Application Example • 09/2015

Control Module (CM) Technology - Efficient Engineering in PCS 7

SIMATIC PCS 7

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Preface

Aim of the document

This document describes the structure, functions, benefits, configuration, as well as typical scenarios that are supported with the new type concept of SIMATIC PCS 7.

Abbreviations

Table 1-1: Designation of the type models

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>English</th>
<th>German</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT</td>
<td>Process tag</td>
<td>Messstelle</td>
<td>CFC according to the old type model</td>
</tr>
<tr>
<td>PTT</td>
<td>Process tag type</td>
<td>Messstellentyp</td>
<td>CFC-type template for instantiation according to the old type model</td>
</tr>
<tr>
<td>CM</td>
<td>Control module</td>
<td>Einzelsteuereinheit</td>
<td>CFC according to the new type model</td>
</tr>
<tr>
<td>CMT</td>
<td>Control module type</td>
<td>Einzelsteuereinheitstyp</td>
<td>CFC-type template for instantiation according to the new type model</td>
</tr>
<tr>
<td>BCM</td>
<td>Basic control module</td>
<td>Basic Control Module</td>
<td>Predefined control module types in form of a library</td>
</tr>
</tbody>
</table>

Note

The document uses the above listed abbreviations for the type models.

Validity

The description refers to the use of CM technology from SIMATIC PCS 7 V8.0. The BCM Type Library is available for SIMATIC PCS 7 V8.1.
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1 Task description and solution

1.1 Task

Standardization of engineering is an important factor for the continuous improvement of competitiveness and for achieving higher planning quality. Different process steps and procedures, different equipment and flexibility in the production make this task even more difficult.

One approach to standardization is the consistent use of control module types (CMT) to create an automation program.

In the ISA-88 standard there is a single control unit, e.g. a valve from the user program, and the physical device. Control modules can either form part of a technical device, such as flow control, or even part of a subsystem, such as a stirred tank.

1.2 Solution

This Application Example describes how to use the Control Module technology in the PCS 7 environment based on individual technology components and typical applications. The CM technology gives additional improvements and efficiency gains in terms of engineering in PCS 7, i.e. the automation project can be continuously adapted to the changing requirements.

Figure 1-1: Functional adaptation in the library and instantiating
1.2 Solution

The technology supports the effect on the automation program during the typical phases of engineering:
- **Concept**: Developing a rough structure using a P&I scheme
- **Development**: Execution of customer requirements, e.g. interlocks, process units, logic etc.
- **Test procedure**: Preparing the hardware connection (sensors and actuators)

The CM technology provides support not only during initial engineering phase but also for program extensions and the determination of changes to the program.

1.2.1 Control Module Types

The basis for standardized engineering is ensured by the consistent use of Control Module Types (CMT).

By determining optional blocks in the CMT, a variety of different variants of this CMT can be instantiated in the project. For instance, a variant could be a display measuring point for the input signal (4-20 mA, PA field device). On the other hand, a selectable feature refers to the program logic, such as a locking function.

The following figure shows a matrix with optional blocks to form a variant and to activate additional features.

Figure 1-2 Variant with selectable features

<table>
<thead>
<tr>
<th>CMT for control</th>
<th>Scale/Unit</th>
<th>ConPerMon</th>
<th>Interlock</th>
<th>PV_In</th>
<th>PV_Fb_In</th>
<th>PV_TE_In</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ctrl Std</td>
<td>x</td>
<td>0</td>
<td>0</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ctrl TE</td>
<td>0</td>
<td>0</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ctrl Fb</td>
<td>x</td>
<td>0</td>
<td>0</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ctrl SW</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **x** = Selection variant
- **o** = Selectable variant

All instances can be compared and synchronized at any time with the type.

