SIEMENS

Automation Designer

Getting Started

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Division Digital Factory
Postfach 48 48
90026 NÜRNBERG
GERMANY

℗ 08/2016 Subject to change

Table of contents

Concepts

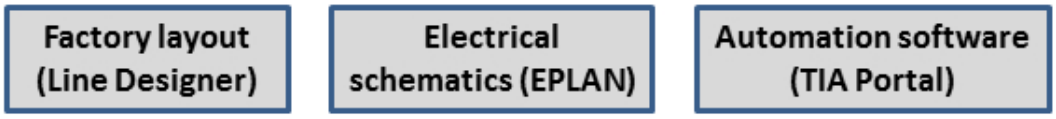
1

1.1 Traditional engineering versus integrated engineering

Traditional engineering

Traditional engineering workflows include

1. Factory layout and line design using Line Designer to design a production line.
2. Electrical engineering using EPLAN to generate schematics for the production line.
3. Automation using TIA Portal to generate PLC software and tags for specific PLC hardware.

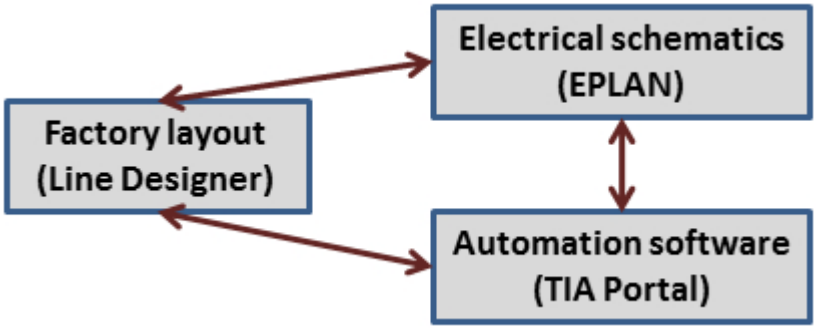


The tools are not linked, leading to the following problems:

1. The Line Designer, EPLAN, and TIA Portal designers must manually synchronize their configurations.
2. TIA Portal software and tag names have no relationship to EPLAN schematic variables.
3. EPLAN and TIA Portal components that repeat (such as conveyors) must be created individually.

Integrated engineering with Automation Designer

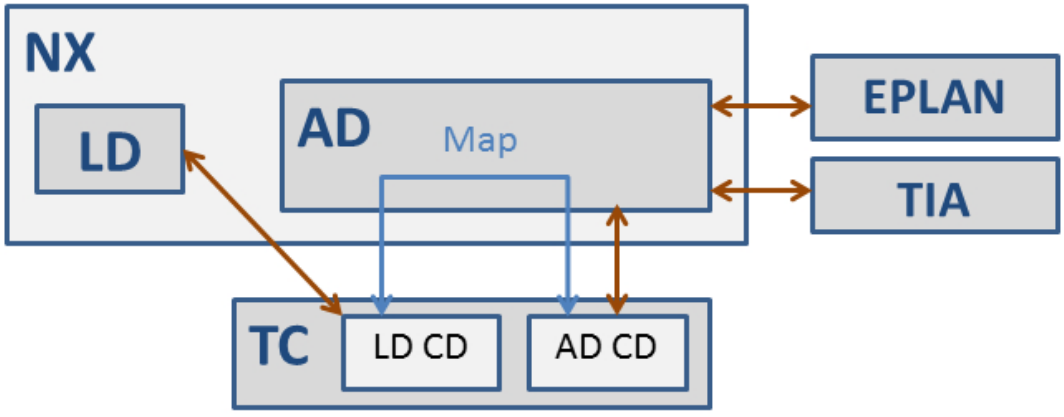
Automation Designer solves the problems above by linking to the above tools to provide centralized functional automation engineering.02d_02



The Automation Designer solution allows you to

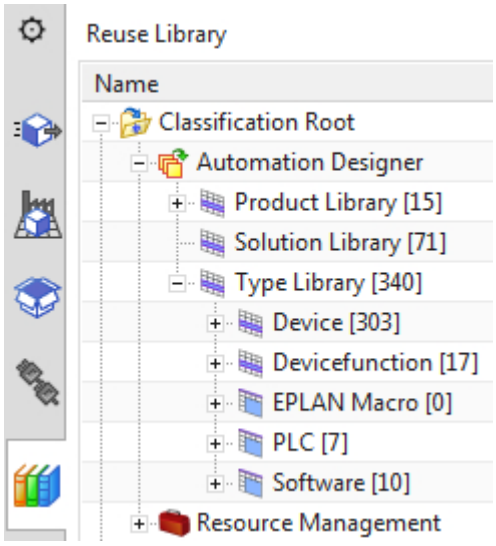
1. Easily determine when the Line Designer configuration is not synchronized with the Automation Designer configuration used to generate EPLAN and TIA Portal.
2. Derive EPLAN macro variables and TIA Portal software and tag names from the same source (from the Engineering Object aspect chain in Automation Designer).
3. Use templates to quickly create TIA Portal software and EPLAN reports for common components (conveyors in this Getting Started). Instantiated templates are automatically assigned unique names as specified in naming rules.

The following diagram shows in more detail how Automation Designer based on NX serves as the central development tool for the entire project lifecycle for mechanics (Line Designer), electrical (EPLAN) and automation (TIA Portal). The two TeamCenter Collaborative Designs are the central project databases for Line Designer and EPLAN/TIA Portal. You can link (map) Line Designer Collaborative Design Design Elements and Automation Designer Collaborative Design Engineering Objects (Design Elements are described in the next section). In this Getting Started the linked Design Element and Engineering Object represent a conveyor.



1.2 Reuse library

Automation Designer distinguishes between library objects and project objects. Project objects are Engineering Objects.

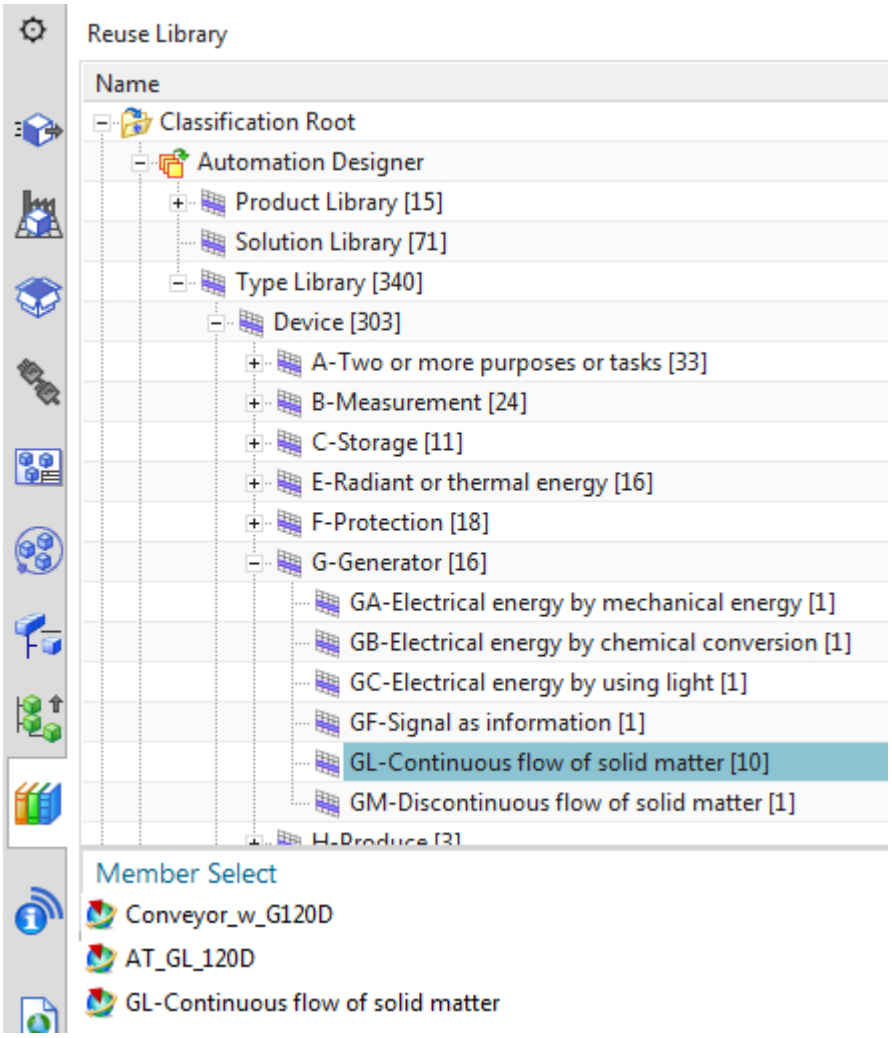


The Reuse Library provides the following objects.

- Types
  Types are prototypes for Engineering Objects. They are made available in the Type Libary, where they are structured based on their classification classes. Objects with the same Type have the same characteristics.
  Availability in the Reuse Library: **Classification Root→Automation Designer→Type Library→Device** or **Devicefunction**
- Products
  Products are purchasable devices from a manufacturer. They have an article number.
  Library administrators can import products from catalogs.
  Availability in the Reuse Library: **Classification Root→Automation Designer→Product Library**
- Template Solutions
  Templates are reusable solutions that consist of several preconfigured objects.
  Every library object has a Classification Class.

Engineering Objects

The following diagram shows Engineering Objects in the Reuse Library.



Engineering Objects are project objects. *Engineering Objects* are the physical and conceptual objects with which you carry out the electrical and automation engineering of a production system or machine in your projects.

To implement a machine or production system, you need the following Engineering Objects:

- Devices and device functions
  For example conveyors, motors, frequency converters, sensors, and signal converters.
- Objects for structuring the system
  For example a line, station, or building.
- EPLAN macros for preparing the generation of electrical schematics
- Program blocks whose code controls the devices and device functions

An Engineering Object can be general or very specific, depending on the number and quality of properties defined by its Type. The more details were provided, the easier it is for you so select a suitable product for a device or devicefunction from the Product Library.

Relation between Classification Class, Type, and Engineering Object

Classification Classes represent the classes and subclasses of the objects that you need for your engineering as proposed by the IEC 81346 standard, part 2. These classes have a purpose- or task-related view of the objects. By creating Naming Rules, you can associate a character code to each Classification Class, to be used for the Engineering Objects' reference designations.

When library administrators create a Type, they must specify the Type's Classification Class. The class defines which properties the Type has by default. The library administrator can add further properties.

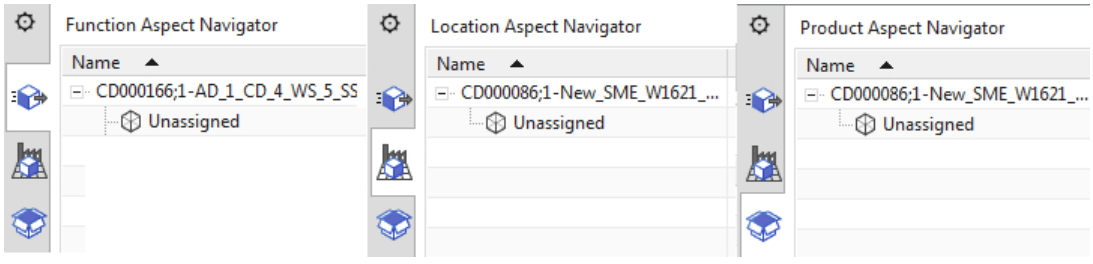
Project engineers can use each Type in their projects as many times as required, by inserting Engineering Objects with this Type. The Engineering Object will have the following data and defaults, as defined by its Type:

- Properties
- Ports
- Default aspects
- Which Line Designer should be used for this Type in Automation Designer (multidisciplinary type mapping)
- Settings for a label which appears in the graphics window if the object is mapped to an Line Designer object.

Project engineers can edit the properties and ports that an Engineering Object takes over from its Type, and they can add new ones. They can add or remove aspects, and, for objects with a Line Designer type mapping, map the object to a Line Designer object with a different type.

Aspects

The following diagram shows the the 3 aspects.



The IEC 81346 standard describes principles for structuring and naming objects and their associated information in industrial systems, installations, equipment, and industrial products. The goal of these principles is to handle the large sets of information that are available in these systems efficiently. Aspects are a central part of these principles.

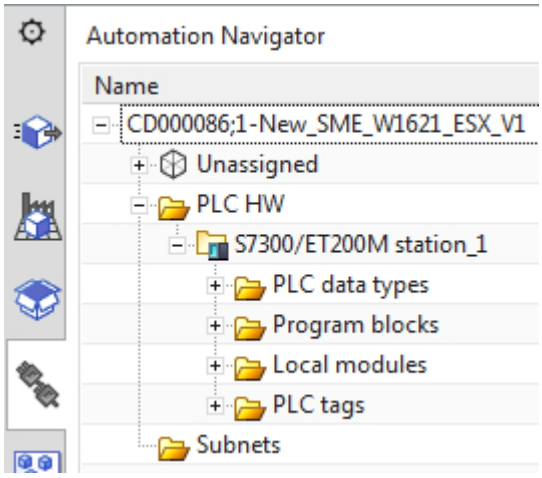
When you automate a production system or machine, you can look at the system or machine from different perspectives. Every engineering task requires a specific view of the machine or production system, of the physical and conceptual objects it takes to realize the machine or production system, and of the relations between these objects.

IEC 81346, part 1, calls these different views *aspects*. It defines the following aspects:

- Functional aspect: What is the functional purpose of an object within the production system or machine or what does the object actually do?
- Location aspect: Where in the production system or machine is the object installed, builtin, or placed, and is it in itself an installation place for other objects?
- Product aspect: Which products are needed and must be ordered to implement the intended function? What are their constructional relations?

You can view the same object under one or more aspects. For each aspect, you consider only those features and relations that are relevant for that specific aspect. The following diagram illustrates this, using the example of a programmable logic controller (PLC).

AD automation tab



The **Automation** Navigator is not an Aspect Navigator. It represents the TIA Portal view on the control-related hardware devices, tags, and program blocks of your production system or machine. Its structure is based on the TIA Portal structure and its object tree displays the same names as in TIA Portal.

When you import a hardware device from TIA Portal, it is initially available only in the **Automation Navigator**. By placing a product for the hardware device, you create an Engineering Object for the hardware device. Automation Designer links the hardware device and the Engineering Object, so that the hardware device is also available in the Aspect Navigators. When you select the hardware device, its Engineering Object is selected in all the Aspect Navigators in which it is available.

Program blocks that you imported to the **Automation** Navigator and tags that were created by importing their hardware devices or program blocks to the **Automation** Navigator are initially also available only in the **Automation** Navigator.

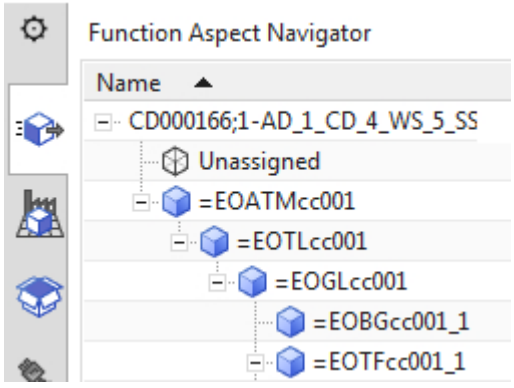
- If a program block is related to a specific Engineering Object, you can place it in one of the aspects that this Engineering Object has. It is then available in the corresponding Aspect Navigator.
- If a tag is related to a specific Engineering Object and you assign the tag to the Engineering Object, the tag is available in the same Aspect Navigators as that Engineering Object.

The project root of the Automation Navigator has the following structure:

- The Unassigned folder collects unassigned tags and program blocks.
- The PLC HW folder collects all the PLC stations of the project. Every PLC station has the following nodes:
  - The PLC modules folder collects the PLC station components. It contains the I/O modules of the PLC station, decentralized stations, or field devices. The channels are under their I/O module.
  - The PLC tags folder collects the tags that belong to the PLC station's control scope.
  - The Program blocks folder collects the program blocks that belong to the PLC s tation's control scope.

Engineering Objects in aspects

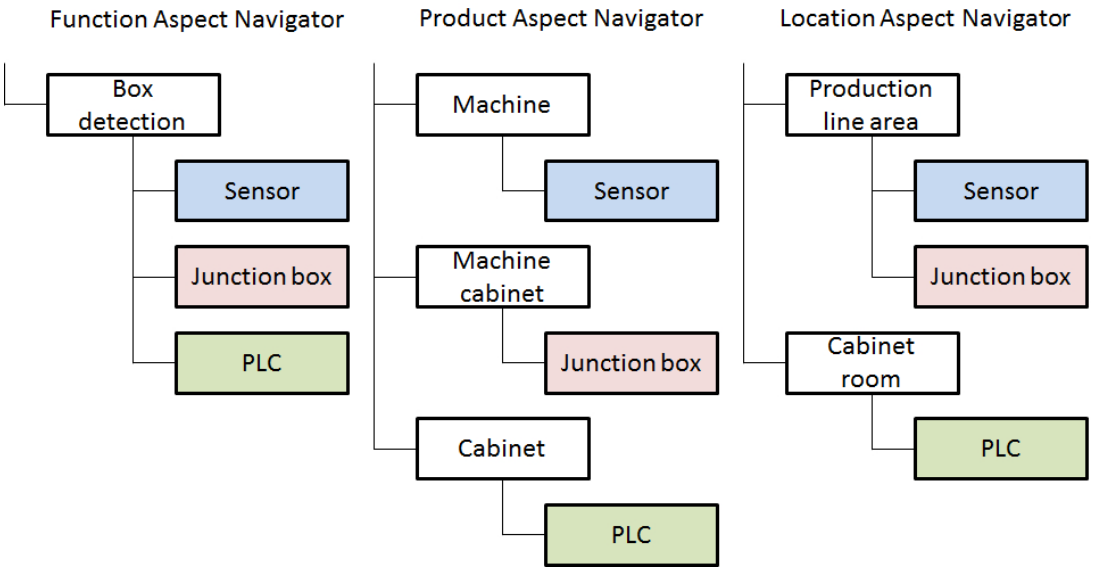
The following diagram shows the Function Aspect Navigator with Engineering Objects. The below configuration reflects the structure of the plant and Line Designer elements and is used to create symbolic names.



