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September 2018

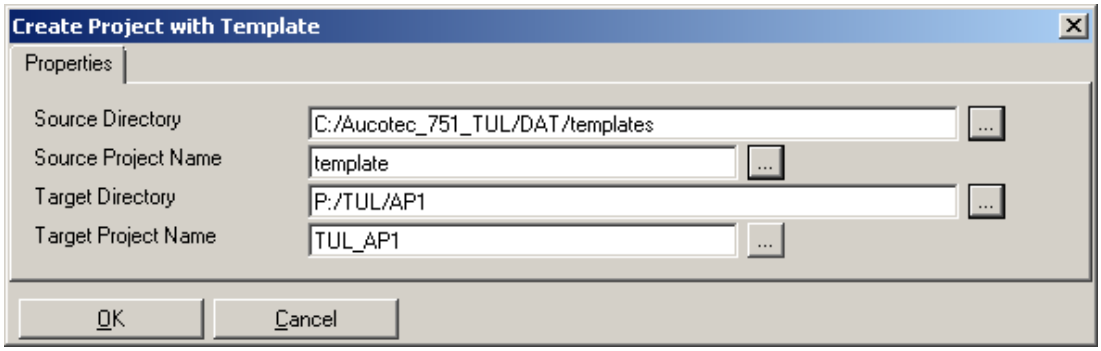
Objective

Introduction to the CAE – System Aucoplan

Unit 1: Setting up a project and working with data bases

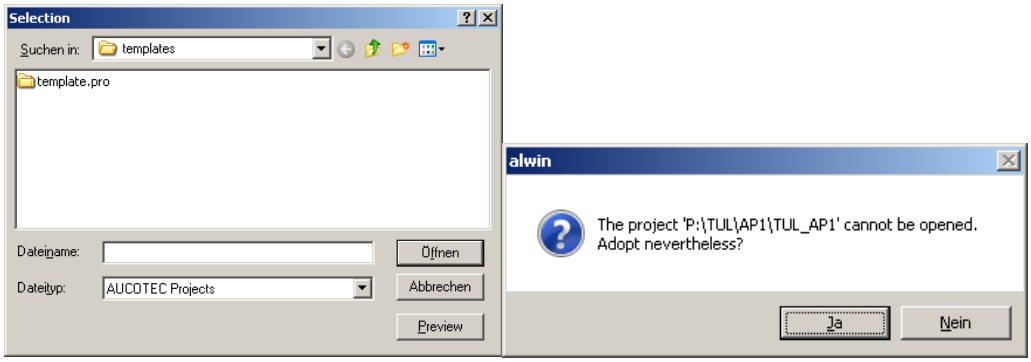
Exercise 1: Configuration of a new project and configuration of the basic settings

Start the **Aucoplan 7.5.1 IEC** Version.
Create by use of the option of the main menu: **File\Project New\with Template** a new project with the name "**TUL_*workstation_number*"** (example "TUL_AP1") in the directory according to your workstation number **P:/TUL/*workstation_number***. The template for the project structure is "**template.pro"** in **C:/Aucotec_751_TUL/DAT/templates**.



*Hint: If available, always use the **selection button [...]** to find appropriate data!*

If you get a german windows dialog box then use "Suchen in" to search, „Öffnen" to open, „Abbrechen" to quit, „Ja" for „Yes" and „Nein" for „No".



Quit with „Ja"

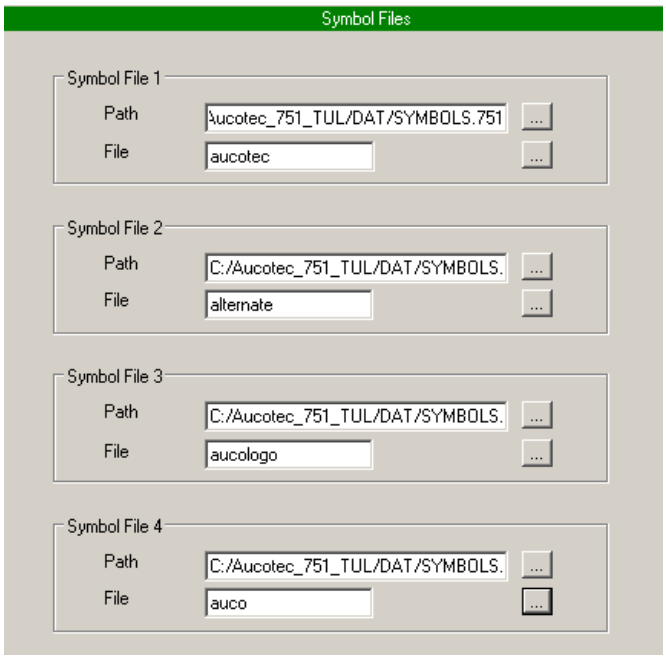
A subdirectory with the selected project name + **.PRO** (e.g. TUL_AP1.PRO) will be created by the system. Please inform yourself about the created files in the subdirectory and the complexity of the basis model of your project by help of the Windows-Explorer.

Then check the relationships of the project to the data base structure in the main menu level:
(**Extras\Options\Settings\User → Projects**)

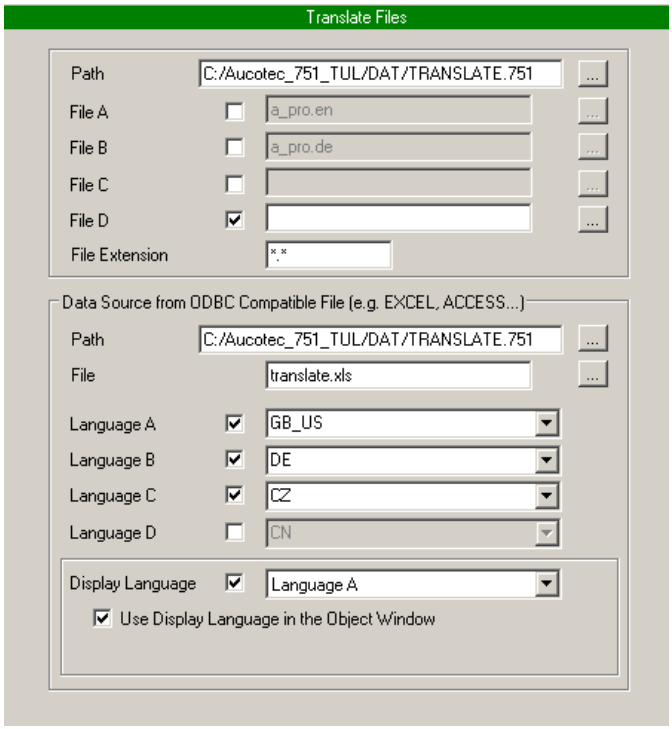
1) **External Project:** C:/Aucotec_751_TUL/DAT/PROJECTS.751/**AUCOTEC**
2) **Original Project:** C:/Aucotec_751_TUL/DAT/PROJECTS .751/**MASTER**
3) **Macro Project:** C:/Aucotec_751_TUL/DAT/PROJECTS .751/**DEMO_IEC**

Change to the settings of your project (**Extras\Options\Settings\Project**) and check the project specific settings:

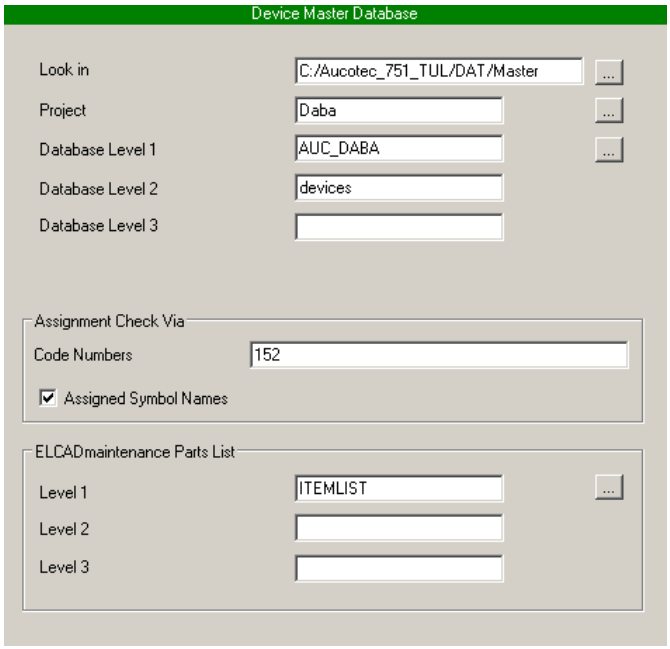
– **Master Data\Symbols\Symbol File *x*:**



– **Master Data\Translate:**



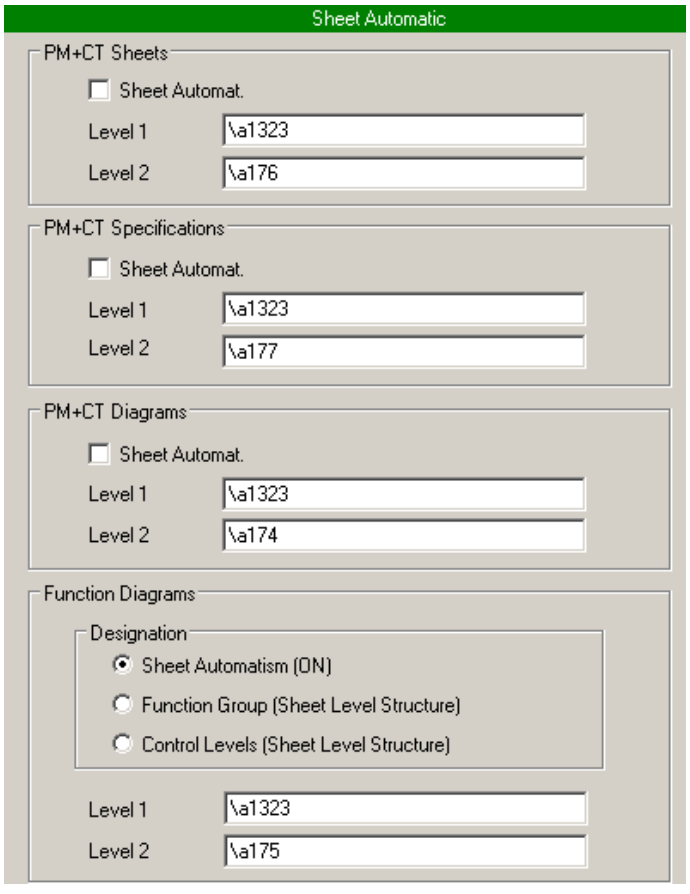
– **Master Data\Devices:**



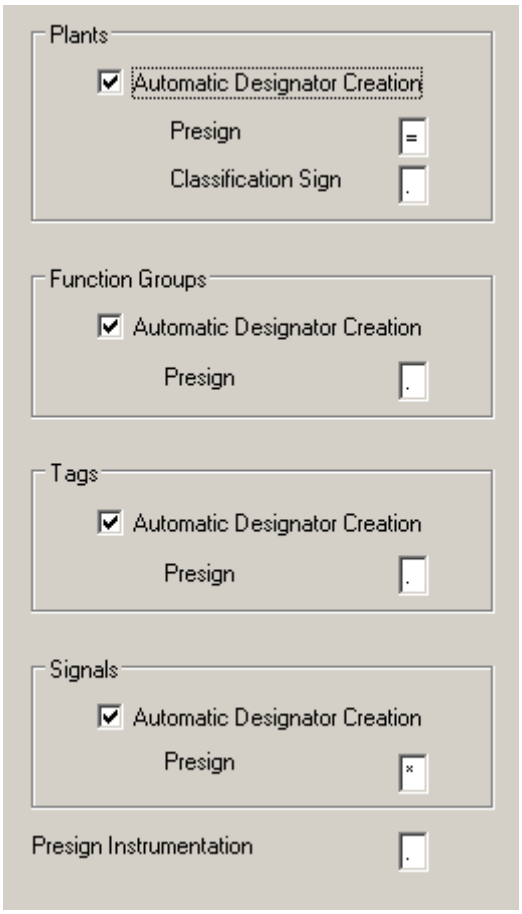
– **Master Data\Cable:**

…/DAT/Master: Daba

– **AUCOPLAN (PM-CT) - Sheet Automatic:**



– **AUCOPLAN (PM-CT)-Designator Creation:**



Remarks:

Extras\Options\Settings\<u>User</u>:
Settings which are linked to the **user** and affect all projects of the according user.

Extras\Options\Settings\<u>Project</u>:
Settings which affect only the opened **project**.

Note that the project settings **override** the user settings!

All changes that you make to your project are automatically stored if you close the project (**File\Close Project**)!

You can copy your project to another media with the function **File\Save Project as**. If you want to use your project on another aucoplan installation you can add the according local symbol files and data to your project and save all by right clicking on your project name in the object window and using the function: **Send Project To.**

Exercise 2: Work with the master data base

a.) Choosing of the master data base

Change by selection of the main menu option: **View\PM+CT Design** to the master data base level „**Plants**“. Open with the right mouse button on the plants table the pull down menu and take over by help of **New Record-Blank\Structure_1\Data selection button […]\External project**\->**Data Preselection Mask\OK** the data structure of the plant “=A1.T1”. Use the buttons **[<<<] / [>>>]** until you reach the display “page through records” and select the plant (“Apply”). Load the new data record with “OK” and than quit the dialog with “Cancel”.

b.) Becoming familiar with the structure of the tables

Take a look at the **table** structure of the data records in Plants, Function Groups, Tags, Instrumentations, Signals: **right mouse button\Change**.

Note that if you select a plant, function group or tag you can see only the items of this preselection in the lower levels. You can display all items by deactivating the “designator default value”  in the symbol bar.

c.) Using the filter function

Change into the level “**Instrumentations”** and deactivate the “designator default value” or go directly from the level “Plants” to the “Instrumentations”.

- Display by help of the filter (**Records\Filter**): **Kind=*"text"*** all data records of the device **kinds**: **BTE**, **UN** and **UNI** and check the contents and data structure.
- Select by the substring filter: **"*text*"$Location** all elements at the location **"F3"**
- Select all elements of the kind **"UM" and** the location **"+C3"**by combination of filters
- Change into the level **“Tags”** and display all **level** sensors.

d.) Modifying of records of the master data base

Choose now the following data records in the level “Instrumentations” by help of filters and make necessary modifications and/or additions to the contents in the fields:

- Sensor and Transducer for Temperature
  Kind: BTE; Instrumentation: .TE; Part number: PT 100/LABOM/0-200;
  Adjustment Type: BTE_PT100_IEC_0…200°C; Device group: 02_4;
  Specification sheet: SP_BTE-001; Item: -BT02; Adjust group: A02_4
- Isolation Amplifier
  Kind: UN; Instrumentation: .UN; Location: +MU/TVS01AD;
  Device group: 02_2; Specification sheet: SP_UN-003; Item: -003
- Analog Input Card:
  Kind: UNI; Instrumentation .UNI; Location: +PLSS01AA;
  Device group: 02_1; Specification sheet: SP_UNI-001,
  Item: -002; System address: PW 120
- Flow-Sensor
  Kind: FE; Instrumentation .FE; Device group: 01_F;
  Specification sheet: SP_F-001, Item: -F01, Measured_media_type: Water
- Device Terminal (green)
  Kind: X; Instrumentation: .X; Manufacturer: PHOENIX;
  Type: UK 6; Part_number.: 3004016; Item: X1

Add, if necessary (**New Record – Blank**), with the help of the “**Part_number**” and the selection button […] the corresponding data record of the missing instrumentations.

e.) Selection of the master data bases ***Cable***

Change via **View\Cable Planning** to the master data base level „**Cable**“. Create the following cables bei use of the “Part_number” and the selection button [...]:

- Data transfer cable J1:
  Part number: JE-LiYCY 2x2x0,5; Cable Type: JE-LiYCY;
  Comment: odbočovací kabel
- Data transfer cable J2:
  Part number: JE-LiYCY 16x2x0,5; Cable Typ: JE-LiYCY;
  Comment: kabel mezi provozem a velínem

Note that all changes that you make to your data base are **automatically** stored.