The use of CMT offers the following benefits:
- Reduced test effort (type-based testing)
- Faster project planning through instantiation
- Reduced maintenance effort for libraries
- Change tracking by detecting deviations on the instance
1.2.2 Basic Control Modules Type Library

The Basic Control Modules (BCM) in the form of a Type Library are available for PCS 7 as a master data library and include typical, already preconfigured and tested CMTs. The BCMs are created using CM technology and enable engineering that is more efficient through standardized program components.

The following benefits are achieved by using the BCM Type Library:

- Extensive library for various application areas and industries
- A decrease in the configuration effort
- Reduced maintenance effort
- Harmonized structures

The BCM Type Library offers typical components as a template for building automation solutions. The CMT of the BCM Type Library contain all the necessary functions and channel blocks and can be customized by instantiating the project-specific circumstances.

The BCMs are based on the PCS 7 Advanced Process Library (APL) and Industry Library (IL). They are preconfigured as hardware independent and modular.

The following CMT groups are provided with the "109475748_BCM_PCS7_Lib_V811.zip" library the following purposes:

- AMON: Analog measured value display
- AOP: Checking and transferring analog input values by the operator
- CNT: Counting (binary/analog)
- CTRL: Controller for standard and cascade control loops
- DMON: Digital measured value display (binary signal)
- DOP: Checking and transferring a digital value by the operator (binary signal)
- MOT: Motor control
- VAL: Valve control

Note: Included with the library you can find a detailed description of each CMT including a functional description, supported variants and controls.

Required knowledge

It is required to have basic knowledge for configuring with PCS 7 and the APL.

1.3 Components of the Application Example

The following list contains all the files and projects used in this example.

Table 1-1

<table>
<thead>
<tr>
<th>Component</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>109475748_PCS7_CMT_Engineering_DOC_de.pdf</td>
<td>This document</td>
</tr>
<tr>
<td>109475748_BCM_LIB_PCS7_V811.zip</td>
<td>BCM library for PCS 7 V8.1</td>
</tr>
<tr>
<td>109475748_BCM_Manuals.zip</td>
<td>BCM description</td>
</tr>
</tbody>
</table>
2 Basics

2.1 ISA-88 Standard (discontinuous mode)

The "ANSI/ISA-88" standard refers to the batch-oriented operating mode in batch systems which, for instance, could be operated with SIMATIC BATCH and includes, among others, all the relevant standards and terminology. The following figure shows a plant design based on CMs (control modules).

Figure 2-1: Plant structure according to ANSI/ISA-88

2.2 ISA-106 Standard (continuous mode)

The "ISA-106" standard refers to the structure of the automation solution for continuous process plants. The standard describes, among other things, the:

- Physical Model: represents the physical system components through to the actual field device.
- Procedure Requirements Model: includes the process-specific requirements for the individual system components.
- Procedure Implementation Model: includes the implementation procedures for the individual system components.

The CMs or CMTs must be assigned to the Procedure Implementation Model. These are needed in the automation program to link the physical system component or for processing.

The basic structure is similar to the ISA-88 but it differs in the operation of the plant. In discontinuous operation, product manufacturing is controlled by a recipe. In this process, equipment modules are controlled differently depending on the application case (phase) and provided with recipe-specific parameter sets. This means that the control strategy is dependent on the product to be produced.

In continuous operation, the process is given precedence, i.e. the plant is started up via sequential process states. After reaching a stable and defined state, a product is continuously produced with consistent quality. The defined control strategy can respond to abnormal conditions by means of defined actions, such as a Safety Integrated System.
2.3 PT/PTT and CM/CMT structure

The following figure shows the structure of a PTT and CMT using the example of an analog valve.

Figure 2-2: Display in the CFC of PT/PTT and CM/CMT

1. In the PT/PTT, blocks are grayed out. The "Technological I/Os" are not supported.
2. In the "Technological I/Os" area, all created and defined objects (parameter, signal, messages, status, command) are displayed.
3. The blocks and the "Technological I/Os" of the CM/CMT are displayed in green.