Each Engineering Object can have more than one aspect. If an Engineering Object has an aspect, it is visible in the corresponding Aspect Navigator. If an Engineering Object has several aspects, the same object is visible in more than one Aspect Navigator.

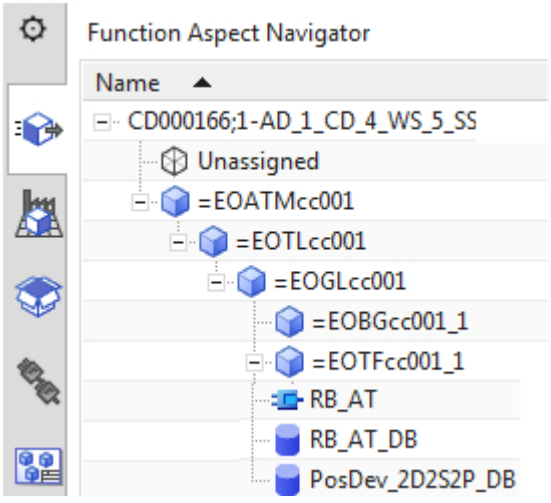
Because the hierarchical structure of objects in an Aspect Navigator depends on the aspect, the Engineering Object can have different parents and different children in each Aspect Navigator. This means that the hierarchical structures of objects in the Aspect Navigators are independent of each other.

The following example illustrates a sensor monitoring the movement of packaging boxes on a conveyor. When the sensor detects a box, it sends a signal to its PLC. The sensor and PLC are wired through a junction box. For each of these components there is one Engineering Object that has a function, location, and product aspect. In each Aspect Navigator, the objects have different parents and siblings.



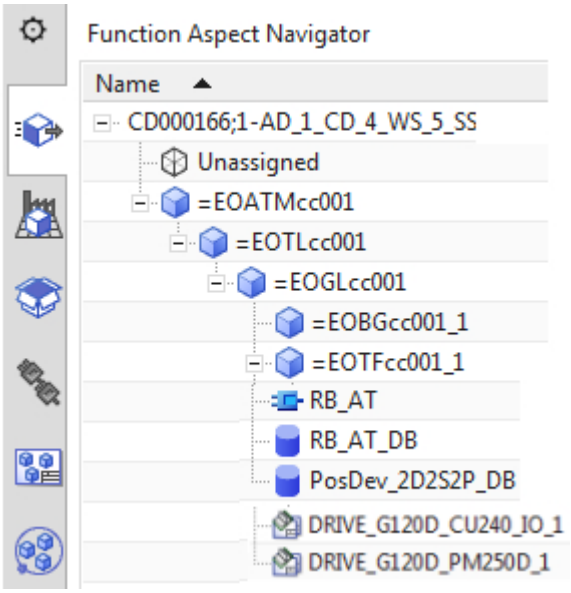
TIA Portal software in aspects

Software placed in the aspects under an Engineering Objecrt. This aspect chain above this Engineering Object is use to determine the the symbolic name (unique identifier) of the Engineering Objecrt. This name is then used to in TIA Portal software (using symbolic names for software and tag names). The software is later assigned to hardware in the Automation tab and then sent to the TIA Portal.



Macros in aspects

Software and macros are placed in the aspects under an Engineering Objecrt. This aspect chain above this Engineering Object is use to determine the the symbolic name (unique identifier) of the Engineering Objecrt. This name is then used to in EPLAN reports (using symbolic names for variables).



Ports and links

Sometimes the required symbolic reference does not belong to the parent Engineering Object of the software or macro, so you must create in the parent Engineering Object a link via a port between the parent and target Engineering Objects using ports.

Objects have vertical relations and horizontal relations to other objects.

• *Vertical relations* define parent-child relations in the Aspect Navigators.

• *Horizontal relations* are connections between ports. They do not define parent-child relations. They can connect objects from different navigators or in the same navigator.

Ports are a means of connecting objects. They are available for Engineering Objects and tags. You connect the port of one object, the source port, to the port of another object, the target port. This creates a bidirectional connection. *Connections* represent port-based relations between objects.

Every port belongs to the object for which it was created. It is an integral part of that object. Every port has a port type, connection type, direction, and cardinality. The port type determines which connection type the port can have. Automation Designer allows you to connect only ports with compatible settings.

If an object has a port connection, you can use navigation expressions to navigate to the conected port. Then you can use navigation expressions to access the following data of the connected object:

- Its properties
- Its ancestors and descendants in the Aspect Navigators
- Its port connections

You have recursive access to the properties, ancestors, descendants, and port connections of further objects.

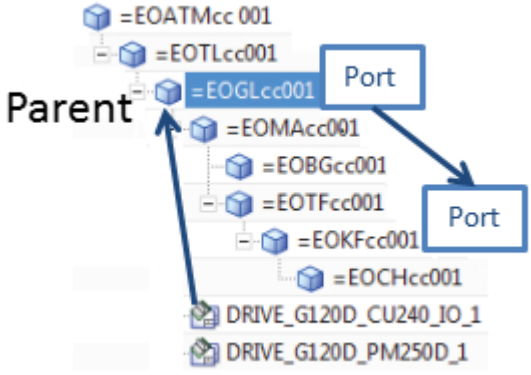
System-defined ports are automatically created by Automation Designer, either when you insert an object in a project, or when you carry out actions that internally require port

connections. You can connect or disconnect system-defined ports. You cannot create or delete them, or edit their settings.

User-defined ports are created by users. You can create, edit, connect, disconnect, and delete user-defined ports.

Tags have only system-defined ports. You cannot create ports at tags. Engineering Objects have system-defined and user-defined ports.

The solution is shown in the following diagram. The macros access Engineering Object KF using a link between a port on the parent GL and a KF port.



To configure this you do the following:

1. Create a port for parent Engineering Object GL.
2. Create a port for target Engineering Object KF.

Expressions

An *expression* is a formula that returns a value. The value can be of raw type, an object, or a list of objects or raw type values. The expression formula can consist of function calls, variables, numbers, operators, and symbols. Automation Designer extends NX functions with navigation functions. You use expressions to do the following:

- To set a property value. You can use navigation expressions or an expression that creates an object reference.
- To create a dynamic connection between objects. Use navigation expressions.
- In program blocks, to create dynamic connections for operand ports, caller ports, or method ports, and to define conditions for inserting calls, methods, or replacing operands.

A *dynamic connection* is a connection that you link to a navigation expression. The navigation expression returns the target port.

Templates

Templates are reusable, ready-made solutions that reduce the complexity of engineering decisions to choosing between prepared solutions. They allow you to take an engineering solution from one project and to reuse it in the same project and in other projects.

A template consists of all objects and aspects that are required to implement this solution, including EPLAN macros, program blocks, and tags. It defines the property values of these

objects and their relations, both within an aspect and between aspects. If required, templates can use expressions to define the properties and relations.

Templates exist in the Solution Library and in the projects in which they are reused. We use the term *template* if it is clear from the context whether template refers to a template in the library or to a template in a project. Else we use the terms *template definition* and *template usage*.

A *template definition* is the blueprint for an engineering solution that project engineers want to reuse in their projects. Template engineers create template definitions in the template environment, where they build the content of the template. This process is called template creation.

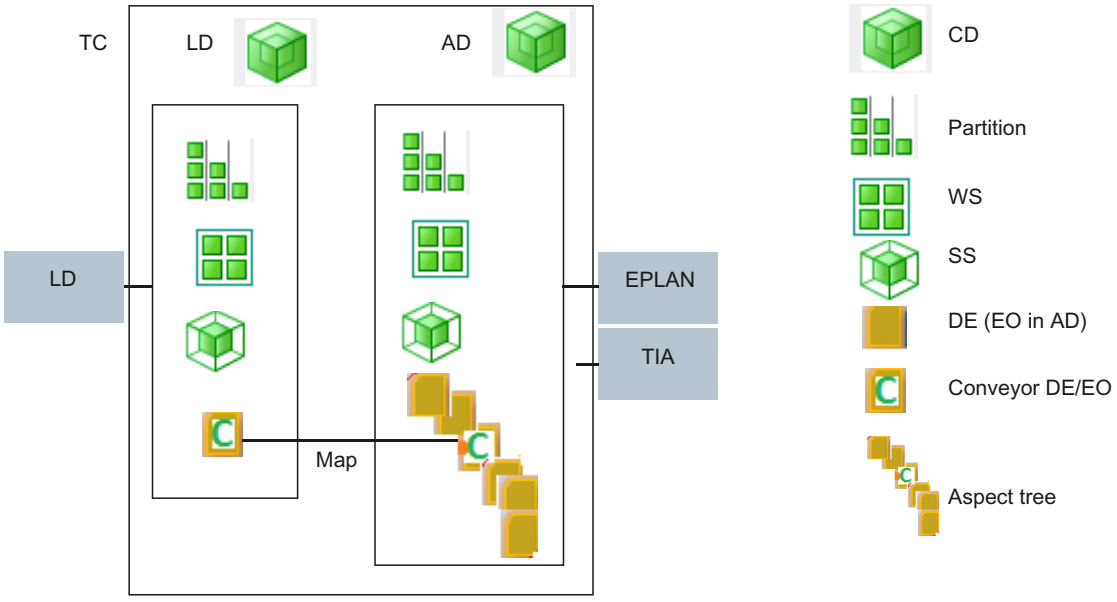
The template definitions are made available to the project engineers in the Solution Library and in the Type Library. In the projects, the project engineers can use each template as many times as required.

In Automation Designer, you can use rules and expressions to define or change the property values, tags, and relations of the hardware configuration, EPLAN macros, program blocks, and other objects that are members of a template. If the project environment changes, these property values, tags, and connections adapt to the changes and are updated automatically. This process increases the reusability of the templates.

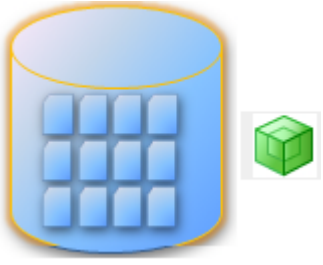
1.3 TeamCenter (4GD) details

This section provides a short introduction to the following 4GD components :

- Collaborative Design
- Partition scheme
- Partition
- Workset
- Subset
- Design element



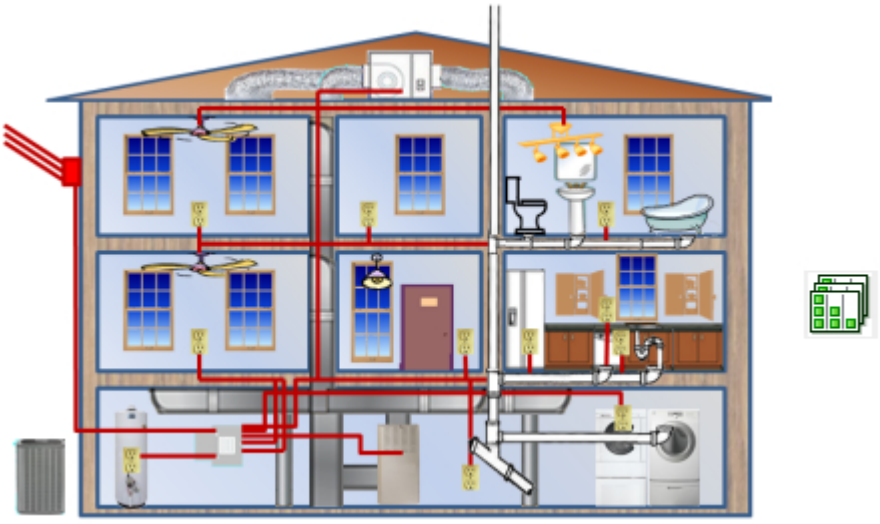
CD



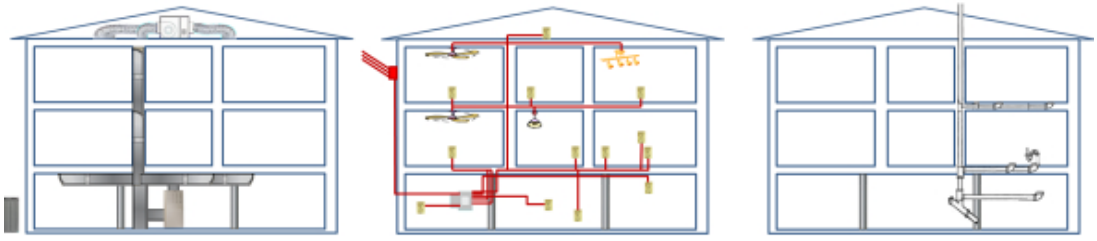
A collaborative design is a model of a project/product that is developed by a team of contributors. The elements of the model are arranged in a hierarchy that allows team members to collaborate and author common project/product information in an efficient manner. A CD is the container object in TC of all the design data that defines a product or a class of products.

Partition scheme

Partition schemes can be functional, spatial, or physical. Partitions are created within partition schemes. For example, in a 4GD design of this house, different types of partition schemes can be used to organize the design elements.



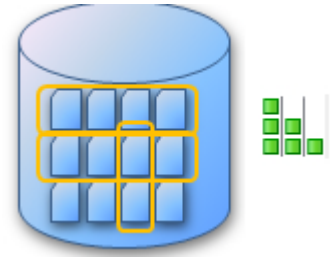
Functional: A functional partition scheme could contain partitions for the HVAC (heating, ventilation and conditioning), electrical, and plumbing systems.



Spatial: A spatial partition scheme could contain partitions for each floor. By default, spatial partitions are defined by a recipe so that new design elements are automatically added to the partition.

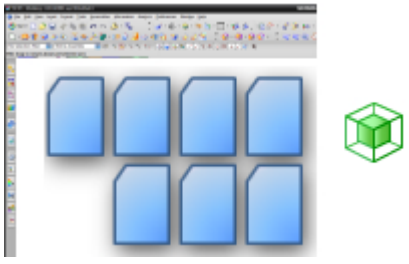
Physical: A physical partition scheme could contain partitions organizing each individual physical room.

Partition



A partition object is a container for data. Partitions can be organized in by a partition scheme (such as function, spatial, or physical as listed above). Unlike traditional subassemblies, partitions do not control the position or any other property of a DE. DE's can be place in multiple partitions. For example, in a CD of a house, a section of pipe might be part of a plumbing partition and part of the kitchen partition. Partitions can be static, requiring manual addition of DEs, or dynamic, where the partition contents are defined by search criteria.

Workset

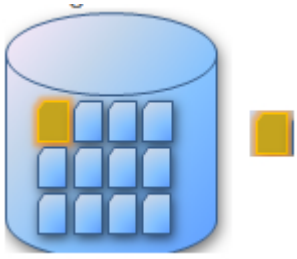


A workset object is the collection of DEs in your NX session. A workset is defined by one or more subsets. There may be many DEs within the workset you work on in your NX session.

Subset

A subset object selects the design elements for a workset. The subset may include specific DEs, or it may contain a dynamic recipe which defines partitions to search. The diagram above shows a session with 2 subsets.

Design element



A design element object is a representation of a component in the product. It is a unique occurrence of 3D geometry in a specific location in the product design. There are different types of DEs. A DE can reference an NX part or assembly model, or other types of geometry.

