TechTip: PLC data exchange with Beckhoff TwinCAT3

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1. Use

This TechTip contains additional information on data exchange with Beckhoff TwinCAT3 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".

2. Beckhoff TwinCAT3

1. The **PLC type designation** as a rule consists of a two-digit character combination and a four-digit numerical combination.

2. The **Symbolic address** complies with IEC 61131 and may not contain special characters such as umlauts or double underlines.

3. 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.

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

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

6. Each stations begins with a bus coupler or a CPU. The associated check boxes (**CPU** or **Bus coupler / head station**) have to be activated here. The **Rack** property has to be filled with the value 0.

7. Each station has exactly one rack.

8. The bus ports of the backplane are not drawn exactly. The following PLC cards are assigned to the CPU or the bus coupler, the **PLC card is placed on rack ID** property has be filled with the value 0.

9. For EtherCAT the bus port "Network / bus cable connection point, general" is used. The **Logical network: Bus port is master** check box must be activated at the bus port at which the bundle begins.
   The **Physical network: Bus ID / item number** property is not used for the "EtherCAT" bus system. The associated check run 004037 can be suppressed by activating the property **Ignore missing bus ID** (ID 20412) for this bus port.
   The sequence of the bus ports is determined on the basis of the connections of the bus nodes. Therefore it is essential to configure the connections between the bus ports and activate the option **Export port-specific interconnection** in the dialog **Export PLC data**.

3. Recommended procedure for the switchover from TwinCAT2 to TwinCAT3

3.1. Allocation of the racks to stations

A station in TwinCAT3 encompasses includes all components that are connected to each other with a backplane bus.
The common backplane bus with its bus ports is - as in the past - not configured but results from the rack structure.
EtherCAT and KBus systems have exactly one rack in each station.

By means of the editing in tables it is easily possible to allocate all PLC cards to stations and racks.

To this purpose use the PLC navigator with the "Main functions" filter. Select the PLC boxes to be edited and start the editing in tables via the popup menu. Here you select the "Rack" scheme.

Supplement or correct the values at the following properties:

ID	Property	Value
20161	**Configuration project**	Not empty, for example `Project1`
20408	**PLC station: ID**	Not empty, enter the same value at all PLC boxes belonging to one station
20427	**Rack**	`0`, if the PLC card is a **CPU** or a **Bus coupler / head station**, otherwise the property remains empty
20410	**PLC card is placed on rack ID**	`0`, if the PLC card is not a **CPU** and not a **Bus coupler / head station**, otherwise the property remains empty
20411	**Position (slot / module)**	Not empty, numerical value, beginning with `1`
20253 [1]	**CPU name [1]**	Not empty, for example `Project1.S0.1` The complete CPU name in the form `[Configuration project].[Station ID].[CPU identifier]` must be unique project-wide.

22020	**CPU**	Activated at the CPU
20164	**Bus coupler / head station**	Activated at all bus couplers

Properties at the PLC boxes which are not used in the AutomationML AR APC format anymore:

ID	Property
20308	**Bus system**
20311	**Physical network: Bus ID / item number**

3.2. Handling of the CPU

During the data exchange with TwinCAT2 it was often necessary that the CPU had to be configured as a PLC box with the **PLC type designation** `ETHERCATPROT` together with a bus coupler, for example the **PLC type designation** `EK1100`. In reality, through, this is a single device with only one order number.

This special feature is not required anymore during the PLC data exchange with TwinCAT3 in the AutomationML AR APC format. Therefore you have to delete the superfluous bus coupler with its bus ports from the project.

The EtherCAT bus system now begins directly at the CPU.

The CPU itself is as described above configured as a simple PLC box, the values `ETHERCATPROT` and `I/O – Configuration` are not required and used in the AutomationML AR APC format anymore.

3.3. Bus ports and network structure

To edit the bus ports and network structures use the PLC navigator with the "Bus port" filter. Now select the bus ports to be edited and start the editing in tables via the popup menu. Here you select the "PLC bus data" scheme.

ID	Property	Value
20026	Function definition	`Network / bus cable connection point, general` Please note that a bus port (port / plug) has only **one** function definition.
20406	Plug designation	Not empty, for example `X001`, `X1`, `X2 OUT`
20447	Bus interface: Name	Not empty for EtherCAT components, e.g. `EC1`, `EC2`, `LAN1`
20448	Bus interface: Main bus port	Activated at the first bus port within a bus interface.
20308	Bus system	`EtherCAT`
20413	Physical network: Name	Not empty
20414	Logical network: Name	Not empty
20310	Logical network: Bus port is master	Activated at the first bus port of an EtherCAT network