Note: The colors described for the display refer to the default setting. The colors can be adjusted in the CFC for each engineering system or reset to their default values via the menu item "Tools > Settings > Colors...".
2 Basics

2.4 Comparison between PT/PTT and CM/CMT

2.4 Comparison between PT/PTT and CM/CMT

The following table compares the features of PT/PTT and CM/CMT.

<table>
<thead>
<tr>
<th>Functionality</th>
<th>PT/PTT</th>
<th>CM/CMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change tracking</td>
<td>Only with special tools</td>
<td>Yes, with the comparison function of the automation interface.</td>
</tr>
<tr>
<td>Variant support</td>
<td>No, because a PTT is needed for each variant</td>
<td>Yes, via CMT with selectable variants (options)</td>
</tr>
<tr>
<td>System-supported instantiation</td>
<td>IEA (Import/Export Assistant)</td>
<td>With COMOS or Advanced Engineering</td>
</tr>
<tr>
<td>Enhanced functions</td>
<td>Yes, by adapting the PTT and instantiating with</td>
<td>Yes, very comfortable due to the extended functionality of the CMT</td>
</tr>
<tr>
<td></td>
<td>the IEA Caution: The export file must be</td>
<td>and comparison with the instances.</td>
</tr>
<tr>
<td></td>
<td>adapted to the new function. Specific changes to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>instances are lost if not read back.</td>
<td></td>
</tr>
<tr>
<td>Type configuration</td>
<td>Easy, by placing and interconnecting the required</td>
<td>Somewhat more extensive, as the technological I/Os have to be also</td>
</tr>
<tr>
<td></td>
<td>blocks.</td>
<td>defined.</td>
</tr>
</tbody>
</table>

2.5 Mass data engineering

The "Comos" and "Advanced Engineering" applications supported the program-assisted generation of the automation data (hardware configuration and automation program).

Under the following links you can find Application Examples for mass data engineering:

- Application Example: Performant Bulk Engineering with SIMATIC PCS 7 Advanced ES using a practical example
- Application Example: Integrated Engineering with COMOS and SIMATIC PCS 7 using a practical example
- Application Example: Adaption of existing PCS 7 Projects for the Use of Advanced ES
2.6 Automation interface

The automation interface is where the CMT of the master data library and the instances (CM) of the automation project are synchronized. The automation interface displays which instances changed as opposed to the CMT and what exactly has changed. Differentiation takes place by means of varying colors and object representations, e.g. encountered deviations when comparing the status of projects.

The following figure shows the detailed structure in the automation interface.

Figure 2-3: Structure of the automation interface

- **(A) Data target/project**: The data target corresponds to the project and contains all instantiated CMs. The project name and project path inside the bar are displayed in a blue font color.
- **(B) Data source/library**: The data source corresponds to the master data library and contains all the CMTs of the library. For the comparison one can select individual CMTs or the entire library. The library name and the CMT are shown in a green font color in the bar.
- **Comparison view**: In the comparison view, differences between the selected folders/CFCs in the selection area are shown as a comparison with the comparative object (data source/library).
- **Selection area**: The selection area shows all instances found in the project. The instances that have a deviation from the template can be selected or deselected for synchronization from the left edge. All instances are selected by default.
2 Basics

2.6 Automation interface

- **Navigation area:** In the navigation area it is possible to swap between the individual data sets (instances). The display can be switched between standard and tabular view or a pre-filtered view (deviations only). The navigation area also contains buttons to update the synchronized projects and to start the synchronization.

- **List view:** The list view gives a comparison between the subordinate objects of the selected folders/CFCs in the selection area and the comparative object (data source/library).

**Note**

It is possible to compare project versions with Comos and the automation interface.
3 Operating principle

3.1 Technological I/Os

In the CFC, objects are defined via the technological I/Os, which are kept during a synchronization with respect to their parameter values or interconnections. With a few exceptions, other changes are reset to their original state in the CMT.

The user-friendly interface allows technological I/Os to be created and extended using drag-and-drop. An added object is assigned automatically.

