

TM820

APROL Solutions



Requirements

Training modules	Basic information about solutions, and additional training modules as required: TM800, TM830, TM811, TM812, TM813
Software	APROL Automation Runtime SuSE LINUX
Hardware	1 control computer, 1 controller

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1 Introduction

You have chosen to take part in the APROL Solutions training module offered by B&R in order to become familiar with different solutions (EnMon, ConMon, PDA, factory automation, plant automation, etc.) in addition to learning how to configure and implement them. Furthermore, you will learn about the possible fields of application.

Some of you may just want to learn about what types of configuration and expansion possibilities actually exist; others might actually be working with Solutions projects and setting up your first installations after this seminar is over.

We will do our very best to provide each and every one of you with the most amount of information possible.



Figure 1: APROL Solutions --> Making the world a better place

1.1 Objectives

The APROL solutions seminar gives you the ability to realize your selected functionality (EnMon, ConMon, PDA, etc.), commission it, and work with it (analysis, reports, etc.).

Once you have finished this seminar, you will be in a position to make the best possible use of the advantages provided by APROL Solutions, including the system's complete and intuitive engineering concept.

The wizard which is described in this training manual will help you to realize your demands. This document can also be used at a later stage when making additions.

This training documentation includes numerous screenshots which should allow you to get a much better idea of your own system.

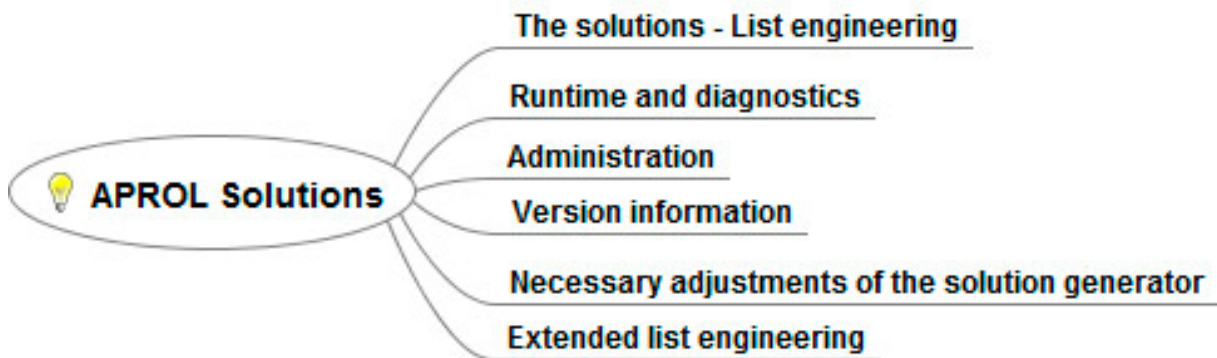


Figure 2: Overview of APROL solutions

2 The solutions - List engineering

Requirements:

The APROL solutions are **stand-alone solutions** which can also be integrated into an existing APROL process control system at any time. An Automation PC 910 with a pre-installed APROL solution is required. This contains the entire system. A Windows PC that has Excel 2010 installed must also be available on the network in order to work with list engineering.

A project which can be downloaded is already installed in the APROL solution (APC 910).

There are "default solution users" which have the necessary rights. (**User: basic, password: BuR1.basic** or **User: advanced, password: BuR1.advanced**). The user "**aprol**" and password "**BuR1.aprol**" can be used for the training project.

A list of necessary or supported hardware and associated templates can be found in the documentation.



Note:

We will continue working with the training project. The solution project is available on the B&R homepage together with the solutions generator (including the wizard). The necessary adaptations for working with another project than the solutions project can be found in this document.

Methodologies:

The engineering can be carried out with several methodologies: The following are conventional:

Methodology	Description
Direct on the APROL server	Log in to the PC directly as an engineer and start the wizard. Data transfer to the Windows PC can be done via USB stick, FTP, or similar.
VNC connection	In a VNC session on the Windows PC and start the wizard there. Data transfer to the Windows PC can be done via USB stick, FTP, or similar.
X Window	In an X session on the Windows PC and start the wizard there. Data transfer to the Windows PC can be done via USB stick, FTP, or similar.
Wizard in Windows + VNC	The wizard is started on the Windows PC and the CAE engineering is done either directly on the PC or via VNC (or X). The (Excel) data can be saved directly in the Windows PC.

2.1 The Solutions Wizard

The solutions wizard implements the APROL engineering in a simple way. The following documentation will describe individual functions in the context of the proper sequence. The wizard itself is web-based and can be launched from a web browser (e.g. Chrome, Firefox). The excel list which is filled out in the course of this represents a sort of list engineering.

There are two methods available:

- Directly on the APROL server via the web portal (engineering environment)

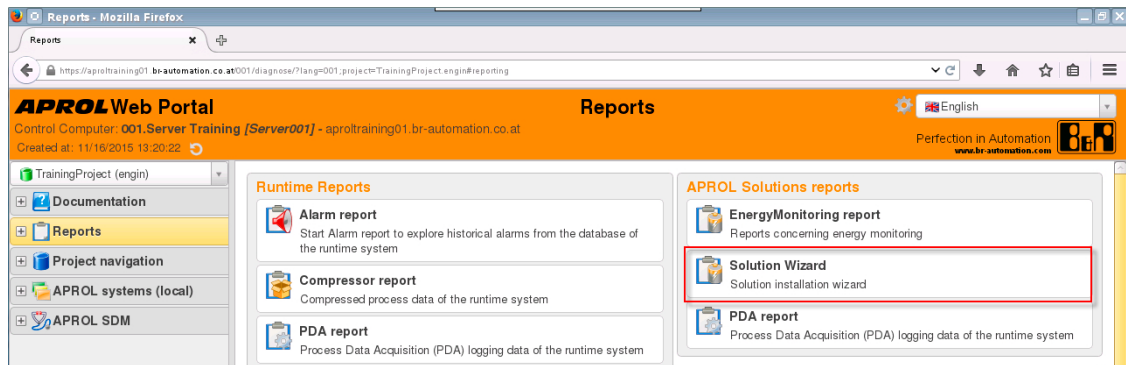


Figure 3: Open the solutions wizard

- With a web browser in Windows

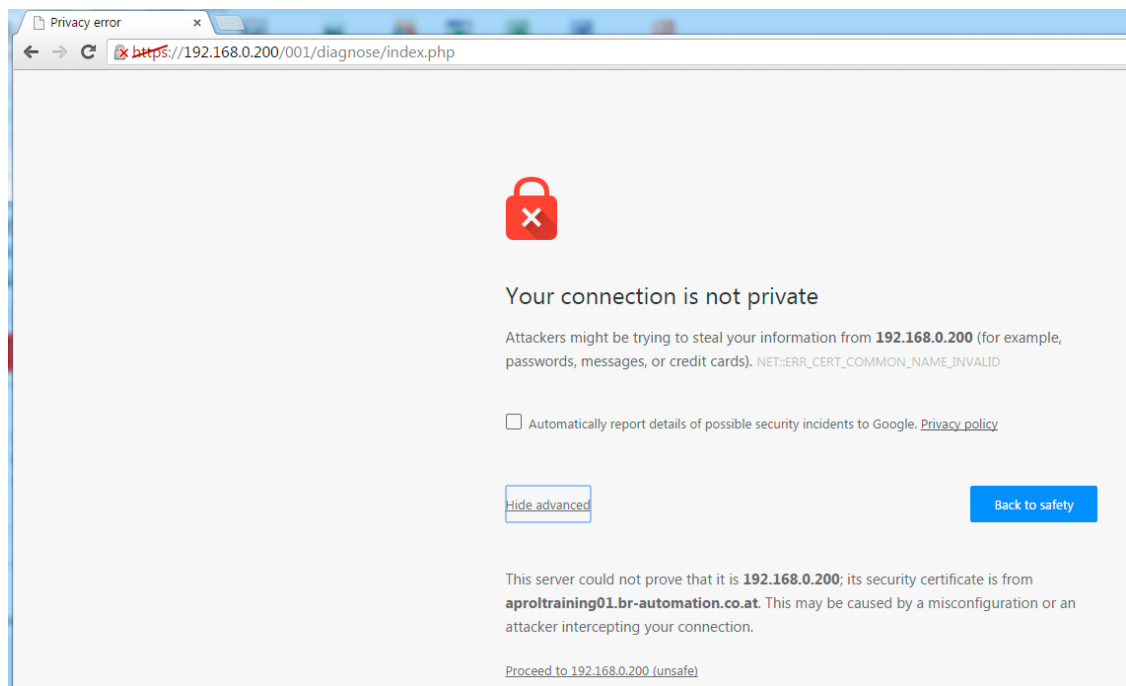


Figure 4: Safety notice

The solutions - List engineering

The name of the solution server together with the IP and FQDN (Fully Qualified Domain Name) should be entered in the hosts file of the Windows PC. Addressing over DNS is an alternative. Otherwise the computer name in the browser address bar must be exchanged with the IP address. Explicit access must also be granted, because of the secure query (see https).

The entry in the "**C:/Windows/System32/drivers/etc/hosts**" may look like this:

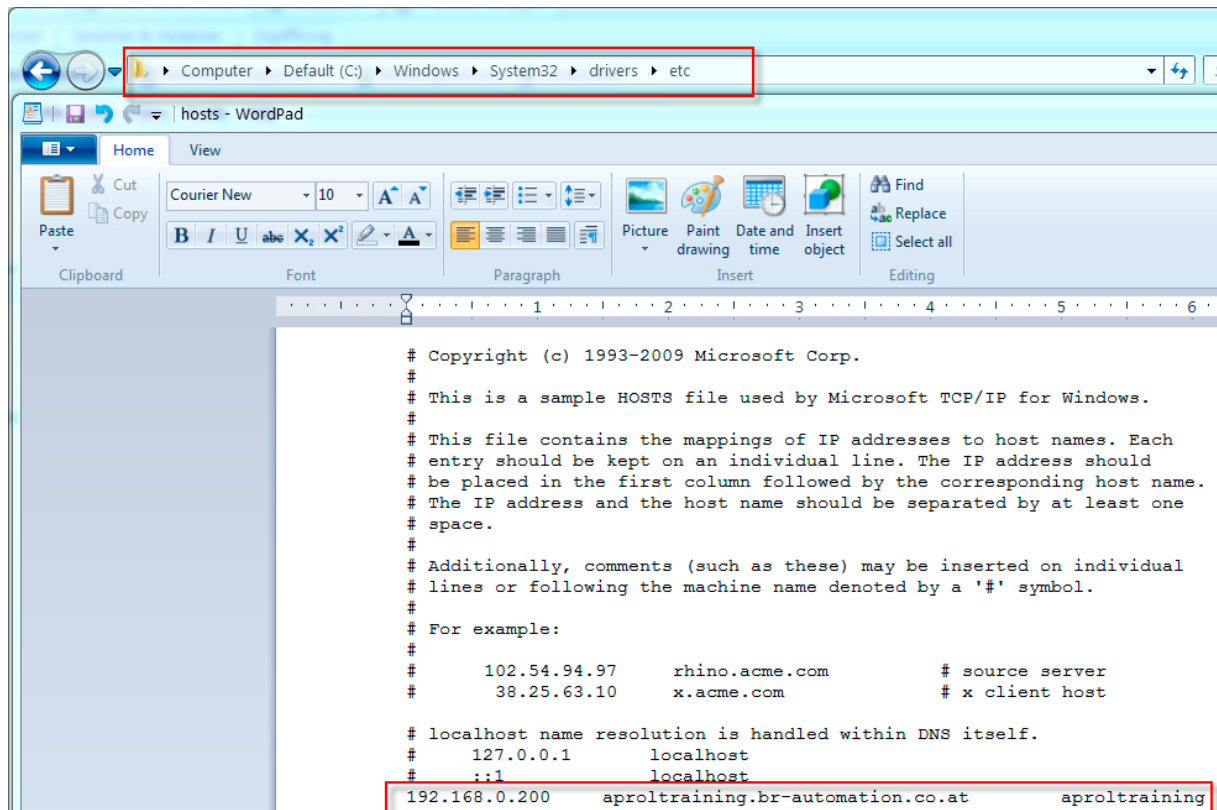


Figure 5: Excerpt of "hosts" file

This methodology will open the project selection main page if the IP address (of the solutions server (//xxx.xxx.xxx.xxx)) is entered in the address bar of the browser.

The APROL web portal is reached by selecting the desired project.