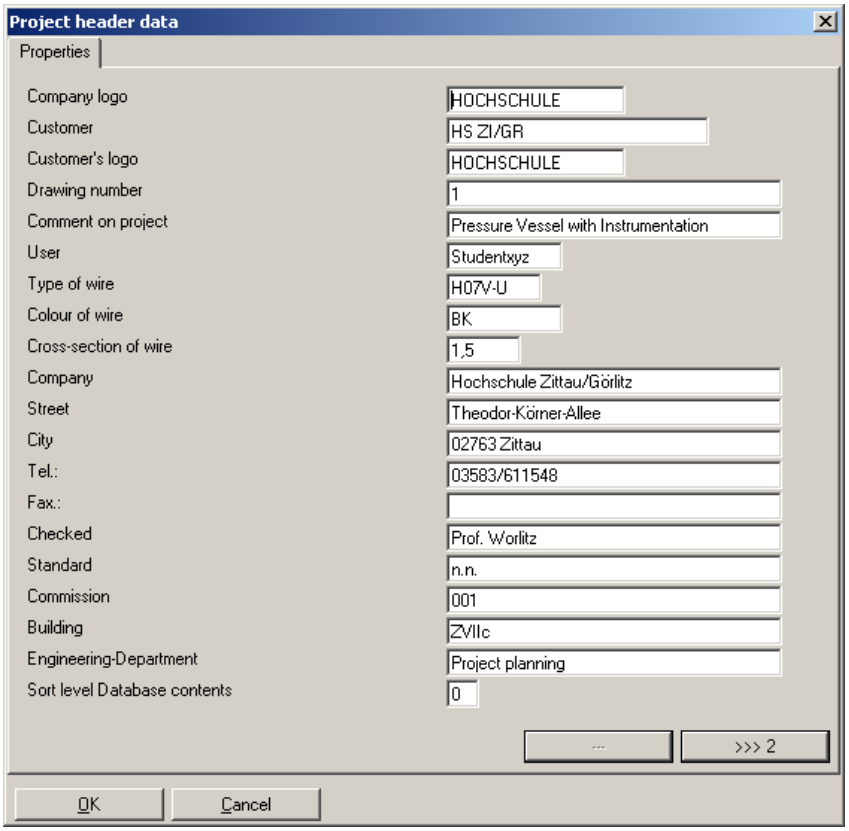
Now go to the View “**Drawing Editing**“.

Exercise 3: Editing of General data (Project Head Data)

Every documentation sheet includes a title block. General Data for this block are saved in a special **project head data** file. The information in this file can be called up in the title block areas of a documentation sheet by using placeholders (so-called “**Z numbers**”).

The aim of the exercise is to create und use the project head data.

Close possibly opened drawings (File\Close Drawing), go from the main menu to the project head data level: **File\Project Header Data/Info** and modify the content manually, using project-relevant information. Put in your name as “User”, Customer as “TUL FM” and Company logo as “TUL_FM”



Exercise 4: Editing of the form sheet symbol

Certain parts of the data model of the system and the whole project documentation are edited graphically.
The algorithms for editing the several documentation kinds are different. But form sheet symbols, list symbols and graphic symbols are always the generally basis stored in the standard data base.
For editing symbols switch to the symbol editor: **View\Symbols** and select the form sheet: **GE_A3L_FORM** from **GE\FORM\9: Form sheet.**

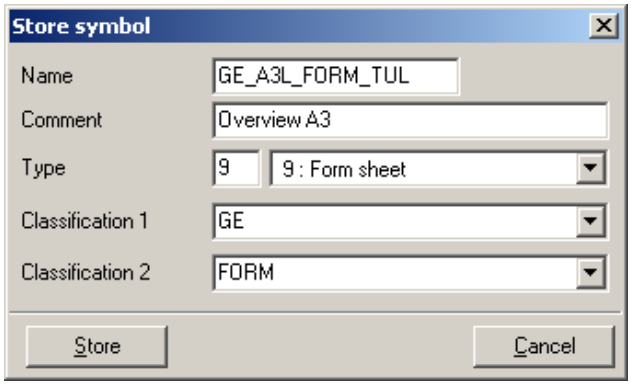
a.) Open the dialogue mask: **Edit\Objects\Dialogs**.

The dialogue mask shows you the line numbers with the default values. To see where the text lines are displayed in the form sheet you can use the function: **Extras\Test Symbol\Texts** that displays the position of the according line number in the form sheet.

Dialogue fields with \z*x* refer to the lines in the file "project head data" that we modified in exercise 3. With \z? you can display and edit this file in the dialogue field.

Modify the dialogue field No. 39 (Created by) Checked) with \z6 and No. 40 (Checked) with \z15. With the button "TRANSLATE ON" you can display the selected content of the translate file

b.) Save the edited symbol under the name: GE_A3L_FORM_TUL: (**Edit\Symbol\Save** or using the toolbar)



Note that the position of the symbol is defined by the crossline cursor when you save it.

Draw the cursor to the lower left corner of the symbol (Position x = 0, y = 0) for the correct position **and than left click**!

Unit 2: Basic engineering

Exercise 1: Work with the "Plant Environment" data model section

According to the conceptional data model, the section "Plant Environment" includes tables on plants and measured materials.

1.) Plant table

Switch to the **data base level** "Plants": **View\PM+CT Design\Plants.**

a.) Becoming familiar with the table structure

- Familiarize yourself with the existing table structure (**right mouse button\Change**) and the keys used (**Extras\Structure\View**).
- Try to remove the field named "Structur_4" from the table: **Extras\Struktur\Extend**.
- Change the labels for the structural levels as follows: "Structure_1" -> "Plant"; "Structure_2**"** -> "Subsystem".
- End the structural editing with **"OK"** and check the result (**right mouse button \Change).**

b.) Entering Data

First delete any data which might be in the table "Plants" (**right mouse button\delete**)**.**
The project is based on the real plant Pressure Holder Model "PHM" (model regulace tlaku) which is assigned to the Laboratory complex of the University of Applied Sciences Zittau/Goerlitz. It is subdivided into the following subsystems: Pressure Vessel „PV" (tlaková nádoba), Disturbance Vessel „DV" (poruchová nádoba), Blowdown Vessel „BV" (výfuková expanzní nádoba) and Connection Pipes „CP" (připojka)**.** The P&I flow chart has been given the number 1. Enter the appropriate dataset for the plant and the four subsystems by filling in all fields (except for structure levels 3 and 4) (**right mouse button\New Record – Blank**). Mind that the filled-in mask is shown for the next dataset when you press **OK.**

After confirming the last dataset, end the entry with "Cancel" and look into the content of the table which you have created. Then end the list work and choose the subsystem "PV" for use in the following projecting process.

Exercise 2: Editing the "Function Environment" data model section

According to the conceptional data model, the following tables belong to the "Function Environment": function groups, tags, instrumentations, signals, specifications and adjustment data.

1.) Function Groups table

Go now to the function group level: **View\PM+CT Design\Funktion Groups**

a.) Becoming familiar with the table structure

Familiarize yourself with the existing table structure and the keys used (**Extras\Structure\View**).

b.) Entering Data: **right mouse button\New Record - Blank**

The project to be edited is based on the already defined Pressure Holder Model. There are four function groups to be defined. The process control level ("**Process_contr_level")** is named "FUG01", and the according group control levels ("**Group_control_level")** are numbered "1", "2", "3" or "4". You therefore get the four function groups, "FUG011", "FUG012", "FUG013" and "FUG014".
Enter the appropriate data sets. Select PHM.PV as the corresponding plant ("**Designation_plant"**) by using the selection button.

After confirming the last data set, end the entry with **"Cancel"** and check the created content.

Now you can select and edit (**right mouse button\Change**) a function group to use in the project planning phase, for instance "FUG013".
Enter "Temperature Control PV" in the entry field "**Fctgrp_comment**"

In this small sample project, the function groups should **not** be used any further. For the sake of simplicity the plant subsystems will be used as intendure levels for the following tags.
Therefore choose the plant subsystem „PHM.PV". Now you can assign the tags to this subsystem. To do this change to the data base level „Tags" (**View\PM+CT Design\Tags**)

2.) Tags table

a.) Becoming familiar with the table structure
Familiarize yourself with the existing table structure and the keys used (**Extras\Structure\View**)

b.) Entering data:: **right mouse button\New Record- Blank**
The system differentiates the tags between "Measuring Tag" and "Actuators". So, to be able to do the rest of this sample project you will need to define the necessary actuators for operating the equipment and the used measuring tags (tables 1 and 2) of the subsystem "Pressure Vessel". Familiarize yourself well with the chosen process values and the actuators.
Take the tags you need from the P&I flow chart of the subsystem "Pressure Vessel" (figure 1).
Enter all known values (tables 1 and 2) for the actuators V101 … V105; H101 and the measurement tags T101...T105; P101...P102; L101...L102.
Please note the following:

- Mark the subsystem you are working on (Plant:=PHM.PV)
- Use the selection button, when possible, for filling in the fields (except for the field "Tag").
- Select the measuring unit according to the processing function.
- Select the according entry in "Meas_tag_or_actuator"
- The "Plant_designator" has to be "=PHM.PV".
- Leave the field "Designation_fctgrp" empty.
- Type of processing: "2. PLC"
- Processing location: "1. Master Tag"
- PI_number: 1

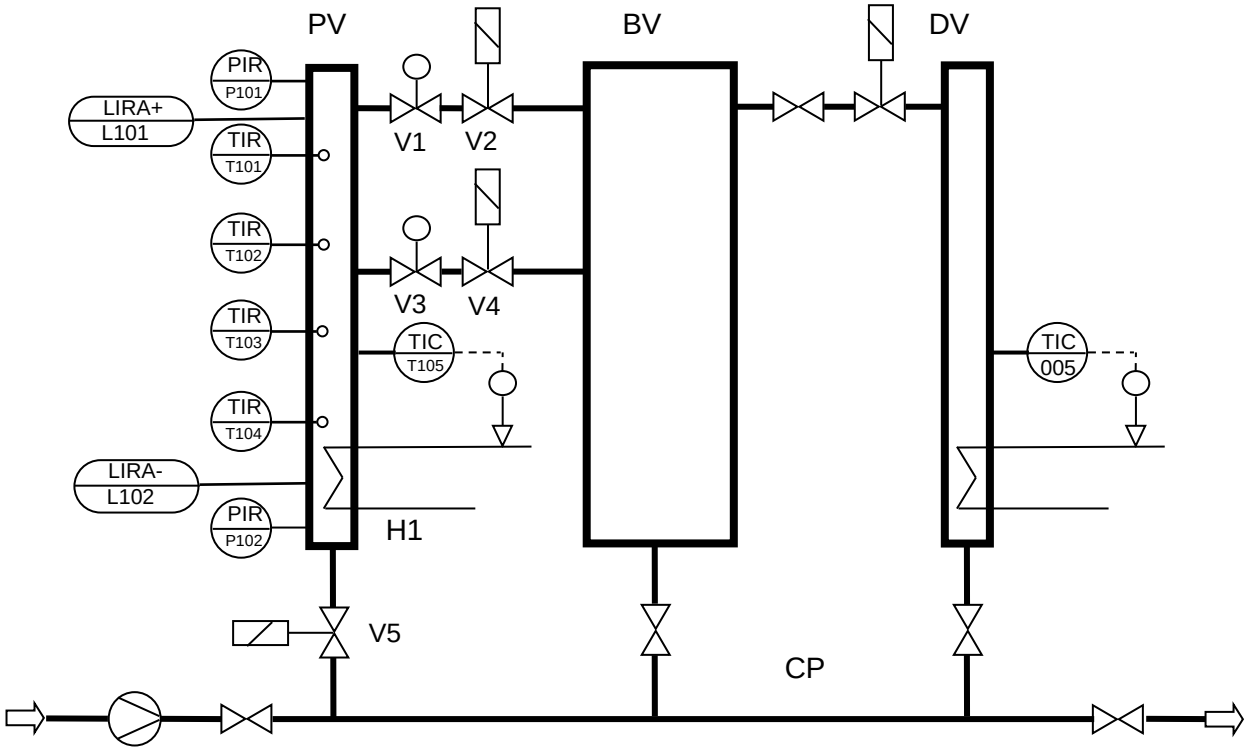


Figure 1: P&I flow chart of the plant PHM with the subsystems PV, BV, DV und CP

Tag	Comment	Processing Function
V101	uzavírací armatura V1	FV
V102	elektromagnetický ventil V2	FIV
V103	uzavírací armatura V3	FV
V104	elektromagnetický ventil V4	FIV
V105	přívodny ventil V5	FIV
H101	topení (elektricke) H1	EIV

Table 1: Actuators

Tag	Comment	Processing Function
L101	horní (hranice) mez	LIRA+
L102	dolní (hranice) mez	LIRA_
P101	tlak páry	PIR
P102	tlak vody	PIR
T101	teplota páry	TIR
T102	rozložení teploty 1	TIR
T103	rozložení teploty 2	TIR
T104	teplota voda	TIR
T105	regulace teploty	TIC

Table 2: Measuring tags

Check that the entry information that has been registered makes sense.

Finally, list all datasets you entered: **View\PM+CT Design\Plants, \Function Groups** and **Tags.** Note the identifier that the system has given the tags.

Choose the tag "T105" to work on: **View\PM+CT Design\Tags:** PHM.PV.T105.

Now you can define adjustment data, specifications, instrumentations and signals which will be assigned to this tag.

3.) Adjustment Data table

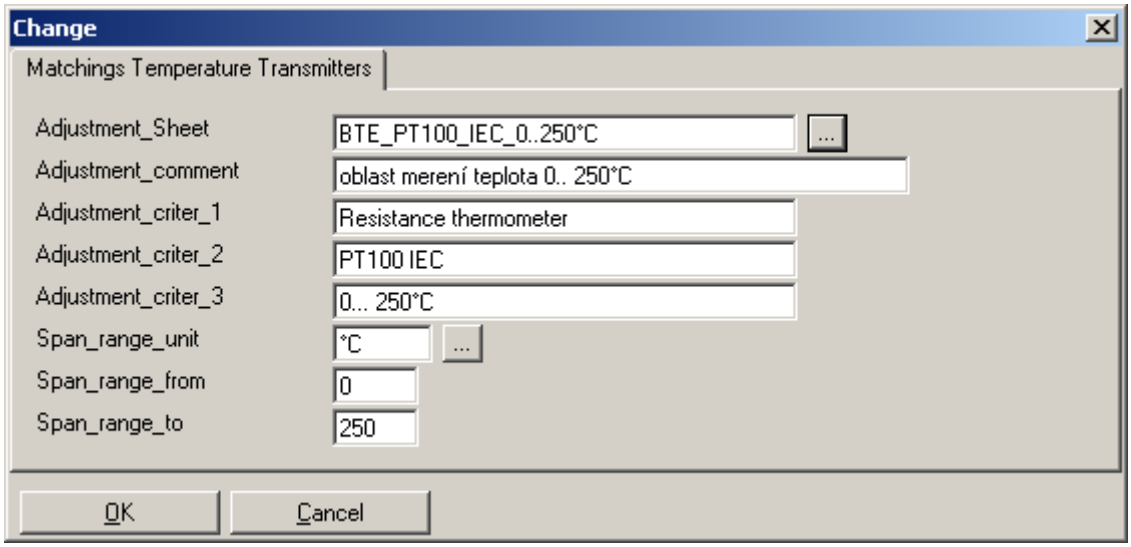
The table „Adjustment Data" contains information for the setup of device parameters. The data is separated in differrent „Adjustment Groups" with „Adjustment Sheets" („Adjustment_type"). The adjustment groups and sheets will be needed in the later to be edited instrumentation table.

For our small example we only create the adjustment data for the temperature transmitter.

Change to the adjustment data level: **View\PM+CT Design\Assignments\Adjustment Data** and modify the according record of the adjustment group „A02_4" („Matchings Temperature Transmitters"):

a.) Becoming familiar with the table structure
Familiarize yourself with the existing table structure and the keys used (**Extras\Structure\View**).

b.) Editing the Data in the table: **right mouse button\Change** to modify existing sheets or **right mouse button\Copy External Data** to copy according sheets from the external project (AUCOTEC)
Check and modify the data in the record for the measuring range 0..250 °C.