Overview of this Getting Started

2

2.1 Prerequisites

This Getting Started assumes you have the following already configured:

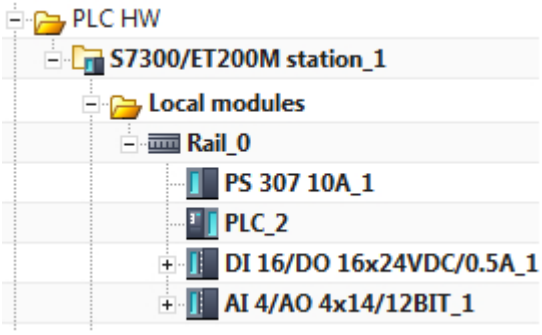
1. NX, TeamCenter and Line Designer with

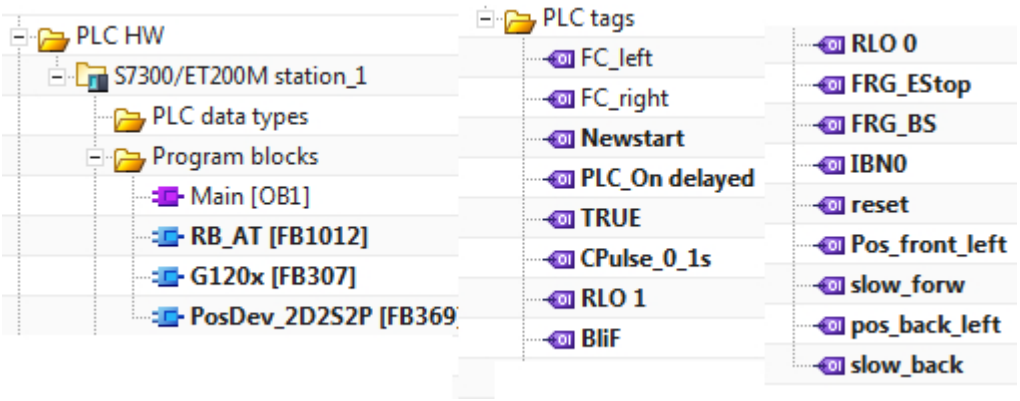
- A conveyor.
- The following in the reuse library Classification Root
  - Device / A ->1 purpose or task / AT
  - Device / U-Keep
  - Device / G-Generator / GL-Continuous flow
  - Device / M-Motor / MA-Electromagnetic
  - Device / B-Measurement / BG-Gauge,position
  - Device / T-Conversion / TF-Signals
  - Device / K-Processing / KF-Electrical signals
  - Devicefunction / Electrical / Input/output

2. EPLAN with:

- Template IEC_bas001.zw9.
- Macro DRIVE_G120D_PM250D_1.emp

3. TIA Portal with the following hardware and software:

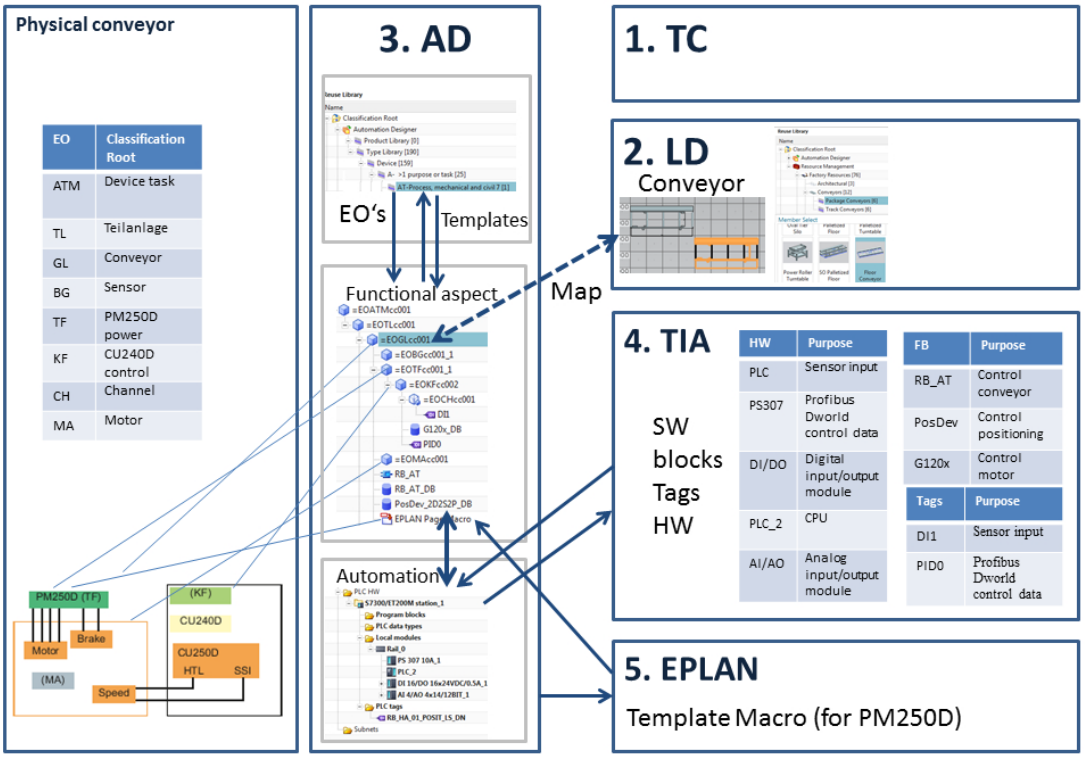




2.2 Workflow from the tools perspective

The following diagram shows what you do in this Getting Started from the perspective of the tools used.

1. TeamCenter: Create a Line Designer 4GD Collaborative Design.
2. Line Designer: Create a 4GD workset, subset, and add two conveyor Design Elements.
3. Automation Designer: Create an Automation Designer workset, Collaborative Design, and subset. Model the plant equipment by adding Engineering Objects from the Reuse Library to the Function aspect. Map the Line Designer Design Element for the conveyor to the Automation Designer Engineering Object for the conveyor.
4. Automation Designer/TIA Portal: Import hardware, software FB blocks and tags from TIA Portal into Automation Designer, placing them in the Automation tab or the Function aspect. Copy software/tags to the aspects, dynamize, and export to TIA Portal. Make the software/tags template-ready, then create and instantiate the template.
5. Automation Designer/EPLAN: Import the EPLAN template and all required macros into Automation Designer in the aspects, set EPLAN variables and generate EPLAN reports. Make the macros template-ready, then create and instantiate a template.



2.3 Workflow

The following describes what you do in this Getting Started.

The workflow can be organized into three parts:

Part 1: Create Line Designer/Automation Designer mechatronic models

Part 2: Mapping Line Designer-Automation Designer, generating EPLAN and TIA Portal (without templates)

Part 3: Generating EPLAN and TIA Portal with templates

Part 1: Create Line Designer/Automation Designer mechatronic models

Automation Designer is based on the NX framework and uses Teamcenter as the data backbone. This allows seamless data exchange from Line Designer, another NX-based and Teamcenter-based solution.

Line Designer objects are an integral part of the Automation Designer system design. The automation engineer sees the line design as the mechanical engineer sees it.

Objects from the Line Designer layout are used in Automation Designer during system design and further enriched during electrical and automation engineering.

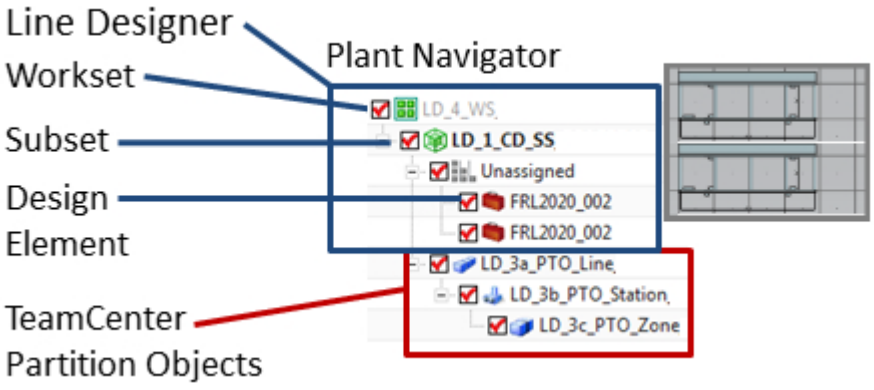
Create the Line Designer Collaborative Design, Line Designer workset, subset and Design Elements

A project is the container that stores the objects you need to carry out the electrical and automation engineering for a production system or machine. In Automation Designer this container is called *project*, in Teamcenter it is called *collaborative design object*. For every Automation Designer project there is one collaborative design object in Teamcenter.

(1) In TeamCenter create the LC Collaborative Design (partition).

(2) In Line Designer create the Line Designer workset, subsets.

(3) In Line Designer add 2 conveyor Design Elements.



Create the Automation Designer workset, subset and Engineering Objects

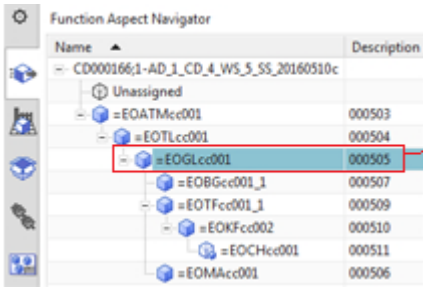
To work in a project, you need a workset. The *workset* is your work context and gives you access to the data that was saved in the workset's project. In a workset, you do the following:

- Add new data to the project.
- Access data that other users added in worksets belonging to the same project.
- Edit the existing data.

When you create a new project, Automation Designer automatically creates a workset for the project. If you have access rights for an existing project, you can also create new worksets for this project. You must create a workset to be able to work in that project.

(1) In Automation Designer create the workset (this automatically creates the TeamCenter Collaborative Design and subset).

(2) In Automation Designer create the Engineering Object aspect tree that models line components (GL is the conveyor). Engineering Object GL corresponds to the conveyor Design Element in the Line Designer Collaborative Design.



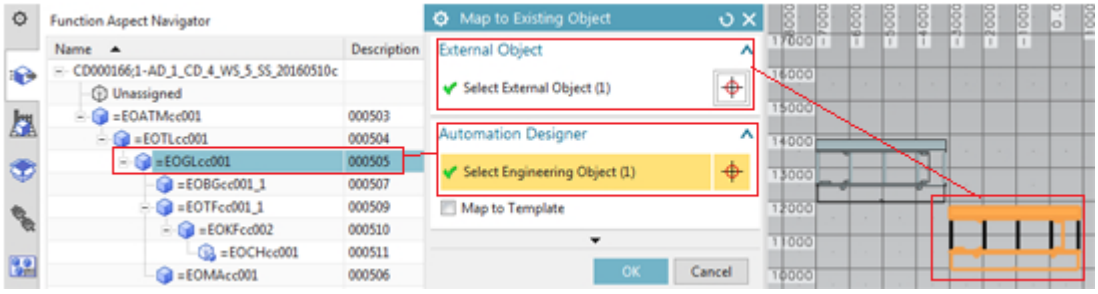
Part 2: Mapping Line Designer-Automation Designer, generating EPLAN and TIA Portal (without templates)

Map Line Designer-Automation Designer

You can map external object types from the Reuse library to Types or to template definitions from the Reuse Library.

If you want to map external objects to new Engineering Objects, you can use the type mappings that were defined as default for all projects.

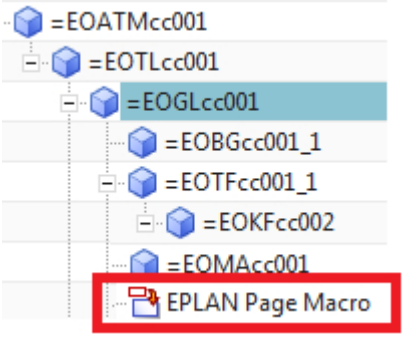
Map the the Line Designer conveyor to the Automation Designer conveyor Engineering Object. This allows you to track changes in Automation Designer and Line Designer.



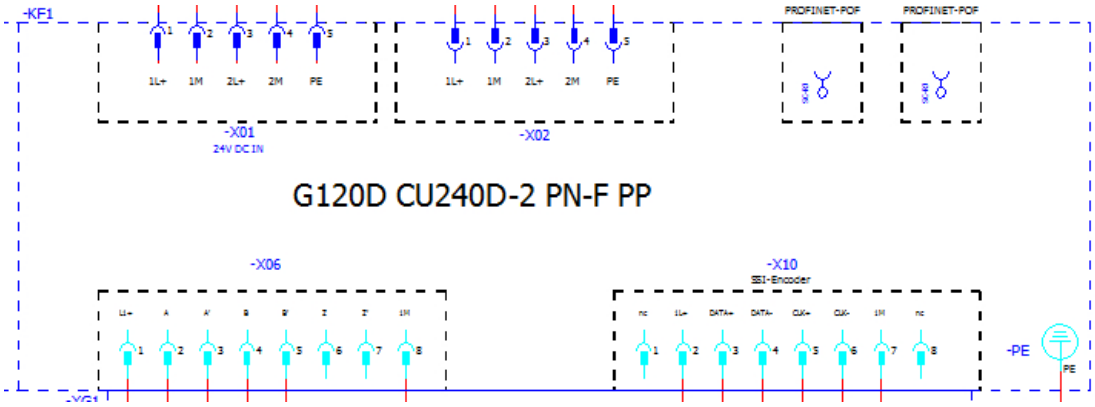
Configure a basic AD project for EPLAN.

Using adaptive ECAD templates and the information provided during electrical engineering, Automation Designer uses the EPLAN Electric P8 API to generate an ECAD project for the automation system in EPLAN Electric P8.

(1) Import an EPLAN template and macro into Automation Designer. You can import macros into a project and use them directly or import them into a template and reuse the template.



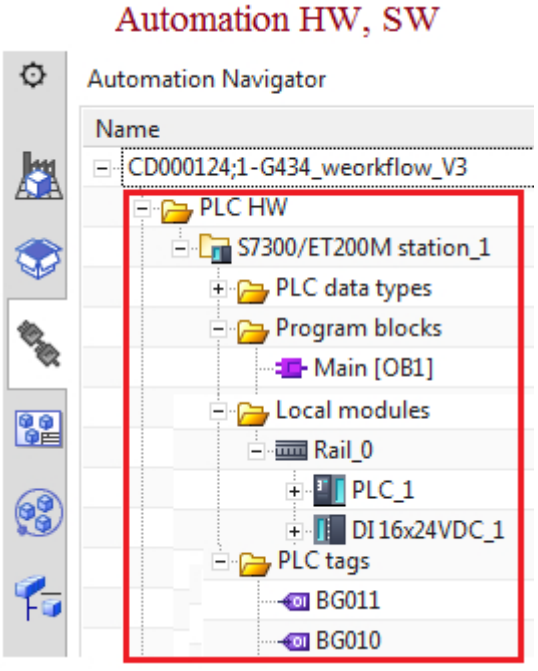
(2) Generate a report with default values. Use the EPLAN project template and EPLAN macros to generate an EPLAN project with electrical schematics for the automation system.



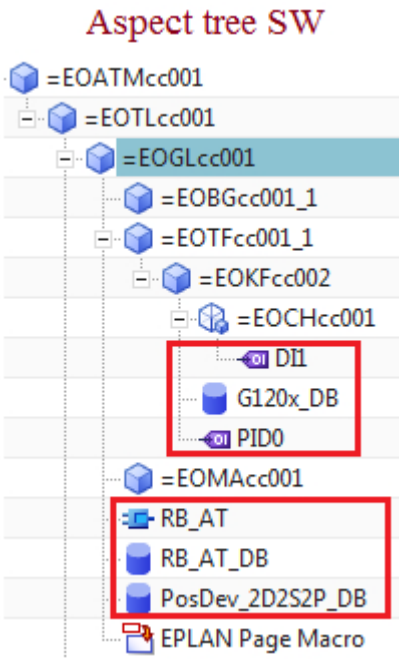
Configure a basic AD project for TIA Portal.

Automation Designer has a connection to TIA Portal. This connection makes the control hardware available in Automation Designer and allows users to change the hardware configuration through TIA Portal. It is also used to transfer tags and control code from Automation Designer to a TIA Portal project and vice versa. The project can be updated at any time.

(1) Import TIA Portal hardware into the Automation tab..

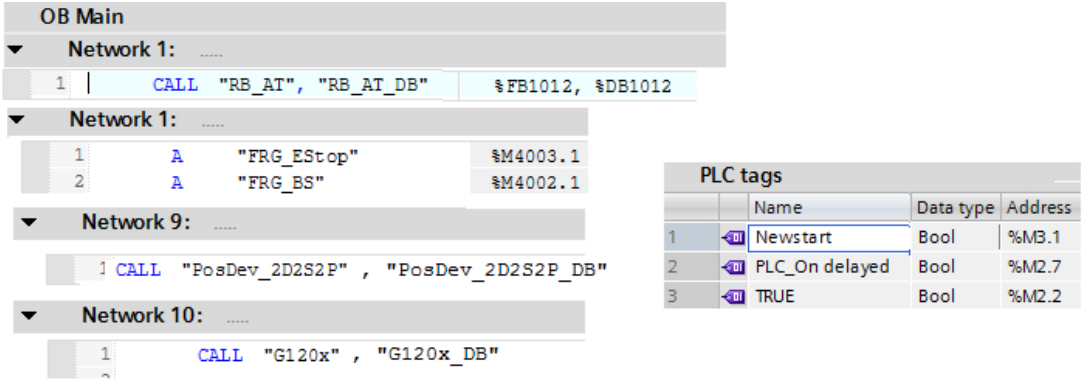


(2) Import software into the Automation tab. Place the software in the aspect tree and create IDB's and tags.



(3) Dynamize the software. Dynamization of software means that the imported software is enhanced in such a way that it can be used in templates for auto-generation of software.

(4) Generate output to TIA Portal. Transfer the hardware configuration, tags, and PLC program to TIA Portal.



Part 3: Generating EPLAN and TIA Portal with templates

Template-related concepts

You can insert objects using templates.

Suppose you need a conveyor that is controlled by a frequency converter for your production system. To implement this conveyor, you need the following Engineering Objects:

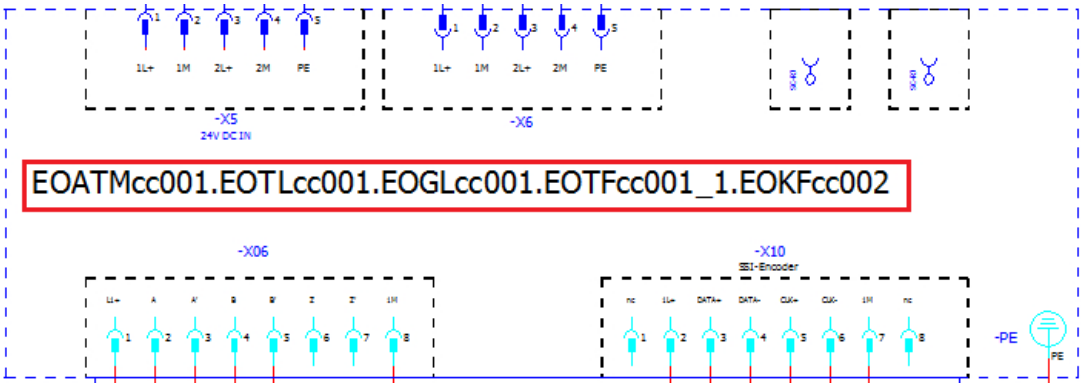
- The conveyor, a motor, a frequency converter, sensors, and signal converters
- EPLAN macros for preparing the generation of the electrical schematics for this conveyor
- Program blocks whose code controls the conveyor, motor, frequency converter, and sensors

If the library has a template that consists of all the objects that are required for such a conveyor, you can insert the template in your project. Automation Designer then inserts all the objects that belong to this template, and assigns their aspects and parents as defined in the template.