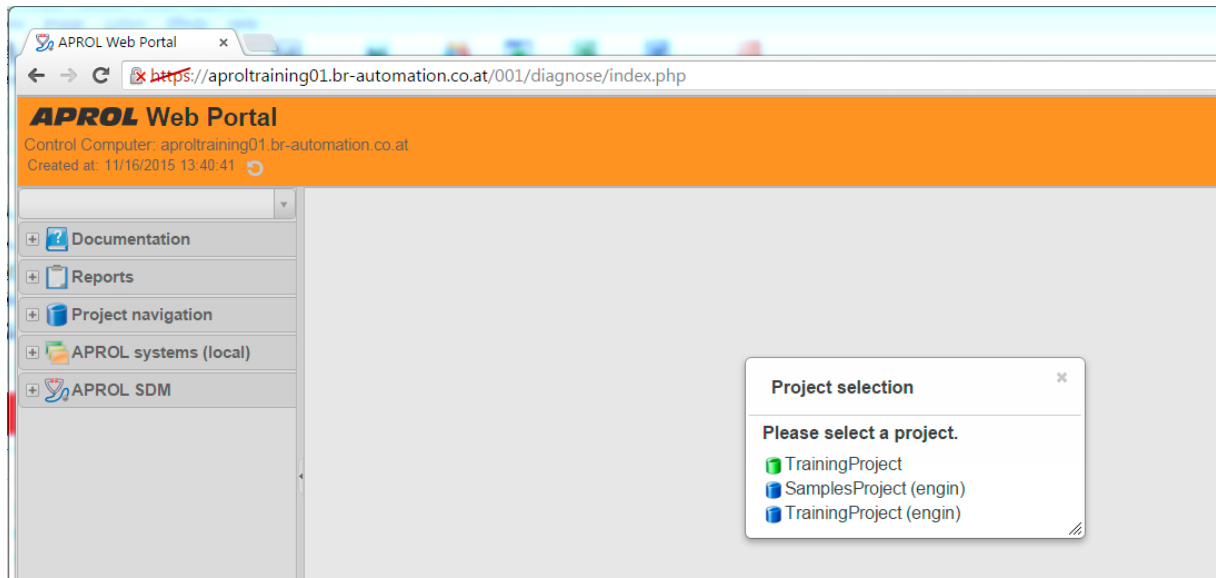


Figure 6: Selecting the project in order to start the wizard

Users must identify themselves and log in before they can use the APROL solutions wizard:

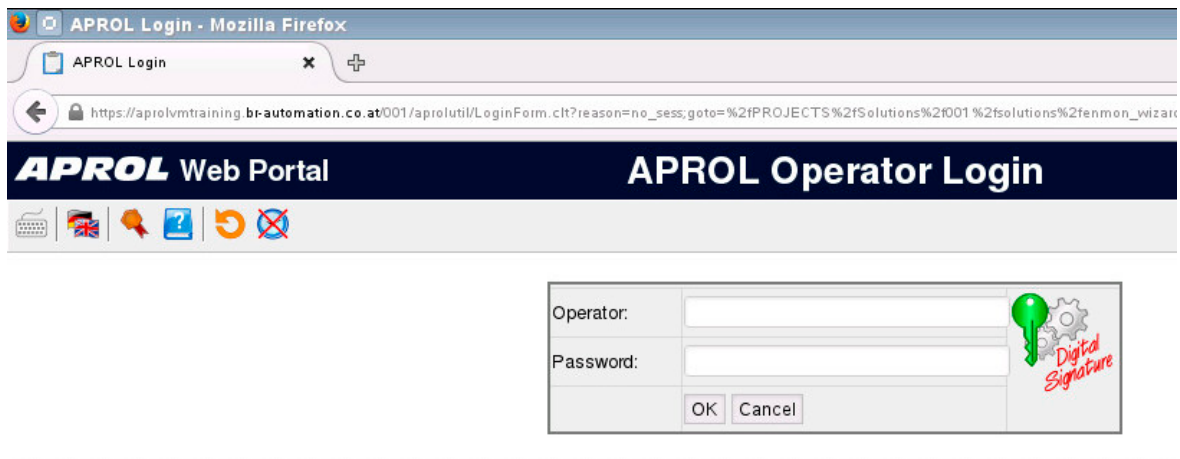


Figure 7: Web-based login

The start page of the Solutions wizard is then opened. It contains several tabs for handling different functions.

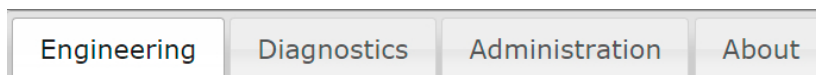


Figure 8: Solutions wizard tabs

Tab	Description
Engineering	All of the necessary steps are here for a successful Solutions Project
Diagnostics	Navigation to the System Diagnostics Manager, DisplayCenter, and Solutions Reports

Tab	Description
Administration	Status display and management of System processes Eventual update possibilities (reports, templates, AR (Automation Runtime), Automation Studio, etc.)
About	Version information, etc.

**Note:**

The current working instructions can be found in the footer of the wizard. This is always basically an instruction.

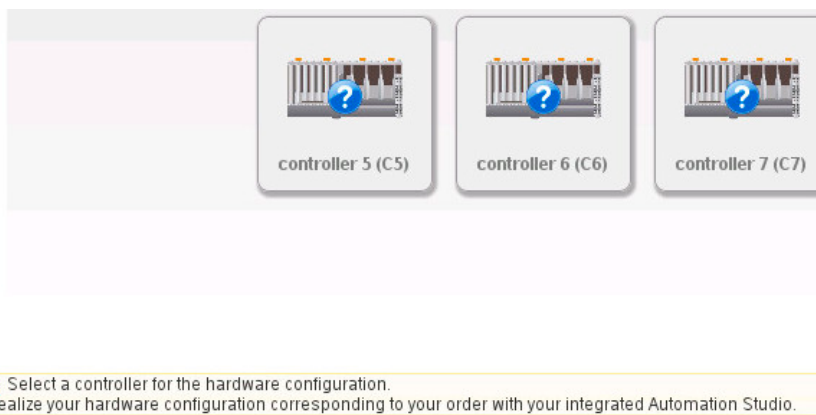


Figure 9: Example wizard footer

2.2 Engineering

The following pages are available in the Engineering area.

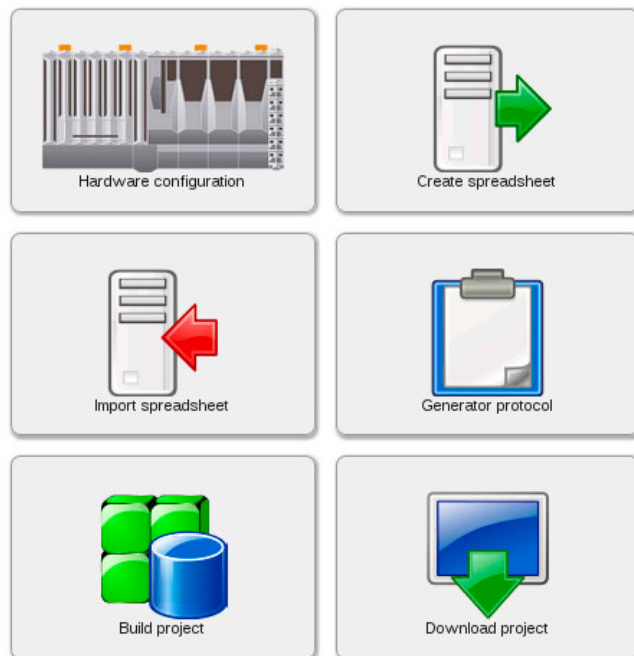


Figure 10: Wizard Engineering Start Page

Step	Description
Hardware configuration	The necessary hardware is created here, step by step with the Automation Studio. Up to eight controllers are predefined in this mask.
Create spreadsheet	This page downloads and allows subsequent editing and engineering in an Excel list.
Import spreadsheet	This entry imports the I/O mapping and imports the Function charts (both I/O mapping and the CFCs) are created generically)
Generator protocol	View of the generator protocol (this is responsible for the generic creation of the I/O mapping and the function charts.)
Build project	The entire build (code generation) of the project is carried out here.
Download project	The entire project is downloaded (controller and control computer).

2.2.1 Hardware configuration

The hardware can be defined according to a pre-planning or corresponding offers by pressing the **"Hardware configuration"** field.

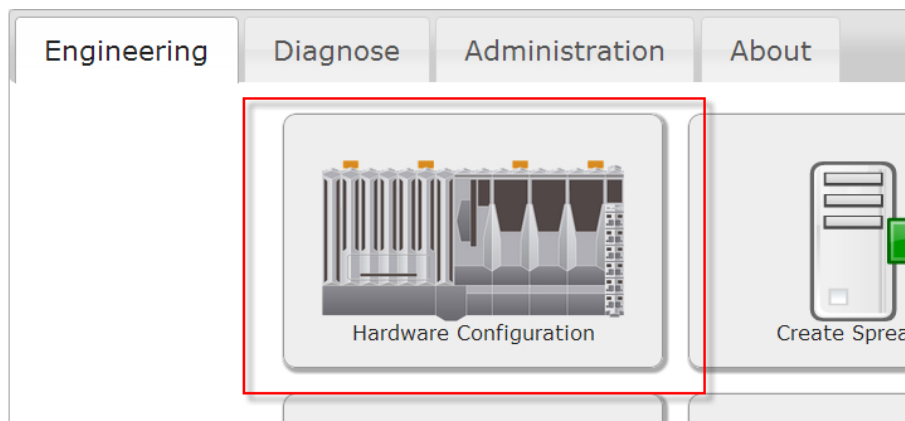


Figure 11: Selecting "Hardware configuration"

Controller selection

One of the eight pre-configured controllers can be selected. A VNC session is now started in the browser and the CaeManager is opened together with the selected controller.

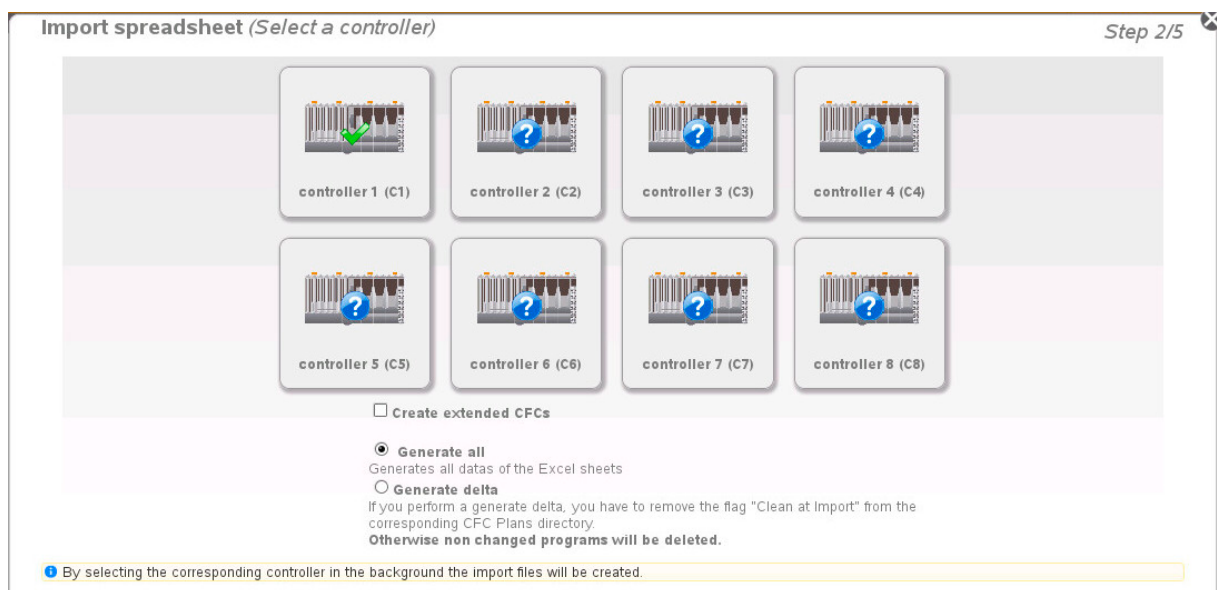


Figure 12: Selection of the corresponding controller

Entering the 'DISPLAY' variable

A valid "DISPLAY" variable must be entered in order to continue. This variable influences the output of other applications:

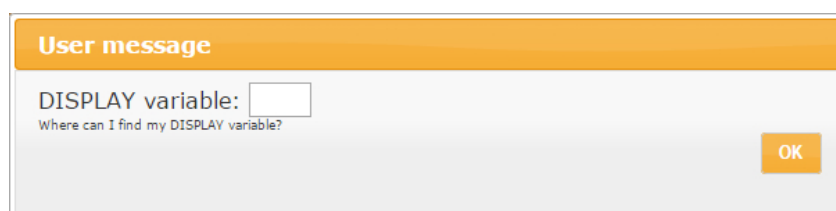


Figure 13: Input dialog of the DISPLAY variable

Possible values for the "DISPLAY" variable:

- 0: Output on the local APROL screen
- 1-99: Output via a VNC viewer or X window. The correct "DISPLAY" variable can be found in the title bar of the VNC viewer.