The following objects are available in the technological I/Os:

- **Control modules**: Block or block group
- **Parameter**: Block input or output with preconfigured value or an interconnection/multiple interconnections, attributes such as unit or value can be configured
- **Signal**: Interconnected input value with process value and status (no multiple interconnection possible, parameter attributes are not present)
- **Messages**: Messages that are associated with the available CM
- **Command and status** are required to connect to sequencers.

**Note**

All block parameters/connections assigned in the technological I/Os are displayed as green in the block and do not change during synchronization.

**Attributes**

The "Attributes" area shows the available attributes of an object (name, option, value, unit, etc.) and assigned CM or linked interconnections.

Each object has different attributes. While the name of the connection is being assigned or the "Optional" function is being set in a block or block group, a process value and/or a unit can be preset at a lower-level parameter.
3.2 Synchronization functionality

The synchronizing function in PCS 7 is done via the automation interface and is carried out for a project. All instances and observed changes are displayed in the automation interface. The user can decide selectively at the instance level about which instances are to be synchronized. For example, modules that have been added to an instance are ignored during the synchronization process. On the other hand, blocks or interconnections that have been added in the type are adopted in the instances when synchronizing.

**Note**
Filter settings, such as deselecting instances, are discarded after closing the automation interfaces.

1. In the plant view of SIMATIC Manager, select the AS project and choose the context menu "Plant types > Synchronize...".

![Simatic Manager Plant Types Synchronize](image)

2. Select the types you want to synchronize and click the "Synchronize..." button.

![Simatic Manager Select Types Synchronize](image)
3. The comparison dialogue shows all the folders, where the previously selected CMTs were created as an instance. Changes made to terminals that are not technical connections, are displayed at the respective instance.

Note
If two blocks are connected to each other in the Type and the destination connection is defined as "Technical connection", the change is kept when synchronizing when the connection in the instance is deleted. If the two connections are not defined as "Technological I/Os" in the Type and the connection is deleted in the instance, the original state is restored after synchronization.

Note
In the Operating Manual "SIMATIC PCS 7 V8.0 Synchronizing control module types" with the entry ID: 99861834, you can find further detailed information such as which attributes are synchronized.
4 Application scenarios

4.1 Scenario A – Creating a CMT with variants

In this scenario, a CMT is configured to display measured values. The CMT supports a variety of variants through optional channel blocks. A CMT can be either generated from an existing measuring point in the project or built from scratch. Initially, the user needs to think about the structure, static or variable parameters, block messages, as well as about possible variants.

This example considers the following configuration:

- Measured value display via the "MonAnL" block
- 3 different channel drivers (analog, thermocouple and fieldbus) are supported
- As an alternative to the channel drivers, it is possible to choose a differential measurement
- Central parameter assignment of the scaling and unit
- Program logic and functionality in chart partition A and channel driver in chart partition B

Creating a CMT

In preparation, a new folder has been created in the "Plant view" of an existing project library in SIMATIC Manager. An empty CMT called "AMon" was added in the folder for measured value display.

1. Open the CMT and place a second chart partition for channel drivers.
2. Add the following blocks with the appropriate names to the CFC.
   a. MonAnL block as "I" in chart partition A, sheet 1
   b. StruScOu block as "PV_Scale" in chart partition A, sheet 1
   c. Sell block as "PV_Unit" in chart partition A, sheet 1
   d. Sub02 block as "DeltaCalc" in chart partition A, sheet 1
   e. Pcs7AnIn block as "PV_In" in chart partition B, sheet 1
   f. Pcs7AnIn block as "PV_TE_In" in chart partition B, sheet 1
   g. FbAnIn block as "PV_Fb_In" in chart partition B, sheet 1
3. Switch the following block inputs and outputs as visible or invisible.
   a. PV_Unit: Hiding the inputs "In2", "SelMode", "Sel_In2" and the output "In2Selected"

Pre-configuration and interconnection

The following parameters are adjusted for the basic configuration:

