack "0". All other fields of the rack assignment remain empty.
2. The **Bus coupler / head station** check box is to be activated.

7.3. Switches

1. The switch is an own station and is configured as **Rack "0"**. All other fields of the rack assignment remain empty.
2. The **Bus coupler / head station** check box is to be activated.
3. Bus ports:
All bus ports have the function definition "Network / bus cable connection point, general" and have the same bus interface names.
 - a) All the required interface data are entered at the bus port that represents the input (including **Physical network: Bus ID / item number**, **Bus interface: Main bus port**)
 - b) At all other bus ports the specifications **Physical network: Name**, **Logical network: Name** and **Physical network: Bus ID / item number**, amongst others, can be empty.

Example "SCALANCE X200IRT" of SIEMENS

Settings at PLC box

ID	Property	Value
20416	PLC type designation	6GK5 204-0BA00-2BA3
20409	PLC station type	Scalance/X200IRT

Settings at the bus ports

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.

7.4. Bus adapter

Stations of the ET200SP type or similar or of a SCALANCE router require bus adapters (media modules) to which the network connections are connected.

In the case of these devices with adapter shafts for the bus ports, the function templates for the bus ports must be entered at the respective bus adapter. Two parts must be created to this purpose in the parts management:

1. The device with the adapter shafts only has one function template for the PLC box (main function) and if necessary further function templates for PLC inputs and outputs.
2. The "Bus adapter" device has one function template for the PLC box (main function) as well as function templates for the bus ports.

Ensure that if the bus adapter is used on a head station, the check box **PLC card is placed on head station** (ID 20444) is activated in the device properties (**PLC structure data** tab) at a bus adapter.

In addition the device identification for the device with the adapter ducts and the "Bus adapter" device must be carried out in the same way. Either both must be identified by means of the PLC type designation or both through the specification of a device description file.

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	<input checked="" type="checkbox"/>

Settings at the bus ports

20447	Bus interface: Name	X1 (for all bus ports at all adapters)
20406	Plug designation	Px R, for all bus ports, whereby x = 1 ... Number of bus ports, the method of counting is non-adapter-specific

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

7.5. PLC subdevices

Specific PLC devices consist of several integrated modules that each have their own [Address ranges](#) and start addresses. Such a device can consist, for example, of an internal CPU module, an internal input / output module as well as internal counter module - however with only one part number. Such integrated modules within a PLC device can be displayed in EPLAN with PLC subdevices. To this purpose up to twelve PLC subdevices are available. Each PLC subdevice is defined by the corresponding properties (x in the following describes the number of PLC subdevice 1...12). You can find further information in the online help in the section "[PLC subdevices](#)" as well as in the TechTip "**TechTip-Preparation-of-master-data-for-PLC-data-exchange**" in the chapter "PLC devices with subdevices".

PLC subdevices are exported if they have at least one start address or one bus port or one I/O connection point or one [Device identification](#).

Note:

If a PLC card has no PLC subdevices (meaning that it only consists of one module), definitions for these can be omitted. The value "0" is entered at the **PLC subdevice: Index** property at the associated PLC connection points.

You obtain further information on the definition of PLC subdevices from your PLC manufacturer or in the TechTip "**TechTip-Configuring-PLC-devices-with-device-description-files**".

7.6. Accessories

A PLC card can have accessories.
The requirement for a data exchange is:

- The accessory is defined in the parts management.
- The accessory has a PLC type designation.
- The number of units used is larger than 0.

Note:

If necessary, you can deactivate the export of the accessories in the [Settings: AutomationML export](#) dialog.

7.7. Device sets ("Bundles")

Device sets (so called "Bundles", meaning bundles that consist of different devices) are not supported by all PLC configuration programs (for example SIEMENS STEP 7 TIA Portal). In this case the device set for the PLC data exchange must be broken up by configuring the devices contained in the device set individually with the associated device identification.

8. Check of the PLC configuration project

All devices that are to be exported or imported via PLC data exchange, require the following structure:

1. **Configuration project** → This is the main node.
2. **Station ID** → A grouping element.
3. **Rack** → If the device is used as the basis for other devices, this property has to be filled numerically.
A rack is numbered consecutively with the **Rack** property.
A CPU or a bus coupler is numbered consecutively with a **Rack** if the device itself is not placed on a rack.
PLC devices that can add other PLC devices are also numbered consecutively with **Rack**.
4. All PLC devices that are placed on a rack or assigned to a rack receive the number of the rack via the **PLC card is placed on rack ID** property.
5. If the **PLC card is placed on rack ID** property is filled, the position at which the device is located has to be defined. This is done via the **Position (slot / module) property**.

8.1. Check via message management

When checking the PLC configuration project, you are supported by check runs. In most cases the "PLC data exchange (Mitsubishi)" run scheme can be used. For adjustments of the check runs a copy of this scheme is recommended.

This check increases the quality of the project and helps with error prevention.