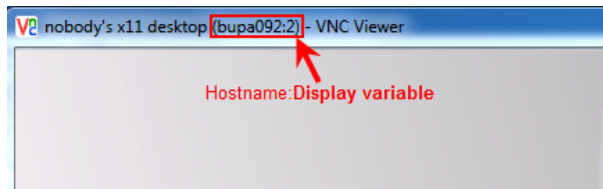


Figure 14: VNC viewer display variable

Setting up the hardware

Just like with actual planning, it is now time to set up the hardware as it is needed. This can be learnt in detail in the **"TM830 Project Engineering"** training manual and in the Automation Studio basic course. In order to do this, a VMware containing Automation Studio is started automatically with the **"AS Hardware Configuration"** button.



Task:

Start the wizard and configure your C1 controller according to the existing platform. Therefore insert the POWERLINK rack into your hardware configuration.

2.2.2 Generating the Excel files

After the **"Hardware Configuration"** menu item is finished in the wizard, the **"Create Spreadsheet"** menu item must be called. This will start the process of generating the Excel files (with respect to the C1-C8 constellation).

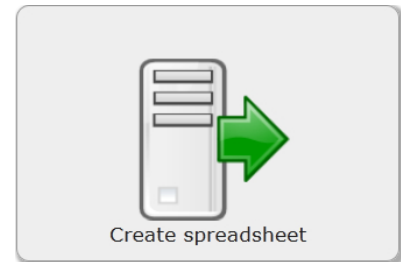


Figure 15: Starting the process of generating the Excel lists

Selection of the controller

Select the controller for which the associated Excel file should be generated.

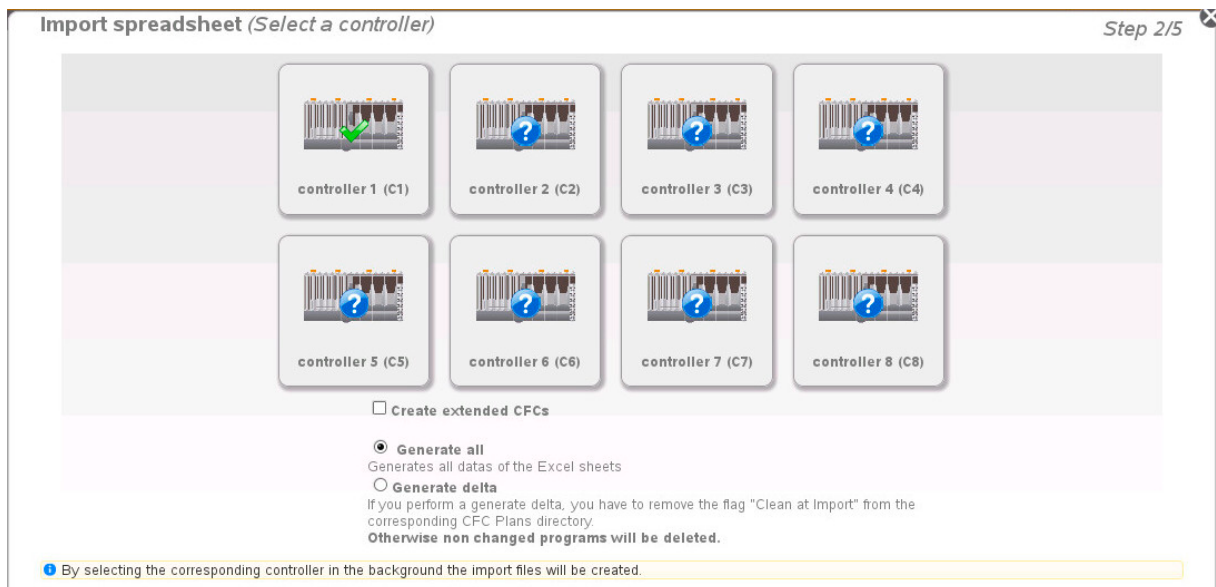


Figure 16: Selection of the corresponding controller

Log file view

The **"Create Spreadsheet"** log is then opened. There, you can see if the spreadsheet was created correctly. Furthermore, you can see which hardware components have an Excel list in order to carry out a list engineering.

Create spreadsheet

Step 2/3

```
Ready
10/22/12 09:55:20 : Start ...
10/22/12 09:55:20 : getConfig ./config.xml
10/22/12 09:55:20 : getProjectConfig ./config.xml
10/22/12 09:55:20 : Found controller C1 in caedb
10/22/12 09:55:20 : Parsing controller hardware C1....
10/22/12 09:55:20 : Export AS hardware configuration for controller C1 into ../dataFiles/internal/C1/
10/22/12 09:55:20 : No config file for module X20CP3486 found.
10/22/12 09:55:20 : No config file for module X20CP3486 found.
10/22/12 09:55:20 : No config file for module X20CP3486 found.
10/22/12 09:55:20 : No config file for module X20CP3486 found.
10/22/12 09:55:20 : No config file for module X20CP3486 found.
10/22/12 09:55:20 : No config file for module X20CP3486 found.
10/22/12 09:55:20 : No config file for module EPL-V2 found.
10/22/12 09:55:20 : No config file for module X20BC1083 found.
10/22/12 09:55:20 : No config file for module X20BC1083 found.
10/22/12 09:55:20 : No config file for module X2X found.
10/22/12 09:55:20 : No config file for module X20PS9400a found.
10/22/12 09:55:20 : No config file for module X20PS9400a found.
10/22/12 09:55:20 : No config file for module X20PS9400a found.
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST2 X20AT4222 Temperature01
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST2 X20AT4222 Temperature02
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST2 X20AT4222 Temperature03
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST2 X20AT4222 Temperature04
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST3 X20AT6402 Temperature01
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST3 X20AT6402 Temperature02
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST3 X20AT6402 Temperature03
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST3 X20AT6402 Temperature04
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST3 X20AT6402 Temperature05
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST3 X20AT6402 Temperature06
10/22/12 09:55:20 : No config file for module X20PS9400a found.
10/22/12 09:55:20 : No config file for module X20PS9400a found.
10/22/12 09:55:20 : No config file for module X20PS9400a found.
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST5 X20AI4632 AnalogInput01
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST5 X20AI4632 AnalogInput02
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST5 X20AI4632 AnalogInput03
10/22/12 09:55:20 : New Channel: IF3.ST2.IF1.ST5 X20AI4632 AnalogInput04
```

[Download Log](#)

The button "Download Log" save the output in a text file(e.g. C1_hw.log).

Figure 17: Log file for creating an Excel list

Navigating with arrow keys

The blue arrows to the left and right can be used to navigate through the wizard. To continue, simply click the right arrow.

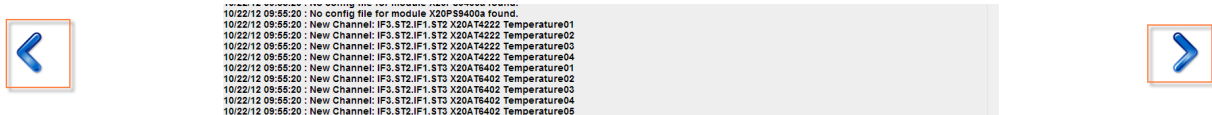


Figure 18: Navigating in the wizard

Link to the spreadsheet and XML file

The wizard now shows an address that points to the created spreadsheet. Click on the address to download and save the Excel file. Depending on the browser being used, it is possible to open the downloaded URL. A folder on the network drive that contains the created spreadsheet and an associated XML file is shown. The **"Done"** button closes this part of the wizard. The Excel file can now of course be edited on another PC.

Create spreadsheet (C1)

Step 3/3

Please edit the Spreadsheet or continue with next controller.

preadsheet can be found here:

<\\10.43.235.209\\enmon>

PccTr("Click on the link to save the Excel file for the in front selected controller. Press "Done" to close the Wizard page.")
Open this Excel sheet and create the whole configuration via list engineering.

Figure 19: Link to the Excel file

The data can be found on the APROL server in the **"/home/engin/ENGINE/cnf/SolutionsGenerator/dataFiles/public/<selected controller (C1)>/"** directory. It can be transferred to a Windows PC with a USB stick, FTP, etc.

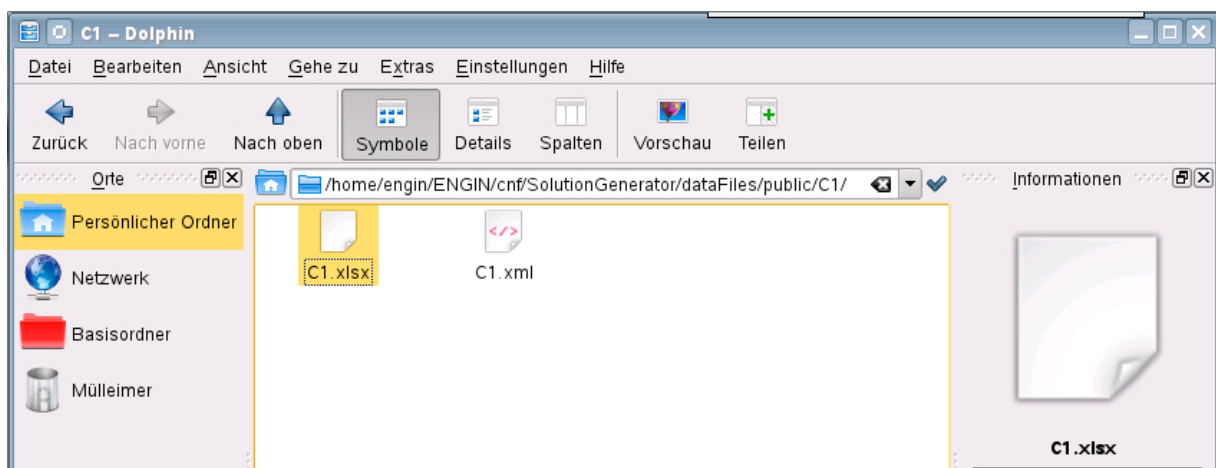


Figure 20: Storage location of spreadsheet and XML configuration file

The data can be accessed using the explorer if the wizard is running on a Windows PC.

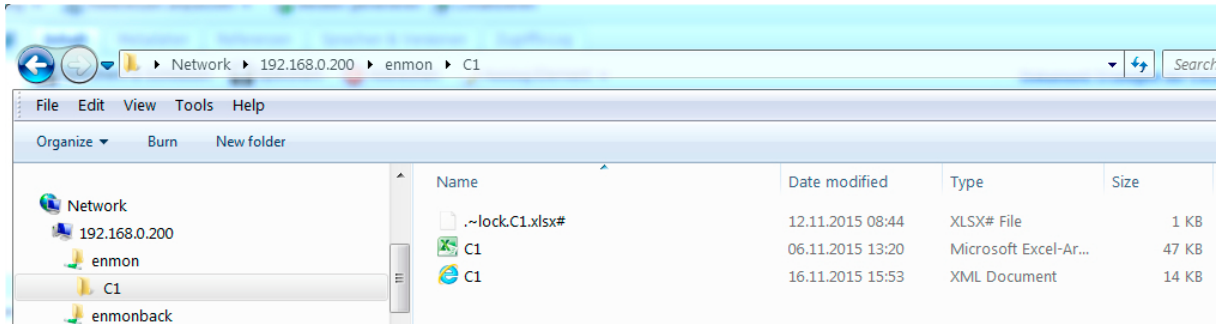


Figure 21: Storage location of spreadsheet and XML configuration file

Editing the Excel table

The Excel file should now include the following table:

	A	B	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	
1	APROL Solution list engineering																						
2	V0.14 (22.04.2013)																						
3	Slot	Module	Channel	Description	Tagname	Medium	measurement	Trend	phys.	Mbeg	Mend	Factor	Cost	climate	correc.	Lvl7	Lvl6	Lvl5	Lvl4	Lvl3	Lvl2	Lvl1	Lvl0
4																							
5																							
6																							
7																							

Figure 22: Excel template

In order to fill the table with the content of the hardware configuration, it must be synchronized with the supplied Cx.XML file. This is done using a data connection in Excel. This must be carried out once per controller as follows:

- Select the **"Data/Connection"** menu item in Excel.

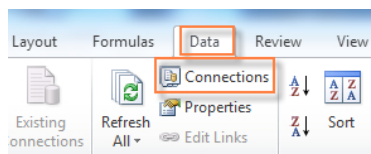


Figure 23: Setting up the data connection

- The **Properties** must now be opened in the sub-window which opens.