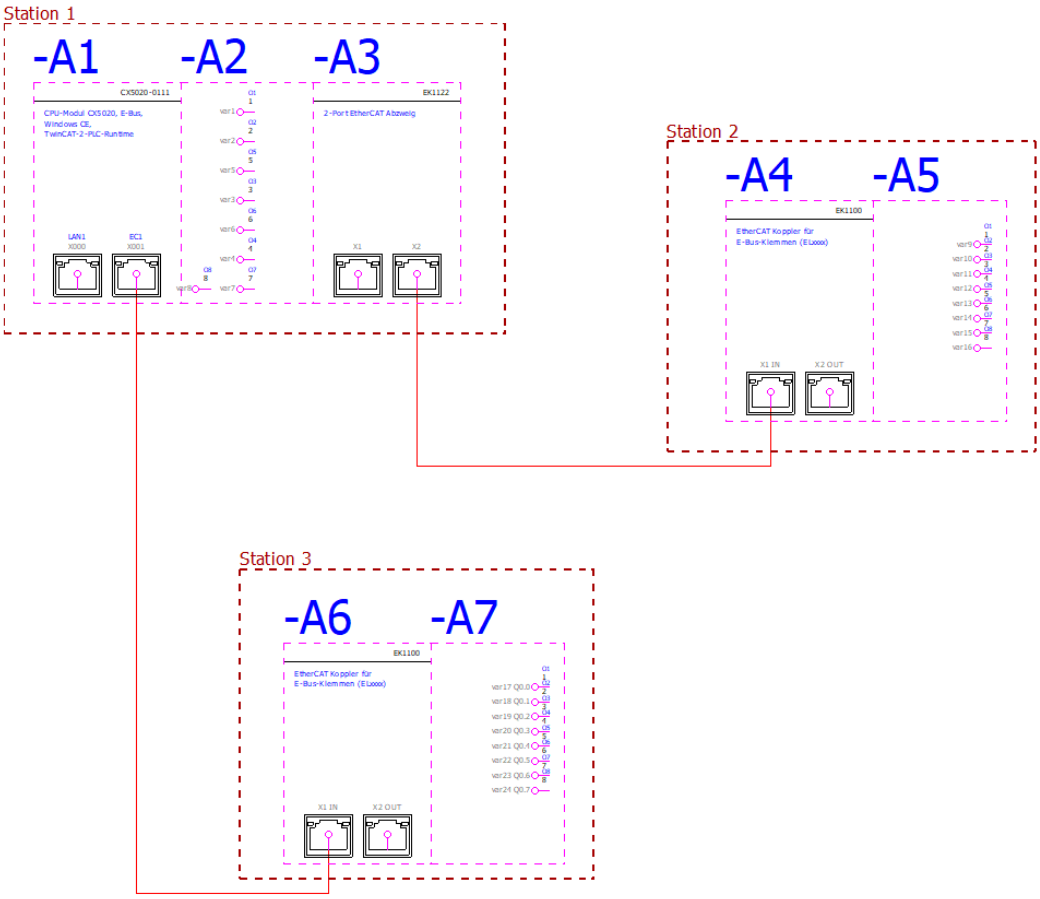
Properties at the bus ports which are not used in the AutomationML AR APC format anymore:

ID	Property
20428	Channel designation

Please note that each EtherCAT network in TwinCAT 3 has its own topology view. The display of the physical structure, as displayed in Eplan, cannot always be displayed in one individual topology view in TwinCAT3 - dependent on the respective hardware. Information about the affected hardware can be obtained from Beckhoff. See also the configuration example from the Beckhoff manual "TC3 AML data exchange".

4. Configuration example from the Beckhoff manual "TC3 AML data exchange"

The hardware used in the Beckhoff manual contains three stations.
This corresponds to the following display in Eplan Electric P8:



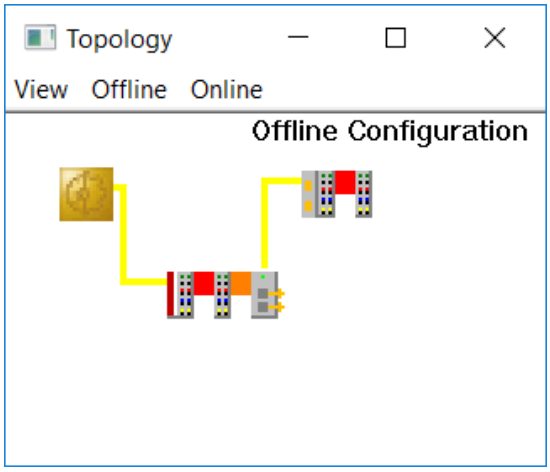
If multiple EtherCAT networks exist in a project, it is required that all networks are additionally defined as logical networks.

To do this for the example above, the **Logical network: Bus port is master** property must be activated:

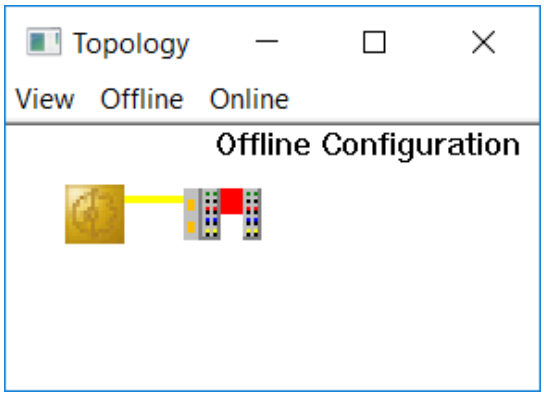
- At the bus port `EC1X2` of the bus coupler `-A3` for the connection between `Station 1` and `Station 2`.
- At the bus port `EC1X001` of the embedded PC `-A1` for the connection between `Station 1` and `Station 3`.

In TwinCAT 3 the individual EtherCAT networks are displayed in different topology views:

- Topology view of `Station 1` and `Station 2`



- Topology view of `Station 1` and `Station 3`



The embedded PC `CX5020` (`-A1`) is displayed within TwinCAT 3 only through the internally installed interface card `EK1200-5000`.

5. Differences between TwinCAT3 and TwinCAT2

The following properties that were used with TwinCAT2 are not used anymore for the PLC data exchange with TwinCAT3:

At PLC boxes

ID	Property
20308	Bus system
20311	Physical network: Bus ID / item number

At bus ports

ID	Property
20428	Channel designation