4.) Specifications table

The devices needed to carry out the T105 functions are to be specified. Please note here that for the purposes of this small sample project only the measurement side of the functions of the tag is to be carried out. To do this you need the following individual functions:

- Data acquisition (Temperature Transmitters),
- Isolation between field area and the process control system (Isolators)
- Analog input into the process control system (IO_Devices)

These three functions should now be specified. Because the specification levels of the AUCO-PLAN system are assigned according to device groups, these must first be adjusted specifically, according to project.

a.) Updating Device groups

Go to the level **View\PM+CT Design\Assignments\Specifications**.

Check the device groups already there. You will need the following groups:

Listname	**Comment**	**Instrumentation**
02_4	Adapter Temperature Transmitters	Temperature Transmitter (převodník teploty)
02_2	Adapter Isolators	Isolation Amplifier (oddělovacé zesilovač)
02_1	Adapter IO-Devices	Analog Input (analogový vstup)

You can create additional device groups if needed (**right mouse button\New**). For a newly-generated device group the structure must be adjusted to meet the requirements of the necessary data.

Choose device group “02_2” and check the structure, following Figure 2 (**Extras\Structure\Extend**).

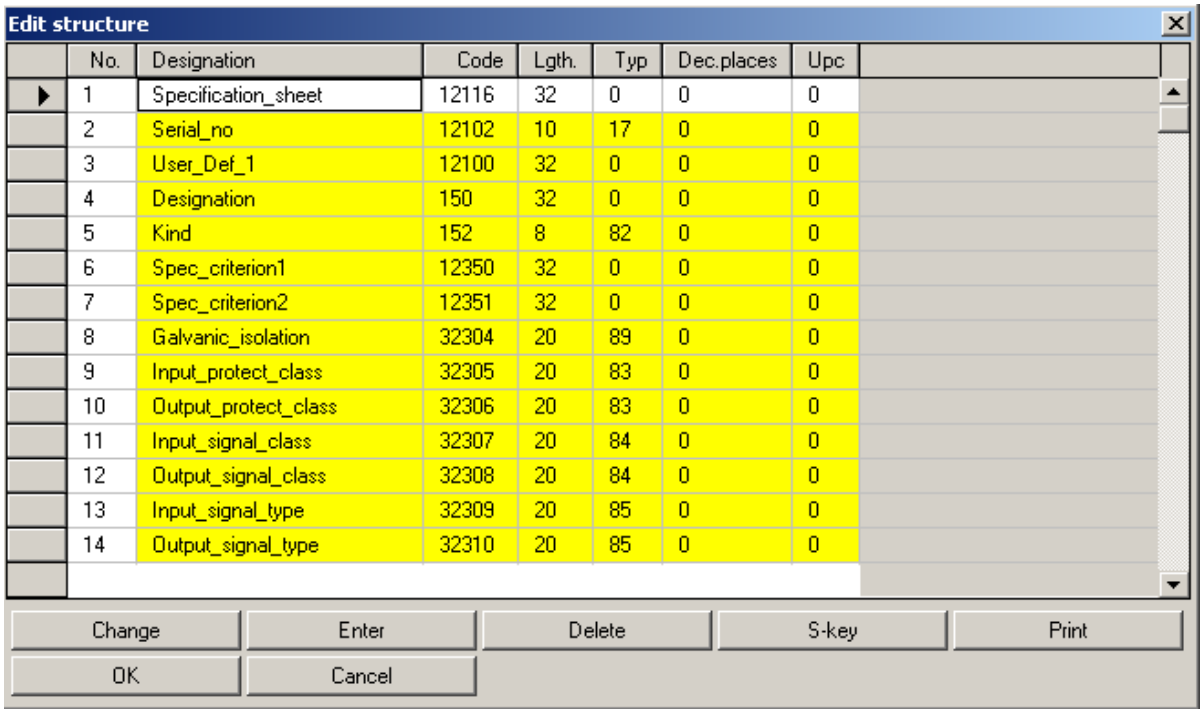


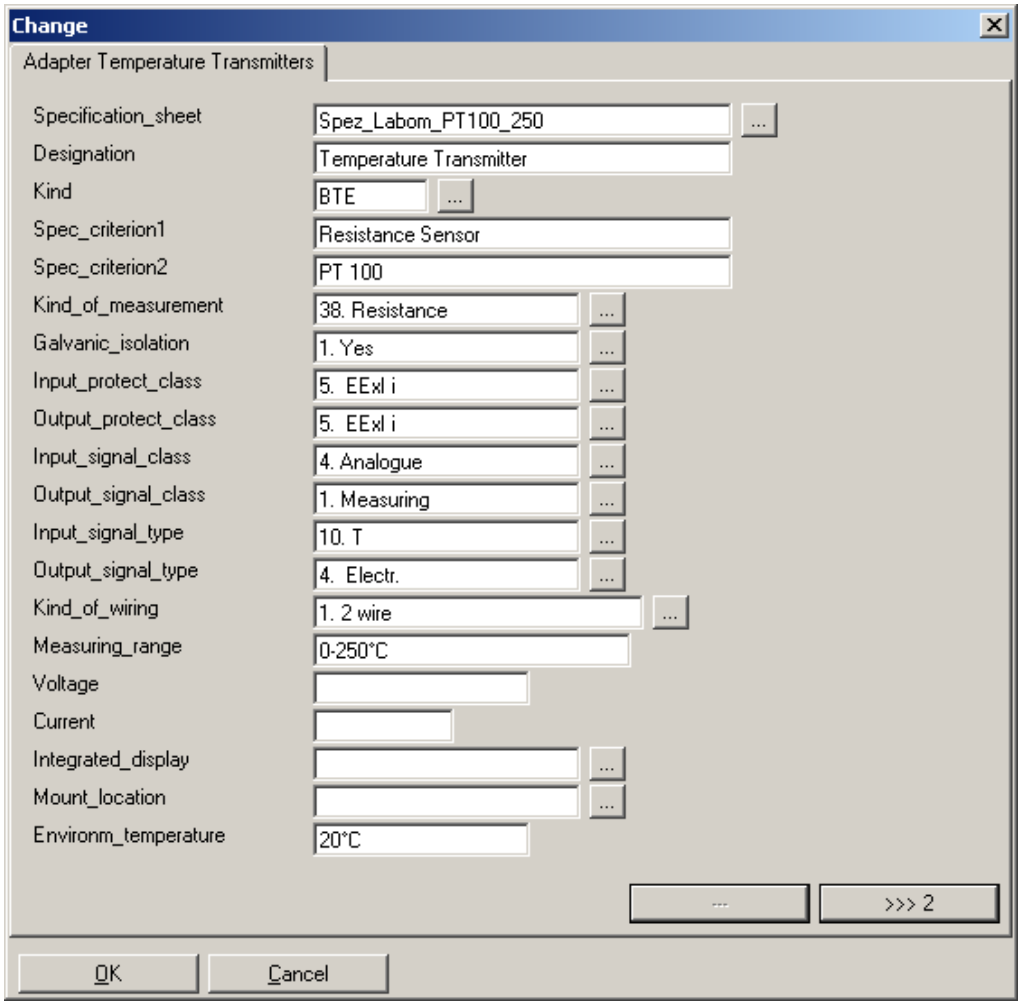
Figure 2: Structur of the device group “02_2” (Adapter Isolators)

Now it is possible to address or generate the three specification sheets needed and to completely fill one data set each with data.

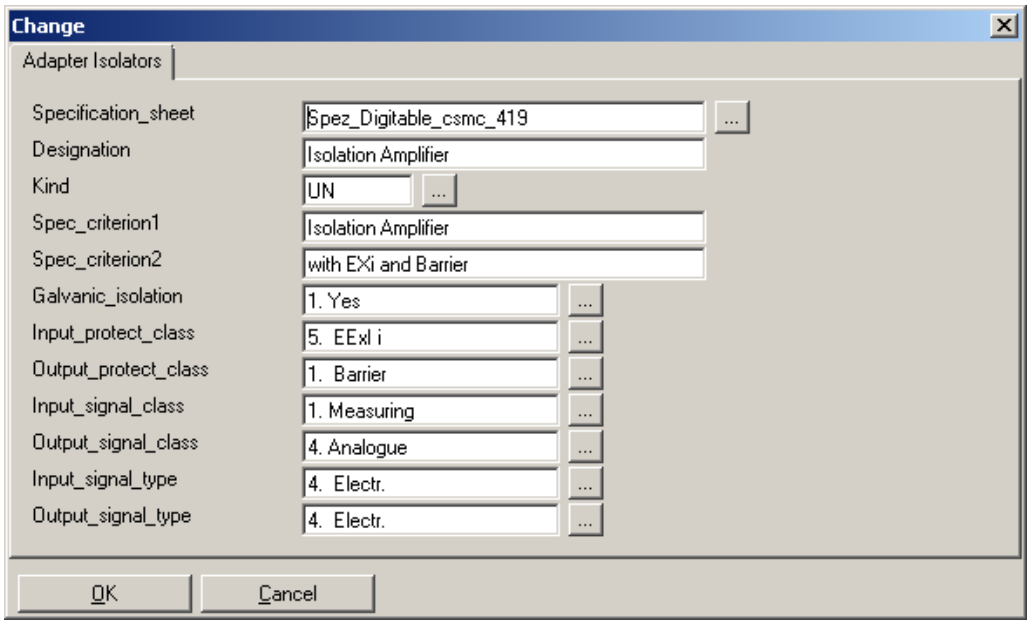
*b) Enter the specification sheets on the appropriate device group level (***right mouse button\New Record – Blank),** modify the existing specification sheets *(***right mouse button\Change)** or copy existing sheets from the external project (AUCOTEC): **right mouse button\Copy External Data.**

Note again here that for all fields marked as such, the selection button ([...]) should be used.

– **View\PM+CT Design\Specifications\02_4**:
Specification sheet: **Spez_Labom_PT100_250** and entry of the necessary data.

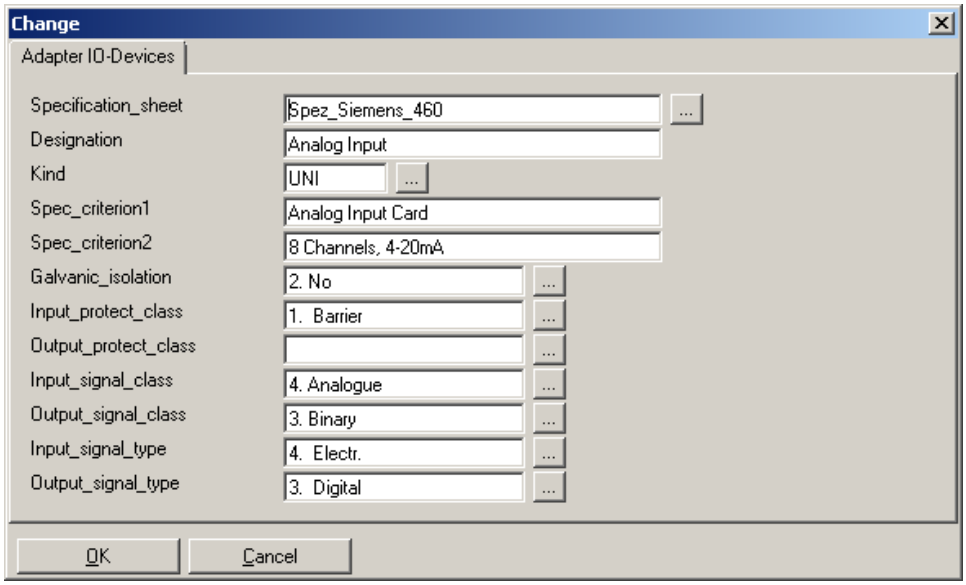


– Change to **...\Specifications\02_2:**
Specification sheet: **Spez_Digitable_csmc_419** and entry of the necessary data.



Change to ... **\Spedifications\02_1**:

Specification sheet: **Spez_Siemens_460** and entry of the necessary data.



5.) Materials table

Switch now into the measuring materials data level: **View\PM+CT Design\Materials**

a.) Becoming familiar with the table structure

- Familiarize yourself with the existing table structure and the keys used (**Extras\Structure\View**).
- Delete any datasets that may be in the table.

b.) Entering data: **right mouse button\New Record - Blank**

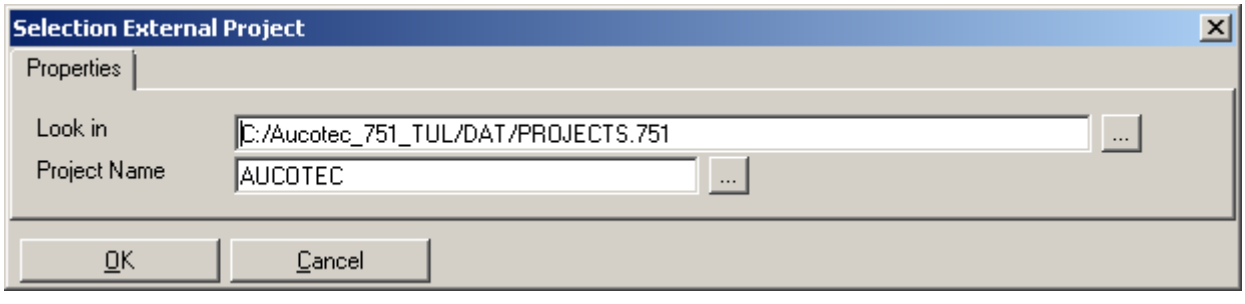
Using the "selection button" ([…]) in the entry "Measured_media_type" transfer the data for the material class "water", "boiler water", "water for heating" from the external project.

Edit the data sets in light of the following criteria:

Meas_media_comment	tlaková voda
Operating_temp_max	250 °C
Operating_pressure	2 MPa
Operating_pressure _min	0.1 MPa
Operating_pressure _norm	1.5 MPa
Operating_pressure_max	4 MPa

Accept the dataset ("OK") and check the content.

Should it not be possible to import the data set from the external project using the selection button as described, then you can copy the data set directly from the external project (**right mouse key\Copy External Data:** AUCOTEC) and then edit the data as described above.



Now we can *instrument* the functions.

5.) Instrumentations table

The instrumentation is based on the functions of the corresponding tags, so at first you have to select over the marked subsystems PHM.PV (plant level) the tag T105 in the tags level: **View\PM+CT Design\Tags.** Mark the entry of the tag T105 and change now to the instrumentations level: **View\PM+CT Design\Instrumentations.**

For the tag T105 you have to instrumentalize on the measurement side the following functions:

- Data Acquisition (temperature transmitter),
- Isolation between field area and process control system (isolation amplifier)
- Analog Input into the process control system (analog input card)

a.) Becoming familiar with the table structure

Familiarize yourself with the existing table structure and the keys used (**Extras\Structure\View**).

b.) Entering the Data in the table: **(right mouse button\New Record – Blank)**

You get access to the master data base over the selection button of the field „**Part_number**“!.