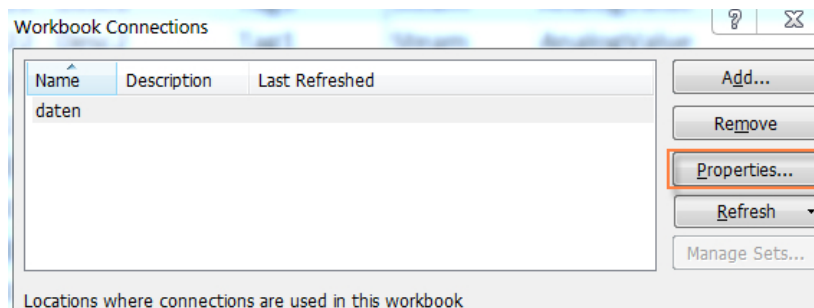


Figure 24: Selection of the data connection

The solutions - List engineering

- Navigate to the corresponding (e.g. C1.xml) file in the **"Definition"** tab of the window which now opens. The address is the same as the one used earlier (see note in Step 3).

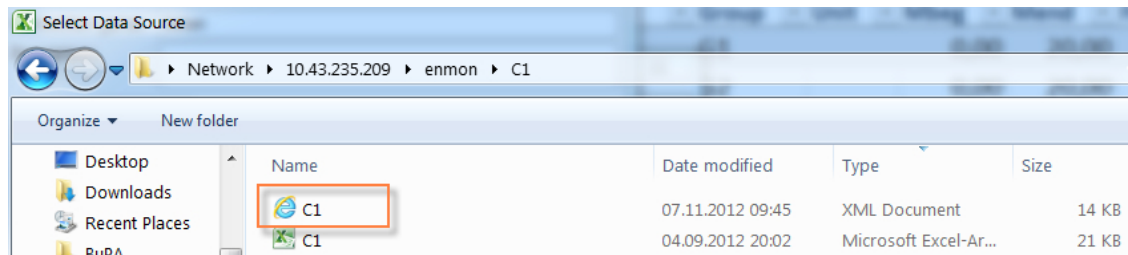


Figure 25: Selecting the associated XML file

- The data connection is established with this, and the created **hardware I/O** should be visible in the **Slot/Module and Channel** table columns.

APROL Solution list engineering																								
Slot	Module	Channel	Description	Tagname	Medium	Measurement Type	Trend Group	Phys. Unit	MBeg	Mend	Factor	Cost Unit	Climate Correc.	lv17	lv16	lv15	lv14	lv13	lv12	lv11	lv10	lv9	lv8	lv7
1	IF3.ST1.JF1.S12	X20D9371	DigitalInput01																					
2	IF3.ST1.JF1.S12	X20D9371	DigitalInput02																					
3	IF3.ST1.JF1.S12	X20D9371	DigitalInput03																					
4	IF3.ST1.JF1.S12	X20D9371	DigitalInput04																					
5	IF3.ST1.JF1.S12	X20D9371	DigitalInput05																					
6	IF3.ST1.JF1.S12	X20D9371	DigitalInput06																					
7	IF3.ST1.JF1.S12	X20D9371	DigitalInput07																					
8	IF3.ST1.JF1.S12	X20D9371	DigitalInput08																					
9	IF3.ST1.JF1.S12	X20D9371	DigitalInput09																					
10	IF3.ST1.JF1.S12	X20D9371	DigitalInput10																					
11	IF3.ST1.JF1.S12	X20D9371	DigitalInput11																					
12	IF3.ST1.JF1.S12	X20D9371	DigitalInput12																					
13	IF3.ST1.JF1.S14	X20A4622	AnalogInput01																					
14	IF3.ST1.JF1.S14	X20A4622	AnalogInput02																					
15	IF3.ST1.JF1.S14	X20A4622	AnalogInput03																					
16	IF3.ST1.JF1.S16	X20A7422	Temperature01																					
17	IF3.ST1.JF1.S16	X20A7422	Temperature02																					
18	IF3.ST1.JF1.S16	X20A7422	Temperature03																					
19	IF3.ST1.JF1.S16	X20A7422	Temperature04																					
20	IF3.ST2.JF1.S12	X20CM4810	ModuleOk																					
21	IF3.ST2.JF1.S13	X20AP3121	InputSequence																					

Figure 26: Results of a functioning data connection

The Excel table can now be filled out. We are now in the realm of list engineering. Information about filling out the table can be found in the table engineering section of this document.

2.2.3 Filling out the Excel table (list engineering)

After the Excel table is filled out, the file must be saved using the name as it is given. A mechanism further down the line will be looking for this particular filename.

[illegible]

Figure 27: A filled out Excel table

Explanation of parameters in the EnMon spreadsheet:

A short description of the individual columns is necessary in order to be able to fill out the list correctly.

Parameters that don't need to be filled in:

The following parameters are taken from the AS hardware configuration and don't have to be specified in the Excel table.

slot	Module address of the I/O card
Module	Description of the I/O card
Channel	Description of the module channel

Parameters that need to be filled in:

The following parameters need to be specified in the table or selected from a drop-down box (if available for that parameter).

Column	Description
Description	General description of the input or output channel
Tag name	Description of the measuring point  Allowed is, a maximum of 8 characters, capital and small letters, underscores and numbers (but not as first character), and the identifier must be unique for each measuring point. This entry will be used as the process variable for the corresponding channel and as tag number.
Media	The medium to be measured (electric energy, heating gas, heating oil, water, compressed air, steam, warmth) is selected in a drop-down list. There are always three configurations available for each medium. They are then provided with the rates which are to be entered (in the DisplayCenter).

templates	Selection of ready-made templates  List of existing templates: AnalogCounter, AnalogValue, DigitalCounter, ConsumerState, DigitalImpulsCounter, DigitalValue, EnergyCounter, ManualInput, ExternalSystemTick, etc. These templates are described in the APROL solutions documentation. These templates can be found in the zzz_Templates directory in the project.
Group	Splitting the measuring points into groups, to achieve a better assignment of trends and alarms. The selection is made manually
Unit	Dimension of the medium (m³, m³/h, kWh, ltr, ltr/h, °C). Up to 6 characters are allowed. Spaces may not be used. The selection is made in a drop-down list. (list, see "Definitions" table)
Mbeg	Measurement range beginning, necessary for scaling. Number are allowed. An entry is only required depending on the signal, and can be ascertained by reading the template descriptions in the APROL solutions documentation.
Mend	Measurement range end, necessary for scaling. Number are allowed. An entry is only required depending on the signal, and can be ascertained by reading the template descriptions in the APROL solutions documentation.
Factor	Pulse bit value factor (e.g. kWh/pulse). Number are allowed. Examples: Adjust amount of energy per impulse on digital impulse counter or current ratio for electric energy.
Cost unit	Cost center of the consumer. A maximum of 10 characters are allowed, capital and small letters, underscores, and numbers. Different departments can normally be found in companies (general cost centers). A filtering and analysis of these energy consumptions has been put into practice here.
Climate correction	Energy consumption dependency of the outside temperature 0 ... independent (default) 1 ... dependent on heating power 2 ... dependent on cooling power 3 ... dependent on heating and cooling power This also allows the climate situation (warmer or colder winter, etc.) to be taken into account in the energy consumption analysis.
Level 7 - 0	Location of the consumption. The sum of the configured levels results in a unique identifier.



Not all of the levels must be filled out! A column (e.g. Level 0) cannot be filled out to define a higher level consumer.

The APROL solutions documentation shows what should actually be entered in the Excel list and individual templates.

Here are two examples to make this clearer:

1. Analog Value:

Acquires and shows the value of an analog hardware variable through an "Analog01_01" PAL block and saves the value with the "IntervalLog01_02" block in a predefined time.

Parameter	Description
Mbeg	Measuring range beginning. Necessary for the scaling of the input signal.
Mend	Measuring range end. Necessary for the scaling of the input signal.
Factor	Not used

2. Energy Counter

Acquires all information from a X20AP31XX card through a "EngyMonX20AP31XX01_02" PAL block and saves the active power (total) and energy (total) with the "IntervalLog01_02" block in a predefined time (e.g. 15 minute measurement).

Parameter	Description
Mbeg	Not used
Mend	Not used
Factor	For adjusting the current ratio (as a current transformer is normally needed).

...

The list must be saved and eventually moved back to the original storage location after the list has been completed.



Task:

Fill out all channels which are in the list for the previously defined hardware. Try to use different templates for this, in order to find and analyze different functions in the operating environment at a later stage.

2.2.4 Importing list engineering

The Excel sheet can now be reimported using the Solutions wizard. The **"import spreadsheet"** menu item must be called in the wizard for this purpose.

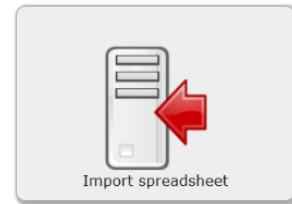


Figure 28: Starting the import procedure in the wizard

Synchronizing the files

The wizard displays the address where the edited spreadsheet should be added. Clicking on the link takes you to the network drive, where you can replace or check the data.

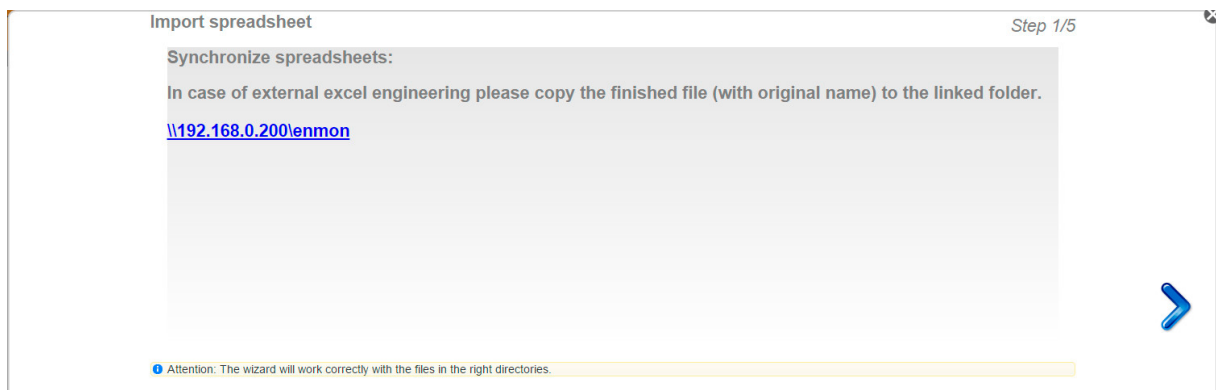


Figure 29: Link to the Excel file



The finished Excel file must be copied into the listed directory if it was engineered externally.

Selection controller

Selecting the controller opens a log file where you can check to see whether the import files have been generated correctly.



This action generates the import files for the hardware (I/O mapping) as well as the import files for the CFCs.

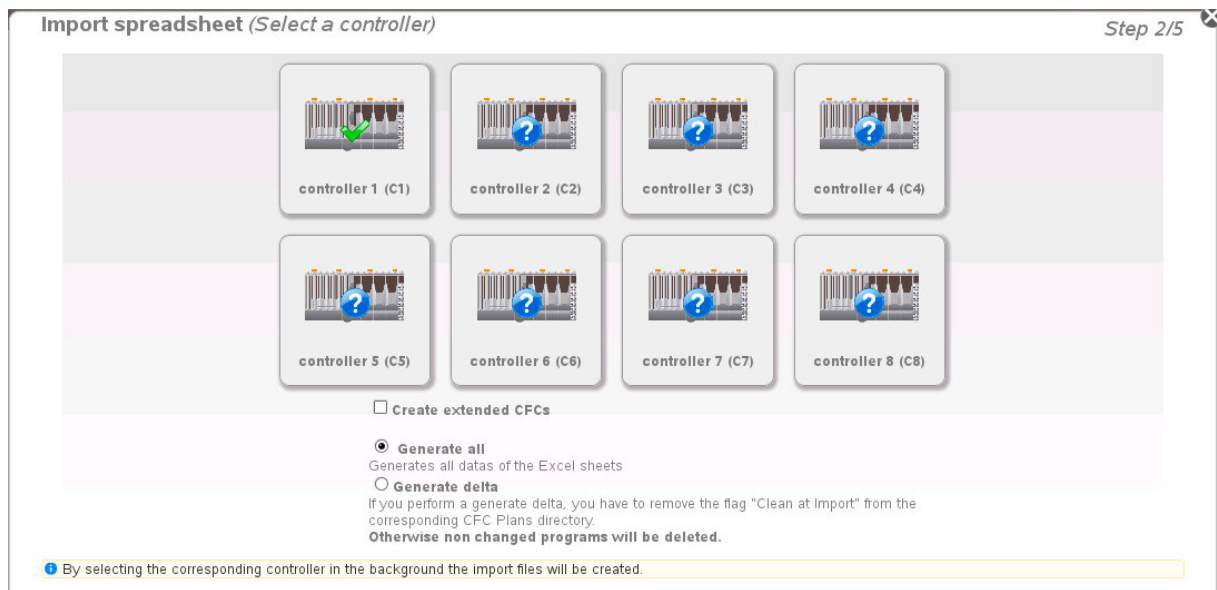


Figure 30: Selecting the desired controller

Protocol for creating the import files

In this step, the log file for generating the import files is displayed. This log file can be saved and potentially used for debugging.