Configure a template-ready AD project for EPLAN

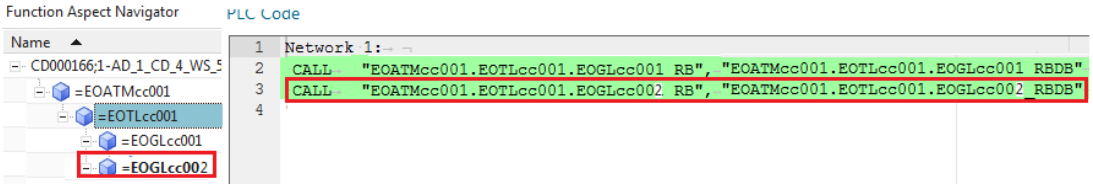
EPLAN macros are Engineering Objects for graphical schematic templates. Use them to prepare the electrical schematics of the production equipment or devices used in your production system or machine.

Set the EPLAN variables to a value based on the Function aspect chain. The following shows the result.



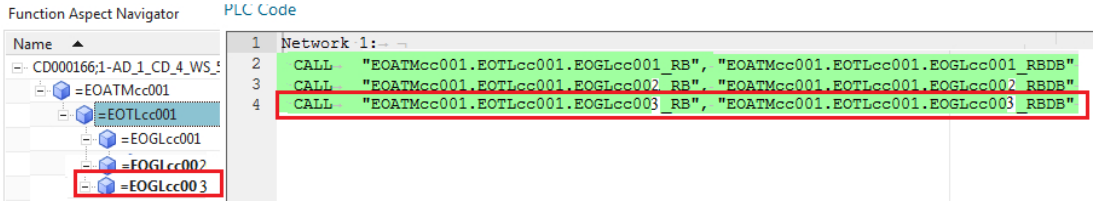
Configure a template-ready AD project for TIA Portal

Set software block and tag names to a value based on the Function aspect chain. The following shows the result after copying a template-ready conveyor.



Create/instantiate template

The following shows an instantiated template.

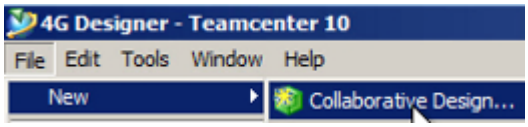


TeamCenter: Create Line Designer Collaborative Design

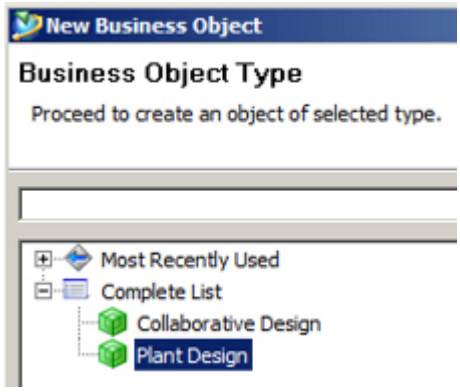
3

3.1 Create plant design Collaborative Design

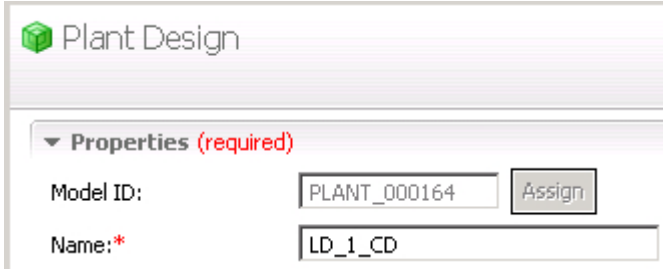
1. In **4GD Designer** select **File→New→Collaborative Design**.



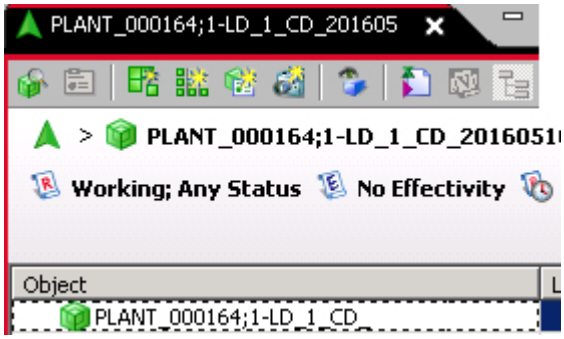
2. Select **Plant Design**.



3. Click **Assign**.
4. For **Name** enter "LD_1_CD " (Line Designer Collaborative Design).



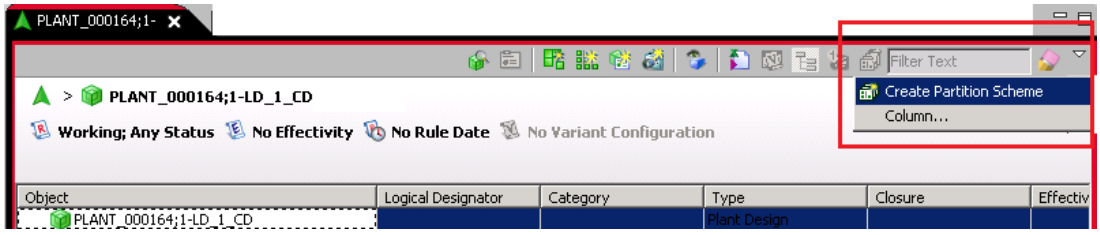
5. Click **Finish**.
6. Click **Close**.



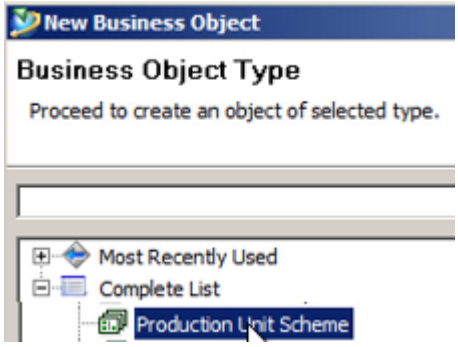
3.2 Create partition scheme

Partition schemes can be functional, spatial, or physical. Partitions are created within partition schemes . For this Getting Started you create a single partition scheme.

1. Click on **Create Partition Scheme**.

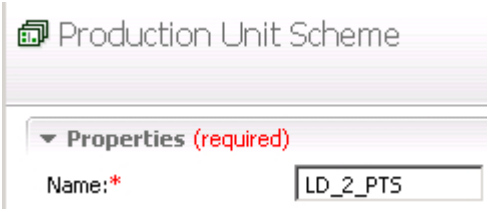


2. Select **Production Unit Scheme**.

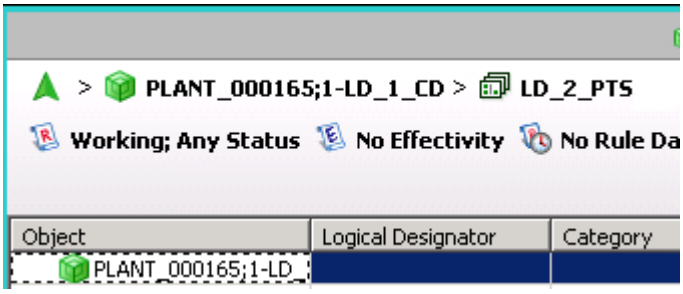


3. Click **Next**.

4. Set **Name** = "LD_2_PTS" (Line Designer Partition Scheme).



5. Click **Finish**.
6. Click **Close**.



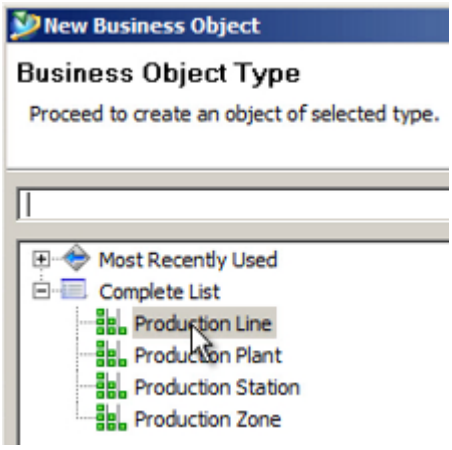
3.3 Create partition objects (and send to 4GD)

A partition object is a container for data. Partitions can be organized in by a partition scheme (such as function, spatial, or physical as listed above). Unlike traditional subassemblies, partitions do not control the position or any other property of a Design Element. Design Elements can be place in multiple partitions. For example, in a Collaborative Design of a house, a section of pipe might be part of a plumbing partition and part of the kitchen partition. Partitions can be static, requiring manual addition of Design Elements, or dynamic, where the partition contents are defined by search criteria.

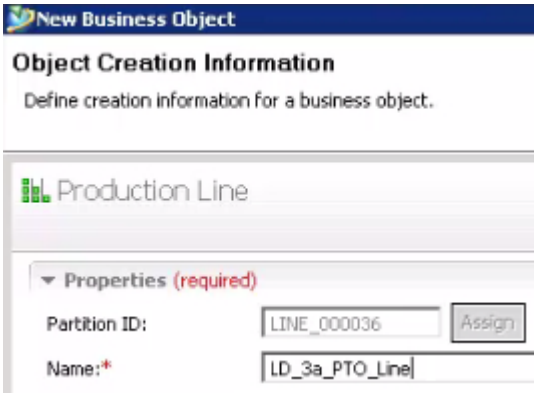
Create the partition objects (business objects) line, station and zone.

1. Click on **Create partition**.

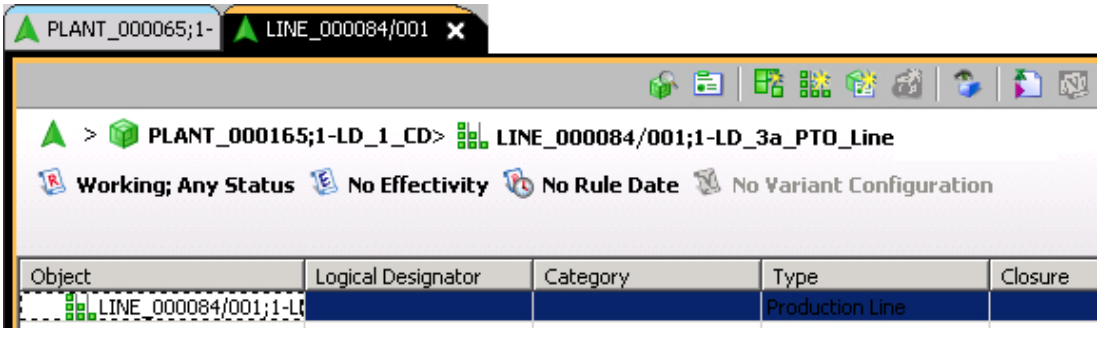
2. Select **Production Line**.
3. Click **Next**.

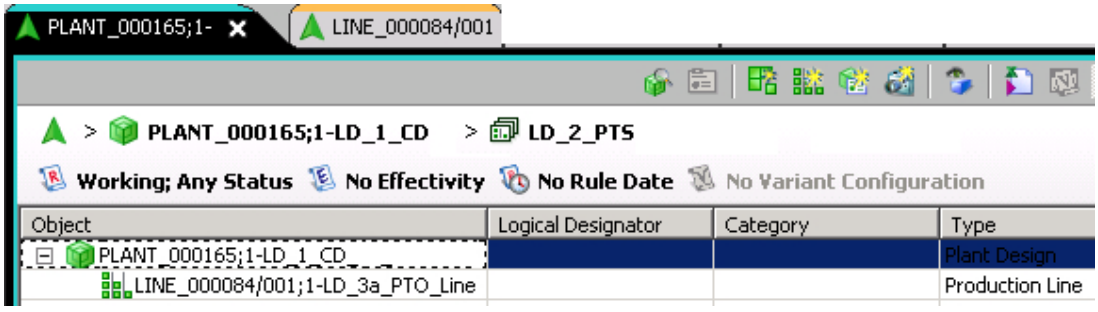


4. Click **Assign**.
5. Set **Name** = "LD_3a_PTO_Line".

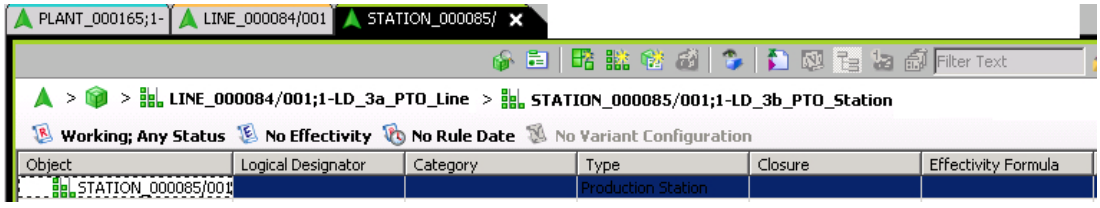


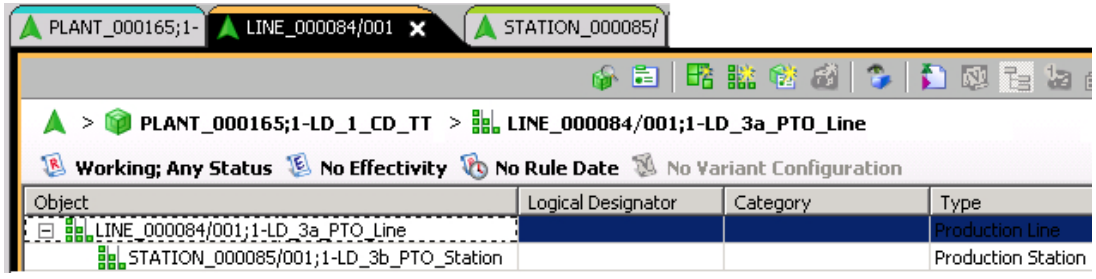
6. Click **Finish**.
7. Click **Close**. The following shows what you have created so far.

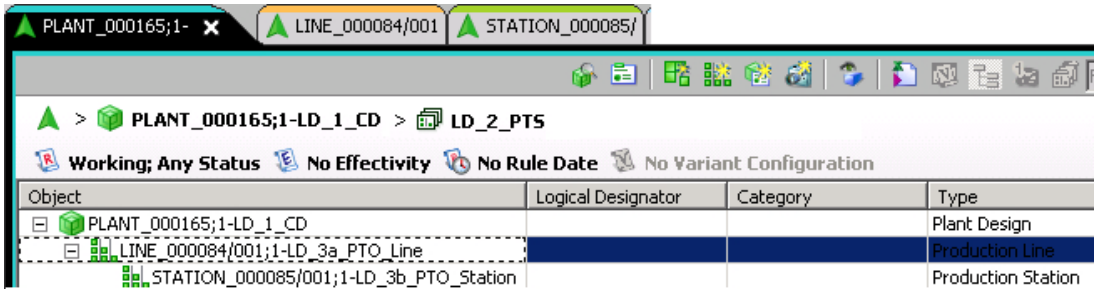




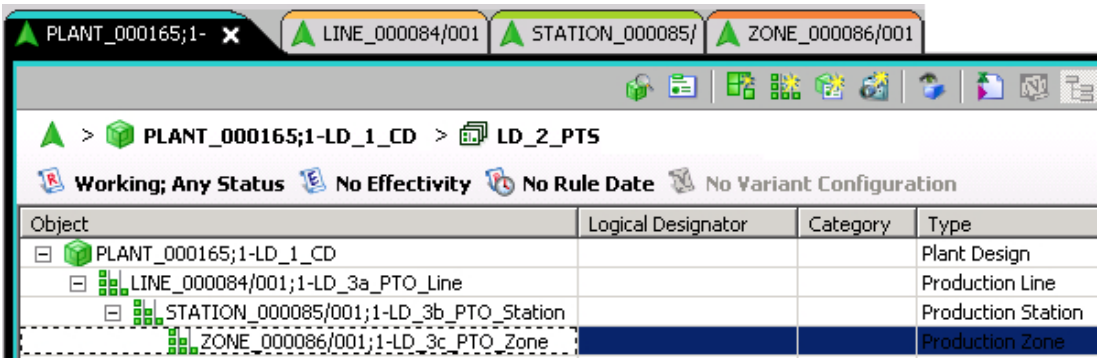
8. Click on the line under Plant in the Plant tab.
9. Click the **Create Partition** Icon.
10. Select **Production Station**.
11. Click **Next**.
12. Click **Assign**.
13. Enter **Name** = "LD_3b_PTO_Station".
14. Click **Finish**.
15. Click **Close**. The following shows what you have created so far.