For the instrumentation of the functions for the tag T105 you have to create three data records and select the three devices from the master data base:

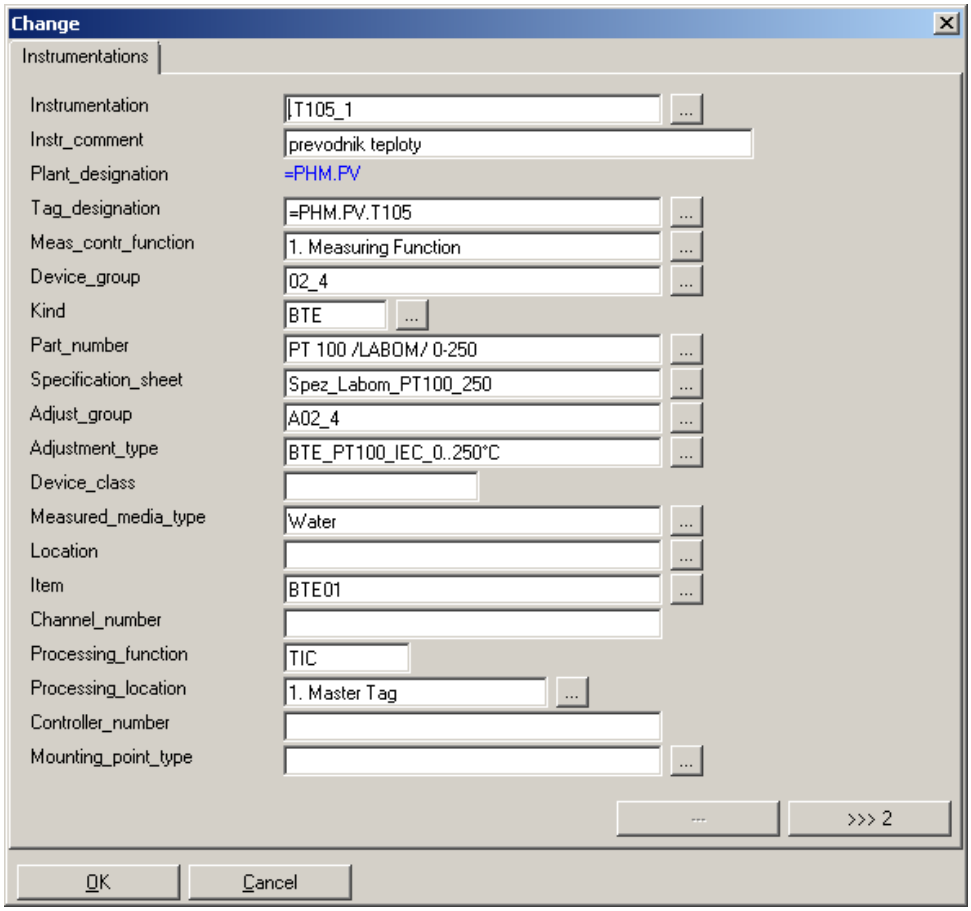
- Temperature Transmitter: Instrumentation: T105_1
  Kind: BTE; Type: PT 100 /LABOM/ 0-250
  Device group:02_4; Item: BTE01
  Comment: převodník teploty
- Isolation Amplifier: Instrumentation: T105_2
  Kind: UN, Type: CSMC 419/DIGITABLE
  Device group: 02_2; Item: UN01
  Comment: oddělovacé zesilovač
- Analog Input Card: Instrumentation: T105_3
  Kind: UNI; Type: Analog Input Card 460/SIEMENS
  Device group: 02_1; Item: UNI01
  Comment: analogový vstup

First select by **Part_number [...]** the according type from the master data base.

Then complete/check the fields Instrumentation, Kind, Device_group, Item and Instr_comment according to the above given data. Select the previously created specification sheet and the according Meas_contr_function (1. Measuring Function) for every data record.

If necessary edit the fields Plant_designation, Tag_designation, Processing_function and Processing_location (1. Master Tag).

The selection of measured media type, adjustment group and adjustment type (adjustment sheet) is only necessary for the temperatur transmitter.



After entering each data set and confirming this with "OK", you will be given the opportunity to re-work this data set. Change the name and delete all information for old data sets (except: Tag_designation) and continue in the same way as for the previous entry.

After the third entry and confirmation of the data set (with **OK**), end the data entry (**cancel**).

Now the signals necessary for the execution of the function should be defined. Since the signals will be assigned to particular instruments (Instrumentations), you need to select the instrumentation first (mark the data set) and then switch to the signal level: **View\PM+CT Design\Signals**.

6.) Signals table

a.) Becoming familiar with the table structure
Familiarize yourself with the existing table structure and the keys used (**Extras\Structure\View**).

b.) Editing the Data in the table: **right mouse button\New Record - Blank**
Check the correct selection of subsystem (=PHM.PV), tag (=PHM.PV.T105) and instrumentation (T105_1, T105_2 bzw T105_3) before you enter your data!

The prefix for the signal name (*) is given automatically by the system.

- Signal of Data Aquisition (signál o měření dat):
  Signal T105.1, Instrumentation: T105_1
- Signal of Inform. Transmission (signál přenosu dat):
  Signal: T105.2; Instrumentation: T105_2
- Signal of Information Input (signál o vstup dat):
  Signal: T105.3; Instrumentation: T105_3

The designation fields for plant, tag and instrumentation should already be filled by the system.

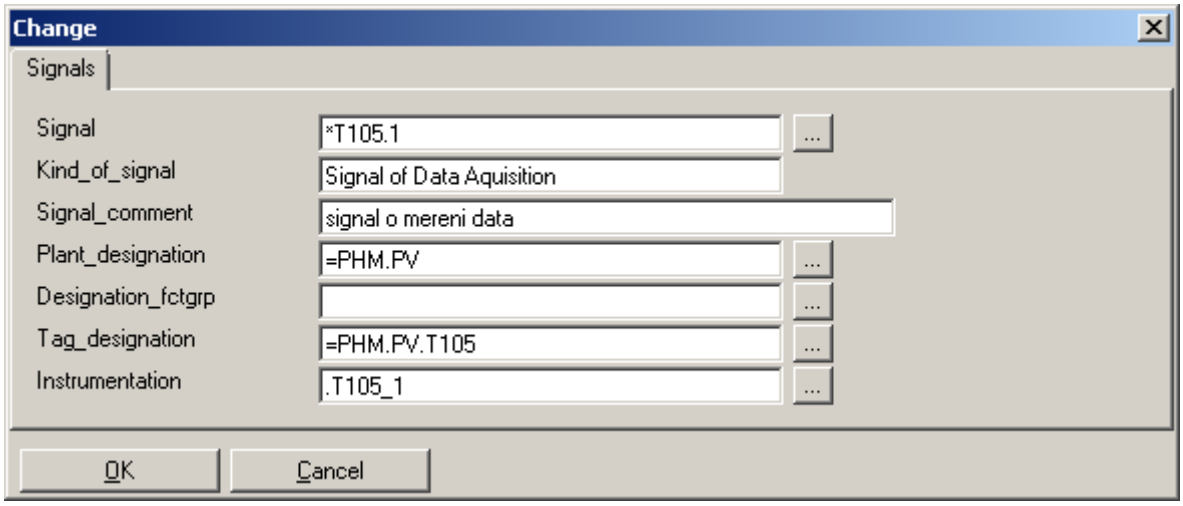


Figure 3: Example for signal T105.1

After the confirmation of the entry of the third data set with OK end the data entry („Cancel"). Check the created data.

Now you are ready with the creation of the „Function Environment" of the tag T105 and you can start with the processing of the „Local Environment"**.**

Exercise 3: *Editing the Data Model Area "Local Environment"*

According to the conceptional data model, the "Local Environment" consists of the locations and the terminals. The editing of the strips and terminals is done with Item Editor or graphically in the Loop Diagram. At first however we have to fill the locations table.

Locations table

Open the table „Locations": **View\PM+CT Design\Locations** and delete all existing data in this table!

a.) Becoming familiar with the table structure

Familiarize yourself with the existing table structure and the keys used (**Extras\Structure\View**). The sorting level 1 ("**Room**") should be used for the **Installation sites**, the second level ("**Distribution Board**") for the **Main mounting places** and the sorting level 3 ("**Subrack**") for the **Sub mounting places**. End the structure view with **Exit**

b.) Editing the Data in the table: **right mouse button\New Record - Blank**

The local environment should be limited to the subsystem PHM.PV (Pressure Vessel) for this automation project. As our example, the rooms as well as the distribution boards and the subracks for the instrumentation of the tag T105 (measuring side) are to be determined.

Installations sites („Room“) are:

- Power plant laboratory **PPL** (for the pressure vessel **PV** and the field junction box **JB1**),
- Control room **CR1** (for the control cabinet **C2** of the isolation amplifier)
- PLC-room **PR1** (for the control cabinet **C3** of the PLC-system).

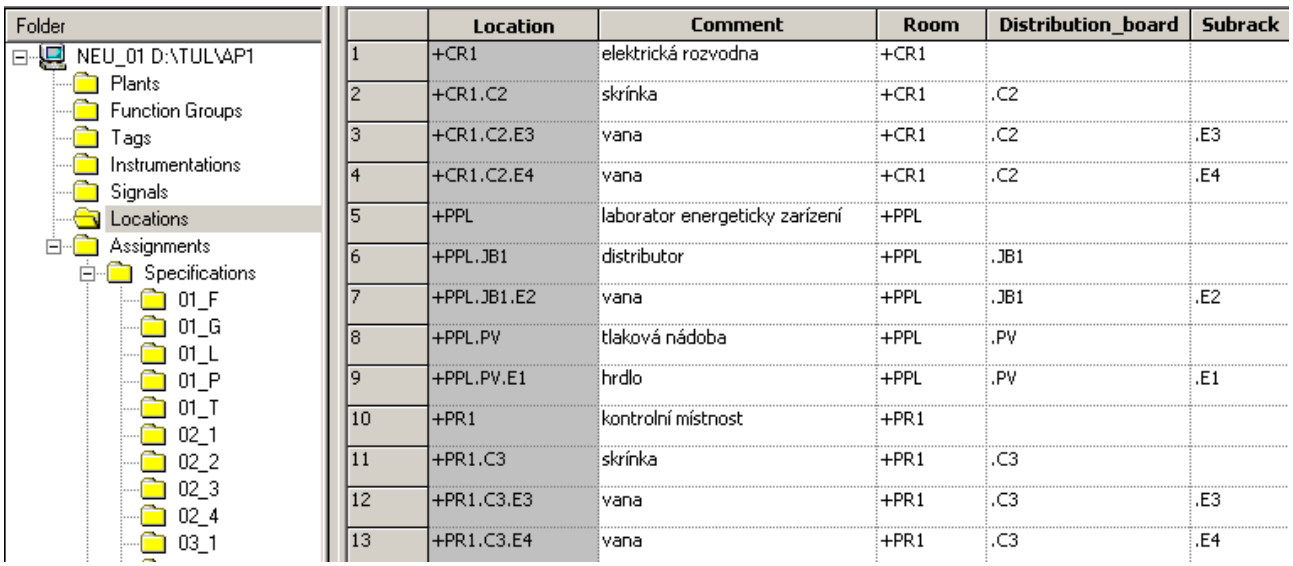
– **Main mounting places** („Distribution Board“) are:

- Pressure vessel **PV** (for the mounting bracket with socket **E1**),
- Field junction box **JB1** (for the switchbox rack **E2**),
- Control cabinet **C2** (for the device rack **E3** and the switchbox rack **E4**)
- Control cabinet **C3** (for the device rack **E3** and the switchbox rack **E4**).

– **Sub mounting places** („Subrack“) **are**

- Mounting bracket with socket **E1** (for temperature transmitter T105_1),
- Switchbox rack **E2** (in V1 for terminal strips and cables),
- Device rack **E3** (in K2 for the isolation amplifier T105_2),
- Switchbox rack **E4** (in K2 for terminal strips and cables),
- Device rack **E3** (in K3 for the analog input card T105_3)
- Switchbox rack **E4** (in K3 for terminal strips and cables).

Enter the appropriate data set by filling in all fields completely. After entering the last data set, end the entry by clicking on “**Cancel**” and check the content.



	Location	Comment	Room	Distribution_board	Subrack
1	+CR1	elektrická rozvodna	+CR1		
2	+CR1.C2	skrínka	+CR1	.C2	
3	+CR1.C2.E3	vana	+CR1	.C2	.E3
4	+CR1.C2.E4	vana	+CR1	.C2	.E4
5	+PPL	laborator energeticky zarízení	+PPL		
6	+PPL.JB1	distributor	+PPL	.JB1	
7	+PPL.JB1.E2	vana	+PPL	.JB1	.E2
8	+PPL.PV	tlaková nádoba	+PPL	.PV	
9	+PPL.PV.E1	hrdlo	+PPL	.PV	.E1
10	+PR1	kontrolní místnost	+PR1		
11	+PR1.C3	skrínka	+PR1	.C3	
12	+PR1.C3.E3	vana	+PR1	.C3	.E3
13	+PR1.C3.E4	vana	+PR1	.C3	.E4

Figure 4: Table „Locations“

For the availabilty of the terminals and strips as items they have to be defined with the **Item Editor: View\Drawing Editing\ -> mark the tab „Item Editor“.** In the **path** „**Strips / Terminals**“ you can see already defined strips and terminals. With **right mouse button click** on this path and selection of „**New\Standard Strip**“ additional strips can be created as items.

Item	Location	Part number	Comment
BTE01	PPL.PV.E1	PT 100/LABOM/0-250	Strip, Field Device T105_1
X1	PPL.JB1.E2	3004016 (PHOENIX)	Strip 1, Junction Box JB1
X1	CR1.C2.E4	3004016 (PHOENIX)	Strip 1, Control Cabinet C2
X2	CR1.C2.E4	3004016 (PHOENIX)	Strip 2, Control Cabinet C2
X1	PR1.C3.E4	3004016 (PHOENIX)	Strip 1, Control Cabinet C3

Fill out the fields for Location, Item (designation), Comment and Part number 1 according to the above given table.. Use the selection-button for the selection of the earlier defined Locations and of the Part number. For the selection of the Part numbers see exercise 2d.The „Number of arrangements“ is 10 for BTE01 and 6 for the terminal strips X1 and X2.

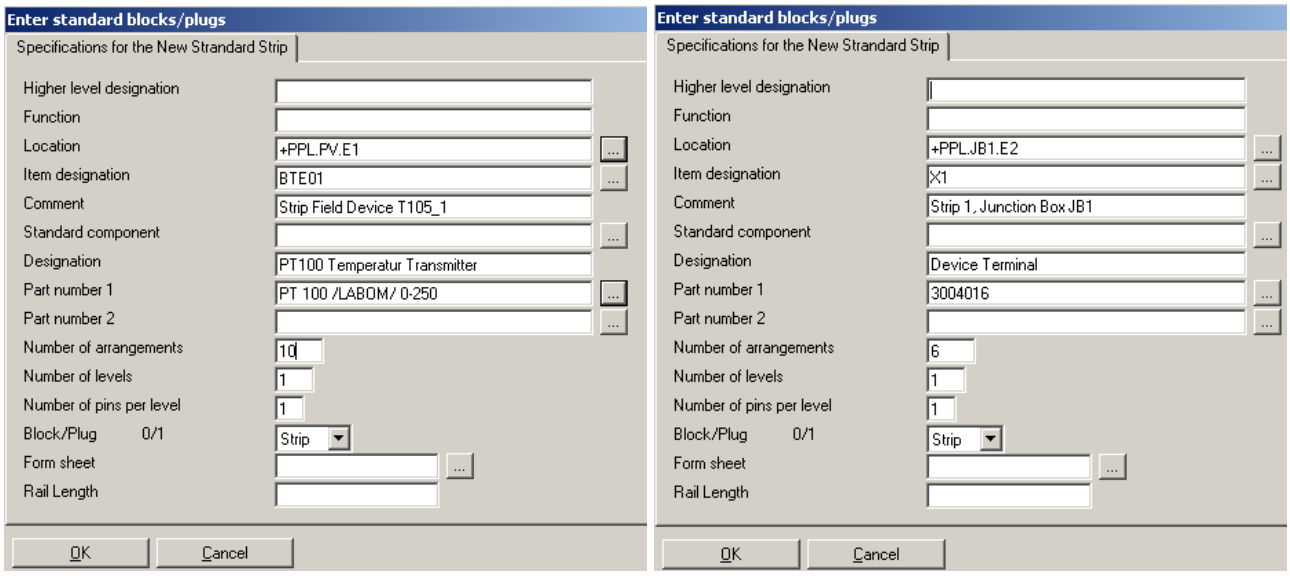


Figure. 5: Example of terminal strips for the field device T105_1 and for the junction box JB1.

The defined terminal strips are now displayed in the Item Editor and can be wired.

Finally, end the list editing and return to the main menu level. Now the connection between the function environment and the local environment has to be prepared.