- I: Deactivate all "PV_xx_En" limit messages ("0")
- I: Pre-assign "99999.0" to all "PV_xH_Lim" upper limits
- I: Pre-assign "-99999.0" to all "PV_xL_Lim" lower limits
- PV_TE_In: Pre-assign Scale to "0" (low) and "1" (High)

The following block interconnections are also carried out:

<table>
<thead>
<tr>
<th>Source (output)</th>
<th>Target (input)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV_Scale.Scale</td>
<td>I.PV_OpScale</td>
<td>Central scaling of the process size for display and channel drivers</td>
</tr>
<tr>
<td></td>
<td>PV_In.Scale</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PV_Fb_In.Scale</td>
<td></td>
</tr>
<tr>
<td>PV_Unit.Out</td>
<td>I.PV_Unit</td>
<td>Central scaling of the process unit for display and channel driver</td>
</tr>
<tr>
<td></td>
<td>PV_TE_In.PV_InUnit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PV_In.PV_Unit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PV_Fb_In.PV_Unit</td>
<td></td>
</tr>
<tr>
<td>PV_In.Bad</td>
<td>I.CSF</td>
<td>Display when process value is invalid</td>
</tr>
<tr>
<td>PV_In.PV_Out</td>
<td>I.PV</td>
<td>Display of the process value</td>
</tr>
<tr>
<td>PV_In.OosAct</td>
<td>I.OosLi</td>
<td>Display when process device is in maintenance mode</td>
</tr>
</tbody>
</table>
4 Application scenarios

4.1 Scenario A – Creating a CMT with variants

Synchronization parameters and messages

The following section shows you how to create all parameters (inputs or outputs) and messages in the technological I/Os.

1. Open the "Technological I/Os" in the CMT.

2. Add the display module "I" to the technological I/Os via drag-and-drop. "I" corresponds to a CM (Control Module) in the technological I/Os.
4 Application scenarios

4.1 Scenario A – Creating a CMT with variants

3. Drag each block connection (inputs and outputs) to the CM "I" you created and refresh the display by pressing the "F5" function key. All linked connections are shown in green.

4. Change the "PV" attribute "variable type" from signal to the parameter. It is only possible to link several interconnections to the input once this is done.

5. Add the "MsgEvId1" messages to the technological I/Os via drag-and-drop. In each of the attributes of the MsgEvId1, enter the message identifier, e.g."SIG1".

Note

Under "Messages ..." in the object properties of the message-type block, you can find the message identifier. This is only possible with message-type blocks, such as display and controller blocks.
4 Application scenarios

4.1 Scenario A – Creating a CMT with variants

6. Carry out step 5 for the message identifier "SIG2" to "SIG8" and repeat the procedure for "MsgEvId2".

7. Also add the following blocks and parameters to the technological I/Os:

<table>
<thead>
<tr>
<th>CM name</th>
<th>Block with parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DeltaCalc</td>
<td>DeltaCalc.In1</td>
</tr>
<tr>
<td></td>
<td>DeltaCalc.In2</td>
</tr>
<tr>
<td></td>
<td>DeltaCalc.Out</td>
</tr>
<tr>
<td>Opt_PV_Scale</td>
<td>PV_Scale.HiScale</td>
</tr>
<tr>
<td>Note:</td>
<td>PV_Scale.LoScale</td>
</tr>
<tr>
<td>The PV_Unit is additionally incorporated in the group.</td>
<td>PV_Unit.In1</td>
</tr>
<tr>
<td>PV_Fb_In</td>
<td>PV_Fb_In.PV</td>
</tr>
<tr>
<td></td>
<td>PV_Fb_In.PV_Li</td>
</tr>
<tr>
<td></td>
<td>PV_Fb_In.PV_ST</td>
</tr>
<tr>
<td></td>
<td>PV_Fb_In.Bad</td>
</tr>
<tr>
<td></td>
<td>PV_Fb_In.OosAct</td>
</tr>
<tr>
<td>PV_In</td>
<td>PV_In.PV_In</td>
</tr>
<tr>
<td></td>
<td>PV_In.Bad</td>
</tr>
<tr>
<td></td>
<td>PV_In.PV_Out</td>
</tr>
<tr>
<td></td>
<td>PV_In.OosAct</td>
</tr>
<tr>
<td>PV_TE_In</td>
<td>PV_TE_In.PV_In</td>
</tr>
<tr>
<td></td>
<td>PV_TE_In.Bad</td>
</tr>
<tr>
<td></td>
<td>PV_TE_In.PV_Out</td>
</tr>
<tr>
<td></td>
<td>PV_TE_In.OosAct</td>
</tr>
</tbody>
</table>