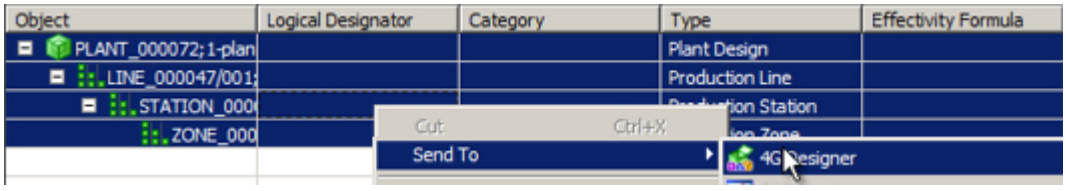




16. Create a "Production Zone" partition under the station partition with **Name** = "LD_3c_PTO_Zone".



17. Send to 4GDesigner.



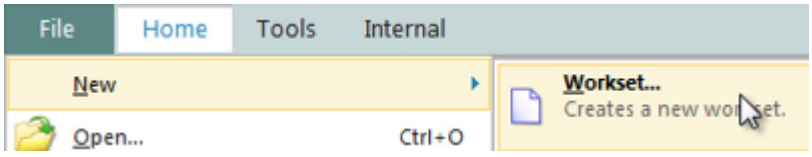
Line Designer: Create Line Designer workset, subset and Design Elements

4

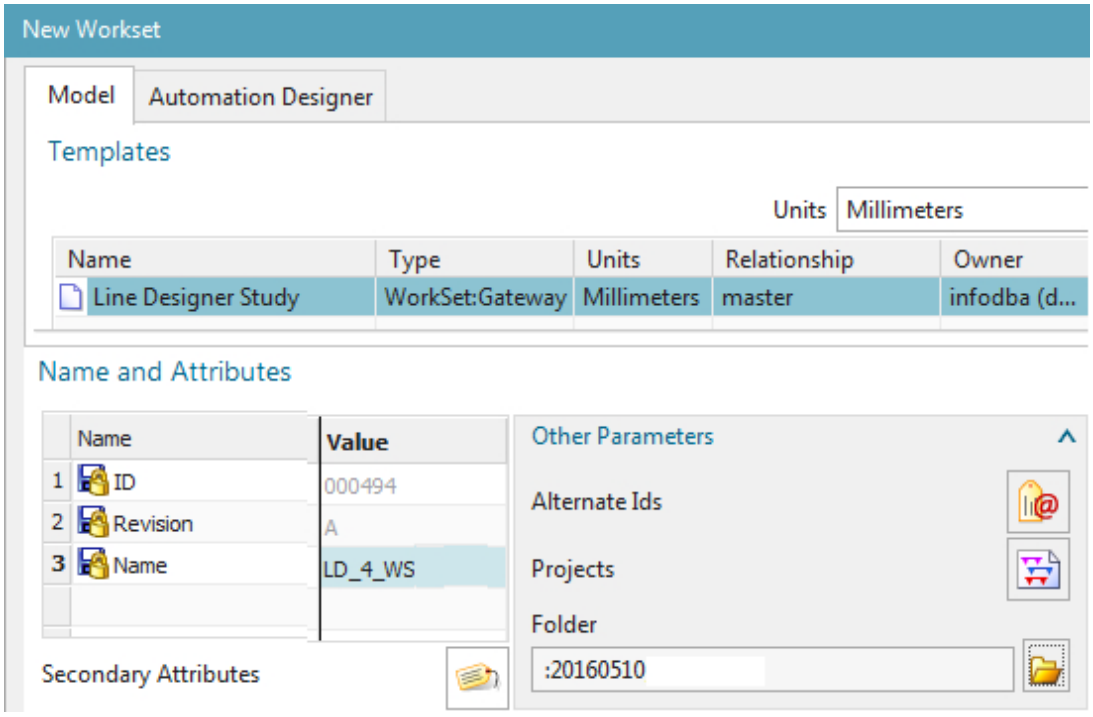
4.1 Create a Line Designer workset

A workset object is the collection of Design Elements in your NX session. A workset is defined by one or more subsets. There may be many Design Elements within the workset you work on in your NX session.

1. Create a new workset.



2. Select **Model→Line Designer Study**.
3. Set **Name** = "LD_4_WS". If you not specify a folder then the project will be put in “Newstuff”.

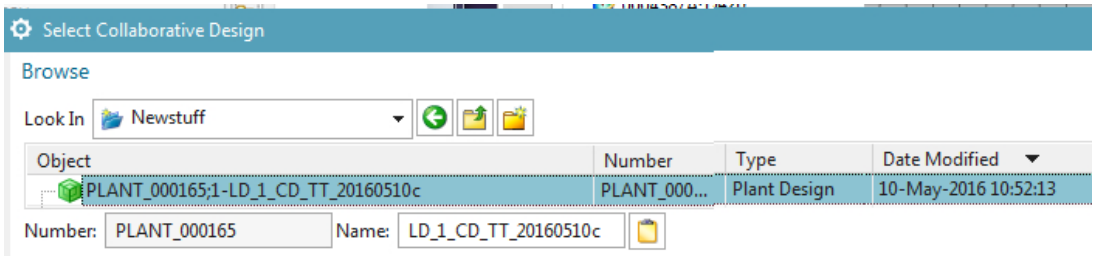


4. Click **OK**. The "Create Subset" dialog appears.

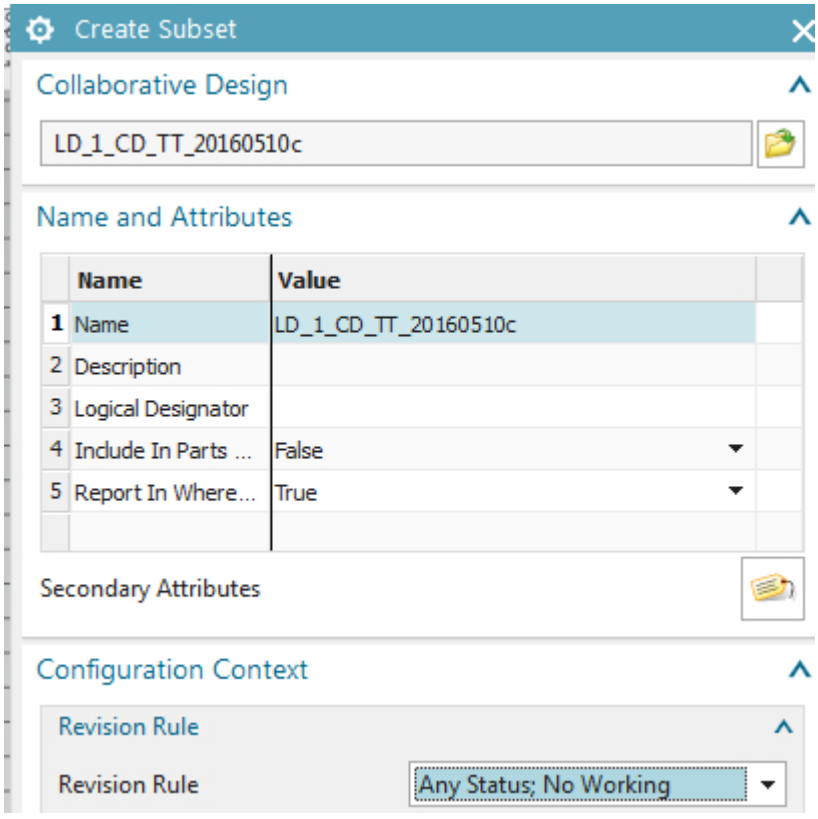
4.2 Create a Line Designer subset and add partitions to recipe

A subset object selects the design elements for a workset. The subset may include specific Design Elements, or it may contain a dynamic recipe which defines partitions to search. The diagram above shows a session with 2 subsets.

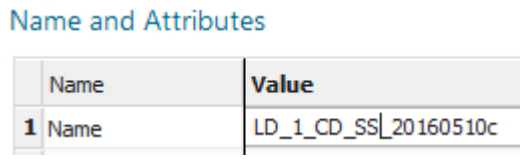
1. For **Collaborative Design** select " LD_1_CD".



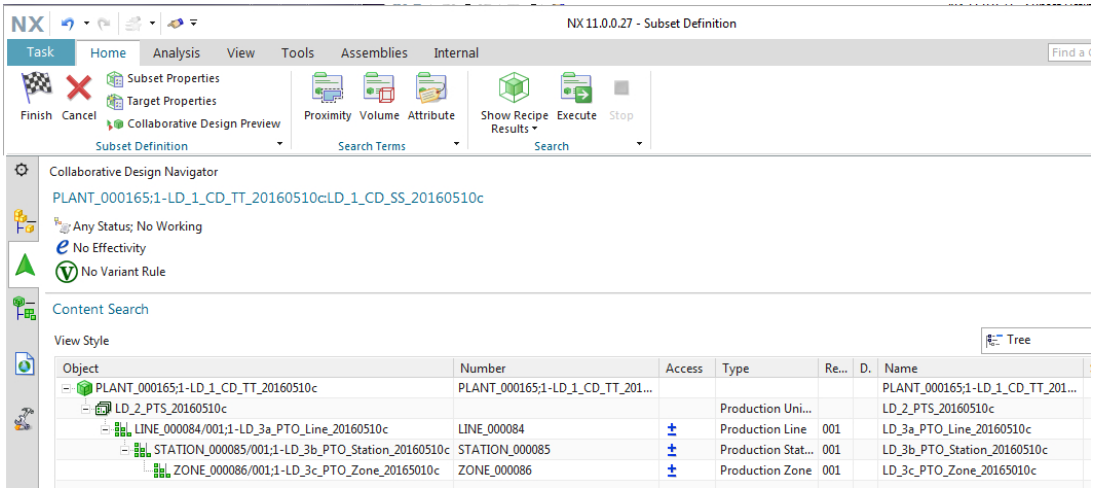
2. Click **OK**.
3. For **Revision Rule** select **Any Status, No Working**.



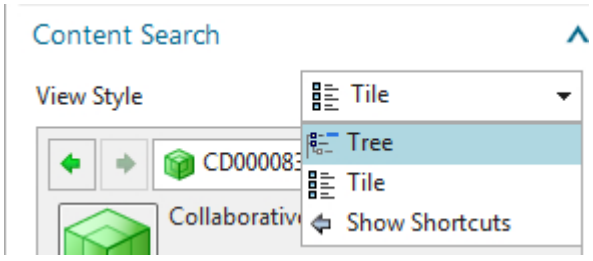
4. Note that the subset has the same name as the Collaborative Design. To rename the subset, click and type in the new name.



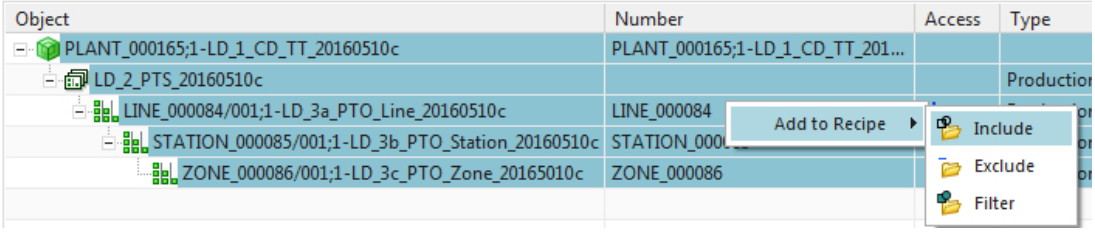
5. Click **OK**. The Subset Definition appears.



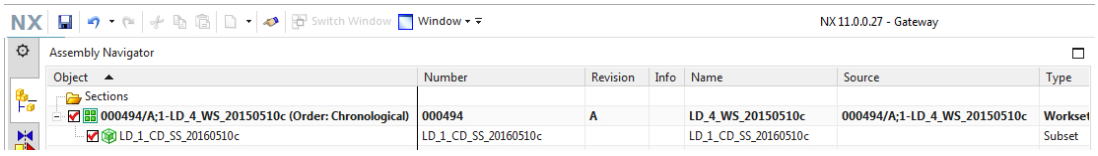
6. Select the tree if not shown as above.



7. Select all, right click and select **Add to Recipe→Include**. This adds the subset to the recipe.



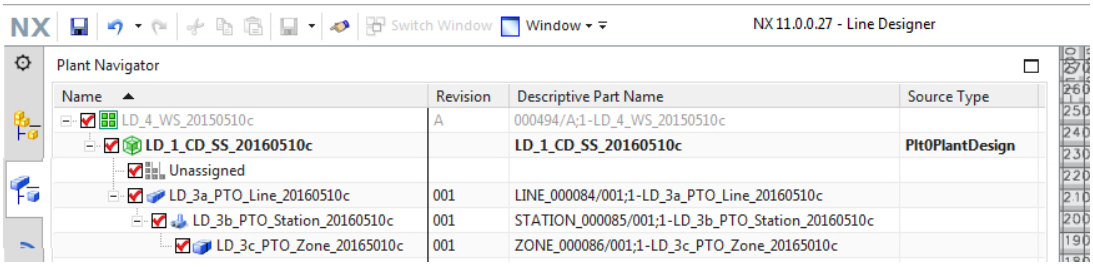
8. Click **Finish**. The workset and subset are shown. Note that you are in the Gateway.



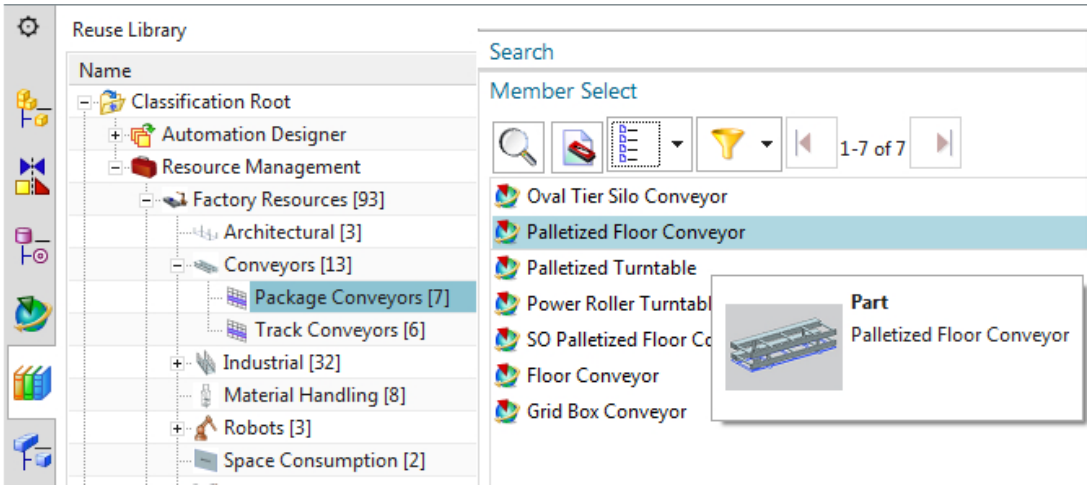
4.3 Add 2 Line Designer conveyors

You now add two conveyors that will be linked (mapped) later to Engineering Objects.

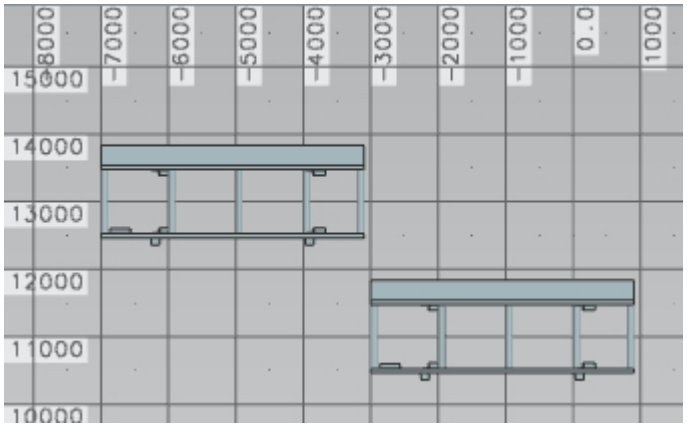
1. Switch to Line Designer. Note the hierarchy under the plant navigator, which shows what you created so far (a workset, subset and the partitions line, station, and zone).



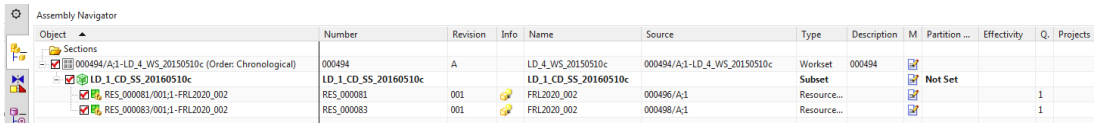
2. Drag and drop 2 conveyors from the Reuse Library.



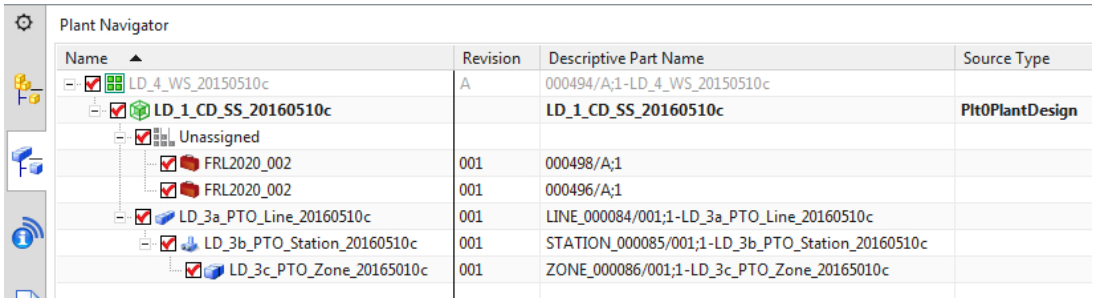
The following shows the resulting conveyors.



The following shows the conveyors under the subset in the assembly navigator.



The following shows the conveyors in the plant navigator.