Exercise 4: *Preparing the connection between "Function Environment" and "Local Environment"*

In preparing the connection between the function environment and local environment, we will start by defining the necessary cable connections – the cable runs and cables.
For the example using the tag T105 the following connections are necessary (not taking the internal wiring in the cabinets into consideration):

- *Branch cable in the field* between pressure vessel PV and field junction box JB1.
- *Trunk cable* between field area (field junction box JB1) and control room (control cabinet C2)
- *Trunk cable* between control room (control cabinet C2) and PLC-room (control cabinet C3)

1.) The table „Cable Runs"

First, from the main menu, open the Cable Runs level: **View\Cable Planning\Cable Runs**

a.) Becoming familiar with the table structure

Familiarize yourself with the existing table structure and the keys used (**Extras\Structure\View**).

b.) Editing the Data in the table: **right mouse button\New Record - Blank**

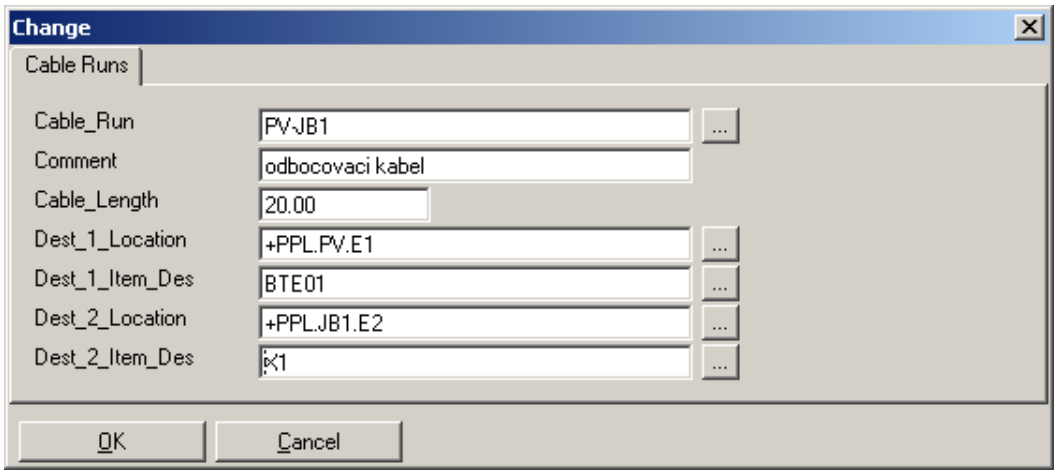
For this small example, the following three data sets will be needed for the realization of the connections:

- **PV-JB1:** from +PPL.PV.E1 *BTE01* (temperature transmitter: T105_1)
  to +PPL.JB1.E2 *X1* (strip 1, junction box JB1);
  odbočovací kabel; 20 m
- **JB1-C2:** from +PPL.JB1.E2 *X1* (strip 1, junction box JB1)
  to +CR1.C2.E4 *X1* (strip 1, control cabinet C2);
  kabel mezi provozem a velínem; 200 m

- **C2-C3:** from +CR1.C2.E4 *X2* (strip 2, control cabinet C2)
  to +PR1.C3.E4 *X1* (strip 1, control cabinet C3);
  kabel mezi velínem a místností s rozvaděčem; 40 m

Enter the three data sets using the names given above.

NOTE: First select the **Item** (over the field "Dest_*x*_Item_Des") for the start and end of the cable run. The "Dest_x_Location" will be filled automatically after quitting the correct item.



Use "Cancel" to end the data entry after entering the final data set.

2.) The table „Cables“

Now, from the main menu, open the Cable level: **View\Cable Planning\Cable**

a.) Becoming familiar with the table structure

Familiarize yourself with the existing table structure and the keys used (**Extras\Structure\View**).

b.) Editing the data in the table: **right mouse button\New Record – Blank or \Change**

To realize the connections between the function environment and the location environment, according to the cable path planning three cables are needed. In exercise 2e you have already worked with the corresponding cable types and defined some of the cables. Use the cable of the type: JE-LiYCY

- **J1**: odbočovací kabel; 2x2x0,5; 20 m; Cable Run PV-JB1
- **J2:** kabel mezi provozem a velínem; 16x2x0,5; 200 m; Cable Run JB1-C2
- **J3:** kabel mezi velínem a místností s rozvaděčem; 16x2x0,5; 40 m; Cable Run C2-C3

Now enter or edit the three required data sets. Begin with the field ***part number*** (see also exercise 2e). Connect the cable data set with the appropriate *cable run*.

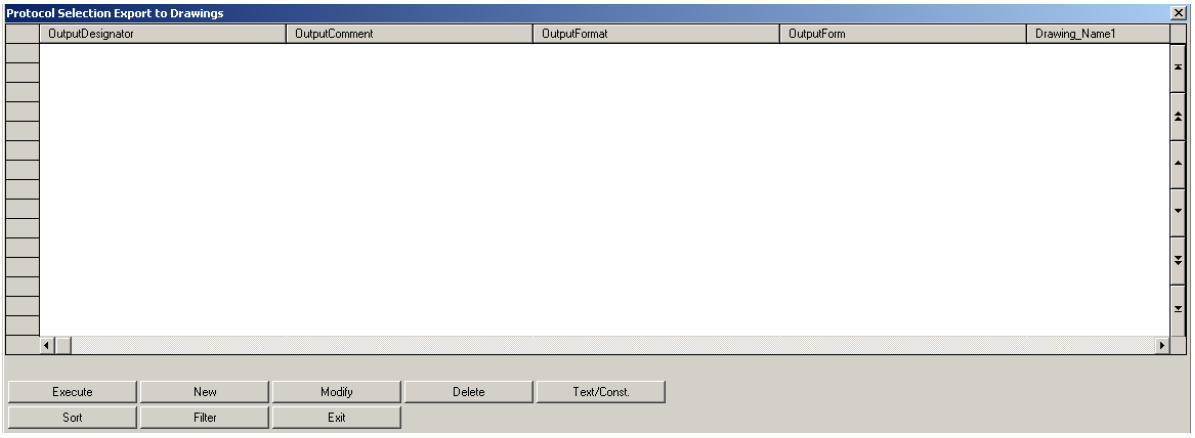
That concludes the data processing for this small example.

Exercise 5*: Documenting Projecting Results in List Format*

To create the documentation we need to enter the data into lists. The lists have been prepared as symbols in AUCOPLAN.

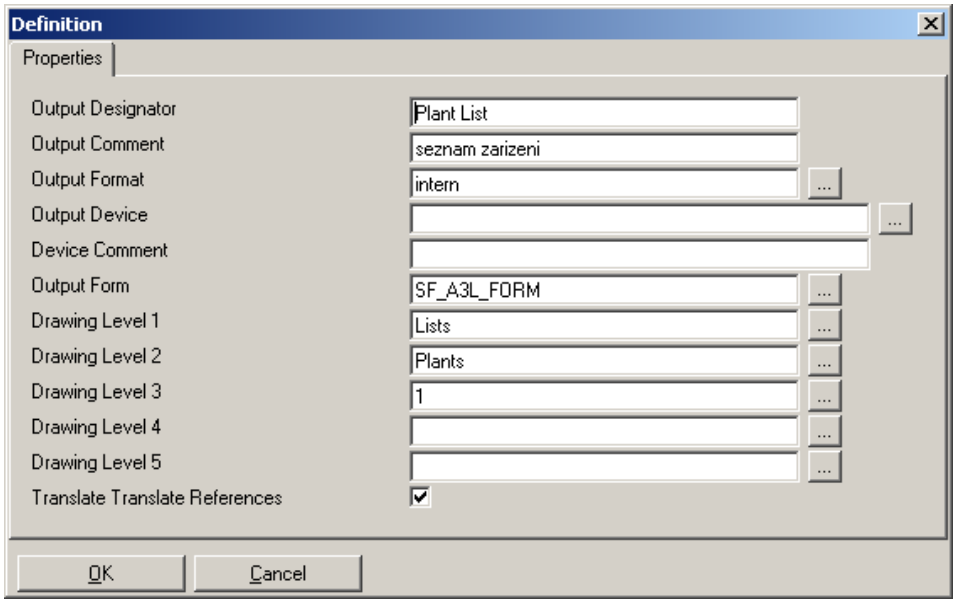
♦ Creating a Plant List

To create the document go to the level “Plants”. Switch into the documentation level using **File\Export\To Drawings**.



Create the first document data set (“**New**”). Choose the output format: “**intern**”, and the output form: “**SF_A3L_FORM”**. With the different “Drawing levels” you define the folder structure for the list. Choose the following folder structure:

Drawing Level 1:	Lists
Drawing Level 2:	Plants
Drawing Level 3 (Sheet-No.):	1



Quit with "OK".

To create the drawing (list), you need to choose "**Execute**." The entry mask that you see shows the entries to the form. Data marked with "\ZX" refer to the translate file "Project Head Data". X stands for the line in the entry mask of the Project Head Data. Quit the mask with "OK".

From the main menu level (**View\Drawing Editing**) you can now select the Plant List in the created drawing level (Drawings\)**Lists\Plants** and make any changes: **Edit\Form\Edit**.

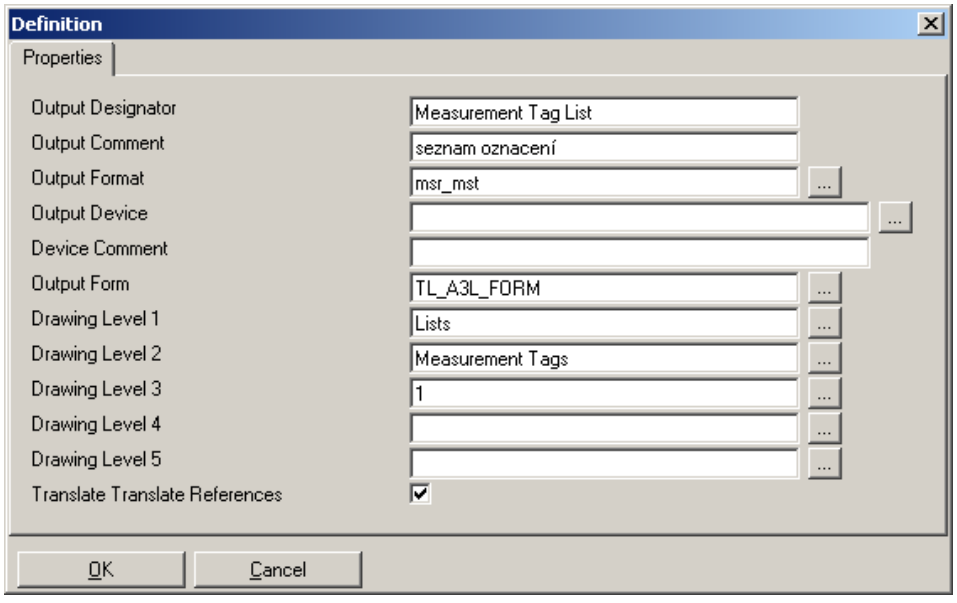
Change the form by entering "seznam zařízení" (Plant List) for the Sheet Name, "Pressure Holder Model" for Special Notes, and "=PHM" for Plant. Check the changes made on the form.

♦ Creating a Measurement Tag List

The task is to list all tags defined as „*1. Measurement Tag"*.
Go from **View\PM+CT Design** choosing plant = **PHM.PV** as your plant to the **Tags** level.

Now switch with **File\Export\To Drawings** to the documentation level.

Create the corresponding document data set ("**New**") or modify ("**Modify**") the data set if it already exists, as follows:



When you have pressed “OK”, set the “Filter” to Meas_tag_or_actuator="1. Measurement Tag". Use, if possible, the selection button ([…]). Make sure the notation is correct when you set the filter.

Check if the correct data set is selected before you execute the creation of the document.

Create the document using the "**Execute**" option

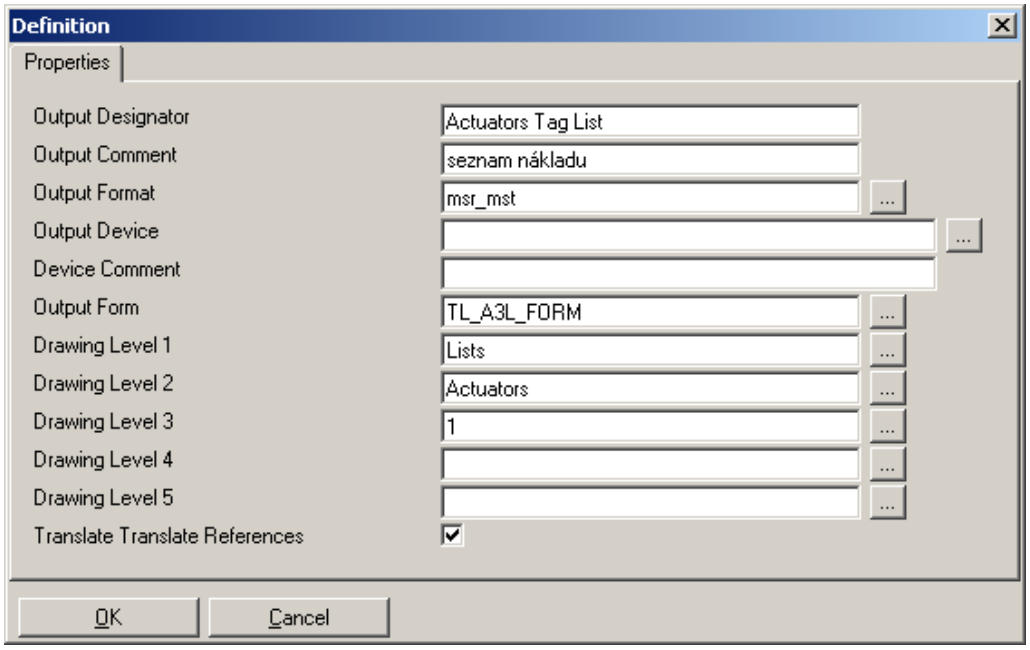
On the drawing level, please check the content of the list you have created (no actuators may be listed!) and make any necessary changes on the form.

Complete the entries on the form with the plant: "=PHM". Also change the Sheet Name to “seznam označení“ (Measurement Tag List).

♦ Creating an Actuators Tag List

The task here is to list all tags defined as *2. Actuator*. How this is done is quite similar to the previous exercise.

Create the corresponding document data set or modify the data set if it already exists, as follows:



When you have pressed “OK”, set the “Filter” to Meas_tag_or_actuator="2. Actuator". Use, if possible, the selection button ([…]). Make sure the notation is correct when you use the filter.

Check if the correct data set is selected before you execute the creation of the document.

Create the document using the "**Execute**" option

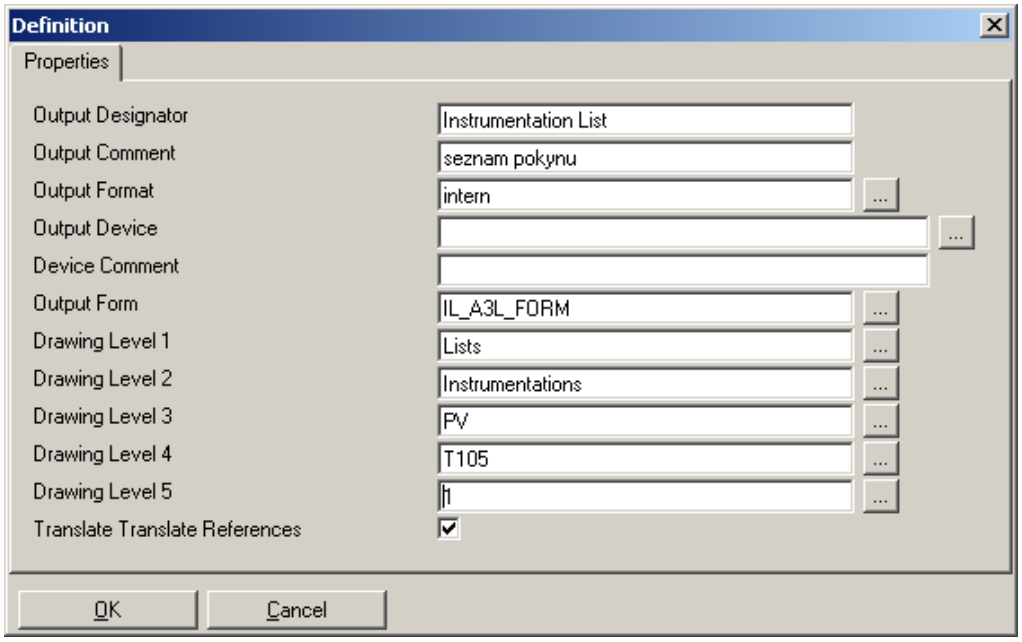
On the drawing level, please check the content of the list you have created (no measurement tags may be listed!) and make any necessary changes on the form.