**Note**

In the "Assigned block" area, you must enter the appropriate chart and block names. In this example, the blocks "Amon\PV_Scale" and "Amon\PV_Unit" are registered in the group "Opt_PV_Scale". If a block is missing, it can be subsequently dragged to the cell via drag-and-drop. In case of a lack of assignment, instances will not be created properly when generating the chart name.
4 Application scenarios

4.1 Scenario A – Creating a CMT with variants

Multiple interconnections (variants)

Simple interconnections to a block input can be created as usual. In the case of variants whose interconnection partner changes by selection, these options must be configured in the technological I/Os.

The following section shows how to preconfigure the CMT for displaying different process values (channel driver or difference calculation). To achieve this, optional modules or block groups and the optional interconnections are created in the technological I/Os.

1. In the technological I/Os, select the CM "Opt_PV_Scale" and activate the Optional attribute. This action allows you to deselect the central specification for the scaling and unit.

2. For the variant formation, activate the Optional attribute for the CM "DeltaCalc", "PV_FB_In", "PV_In" and "PV_TE_In".

3. Link the other process value outputs of the channel driver and the differentiation with the PV input of the display block via drag&drop.
4 Application scenarios

4.1 Scenario A – Creating a CMT with variants

**Note**

All links and interconnections are listed in the attribute "Interconnection to".

![Diagram]

4. Follow step 10 to complete the interconnections for the following parameters in the technological I/Os, from the source to the target:

<table>
<thead>
<tr>
<th>Parameter source</th>
<th>Parameter target</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV_Fb_In.Bad</td>
<td>1.CSF</td>
</tr>
<tr>
<td>PV_In.Bad</td>
<td></td>
</tr>
<tr>
<td>PV_TE_In.Bad</td>
<td></td>
</tr>
<tr>
<td>PV_FB_In.OosAct</td>
<td>1.OosAct</td>
</tr>
<tr>
<td>PV_In.OosAct</td>
<td></td>
</tr>
<tr>
<td>PV_TE_In.OosAct</td>
<td></td>
</tr>
</tbody>
</table>

**NOTICE**

The multiple interconnection of the variant formation will only work if all variant blocks (CM) have the "Optional" attribute enabled at the beginning. The interconnections of the parameter source to the parameter target are only done in the technological I/Os.

The display CMT forms part of the BCM library and the project "Equipment Modules for PCS 7 using the example of the Chemical Industry". The example project can be found under the entry ID: 53843373.
4.2 **Scenario B – Configuring cascade control with CMT**

The basis for sustainable engineering in PCS 7 is the use of a master data library with CMT. In the following scenario, the BCM Type Library is used to create Temperature-Flow-Cascade control. Cascade control is used for applications where fluctuations are compensated within the auxiliary control loop (by the flow controller) or where the actuator has a non-linear valve characteristic.

**Figure 4-1: P&I of a Temperature-Flow-Cascade**

1. In the SIMATIC Manager switch to the “Plant view” of your project and create a hierarchy folder named “CMT” in your master data library.

**Note**

The folder name is not binding. Even the Process Tag Type folder can be used.

---

Note: The project/multiproject was created according to the procedure in the manual "SIMATIC Process Control System PCS 7 Compendium Part A - Configuration Guidelines (V8.1)". The configuration guidelines can be found under the entry ID 107196780.
2. Retrieve the Library "109475748_BCM_LIB_PCS7_V81.zip" and switch to the "Plant view".