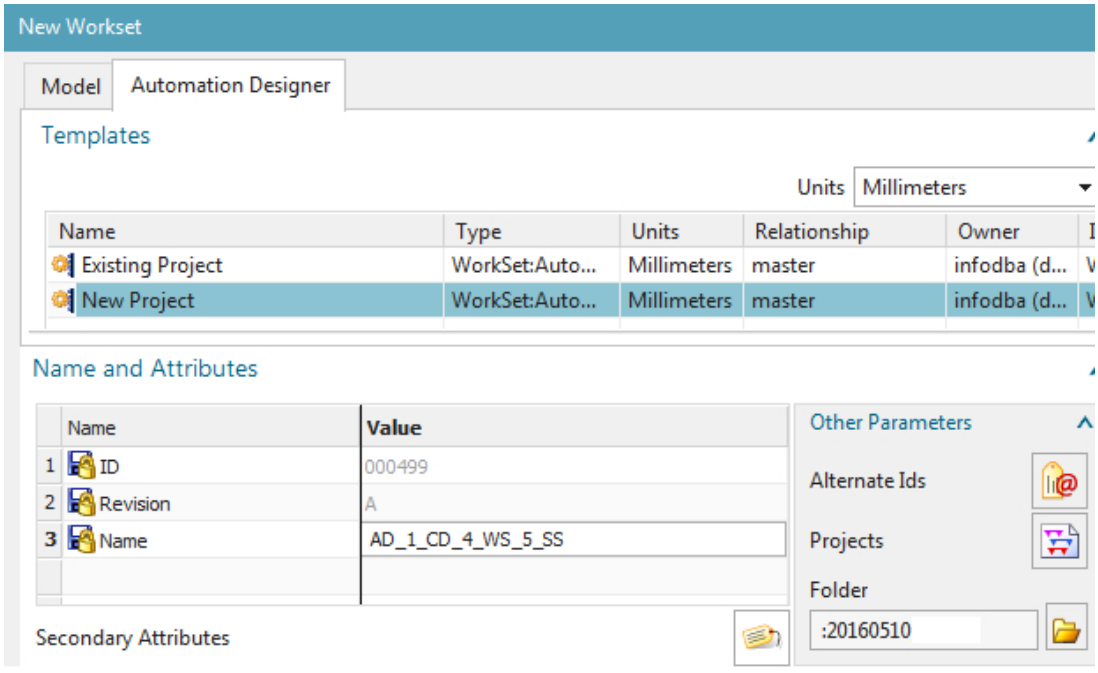


Create Automation Designer workset and Engineering Objects

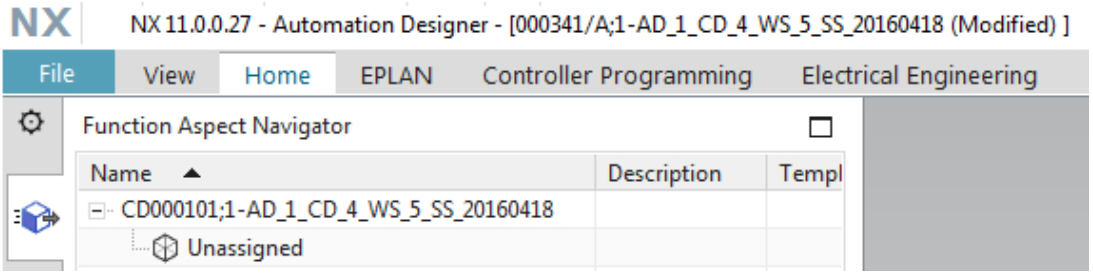
5

5.1 Create project workset (and Collaborative Design + subset)

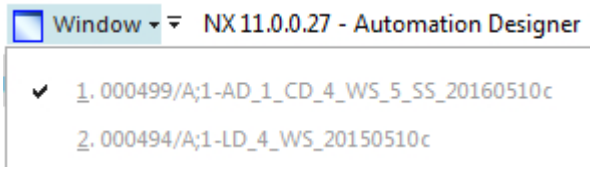
1. Select **File→New→Workset**.
2. In tab "Automation Designer" select **New Project**.
3. Create a new Automation Designer project with name "AD_1_CD_4_WS_5_SS".



4. Click **OK**.



Note that the Line Designer workset and the Automation Designer Collaborative Design, workset and subset are open.

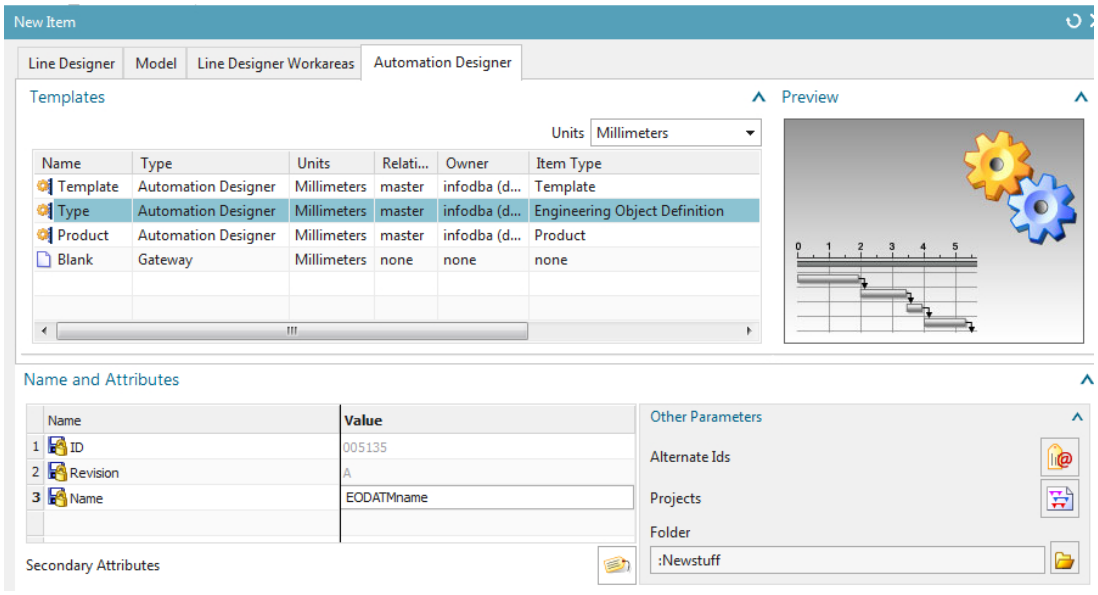


5.2 Create Engineering Object Definitions

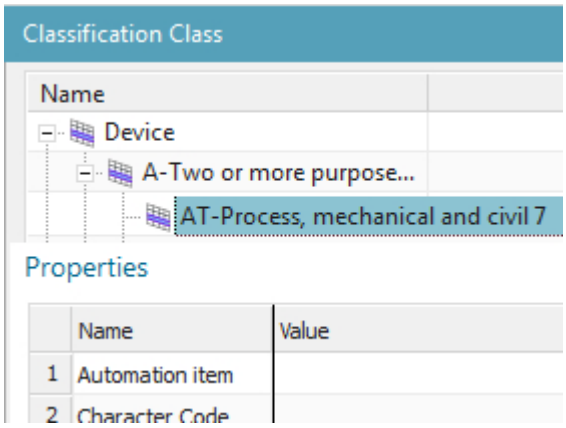
Now you create the definitions for the Engineering Objects you create later. These definitions specify the classification class of the Engineering Objects.

Create the first Engineering Object Definition.

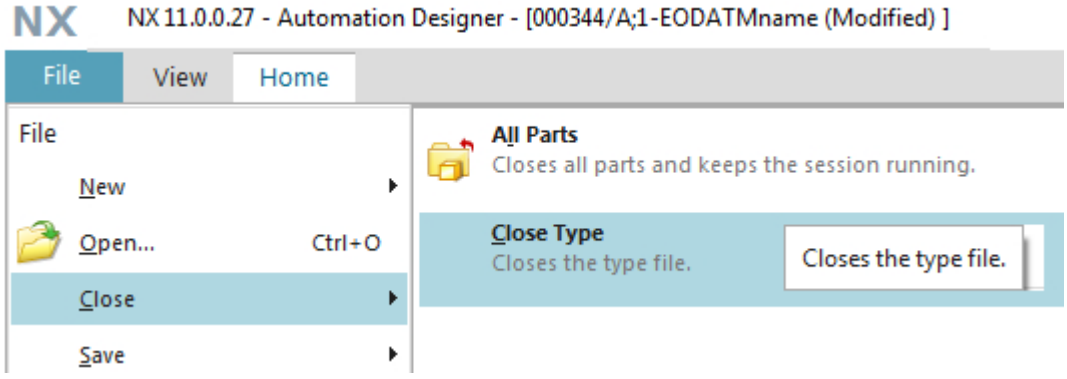
1. Select **File→New→Item**.
2. In tab **Automation Designer** select **Type**.
3. Enter the name "EODATMname". This will be locked after you set it. This is the "description" when you add an Engineering Object.

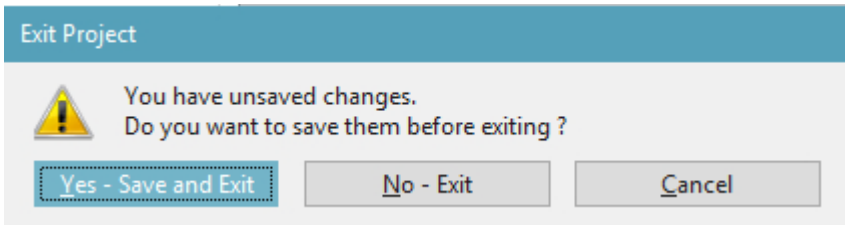


4. Click **OK**.
5. In the **Classification Class** dialog select **Device / A / AT**.

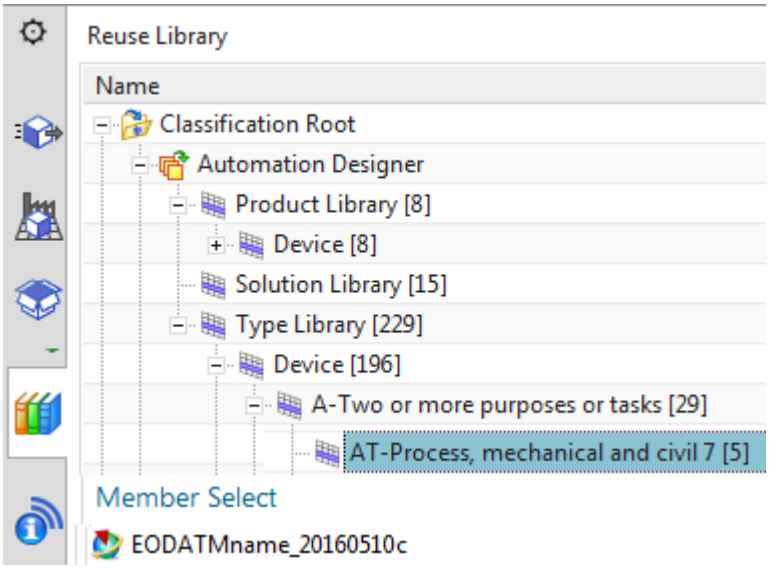


6. Click **OK**.
7. Select **File→Close→Close type**.





8. Click **Yes - Save and Exit**.
9. Verify that the Engineering Object Definition is in the Reuse Library.



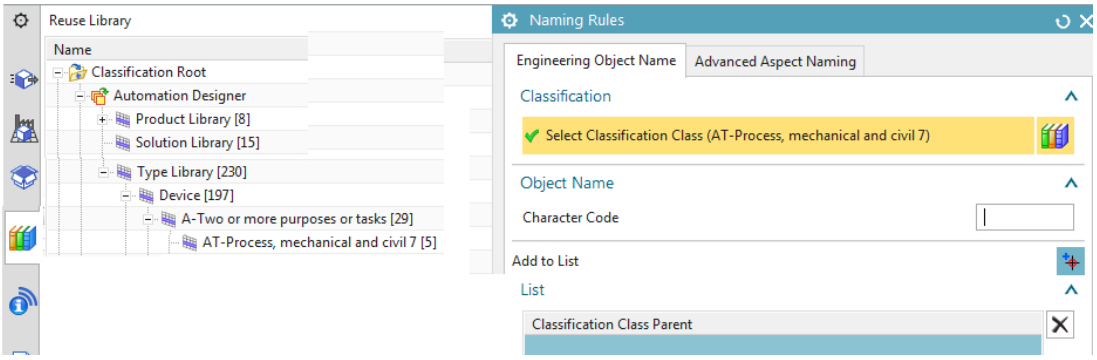
10. Create the remaining Engineering Object Definitions:

EODef	Classification Root
1. EODATMname (created above)	Device / A ->1 purpose or task / AT
2. EODTLname	Device / U-Keep
3. EODGLname	Device / G-Generator / GL-Continuous flow
4. EODMAname	Device / M-Motor / MA-Electromagnetic
5. EODBGname	Device / B-Measurement / BG-Gauge,position
6. EODTFname	Device / T-Conversion / TF-Signals
7. EODKFname	Device / K-Processing / KF-Electrical signals
8. EODCHname	Devicefunction / Electrical / Input/output

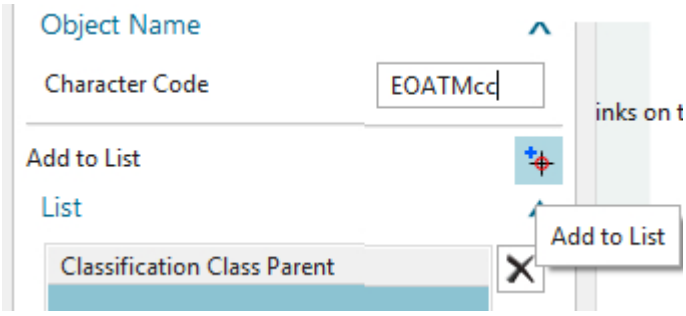
5.3 Create Engineering Object names

You now create the Engineering Object names that will display in the aspect tree.

1. Click on **Home→Naming Rules**.
2. Select **Classification Root/Automation Designer/Type Library/Device/A/AT**.

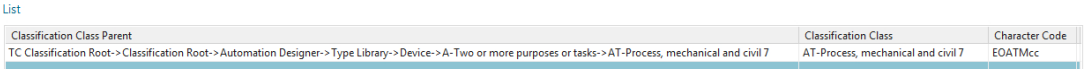


3. For “Character Code” enter “EOATMcc”.



4. Click **Add to List**.

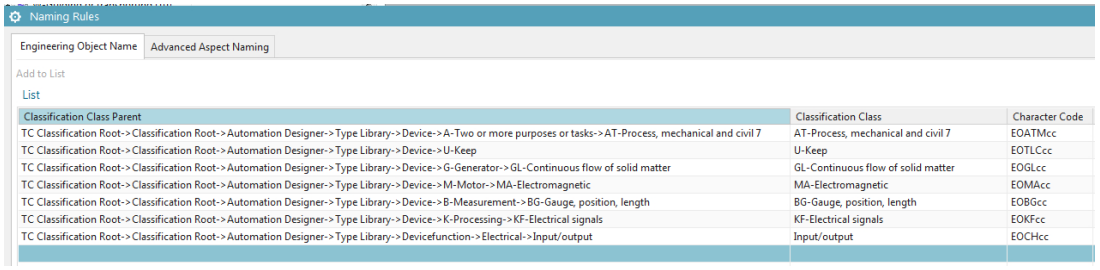
The following is the result.



5. Create the remaining Engineering Object names.

Character code	Classification parent
1. EOATMcc (created above)	Device / A ->1 purpose or task / AT
2. EOTLcc	Device / U-Keep
3. EOGLcc	Device / G-Generator / GL-Continuous flow
4. EOMAcc	Device / M-Motor / MA-Electromagnetic
5. EOBGcc	Device / B-Measurement / BG-Gauge,position
6. EOTFcc	Device / T-Conversion / TF-Signals
7. EOKFcc	Device / K-Processing / KF-Electrical signals
8. EOCHcc	Devicefunction / Electrical / Input/output

The following shows the result.

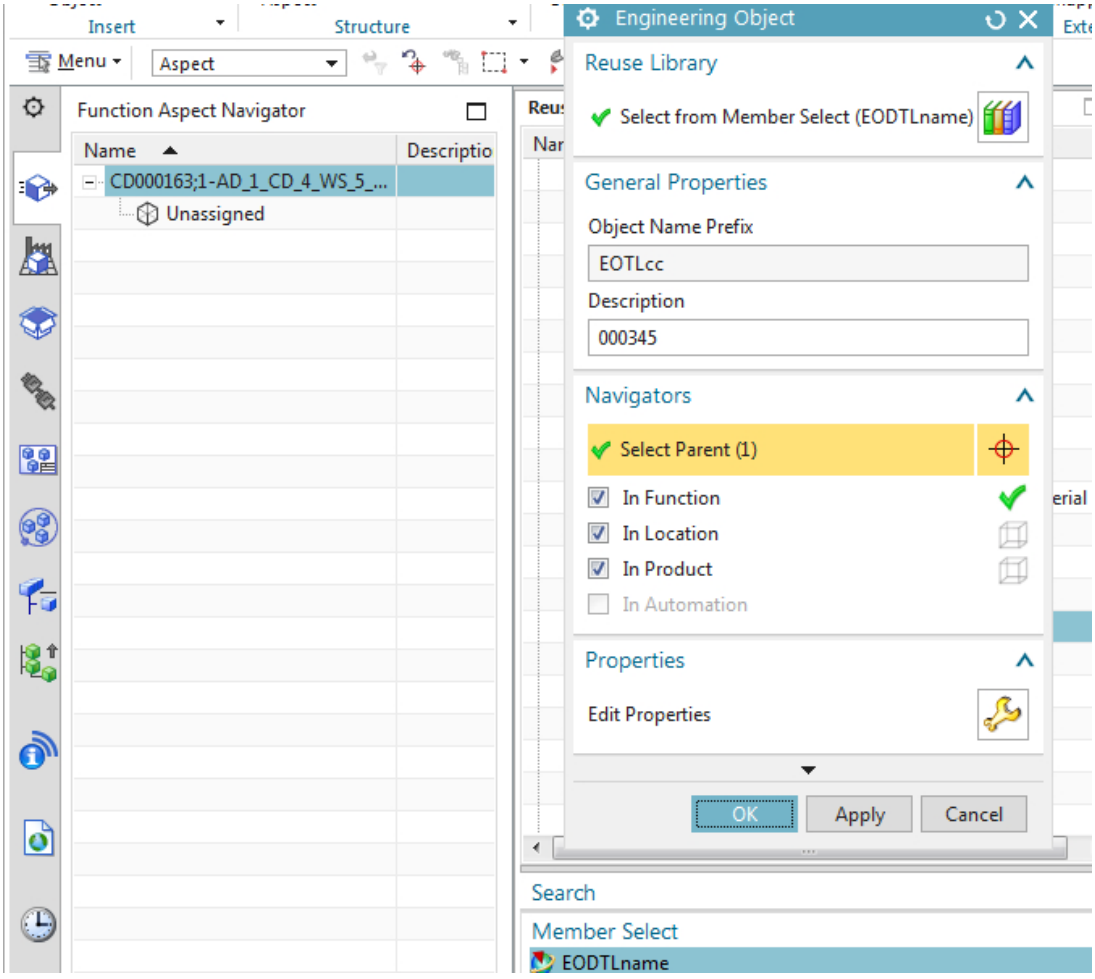


5.4 Add Engineering Objects

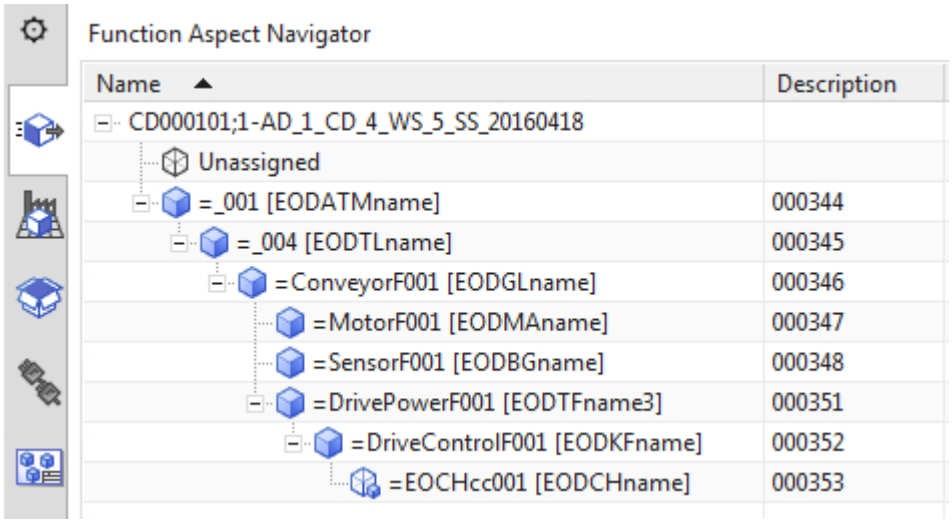
In this section you will only add Engineering Objects in the Function aspect.