Complete the entries on the form with the plant: "=PHM". Again use the selection button ([…]). Also change the Sheet Name to “seznam nákladů“ (Actuators List).

♦ Creating an Instrumentation List

Your task is to list all pieces of equipment defined as *Instrumentation* for the tag T105. The way to do that is very similar to the previous exercise.
Having chosen the subsystem **PHM.PV** and the tag **T105**, switch to the instrumentation level and complete the data sets with the (installation) **Location** (**right mouse button\Change:** select PPL.PV.E1 for T105_1, CR1.C2.E3 for T105_2 and PR1.C3.E3 for T105_3)

Now switch with **File\Export\To Drawings** to the documentation level und create the corresponding document data set or modify the data set if it already exists, as follows:



Cause we want only to list the instrumentations for T105, set the “Filter” to Tag_designation="=PHM.PV.T105”. Use, if possible, the selection button ([…]). Make sure the notation is correct when you use the filter

Create the document using the "**Execute**" option

On the drawing level, please check the content of the list you have created and make any necessary changes on the form.

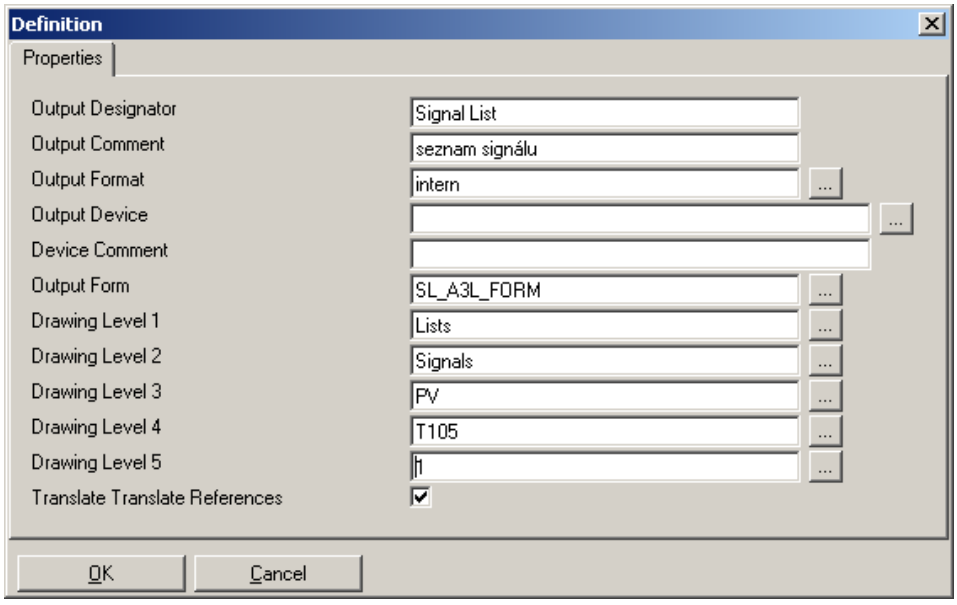
Complete the entries on the form with the plant: "=PHM.PV and the tag: “T105”. Again use the selection button ([…]). Also change the Sheet Name to “seznam pokynů“ (Instrumentations List).

♦ Creating a Signal List

Your task is to list all *Signals* defined for the tag T105. The way to do that is very similar to the previous exercise.

To do this, switch to the Signal level after having chosen the subsystem **PHM.PV** and the tag **T105.**

Create the document data set (File\Export\To Drawings) or modify it if it already exists, as follows:



Cause we want only to list the signals for T105, set the "Filter" to Tag_designation="=PHM.PV.T105". Use, if possible, the selection button ([…]). Make sure the notation is correct when you use the filter

Create the document using the "**Execute**" option

On the drawing level, please check the content of the list you have created and make any necessary changes on the form.

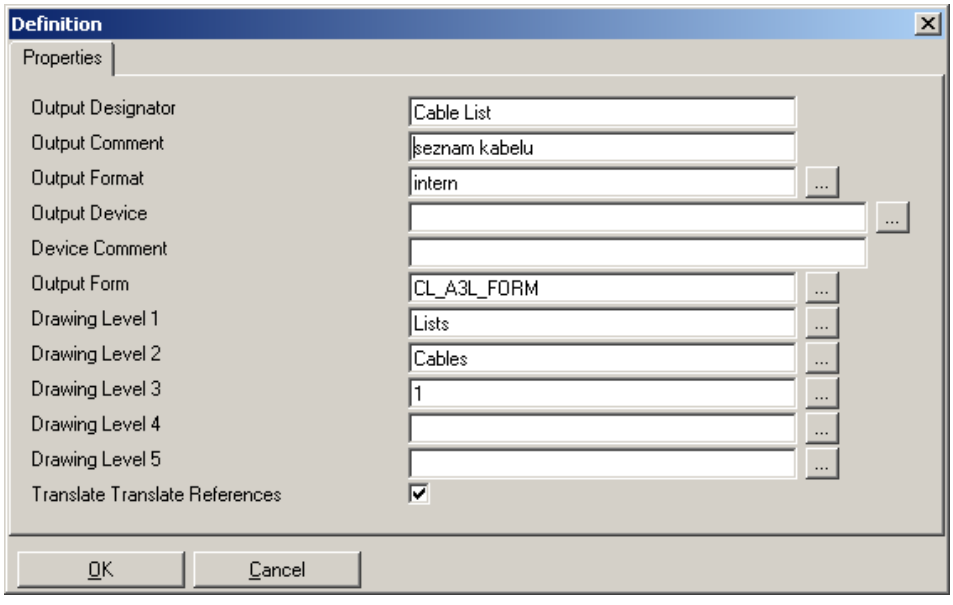
Complete the entries on the form with the plant: "=PHM.PV" and the tag: "T105". Again use the selection button ([…]). Also change the Sheet Name to "seznam signálů" (Signal List).

♦ Creating a Cable List

Your task is to list all defined *Cabels*. The way to do that is very similar to the previous exercise.

To do this, go from the main menu to **View\Cable Planning\Cable.**

Create or modify the document data set for the cables as follows (File\Export\To Drawings):



Create the document using the "**Execute**" option

On the drawing level, please check the content of the list you have created and make any necessary changes on the form.

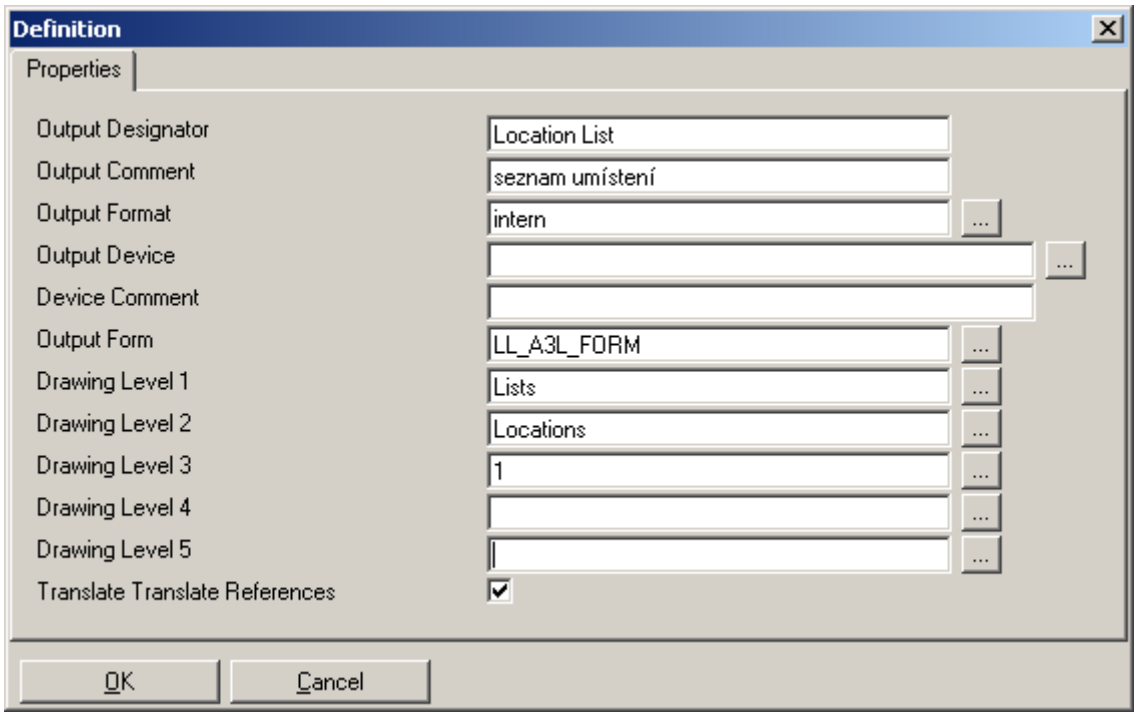
Complete the entries on the form with the plant: "=PHM" and the sheet name "seznam kabelů" (Cable List).

♦ **Creating a Location List**

Your task is to list all defined *Locations*. The way to do that is very similar to the previous exercise.

To do this, go via **View\PM+CT Design** to the **Location level**.

Create the document data set for the location list or modify it if it already exists, as follows:



Create the document using the "**Execute**" option

On the drawing level, please check the content of the list you have created and make any necessary changes on the form.

Complete the entries on the form with the plant: "=PHM" and the sheet name "seznam umístění" (Location List).

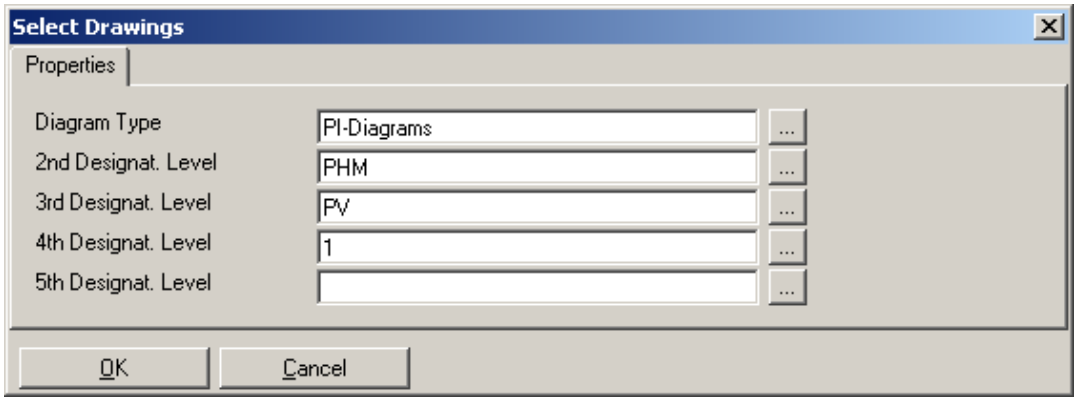
Exercise 6: *Creating a P&I-Diagram (flow chart) and entering the tags*

It is well known that automatisation tasks are presented in a clear way using P&I-Diagrams (flow charts). AUCOPLAN also offers this option. Now your task is to create a flow chart for the subsystem PHM.PV and enter and edit the measurement and actuator tags which have already been defined. Do this as follows.

♦ **Creating the P&I-Diagram**

a.) *Creating the drawing sheet*

PM+CT Design\Plants\PHM.PV -> right mouse button\Documents\New



Use the form you have created named “GE_A3L_FORM_TUL”.

From the main menu level (**View\Drawing Editing**) you can now find the created P&I-Diagram in the previously defined drawing level “PI-Diagrams\PHM\PV\1”

Complete the entries on the form with the sheet name “schema MAR” (PI-Diagram).

b.) *Editing/Drawing the flow chart*

The flow chart for the subsystem PHM.PV will now be drawn (see also figure 1 and 6). You can do this in several ways – by using the graphic tools, by copying a previously-created drawing from another project and/or by inserting **objects** from the toolbar or command line.

At first we insert the objects from the toolbar (select and OK it) or via the command line (entering the name, move it and position it with right click).

NOTES:

*- Set the grid at **5 mm** (Extras\Symbol Info -> right mouse button-> set “Grid” to 5 mm -> "Continue" -> ESC).*
*- The **Zoom** function can make it easier to find the connectors and catching the objects.*
- Using “Extras\Test Drawing” connectors and other things can be made visible/shown.
*- To change the size of an object use the **Scaling** function (Edit\Objects\Scale), to rotate it use the **Rotation** function (Edit\Objects\Rotate,) than select the object with the left mouse button.*
- To activate/deactive the auto connection function use the key “V”.

When the object has been placed on the drawing area using the left mouse key, you can use the right mouse button to edit it, copy it or move it around. Here is the order of how you should work through the flow chart:

1. Container (PI_CONTAINER_CON)
2. Valves (PI_ISO_VALV_A_01)
3. Drives (PI_DRIVE_E_C, PI_DRIVE_E_M)
4. Heating (PI_HEAT_PLT)
5. Pumps (PI_PUMP_UNI)
6. Measurement tags (PI_PLT_R, PI_PLT_L)
7. Other symbols (arrow: PI_ARROW_02, control loop: PI_DRIVE_LOOP)
8. Process connection (over the toolbar („Process connections“  with type „PC..“)
9. Connection of the measurement symbols with the corresponding tags

The additions/changes made in the graphic model are automatically adopted by the database.

Give the container the name “PV” and the comment “Pressure Vessel” and test the adoption of these changes in the database (Instrumentations).

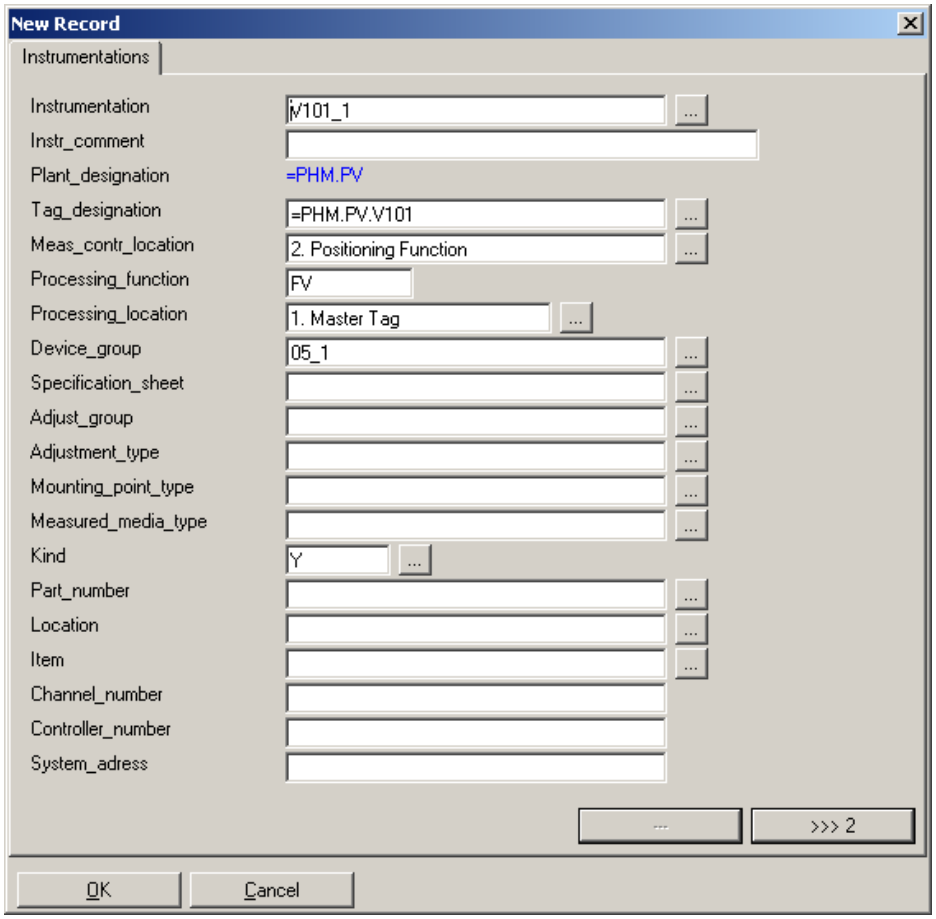
Then complete the drawing with the graphic tools (Insert\Line, Insert\Circle, Insert\Text). Change the grid size if necessary.