3. Drag the included CMT folders "AMon", "Ctrl" and "ValAn" in the master data library of your project.

Note: All the necessary blocks are adopted when transferring the CMT.
4 Application scenarios

4.2 Scenario B – Configuring cascade control with CMT

4. Change the folder names for the "Unit" hierarchy folder in the AS project "CMT_Eng_AS" and the technical function "Temperature-Flow-Cascade" branches off underneath.

5. Copy two controller CMs "Ctrl" and a valve-CM "ValAn" from the master data library into the folder "Temperature-Flow-Cascade".

6. Change the names of the "Ctrl" CM to "TIC_Temperature", "Ctrl(1)" to "FIC_ServMedium" and "ValAn" to YC_ServMedium".

7. Open the CFC "YC_ServMedium", hide the "Technological I/Os" and select the context menu "Variants...".

8. In this example, the valve receives the manipulated variable from the controller. The control range and the unit are centrally configured and the valve (actuator) provides an analog signal incl. actuating position read-back.

If you cannot imagine any precise function under the individual selection points, in the CMT you get a thorough overview of the interconnected blocks and the configured technological connections. You can find the assigned CMT in the object properties of the CFC.
4 Application scenarios

4.2 Scenario B – Configuring cascade control with CMT

9. If necessary, change the setting range on the "MV_Scale" block and the unit on the "MV_Unit" block. The default is 0% to 100%.

**Note**
If the communication interfaces of the actuator are unknown, the variation in the CFC can be changed subsequently.

10. Open the CFC "FIC_ServMedium", hide the "Technological I/Os" and select the context menu "Variants...".

11. In this example, the controller receives its setpoint from a master controller and defines the manipulated variable for the valve. The process variable and unit are set centrally and the flow rate is recorded by a field device with digital communication.

12. For the process variable, set the range 0 to 10 on the "PV_SCALE" block and the unit in 1328 (t/h) on the "PV_Unit" block.

13. Connect the block output "to_Actor_Slave" to the block input "from_Ctrl" of the valve CM and the block output "to_Ctrl" to the block input "from_Actor_Slave".

14. Open the CFC "TIC_Temperature", hide the "Technological I/Os" and select the context menu "Variants...".
4 Application scenarios

4.2 Scenario B – Configuring cascade control with CMT

15. In this example, the master controller “TIC_Temperature” defines the setpoint for the slave controller “FIC_ServMedium”. The process variable and unit are set centrally and the temperature is recorded as an analog measured value.

16. For the process variable, set the range 0 to 10 on the “PV_SCALE” block and the unit in 1001 (°C) on the “PV_Unit” block.

17. Connect the block output “to_Actor_Slave” to the block input “from_Master” of the slave controller “FIC_ServMedium” and the block input “from_Actor_Slave” of the master controller “TIC_Temperature” to the block output “to_Master” of the slave controller “FIC_ServMedium”.

**Note**

You must also link the individual channel driver of the CM with the respective periphery via the symbolic name. In a second step, the two loops must be set, starting with the flow control “FIC_ServMedium” and then the temperature control “TIC_Temperature”.

The preconfigured “Temperature-Flow-Cascade”, which is provided with a simulation, forms part of the project “Equipment Modules for PCS 7 using the example of the Chemical Industry” with the entry ID: 53843373.
4.3 Scenario C – Efficient functional enhancement to APG using type synchronization

The following section shows how the existing project "Unit Template Distillation Column" is expanded to include an optimized process control by means of APG (Advanced Process Graphics). The project is structured, i.e. it contains the levels of the unit, equipment modules (EM) and control module (CM) and is based on the BCM library.

APG provides both an AS object to connect the automation software and some OS objects to display process information. This scenario focuses on the efficient AS configuration, which can be carried out quickly and with the necessary flexibility by means of CM technology. The APG connector block, which is necessary for the display, is added and pre-configured once in each type. Once this is done, each instance will be available as an option.