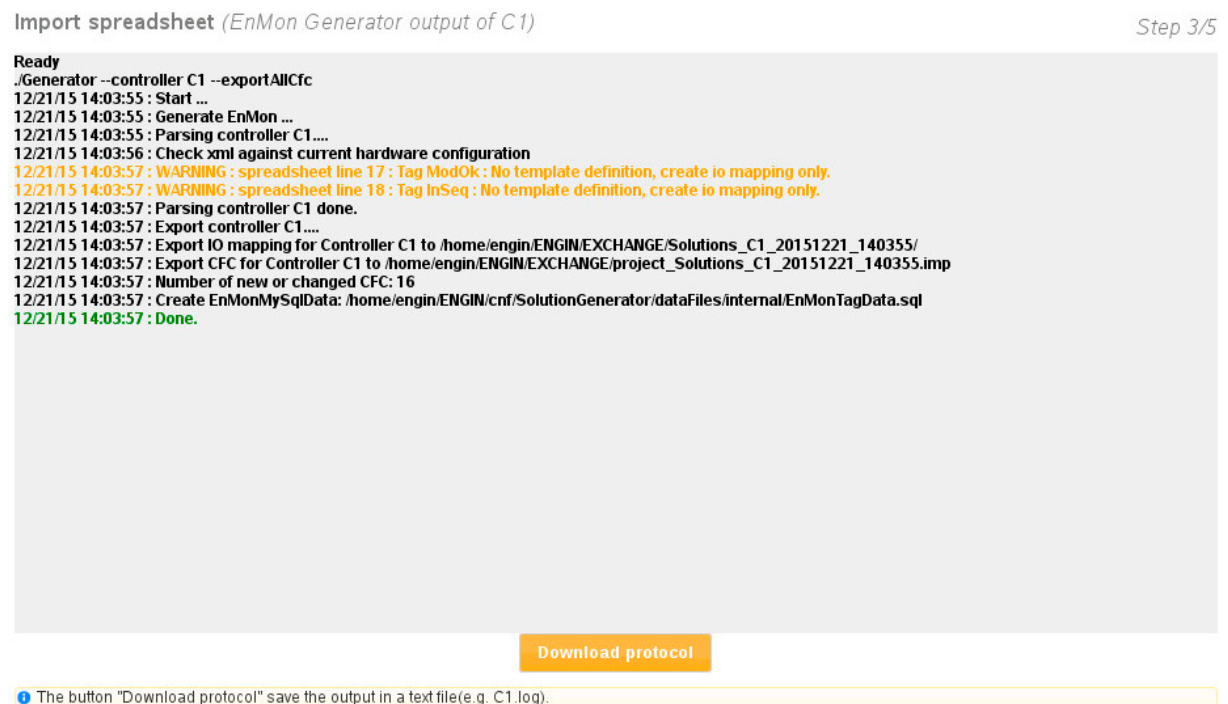


Figure 31: Example log output

Import I/O mapping

The I/O mapping import now follows in the sequential execution.

Procedure for importing the I/O mapping:

- Open the submenu with the right mouse button on the root (Label **"Module configuration"**).
- Select the **„Import I/O -Mapping“** submenu item.

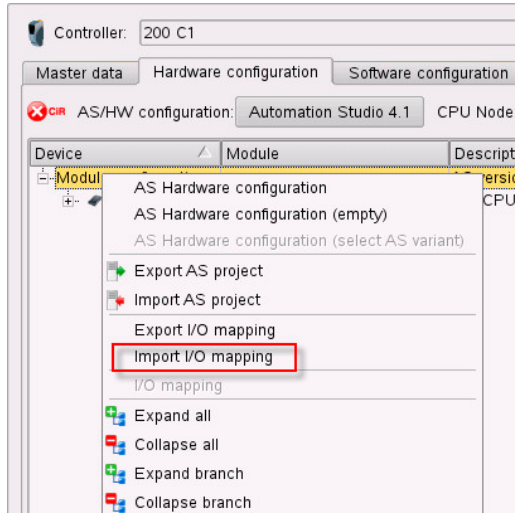


Figure 32: Import I/O mapping

- Select the directory which includes the last change.
- Confirm the message that data will be cleaned. It must be taken into consideration if an I/O mapping is already configured, and thus only the data in the list is imported without overwriting the data which is not affected.
- Check **'Import summary'** output. Red entries can be found on the I/O mappings which are not configured via the list (see all types of outputs, for example). This represents the correct behavior.
- Close the hardware project part.
- Save, activate, compile (controller) project part.

It is possible to continue working with the wizard after this configuration has been saved. To do so, click on the blue arrow (right).

Importing the automatically generated function charts

Only the function charts created by the wizard now need to be imported. Once you have finished enabling and compiling the CFCs (function charts), the actual "basic" engineering is complete.

Procedure for importing CFCs

- Selection of the project in the **"Project: Name (logical structure)"** view.
- Open the submenu with the right mouse button and select the **„Import project parts ...“** entry.
- Select the import file in the window which opens and open it with the **"Open"** button.
- All CFCs must now be selected (button **"Select all"**) and adopted (button **"Apply"**). You can now close the window.

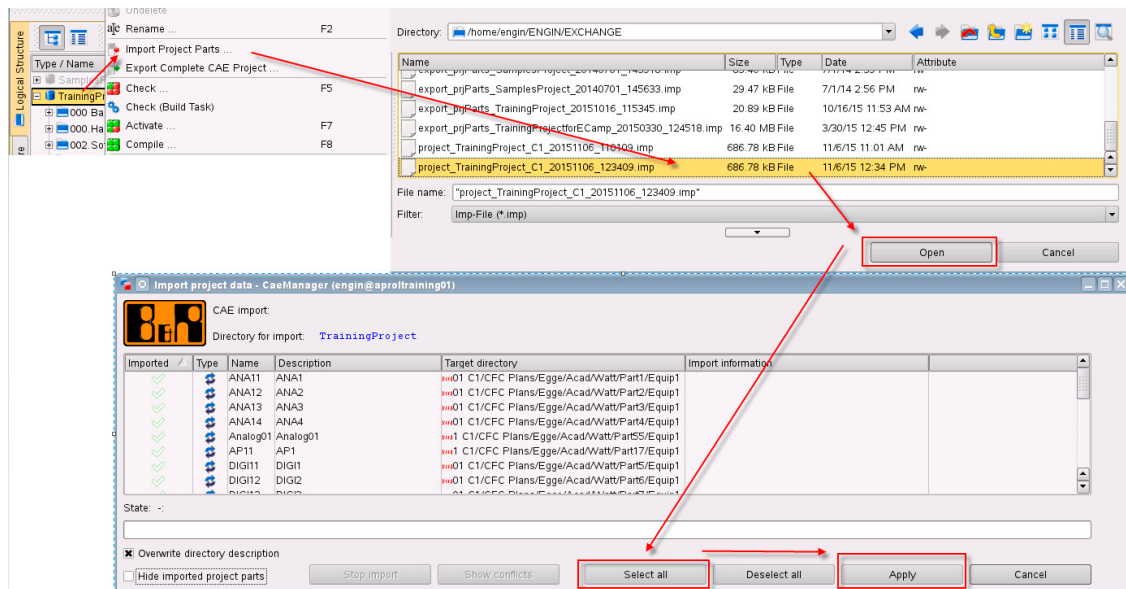


Figure 33: Import CFC procedure

- The imported CFCs are now located in the project. This can be seen with the APROL import character (black arrow to the left on yellow background). Now select the higher-level directory of the CFC import.
- Compile imported directory. Another submenu opens by clicking the right mouse button on the directory. The **"Compile"** function must be selected here. This automatically versionizes, enables and compiles the imported function charts.

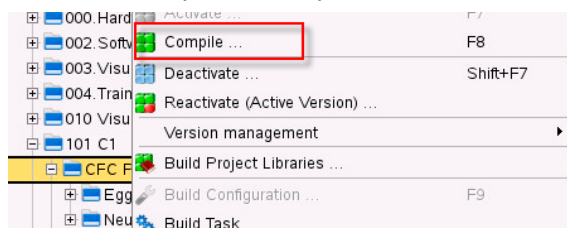


Figure 34: Compile all imported CFCs

If necessary, you can now do the same for the next controller. This part of the wizard is closed by pressing the **"Done"** button.



Task:

Import your I/O mapping and your CFCs, and compile all of these project parts.

2.2.5 Generator Protocol

The solution generator output can be checked in the solutions wizard with the **"Generator protocol"** button.

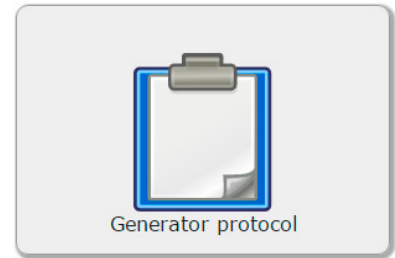


Figure 35: Opening the generator protocol

The desired controller must be selected in the wizard.

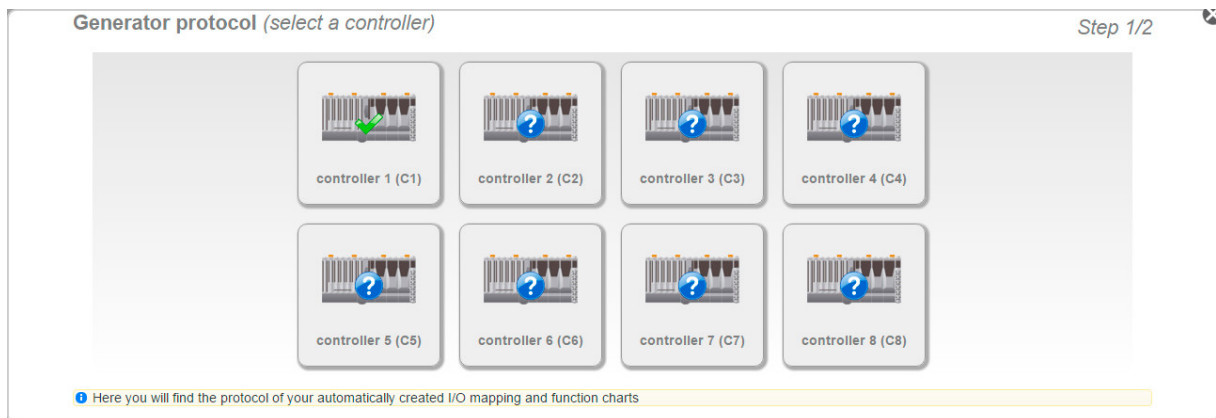


Figure 36: Select controller



Note:

It will only be possible to see something in this protocol if one of the previous steps was finished with an error.

The log file can be saved in order to make it available to the support department.

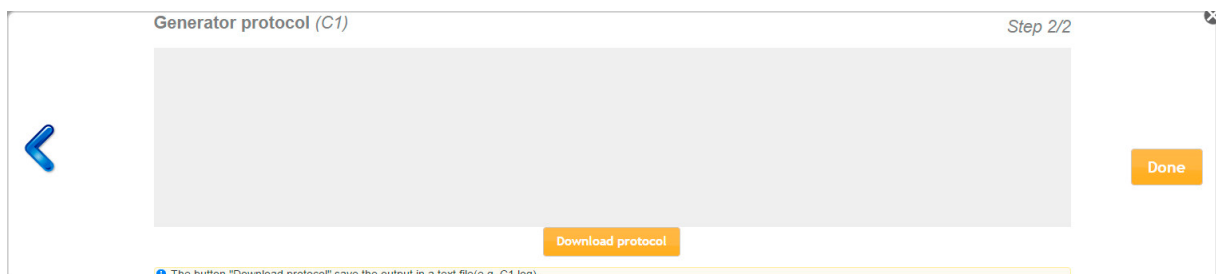


Figure 37: Finished correct protocol

If necessary, you can now do the same for the next controller. This part of the wizard is closed by pressing the **"Done"** button.

2.2.6 Build of the Project

The data for a subsequent download (tasks, alarm configuration, process graphics, etc.) can be created in the solutions wizard with the **"Build project"** button.

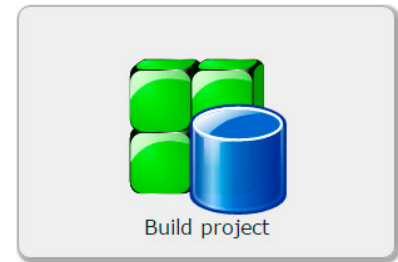


Figure 38: Calling a build project

The corresponding DISPLAY variable must be entered once again in order to start the CaeManager automatically. The build should be started, as described in the wizard. The **"Compile all necessary"** item is normally selected in the build configuration menu.