Drag and drop the Engineering Object Definitions to create the Engineering Objects in the aspect tree.

1. Drag and drop EOTLcc.



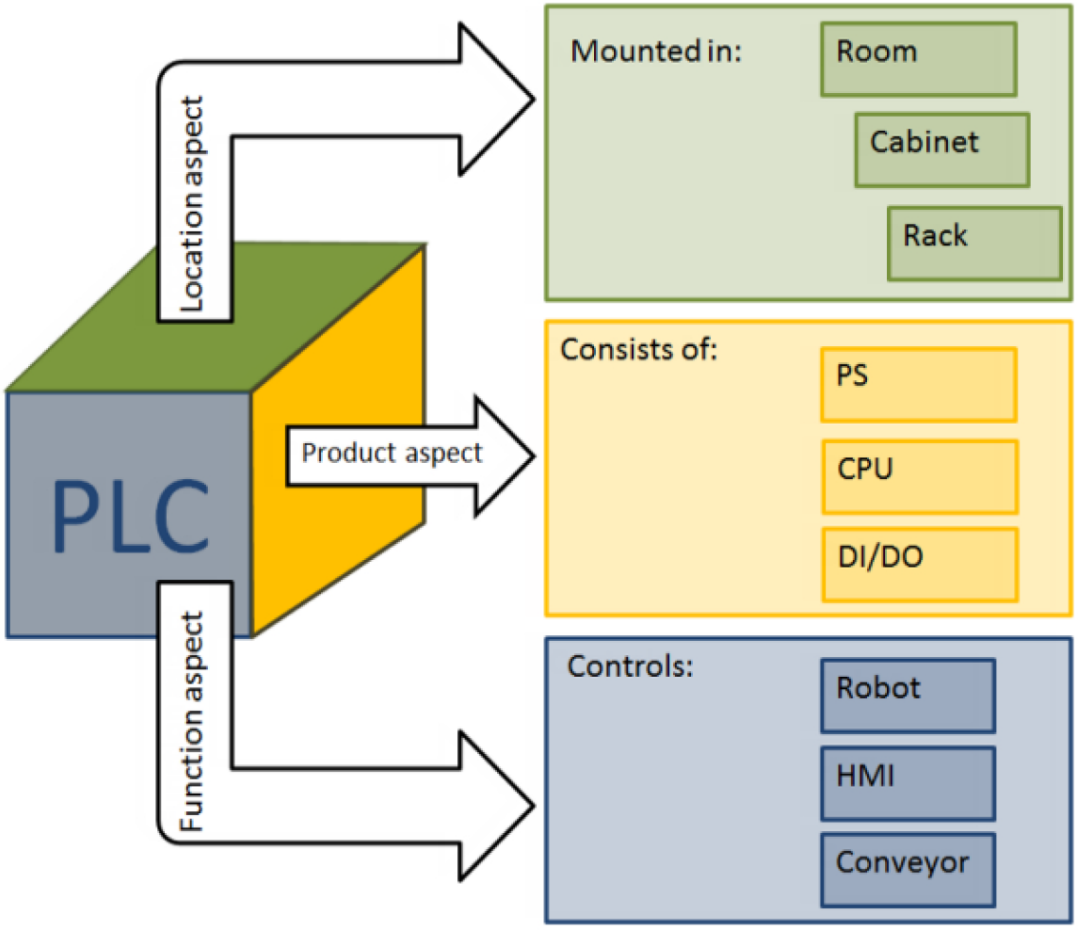
3. Drag the remaining Engineering Objects to create the following Function aspect tree.



5.5 Location-Product aspects

Introduction to Engineering Objects and aspects

You can view the same object under one or more aspects. For each aspect, you consider only those features and relations that are relevant for that specific aspect. The following diagram illustrates this, using the example of a programmable logic controller (PLC).



Relevance of aspects for engineering applications

Many engineering applications are designed for a specific discipline and support only one particular view. The view influences how you model the production system or machine in the engineering application. It determines the following:

- The objects with which you work
- The hierarchical structure of the objects
- Object names

By providing separate Aspect Navigators for the function, location, and product aspects of your engineering, Automation Designer allows you to combine different views of engineering in one application and even in one object.

Aspect Navigators

How you structure a production system or machine in an engineering application depends on the aspect that you consider.

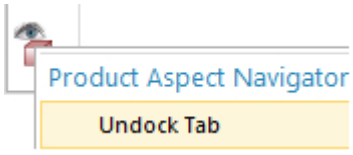
Because each aspect represents a view that may structure objects differently, Automation Designer provides several Aspect Navigators. Each *Aspect Navigator* represents one view of

planning. In each Aspect Navigator, you define the hierarchical structure of the Engineering Objects for the current aspect.

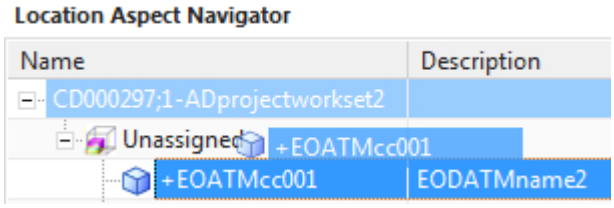
- In the Function Aspect Navigator, you organize Engineering Objects based on their intended function within the production system or machine.
- In the Location Aspect Navigator, you define the spatial relations of the Engineering Objects. Using location-related objects like buildings, floors, cabinets, or racks, the Location Aspect Navigator organizes all objects based on where they will be installed or mounted.
- In the Product Aspect Navigator, you document which hardware devices and software objects are physically needed to fulfill the function.

Now you will configure the location and product aspects.

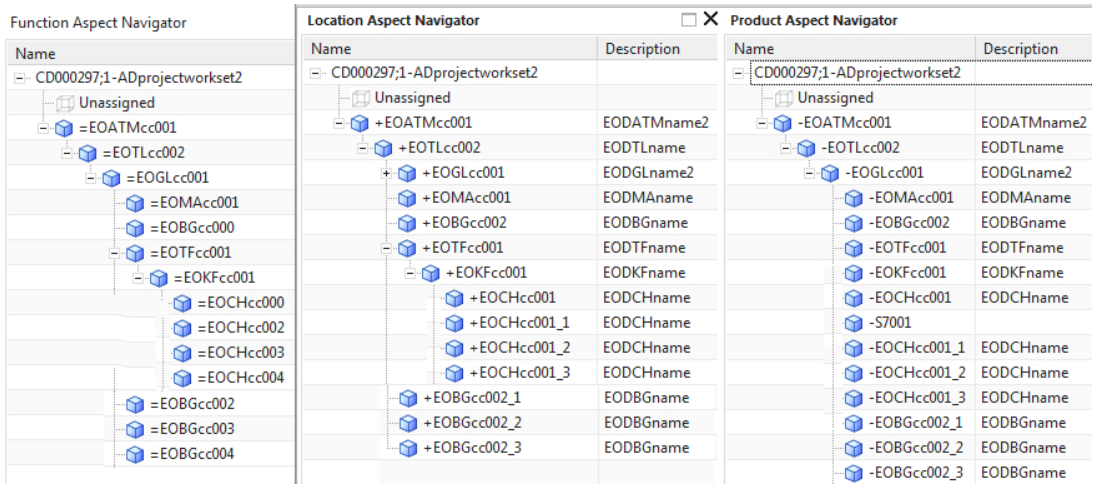
1. Undock the location and product aspects.



2. Organize (with drag and drop) the Engineering Objects in the Location and Product aspects.



3. The result should look like this.



Map Line Designer and Automation Designer 6

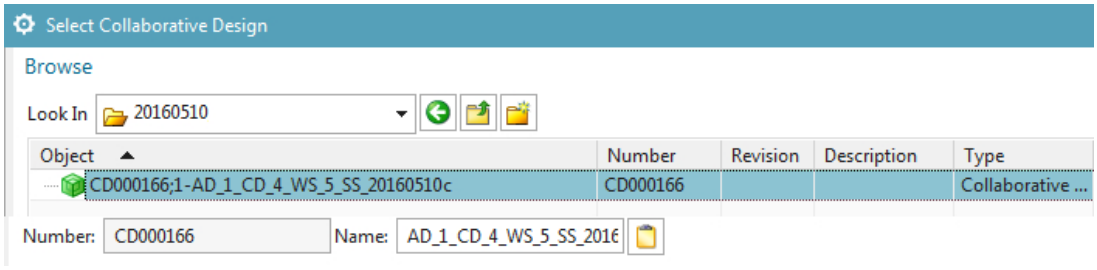
6.1 Link Automation Designer and Line Designer Collaborative Designs

Mappings from mechanical and line design data to automation data eliminate the need for reentering data and make mechanical changes transparent. You can directly use the mechanical and line design data in Automation Designer.

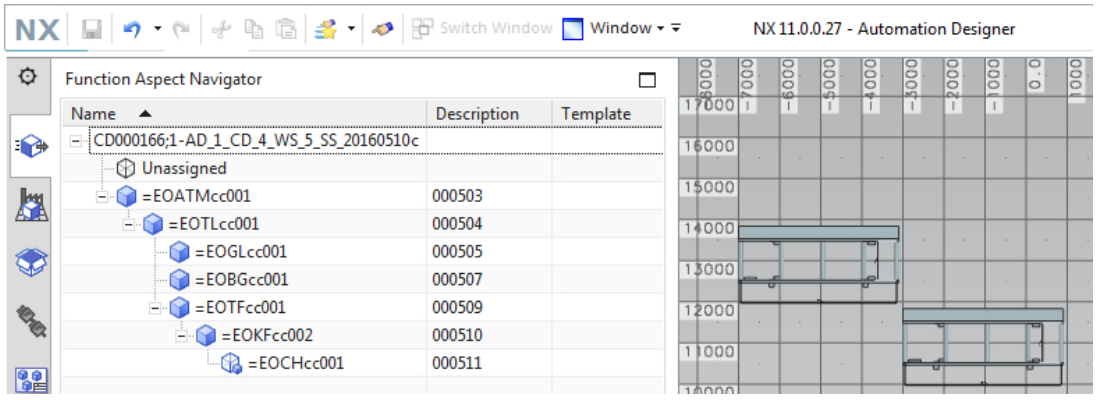
The mapping rule between external type and Automation Designer Type is stored in the database. It is used as the default in all projects and shown as a predefined mapping in the **Type Mapping** dialog box.

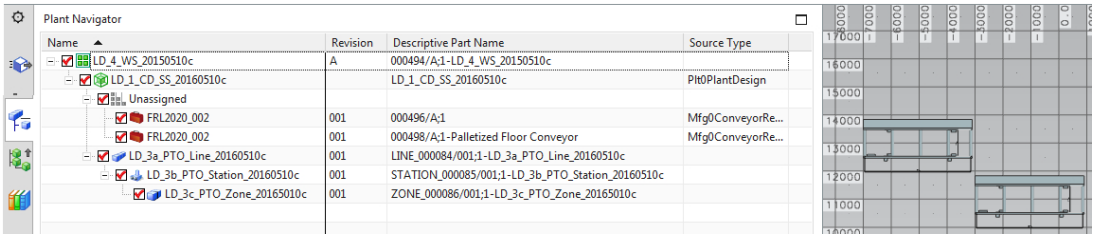
The Line Designer project is structured in TeamCenter using a Plant Design. The Automation Designer project is structured in TeamCenter using a Collaborative Design. To connect the two designs you need to link the Plant Design (Line Designer) with the Collaborative Design (Automation Designer). This action needs to be done only once. After this you can map the mechanical layout (Line Designer) to Automation Designer Engineering Objects.

1. Close the Automation Designer project you created previously.
2. Open the Line Designer Collaborative Design.
3. Select **File→All Applications→Automation Designer**.
4. Select the Automation Designer Collaborative Design.



The Automation Designer Collaborative Design is on the left and the Line Designer Collaborative Design on the right.

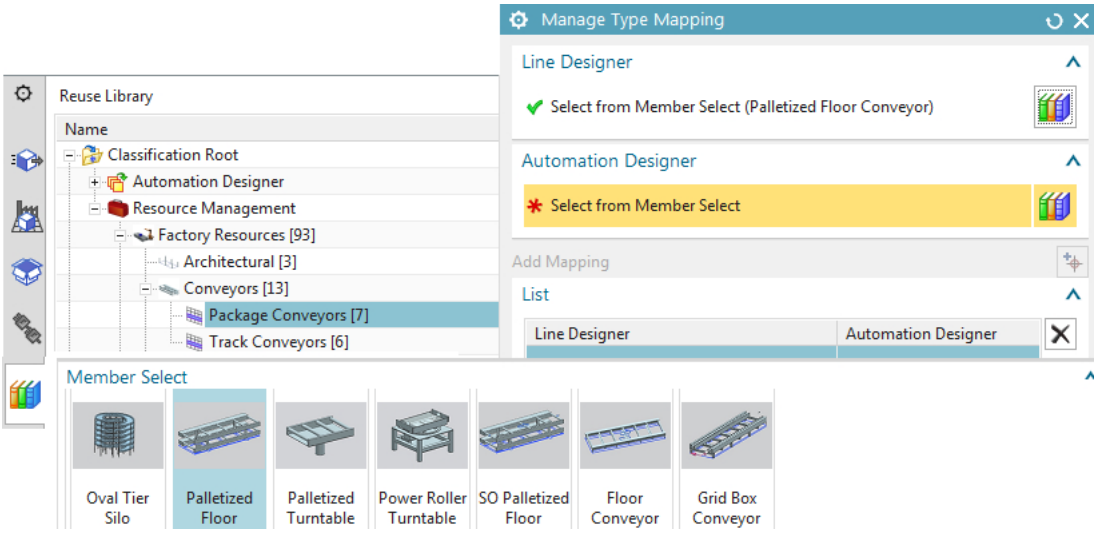




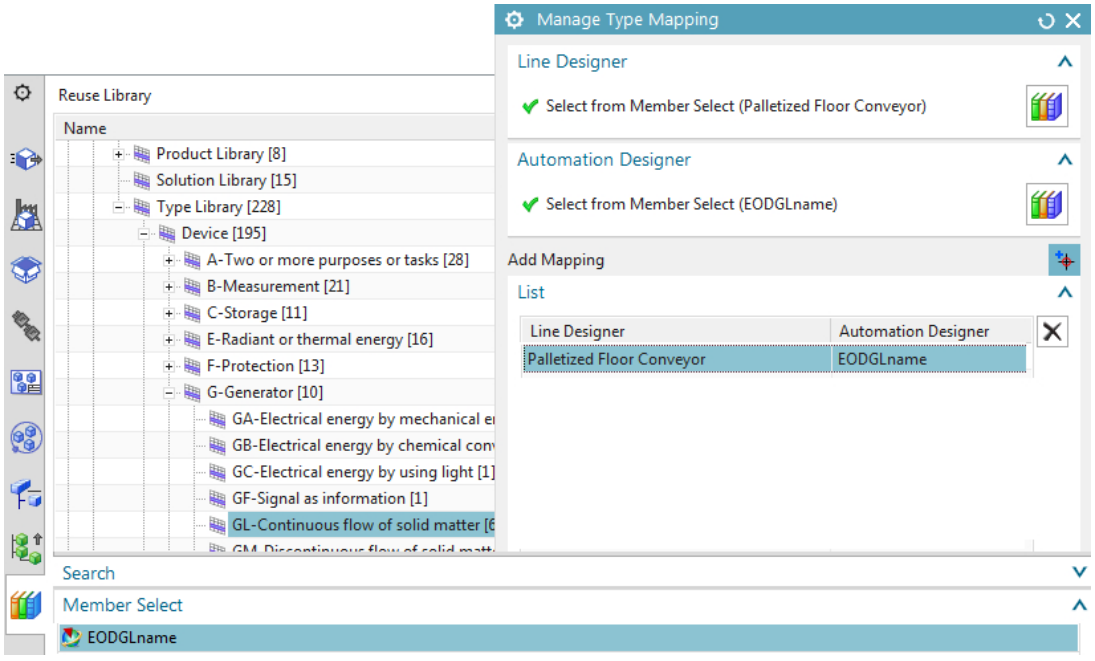
6.2 Manage type mapping

You now will define the type mapping. Type mapping determines for which type of Line Designer object what type of Engineering Object will be created when you use **Map to new**.