Preparations

1. Retrieve the example project "Distillation column" in SIMATIC Manager and switch to the "Plant view".
2. Add the "HMIpConn" APG connector block to the master data library.
3. Add the "HMIpConn" block to the CMT "Ctrl" and change the name to "HMI".
4. Interconnect the input "ReadPointer" of the "HMIpConn" block with an output of the "PIDConL" block.
4 Application scenarios

4.3 Scenario C – Efficient functional enhancement to APG using type synchronization

**Note**

Use an unused output on the source block for the interconnection. The "Status2" output on the controller block has been made visible and connected for this configuration example.

5. Assign the parameters to the "HMIpConn" block using the following parameters:
   - "BlockType": 2 as a suitable representation of PIDConL
   - "ViewMode": 1 for absolute value range
   - "ViewRange": 4 to display the working range
   - "DispRatio": 0.6 ratio of display to ViewRange

6. Add the APG block "HMIpConn" with the "APG" designation to the technological I/Os via drag-and-drop.

7. Drag the block inputs "ViewMode", "ViewRange", "DispRatio" together with the work and limit monitoring "PV_Xx_Li" to the created "APG" CM and refresh the screen with the "F5" function key.

8. In the technological I/Os, select the "APG" CM and activate the Optional attribute. Thanks to this action, the visualization can be selected when needed.

9. Repeat steps 3 to 7 for the "Amon" CMT with "BlockType": 1 as a suitable representation of MonAnL.

**Note**

Configuration is carried out equally for the controller and for the display CMT using "MonAnL" blocks. In this case, the "Status2" output of the "MonAnL" block can be connected to the APG connector block.

The "ENO" output from the block must not be used for the "ReadPointer" connection.

If you configure a different range, e.g., the alarm range, for the "ViewRange" parameter, you must also configure the corresponding limits "PV_Xx_Li".
4 Application scenarios

4.3 Scenario C – Efficient functional enhancement to APG using type synchronization

Synchronization

1. In the plant view of SIMATIC Manager, select the AS project and choose the context menu "Plant types > Synchronize...".
2. Select the two types "Amon" and "Ctrl" and click the "Synchronize..." button.
3. Press the "Synchronize template" button in the comparison dialog.

Note

The "APG" option is available in the instances after propagating the change. The option is deselected by default.

Instance adjustment

1. Activate the "APG" option for the following instance:
   a. Controller: "FIC_Feed", "FIC_Reflux", "FIC_Vapor", "PIC_ColuHead", "LIC_Bottom", "LIC_RefluxDrum"
   b. Display: "TI_Head", "TI_HeadPacking", "TI_AboveFeed", "TI_BelowFeed", "TI_BottomPacking", "TI_Bottom", "PI_ColuBottom", "FI_Distil", "FI_Bottom"

2. The final steps are:
   a. Setting the workspaces "PV_Ol_Li" and "PV_OH_Li" in each instance
   b. Creating a process picture with APG objects using the templates 
      "@Template_APG.pdl" and "@Examples_APG.pdl"
   c. Interconnecting the process picture objects with the respective instance using the Dynamic Wizard

Note

For a detailed description on how to configure the process picture and interconnect the APG objects (AS-OS connection), please refer to the Application Example "Integration of Advanced Process Graphics in SIMATIC PCS 7" with the entry ID: 89332241.
5 Related literature

Table 5-1

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</tr>
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<td>\2\ Download page of this entry</td>
<td><a href="https://support.industry.siemens.com/cs/ww/en/view/109475748">https://support.industry.siemens.com/cs/ww/en/view/109475748</a></td>
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<td>compendium, forum, application examples and videos)</td>
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<td>\5\ Performant Bulk Engineering with SIMATIC PCS 7 Advanced ES</td>
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6 History

Table 6-1

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<th>Modification</th>
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<td>09/2015</td>
<td>First edition</td>
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