♦ Observing and Entering the tags

All the **tags** that have already been determined in tables (measurement and actuator tags) should be put in at the correct place in the drawing, graphically linked to the location and edited. Call up the empty tag symbol from the command line or from the toolbar, position it and assign the symbol to the appropriate tag in the working project. As always, you can use the right mouse button to edit. The data already defined will be automatically inserted. Add, if necessary, the processing location (“Master Tag”) and the type of processing (“PLC”). Compare the illustration with the tag lists you have created to see that all the tags have been included.

Change the content of the processing location field of one measuring tag to “Slave Tag” and “Standby Control Tag” and observe how the symbol changes, than redo it.

The symbols are different for **tags** and **instrumentations**. Mind that the valves and accessories consist of a symbol for instrumentation (PI_ISO_VALV_A_01) and a symbol for the tag (e. g. PI_DRIVE_E_S). So you must add the (not yet defined) instrumentation to every valve tag. This can also be done in the flow chart. Choose the instrumentation you want to edit and assign it to the tag that has been set up (“Tag_designation”). Then name the instrumentation according to the notation already used with T105. Check the instrumentations you have created in the instrumentation table.



The following P&I-Diagram should be your end result.

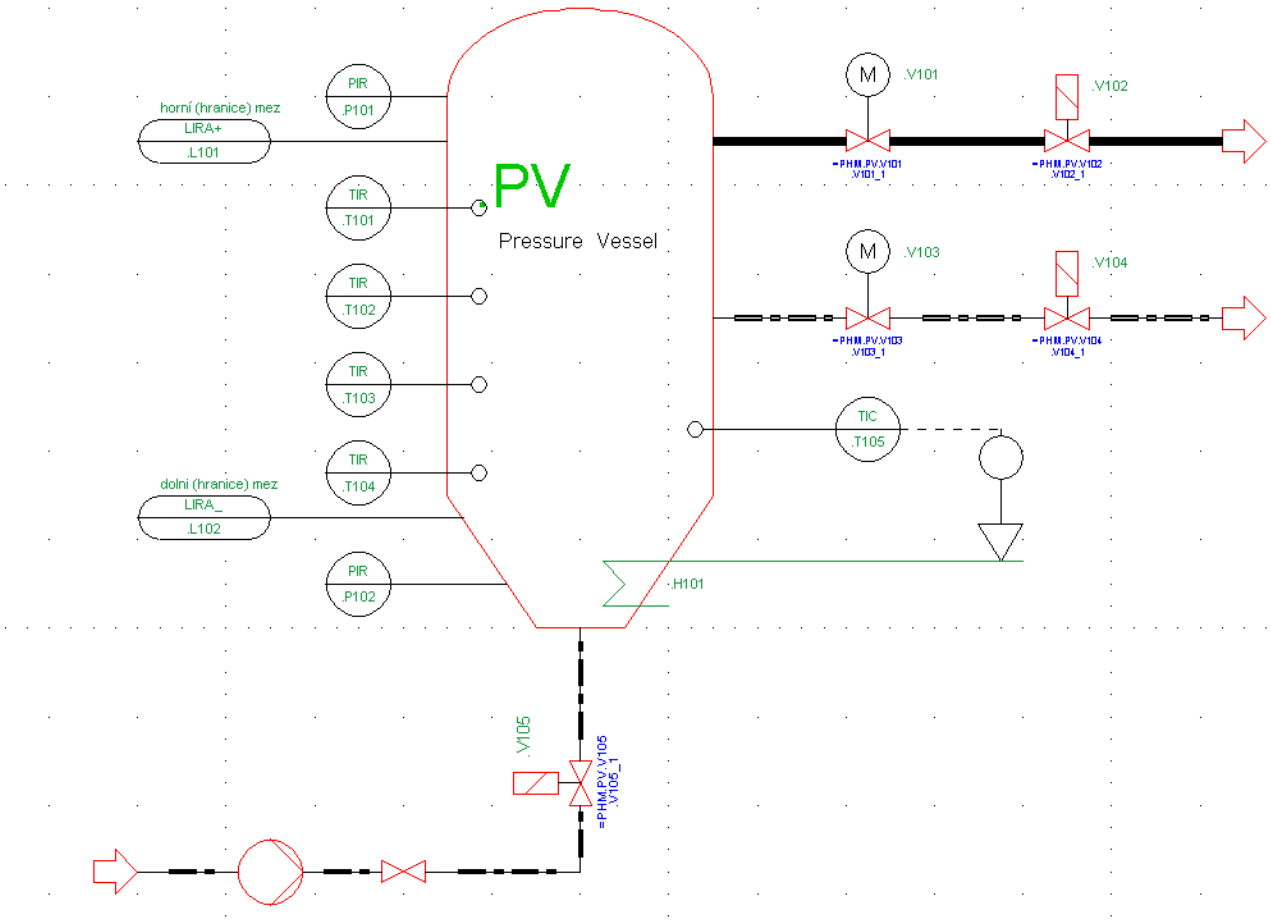


Figure 6: P&I-Diagram PHM.PV

In addition to listing data sets with little information, there are also data sets with more detailed information or descriptions that access several tables which are to be documented as project documents. In these cases the pertinent information is presented on a separate page. Typical representations of these project documents are *SpecificationData Sheets* and *Tag Sheets*.

Exercise 7: *Creating a Specification Data Sheet*

Specification Data Sheets document the specifications of the individual functions or function elements of a tag.

In editing the table “Specifications”, the individual data sets relating to the device groups Adapter Temperature Transmitters (02_4), Adapter Isolators (02_2) and Adapter IO-Devices (02_1) were created for the tag T105. Therefore the respective specification data sheets can also be created, as documents which relate directly to device groups.

The templates for the data sheets are stored in the original project (Master_750).

Before you begin creating the specification data sheet, go into the individual specification levels and check that the data sets agree with the content determined in Exercise 2. Make any necessary corrections.

♦ **Creating a Specification Data Sheet for the instrumentation T105_1**

There is an automatic function in the "AUCOPLAN" CAE system for filling current data into the individual specification data sheets.
As an example, for the device group „Adapter Temperatur Transmitters" a specification date sheet has to be created.

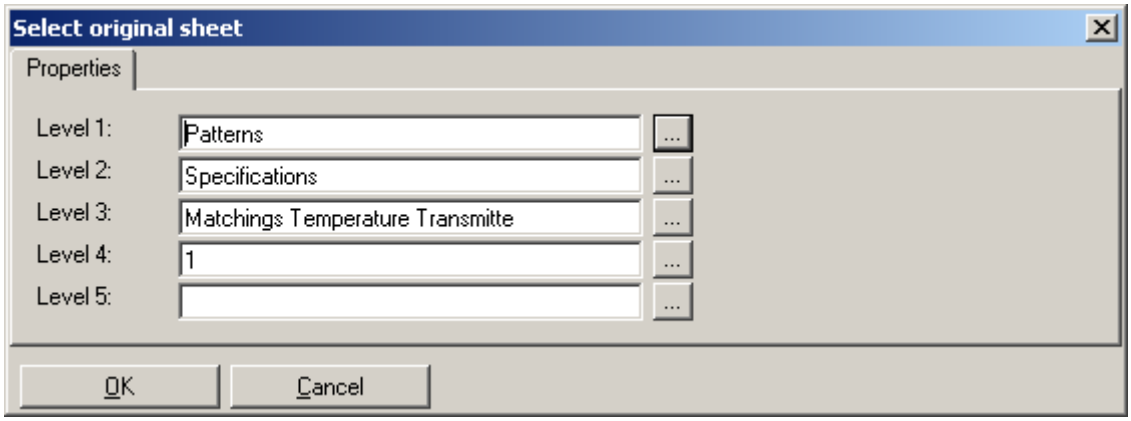
Go now to the subsystem PHM.PV and from there to the tag table, and mark the tag **T105**. Then use **right mouse button\Create Specification** and select the template from the original project (Master_750).

Level 1: Patterns

Level 2: Specifications

Level 3: Matchings Temperature Transmitte

Level 4: 1



The drawing management levels will be determined by the system automatically according to the setup of the sheet automatic (exercise 1). Entries can be changed later in the drawing management level by renaming.

After the specifications data sheet has been created in this way, it can be listed and viewed in the drawing editing level (**View\Drawing Editing\Drawings\Basic Engineering\Specifications**). Note that the content of the specification data sheet can be edited using the right mouse button. On this way assign the corresponding instrumentation (T105_1). You can also create the sheets for T105_2 and T105_3 this way.

Check the entries in the form sheet and complete the sheet name "specifikace" (Specification Data Sheet).

Exercise 8: *Creating a Tag (Data) Sheet*

Every tag is described in a tag sheet. This sheet documents what process connection points (i.e. measured media type and pipe data) have been determined, as well as the assigned tags specifications (i.e. adjustment data and instrumentations).

The templates for the sheets are stored in the original project (Master_750).

♦ **Creating the Tag (Data) Sheet for the tag T105**

There is an automatic function in the "AUCOPLAN" CAE system for filling in individuell tag sheets with the current data.
As an example, for the tag T105 a tag sheet has to be created.

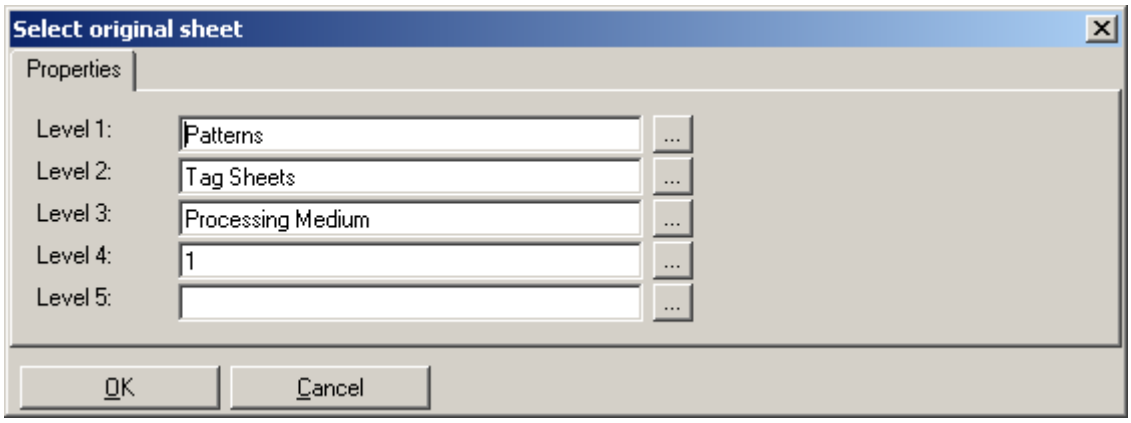
Go now to the subsystem PHM.PV and from there to the tag table, and mark the tag **T105**. Then use **right mouse button\Create Data Sheet** and select the template from the original project (Master_750).

Level 1: Patterns

Level 2: Tag Sheets

Level 3: Processing Medium

Level 4: 1



The drawing management levels will be determined by the system automatically according to the setup of the sheet automatic (exercise 1). Entries can be changed later in the drawing management level by renaming.

After the tag sheet has been created in this way, it can be listed and viewed in the drawing editing level (**View\Drawing Editing\Drawings\Basic Engineering\Tag Sheets**).

Check the entries in the form sheet. The form sheet is configured to automatically fill in the fields for Factory, Building, Engineering Department and Commision with the corresponding project header data. Complete the form with the sheet name "seznam merení" (Tag Sheet).

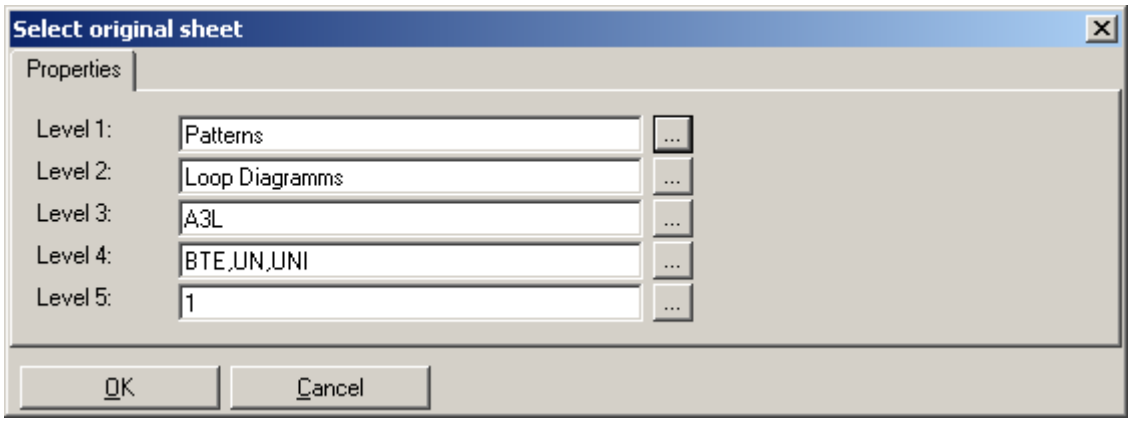
Exercise 9*: Creating a Loop Diagramm*

Loop diagrams can be created in different ways. One easy way is the use of predefined templates, so called “Loop Typicals“. The original project offers various versions of this templates.

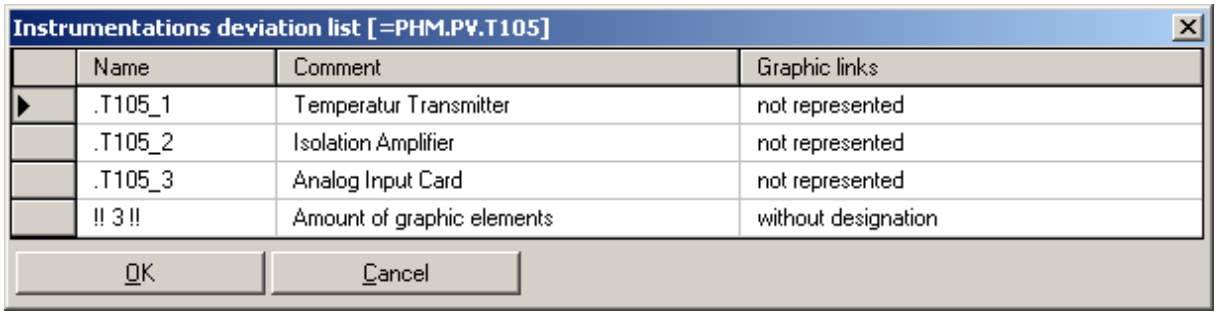
Similarly to a specification sheet or a data sheet, a loop diagram is also set up from the marked tag!

Create now the loop diagramm for the tag **T105** (**right mouse button\Create Loop Diagram**) using a loop typical template.

In our example the measurement is done with a temperature transmitter (BTE), and through the isolation amplifier (UN) fed into the process control system with an analog input card (UNI). Choose the corresponding loop typical from the original project (Master_750):



The “Instrumentation deviation list” that will appear in the window shows which instrumentation was set up. Not represented links have to be connected later manually!



You can now view the loop diagram in the drawing editing level **(View\Drawing Editing\Basic Engineering\Loop Diagrams\1)** and correct the entries in the form sheet. Complete the form with the sheet name "diagram cyklů“ (Loop Diagramm).

The processing of the loop diagram basically includes the following steps:

1.) Entering the tag functions as symbols and their electric connections,
2.) Editing the tag symbols (connecting the symbols with the instrumentations),
3.) Entering the necessary terminals/strips as symbols in the electric connections,
4.) Entering the necessary symbols for the cables and cores,
5.) Editing the terminals/strips and cable symbols (assignments),
6.) Evaluating the preliminary loop diagramm.