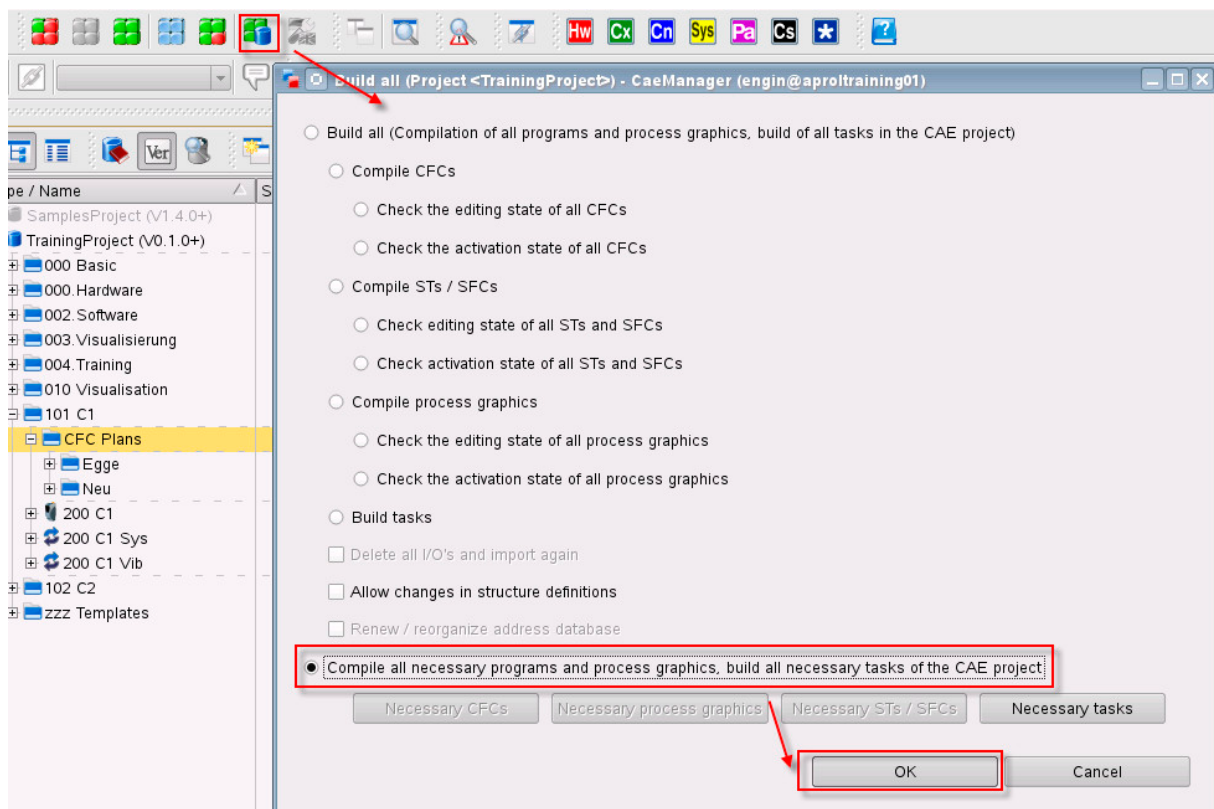


Figure 39: Build selection



Note:

All of the data which is relevant for a start-up and download is created in this build procedure.



Task:

Carry out a build of your project ("Compile all necessary").

2.2.7 Downloading the project

Finally, the download and start-up must be carried out. For this purpose, go further in the wizard with the **"Download project"** button.

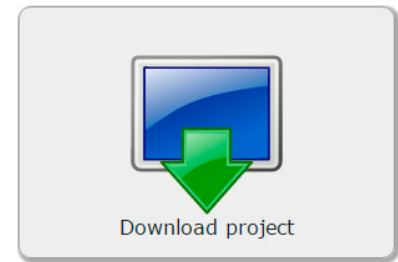


Figure 40: Calling download project

The corresponding DISPLAY variable must be entered once again in order to start the DownloadManager automatically. The download should be started, as described in the wizard. The download can be carried out after the desired downloads have been composed. The first controller download is normally done via CF card.

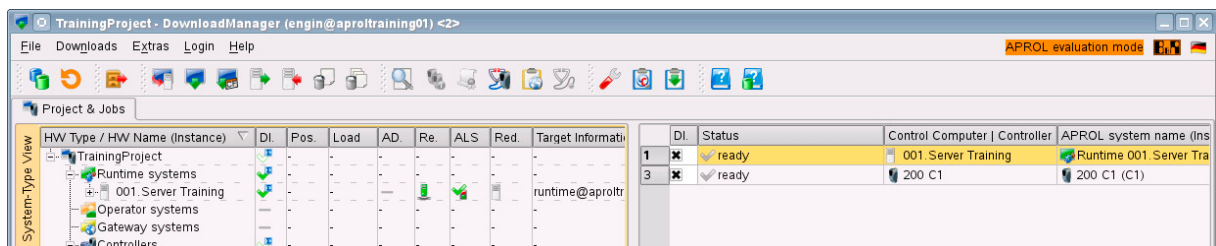


Figure 41: Download with DownloadManager



Task:

Carry out a download of your project.

3 Runtime and diagnostics

As the download is finished, the next step is to look at the runtime and operating environments. They can be reached simply by using the VNC viewer or the solution wizard. The "Diagnosis" tab was created for this purpose and different functionalities can be started and organized there.

Range	Description
APROL SDM	The APROL SDM (APROL System Diagnostic Manager) is available here. It starts the APROL Web Portal. A great number of analyses can be carried out there, as explained in TM813.
Controller SDM	This page starts the controller SDM. The controller must be selected in order to start the corresponding SDM after entering the desired DISPLAYS.
DisplayCenter	In this entry area, the DisplayCenter is started on the desired DISPLAY port. It is thus possible to operate the "Plant".
Alarm report	Supplies the alarm report for further analysis if desired.
TrendViewer	The TrendViewer is started to be able to carry out an extended analysis. (in turn on the intended display)
EnMon Dashboard	Entry area for the Energy Monitoring Dashboard in order to be able to use all of the functionalities of the energy monitoring reports.

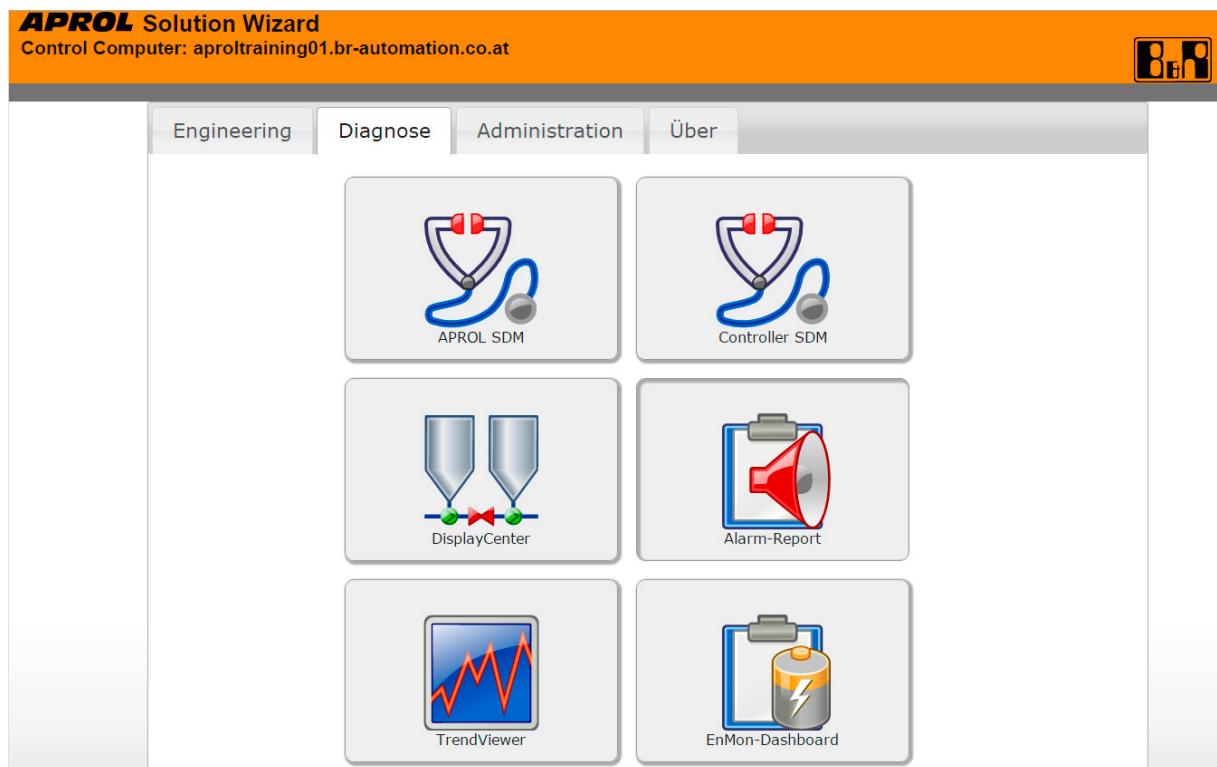


Figure 42: Diagnosis section of the solutions wizard

3.1 Commissioning of the list engineering

Basically, only three steps must be carried out.

Step	Description
Activation of the logic	All PAL hyper macros are locked after the first download (inhibit is set) to avoid an uncontrolled starting of the plant. This also affects our data acquisition blocks for the energy monitoring.
Set rates	The rates must be entered in the corresponding process graphic and configured. If this did not happen, the data record would be multiplied by "0".
Energy equivalent	The energy equivalent must be entered for each medium. If this did not happen, the data record would be multiplied by "0".

This step ensures that the data is recorded with the correct values and is available to the energy monitoring reports.

3.2 Necessary configuration of blocks in the DisplayCenter

All blocks which are used in the list engineering are represented by faceplates in the operating environment. The **"Show faceplates"** option must be selected in the graphic tree in order to show these faceplates.

The block lock (**inhibit**) must be lifted in the block faceplates which are responsible for the consumption measurements. Apart from that, the blocks may have to be started by clicking the **"Play"** button. (different depending on the block)

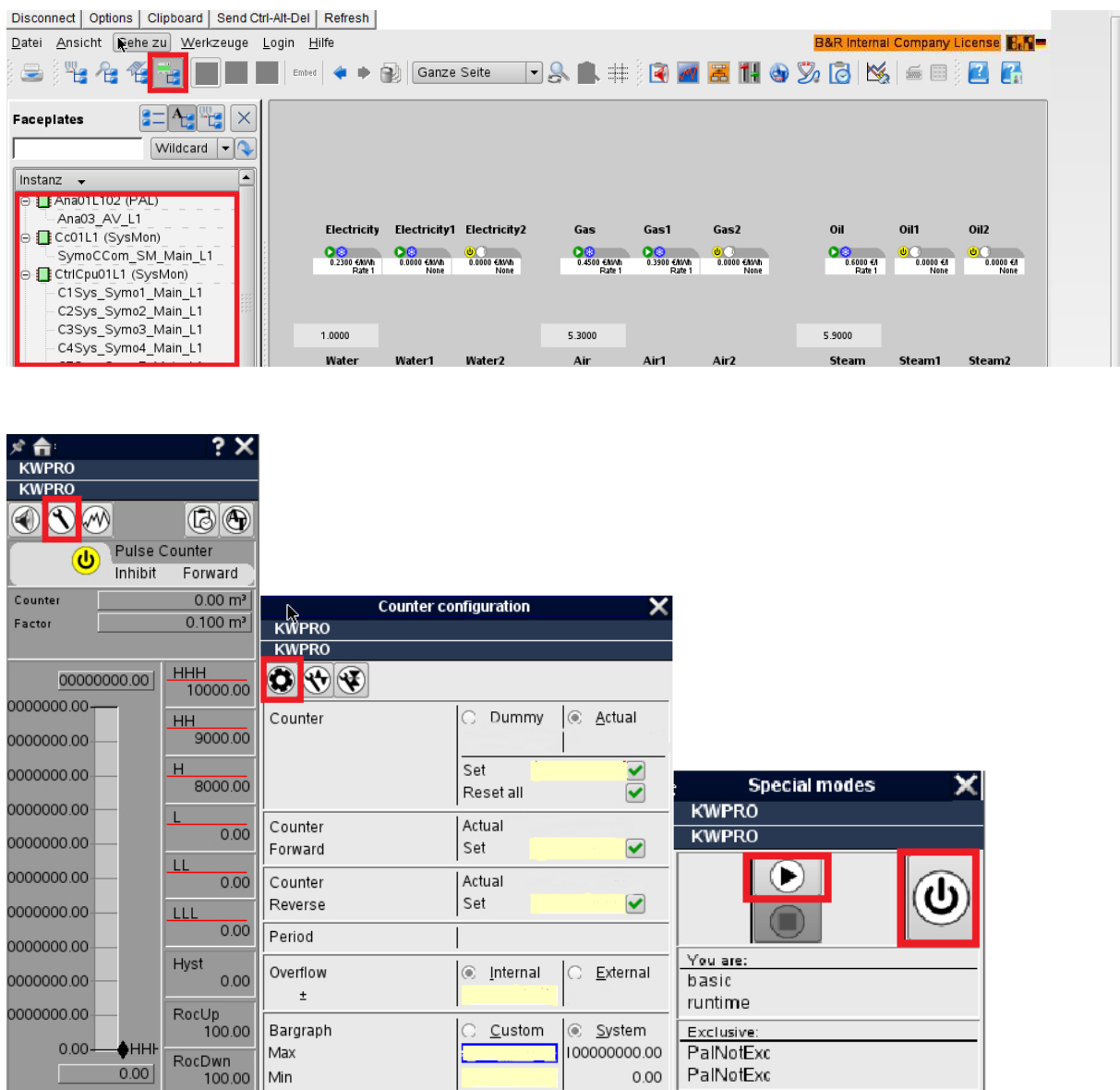


Figure 43: Inhibit mode and play to activate the functionality

3.3 Setting the rates

The energy consumptions must be impinged with the corresponding rate, so that the correct financial expenditure can be seen in the reports.