1. Open the **Manage Type Mapping** dialog.
2. Under **Line Designer** select the conveyor.



2. Under **Automation Designer** select GL. A list of existing mappings may appear.



6.3 Manage object mapping

Use the **Manage Object Mapping** dialog box to map single external objects to single Engineering Objects or templates. Then continue engineering with the mapped Engineering Object or template.

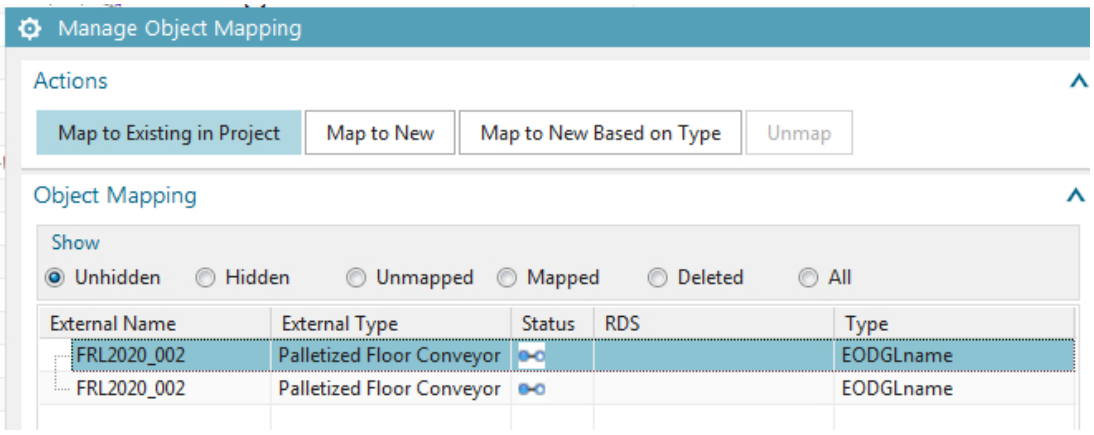
There are 3 ways to map objects:

1. Map to existing
2. Map to new
3. Map to new based on type

1. Map to existing

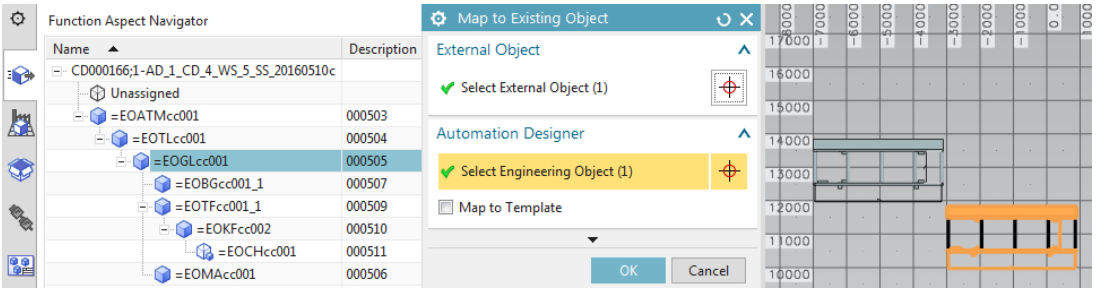
You can map external objects to existing Engineering Objects or templates. You can choose an Engineering Object or template whose type matches the type mapping defined for all projects. Or you choose an Engineering Object or template whose definition deviates from the type mapping. In that case, the type mapping is overridden for this one object mapping.

1. Click **Manage object mapping**. 2 conveyors appear.
2. Select a conveyor.



3. Click **Map to existing in project**.

4. Select GL.



5. Click **OK**. The following is the result.

External Name	External Type	Status	RDS	Type
FRL2020_002	Palletized Floor Conveyor		=EOATMcc001.EOTLcc0...	
FRL2020_002	Palletized Floor Conveyor			EODGLname

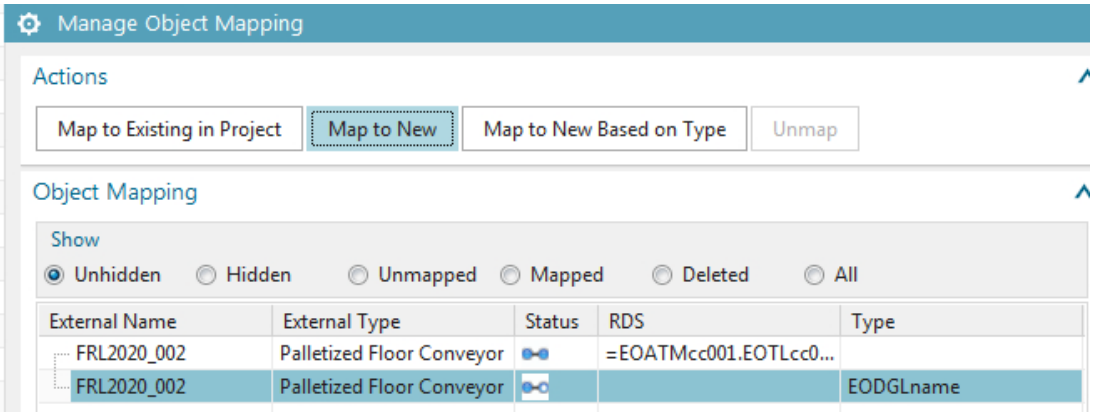
2. Map to new

You can map an external object to a new Engineering Object and override the type mapping defined for all projects for this one mapping.

Now try to create a new Engineering Object based on the mapping.

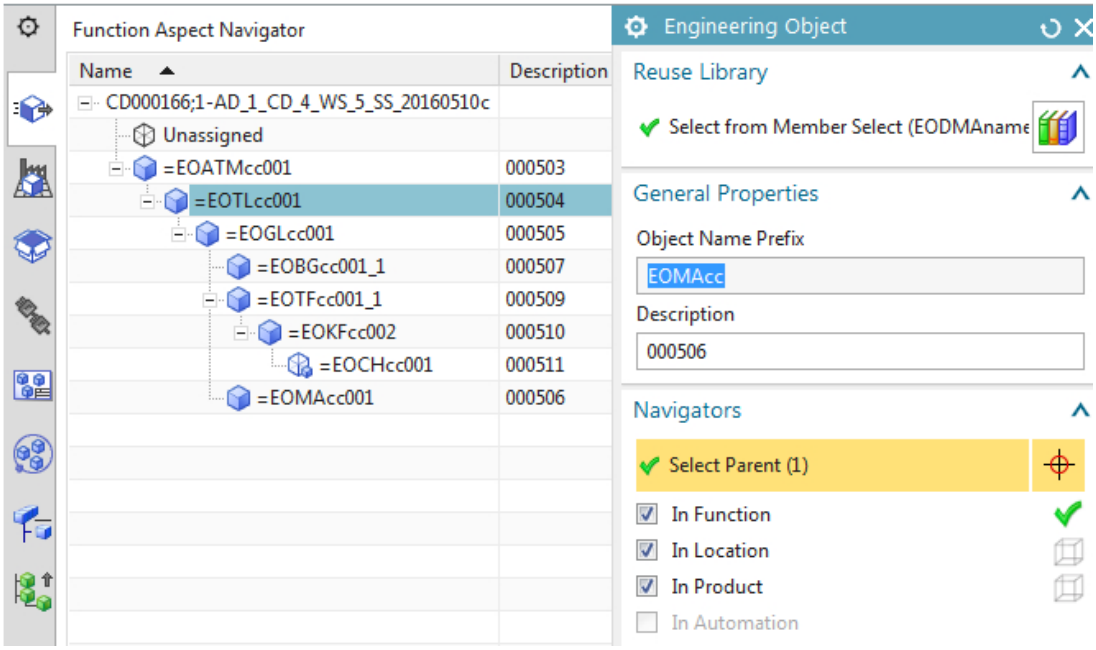
1. Select the unmapped Engineering Object.

2. Click **Map to new**.

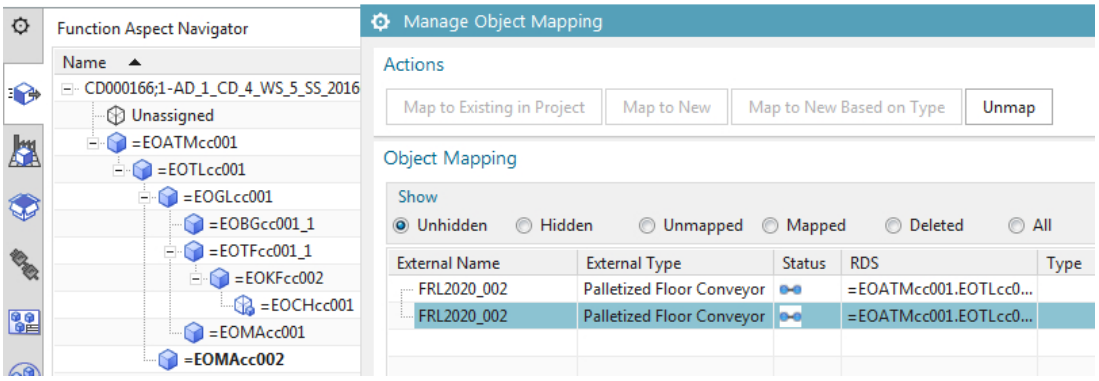


3. Select the Engineering Object from reuse library (you cannot select GL, because it is mapped).

4. For the parent select TL.



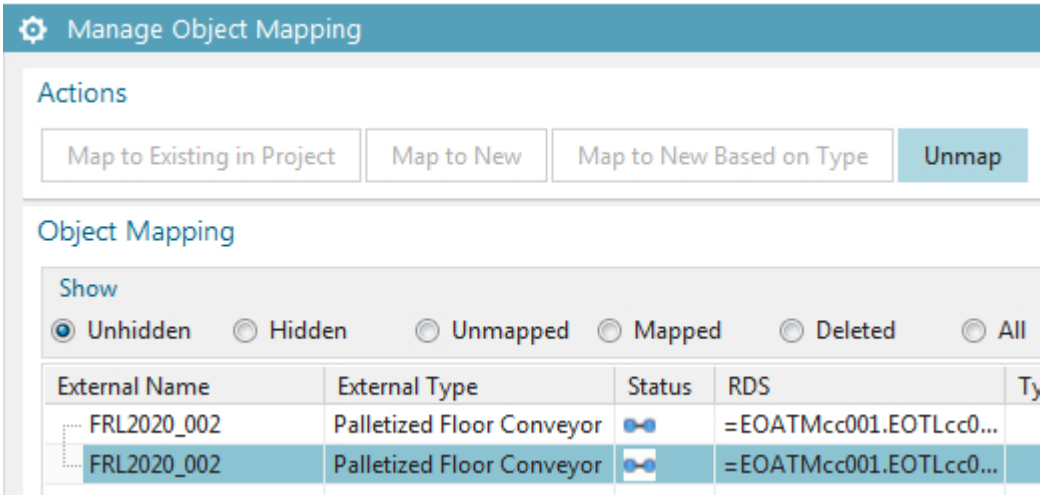
5. Click **OK**. A new Engineering Object is created and mapped to the conveyor.



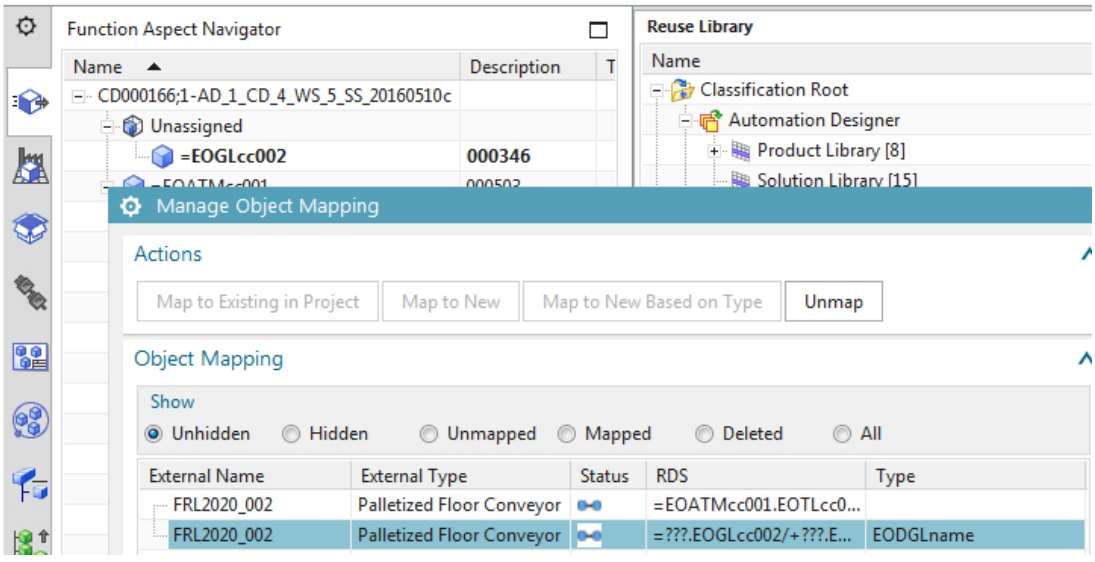
3. Map to new based on type

If you want to map external objects to new Engineering Objects, you can use the type mappings that were defined as default for all projects.

1. Unmap the previous mapping (select and click Unmap).



2. Click **Map to new based on type**. GL is automatically selected.

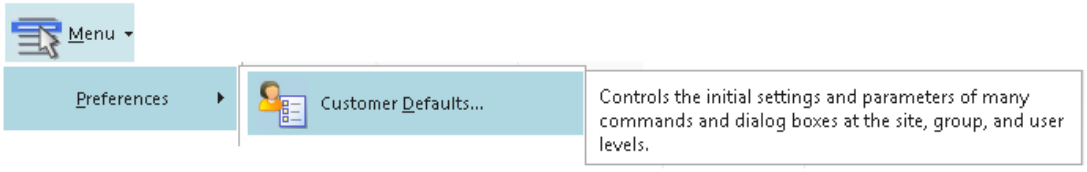

Function Aspect Navigator
Name
Description
CD000166;1-AD_1_CD_4_WS_5_SS_20160510c
Unassigned
=EOGLcc002
000346
Reuse Library
Name
Classification Root
Automation Designer
Product Library [8]
Solution Library [15]
Manage Object Mapping
Actions
Map to Existing in Project
Map to New
Map to New Based on Type
Unmap
Object Mapping
Show
Unhidden
Hidden
Unmapped
Mapped
Deleted
All
External Name
External Type
Status
RDS
Type
FRL2020_002
Palletized Floor Conveyor
=EOATMcc001.EOTLcc0...
FRL2020_002
Palletized Floor Conveyor
=???.EOGLcc002/+???.E...
EODGLname

Configure (non-template) EPLAN 7

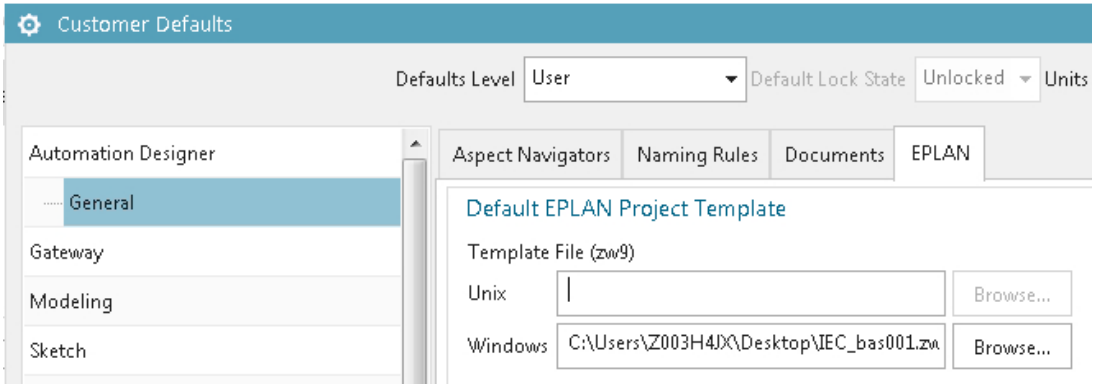
7.1 Import EPLAN project template

You must predefine a Default EPLAN Project Template in Customer Defaults for macro import. If the path is not set to the template, you cannot import any macro. It is recommended to do so before starting a project. Ensure that the used EPLAN project template includes the symbol libraries used in the macros. Otherwise the symbols are not visible, neither on the imported EPLAN macro nor on the created PDF.

1. Select **Menu→Preferences→Customer Defaults**.



2. In **Automation Designer→General**, under tab EPLAN, select the Default EPLAN Project Template for Windows.



3. Click **OK**.

7.2 Add PM250D macro

EPLAN page macros contain full pages. EPLAN window and symbol macros represent cut-outs of a page which can be reused by placing them on the page.

In EPLAN, macro placement is done graphically. In the Automation Designer you want to do the same and place window macros on pages to reuse the configurations.

As the graphics of EPLAN macros are not accessible from Automation Designer, insertion points on the EPLAN macros allows you to place your macros.