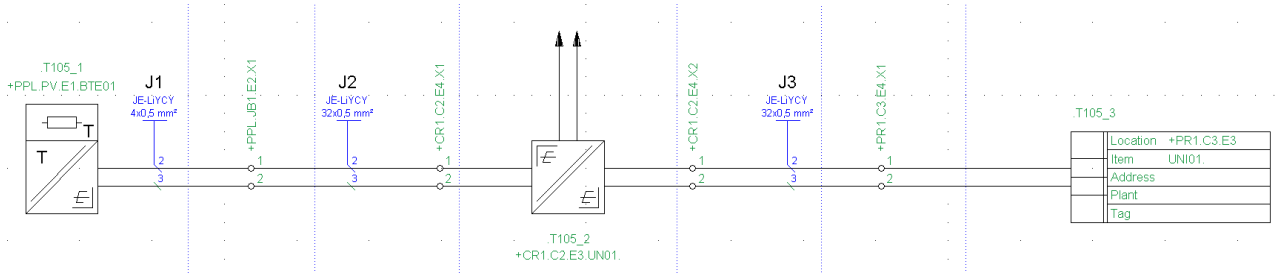


Figure 7: Loop Diagramm of the tag T105

Used symbols:

Transmitter/sensor:	**LD_SENSOR_A**
Isolation amplifier:	**LD_ADAPTER_A**
Analog input:	**LD_IO_DEVICE_L**
Terminals/strips:	**LD_X_2C, LD_X_2C***
Cables/cores:	**CD_W_CORE_E, CD_W_CORE_E***

Look at the loop diagramm you have created. Using the loop typical all symbols and connections are already created. Connect the symbols with the according instrumentation **(right mouse button\Edit)** and check that the correct specification sheets have been used!

Then check the editing options. Change the entries (especially the Specifications/Specification sheet) and check the changes in the graphic display, than undo the changes.

Develop the loop diagram further as pictured in figure 7.

Allocate the cables/cores!

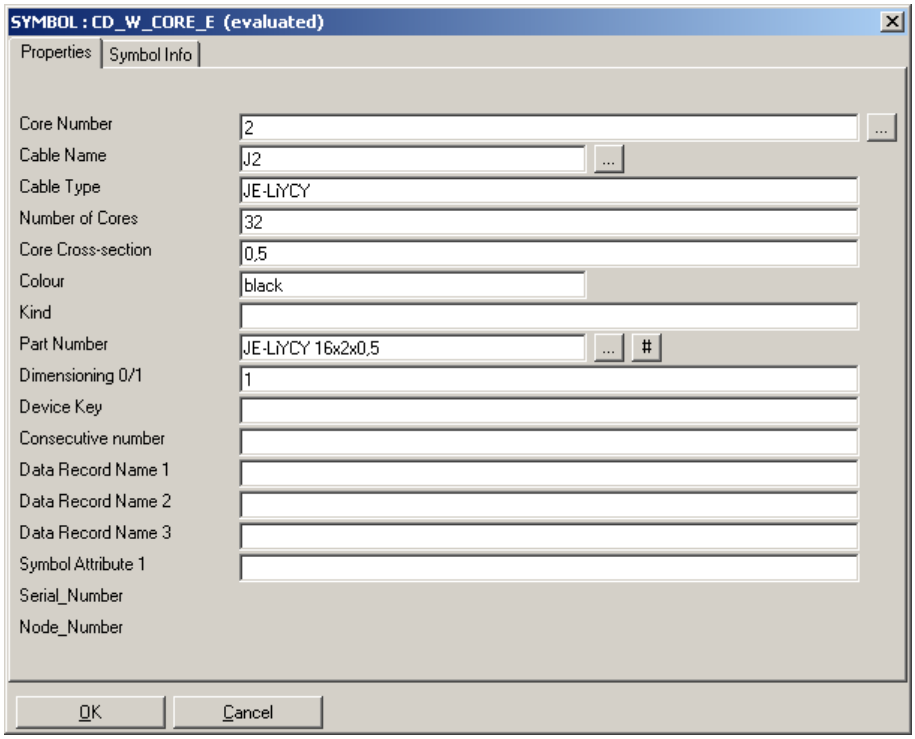


Figure 8: Example of the core connection J2.2

Get informed about the allocation of the terminals/strips and make the correct assignments!

The assigment can be done by editing the symbol (right mouse button\Edit) or via the drag-and-drop-function in the item editor.

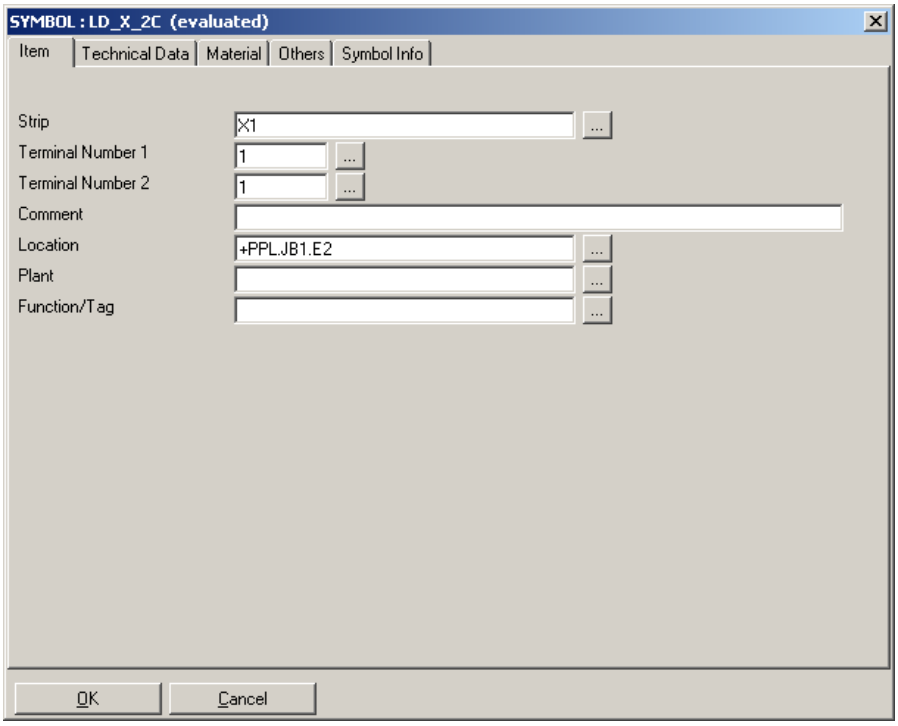


Figure 9: Example of the strip X1 in the junction box JB1

With the command „aa“ you can at last check the correct assignments of all symbols and connections, the entries in the item editor will be refreshed.

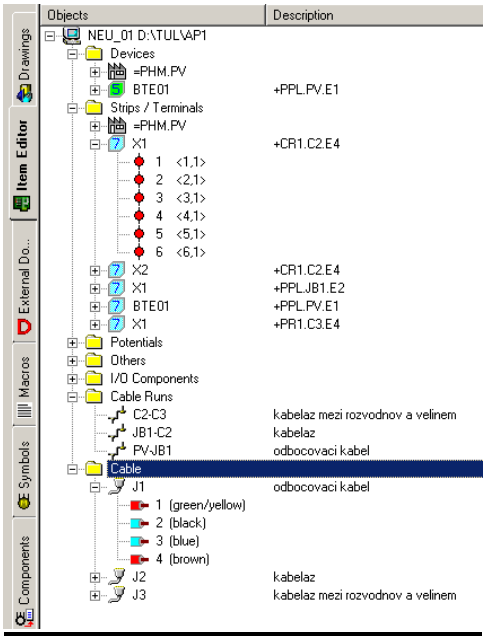


Figure 10: Example of the Item-Editor Display

Exercise 10: *Creating a Hook Up for the field device „Temperature Transmitter“*

To prepare and realize the connections between the function and the local environments as well as the assembly of the projected process automation system, the installation site must be illustrated graphically. This is true for the illustration showing the placement of the containers and devices in so-called “*assembly plans*” as well as for giving assembly details for field devices in *assembly drawings*, so-called ***Hook Up’s***.

In creating the hook up we follow a similar procedure as in creating other drawings:

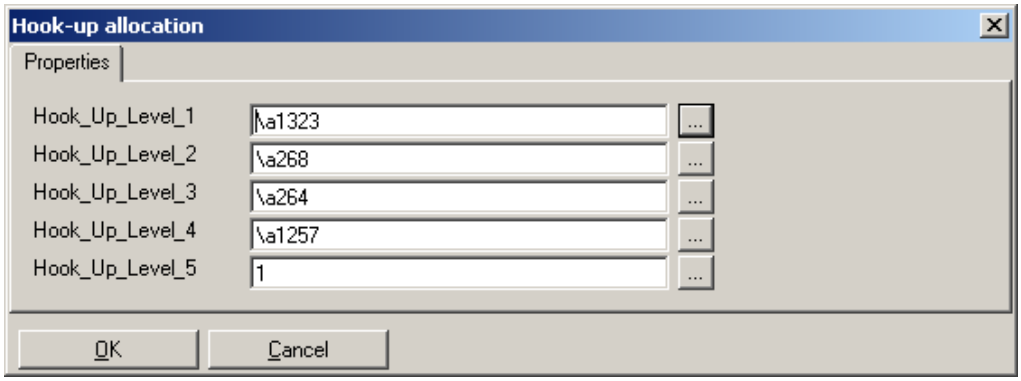
1) Create or Edit the appropriate form sheet,
2) Create or copy an assembly drawing,
3) Edit the drawing using the graphic tools or by inserting or pasting copies from other projects or from the macro-project,
4) Assign the drawing to the respective instrumentations,
5) Make a list of the assembly materials needed.

Form sheet for the Assembly Drawing

We assume here that the form sheets you need have been saved in the **external project** to serve as draft versions. These drafts for the assembly drawings consist of a figure or illustration with a title block (HU_A3P_Form) as well as a list section for the assembly material (HU_MAT_E) and for the respective tag (H_TAG)

Assigning the Assembly Drawing to the Instrumentation T105_1

Go now to the instrumentation table, mark the data set T105_1 and assign this data set the appropriate assembly drawing (Hook-Up) from the **External Project** (**right mouse button\Assign Hook up**). Use the selection button […] to choose an appropriate allocation of the hook-up levels (Basic Engineering\Hook Up\Temperature\resistance thermometer\1) for the instrumentation T105_1.



In this example the template uses pointers to the translate data file for the labels:

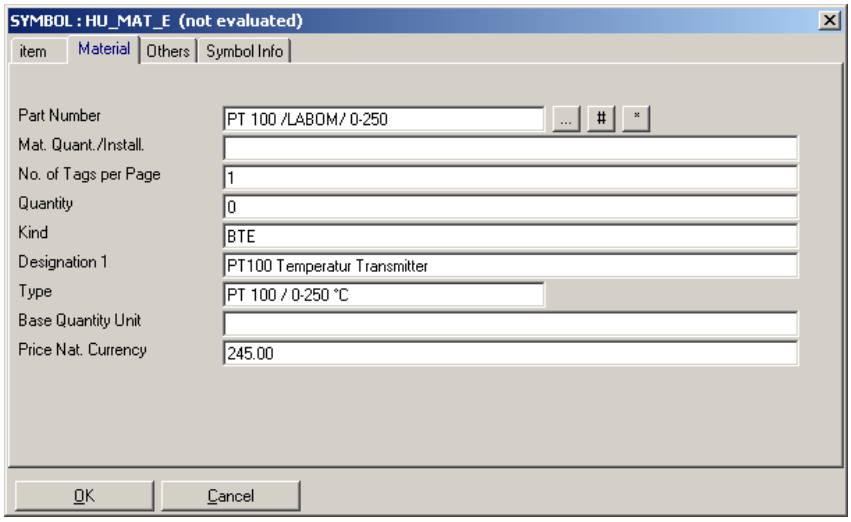
\a1323	„Basic Engineering“
\a268	„Hook Up“
\a264	„Temperature“
\a1257	„resistance thermometer“

Switching the translate data files you can change the display language for labels defined with this pointers.

After the allocation the hook up will be created. You can find it in the drawing editing level under the defined path. Check the created hook.

Entering the Transmitter

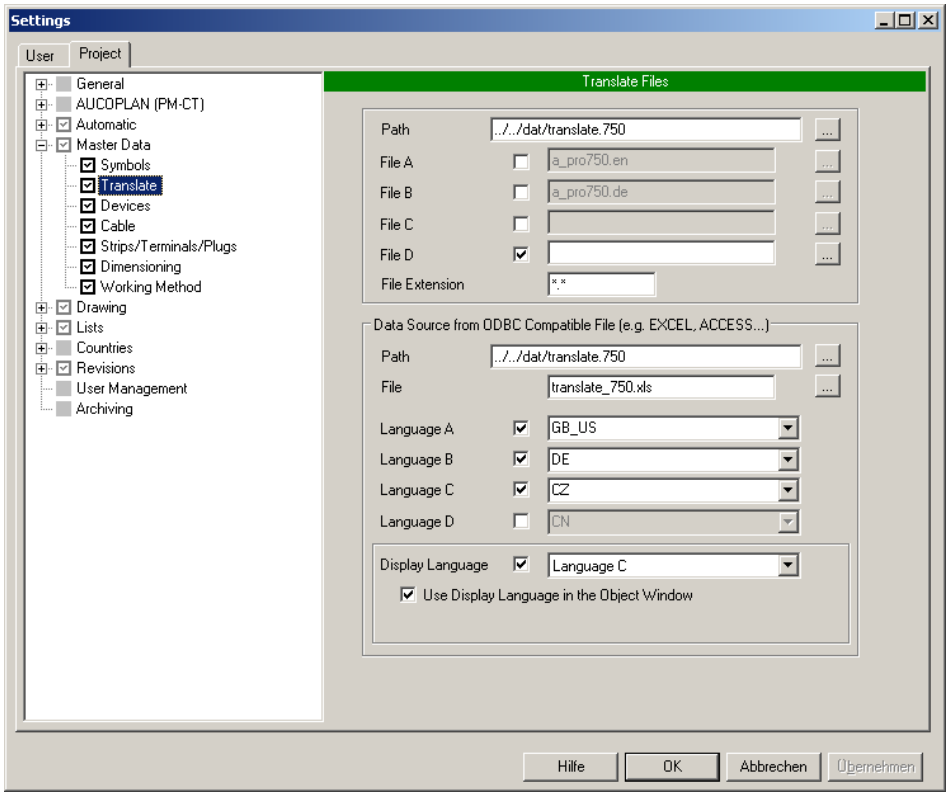
With the right mouse button you can edit the individual lines of the list for the assembly **material** on the assembly drawing (left side). Use the selection key to select the part number and enter the appropriate transmitter (Labom) in the first position.



Now your project is finished!

Exercise 11: *Using Translatefiles*

Close the drawing and switch to the display language C (czech) in Extras\Options\Project\Master Data\Translate and check the effects on the labels in the drawing and and PM+CT-Design levels.



Using this function consequently for all labels gives you the possibility to easily change between different languages.

Exercise 12: *Creating a Revision and Printing of Drawings and Tables*

The current state of the drawings you can save as a **revision** and print out.

Go to the view "**Drawing Editing**" and right click on the drawing or the path of the drawings to print and select **"Output\Current Drawing as Document"** or respectively **"Output\Drawings as Document"**. Aucoplan automatically creates a copy of the drawing(s) as a revision state. So you can easily find and print out changes that are made to the drawing afterwards.

If you select **"Output\Current Drawing as Working Sheet"** or respectively **"Output\Drawings as Working Sheet"** no revision is created and the drawing(s) are printed out with the watermark "WORK SHEET" as information that this is not the revision state of the drawing.

If you just want to print out a table from the view **"PM+CT Design"** than mark the table and select "**File\Print".**

Literature

/1/ Lecture projecting

/2/ Polke: Prozessleittechnik, OLDENBOURG Verlag München Wien