An additional **"Rates"** process graphic is available in the solutions project. The configuration of the rates for the different mediums can be found there. Each medium has three rate blocks to map different providers with different rates.

It was possible to select that in the list engineering column **"Medium"** (e.g. gas, gas1, gas2, oil, ...). That is now the connection from this medium to the corresponding rate.

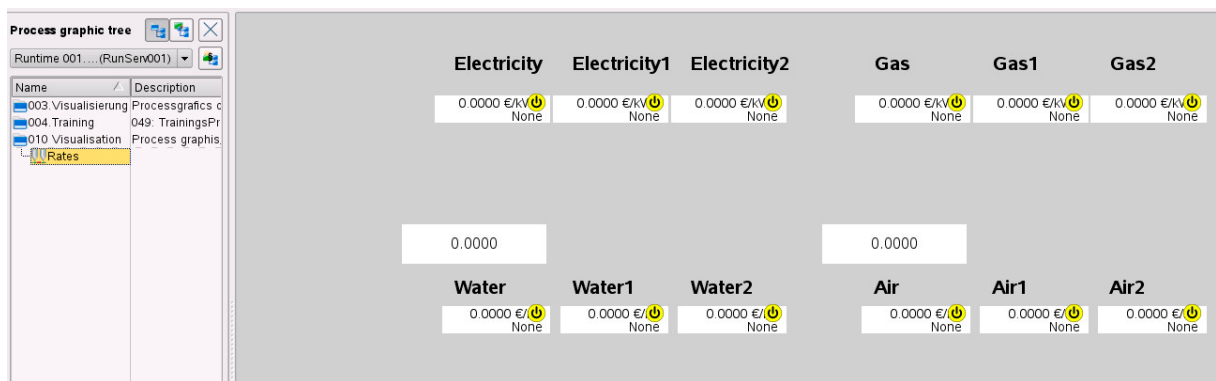


Figure 44: Process graphic "Rates"

If one uses the medium **"Electricity"**, for example, the respective rate must be entered by editing the function (opening the faceplate) and defining the times.

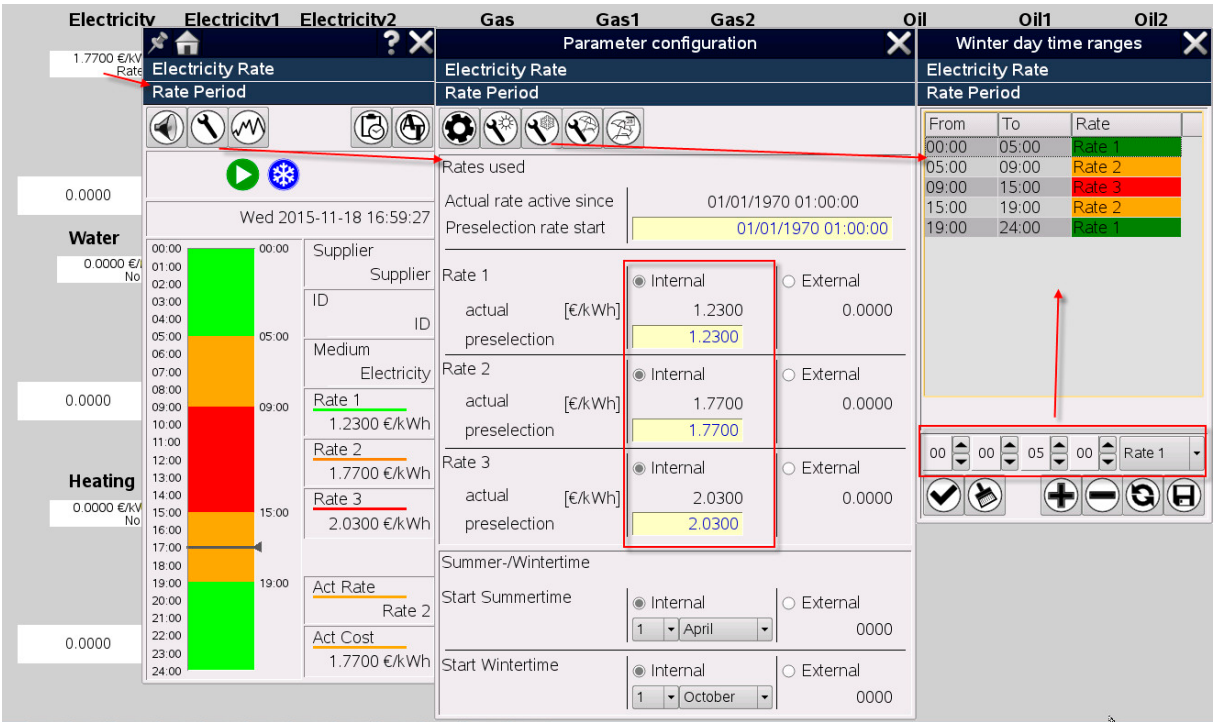


Figure 45: Rate settings

Details for editing and operating the rate settings can be found in the APROL solutions documentation and in the PAL documentation.

3.4 Set energy equivalent

We must deal with many different types of energy for the energy recording and evaluation. A calculation factor must be introduced in order to bring all of these different physical values to a mutual unit (kWh). In this way for example, yy.yy kWh energy is derived from xx.xx m³ gas.

Electricity	Electricity1	Electricity2	Gas	Gas1	Gas2
1.7700 €/kWh Rate 2	0.0000 €/kWh None	0.0000 €/kWh None	0.0000 €/kWh None	0.0000 €/kWh None	0.0000 €/kWh None
Electricity Equivalent			Gas Equivalent		
1.0000			8.8160		

Figure 46: Examples of calculation factors

These inputs are important to correctly amount the entire energy requirements of one charge with a unit.



Task:

Activate your logic and configure your rates as desired. Set the corresponding energy equivalent for the mediums which you use. Valid data records of your energies can then be saved from this point onwards.

3.5 Solutions reports

The results of our efforts is now mirrored in the solutions reports. There must be at least one data record per CFC in the respective ChronoLog container after 15 minutes.

The energy monitoring reports can be started via the APROL web portal.

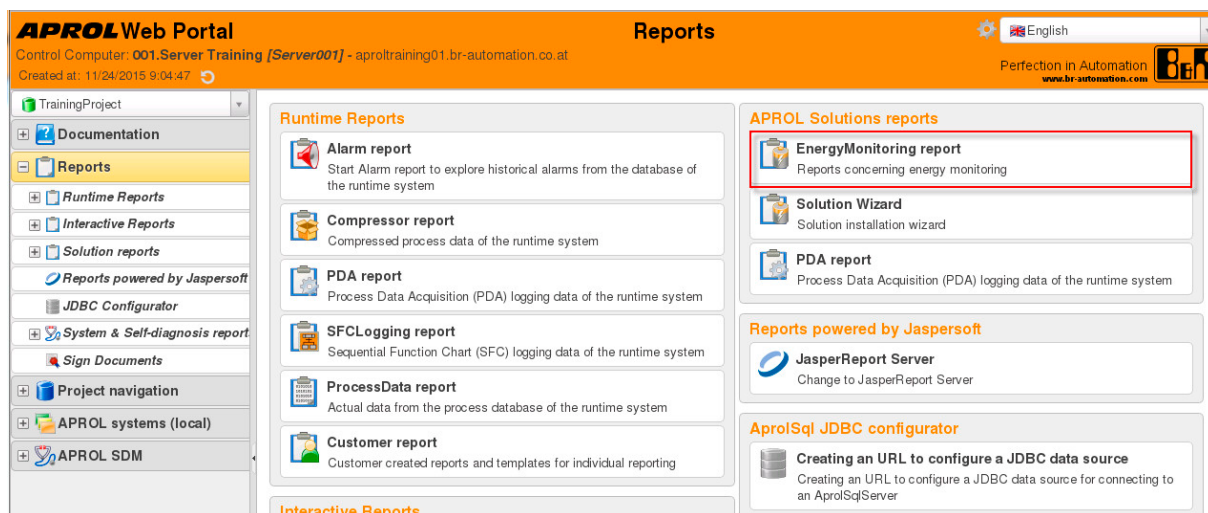


Figure 47: Starting the EnMon report

The energy monitoring report is shown after logging in. This may appear as follows after a longer recording period:

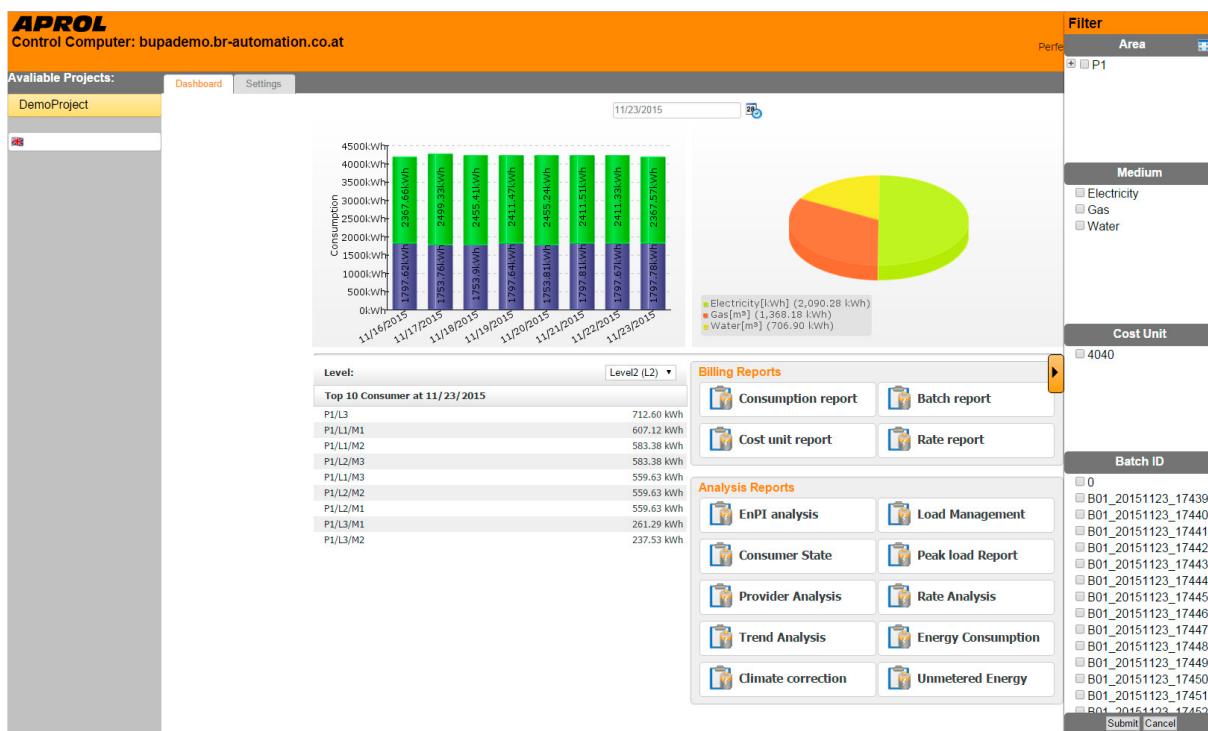


Figure 48: Energy monitoring reports and navigation

Exact descriptions about the individual reports can be found in the APROL product documentation. The reports are explained well with the tool tips and can be used immediately without any further preparation. There is a differentiation between two types of reports:

- Billing reports
- Analysis reports

Billing reports	Description
Consumption report	The consumption data and costs are displayed for each consumer.
Batch report	The consumption data and costs are displayed for each batch.
Cost center report	The consumption data and costs are displayed for each cost center (department).
Rate report	The consumption data and costs are displayed for each rate.

Table 1: Billing reports

Analysis reports	Description
EnPI evaluation	EnPI --> Energy performance indicator: In order to calculate the energy consumption for each produced batch.
Load management	History of the predicted load plus display of the switching on and off of loads.
Consumer status	Each consumer status permanent (even during production standstill) to analyze consumers which are not necessary.
Peak value report	Display of the peak values and the possible peak values (worst case).
Provider analysis	Current costs can be compared with an alternative provider.
Rate analysis	Display of which percentage of the entire energy is used at a certain rate.
Trend analysis	The entire consumption of the individual measuring points displayed as a trend.
Energy consumption	Comparison of daily, weekly, monthly, and yearly history.
Climate adjustments	For detecting the climate corrected energy consumption (key word: warmer winter).
Unmeasured energy	Non-measured levels are brought into the display.

Table 2: Analysis reports

4 Administration

A couple of necessary configurations and functionalities are shown in the Administration tab.

The following reports are available:

Range	Description
Controller SDM configura- tion:	The IP addresses of the controller can be maintained here if they do not conform to the standard IP, so that the controller SDM is addressed correctly.
DisplayCenter:	The DisplayCenters status will be shown and a restart can be carried out.
Complete backup:	An engineering backup is being carried out. The default target directory is "/tmp/BackupEnMon" (see ~scripts/CallCaeBackup)
Update:	A solutions wizard update is being carried out.

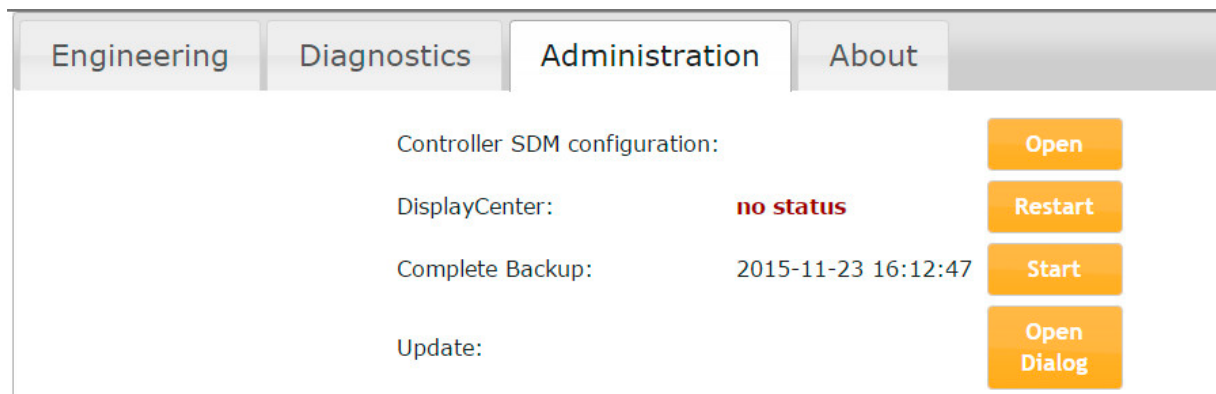
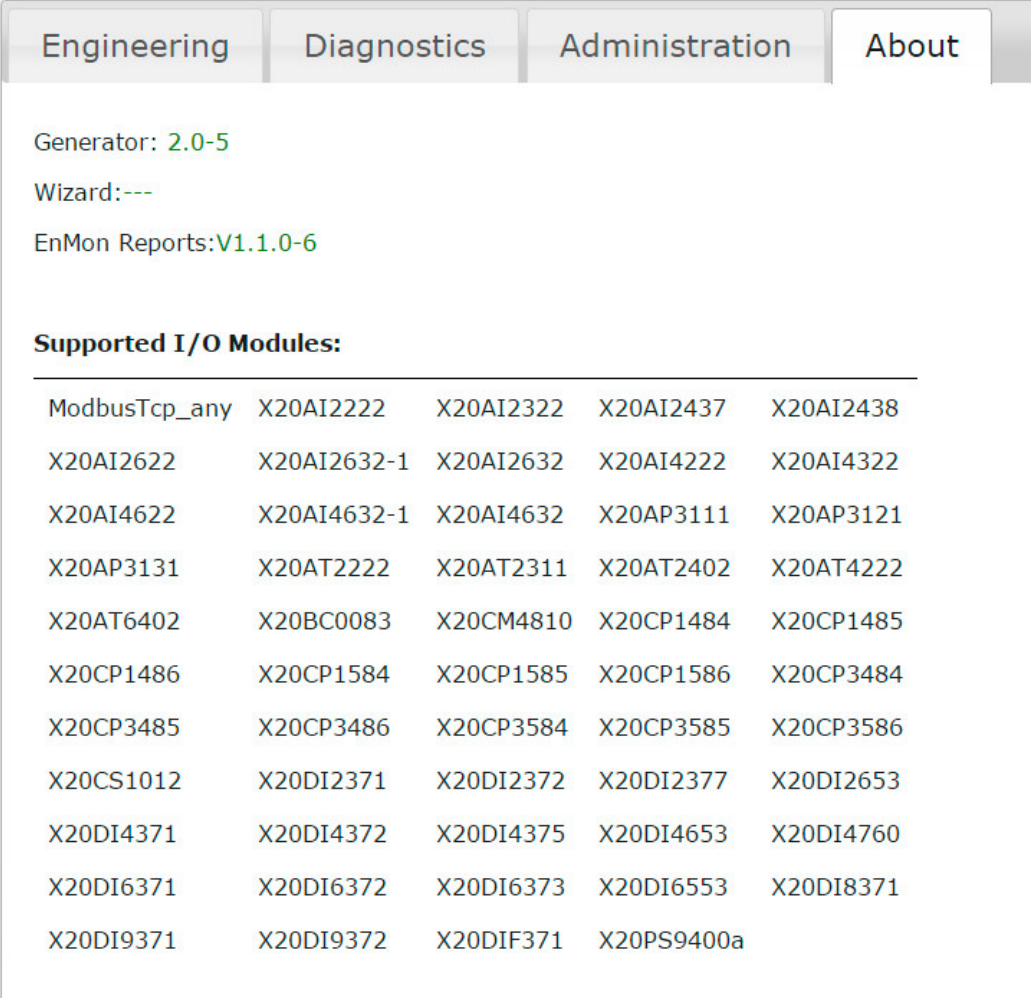


Figure 49: Administration

5 Version information

The "**About**" area is for displaying the version information regarding the generator, wizard, and EnMon reports.

In addition, all supported hardware modules are listed.



The screenshot shows a software interface with four tabs: Engineering, Diagnostics, Administration, and About. The 'About' tab is selected. Below the tabs, the following version information is displayed:

Generator: 2.0-5
Wizard: ---
EnMon Reports: V1.1.0-6

Below this, a section titled 'Supported I/O Modules:' is followed by a table listing various hardware modules.

ModbusTcp_any	X20AI2222	X20AI2322	X20AI2437	X20AI2438
X20AI2622	X20AI2632-1	X20AI2632	X20AI4222	X20AI4322
X20AI4622	X20AI4632-1	X20AI4632	X20AP3111	X20AP3121
X20AP3131	X20AT2222	X20AT2311	X20AT2402	X20AT4222
X20AT6402	X20BC0083	X20CM4810	X20CP1484	X20CP1485
X20CP1486	X20CP1584	X20CP1585	X20CP1586	X20CP3484
X20CP3485	X20CP3486	X20CP3584	X20CP3585	X20CP3586
X20CS1012	X20DI2371	X20DI2372	X20DI2377	X20DI2653
X20DI4371	X20DI4372	X20DI4375	X20DI4653	X20DI4760
X20DI6371	X20DI6372	X20DI6373	X20DI6553	X20DI8371
X20DI9371	X20DI9372	X20DIF371	X20PS9400a	

Figure 50: Version information

6 Necessary adjustments of the solution generator

The solutions generator is available on the B&R homepage together with the solutions project.

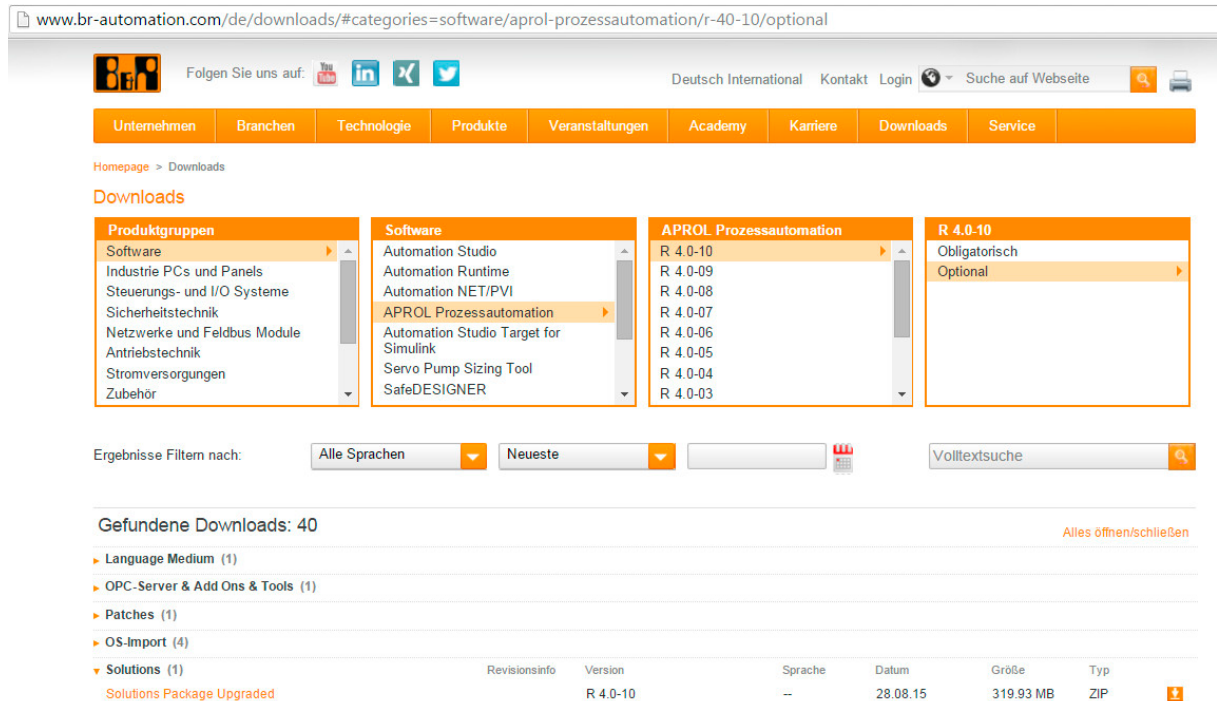


Figure 51: Download solutions generator

Basic requirements for the installation of the solution generator are as follows:

Requirements	Description
Solutions project (partly)	A certain amount of solution project content is the requirement for a complete functionality of the wizard. (zzz_Template, C1 -- C8, ...)
Engineering user "engin"	The solutions installation mechanism saved several scripts in the "/home/engin/scripts/" directory.
Runtime user "runtime"	The solutions installation mechanism saved several scripts in the "/home/runtime/scripts/" directory.
Version match	The solutions generator which corresponds to the APROL release must always be installed.

Necessary adjustments of the solution generator

6.1 Installation of the solution generator

After downloading the solution generator package from the B&R homepage, it can be transferred to and unpacked on the intended computer. There are three relevant parts of the software and a "Readme" in German and English.

Name	Type	Compressed size
 CAE_BACKUP_4.0-10_solutions01_engin_20150804_124007.t...	TAR File	326.401 KB
 Readme_R40_001	Adobe Acrobat Document	112 KB
 Readme_R40_049	Adobe Acrobat Document	113 KB
 solution_enmon_wizard-3239_1.0-733.noarch.rpm	RPM File	870 KB
 solution_general-3221_1.0-755.noarch.rpm	RPM File	114 KB

Figure 52: Extracted solutions package

Package description	Description
CAE_BACKUP_...	The desired solutions project.
solution_general-....rpm	The RPM package of the solutions generator
solution_enmon.....rpm	The RPM package of the solutions wizard

This package can now be installed in several steps.

- Carry out a CaeRestore of the solutions project if desired. (also see TM810)
- Installation of the solutions generator with the command "**rpm -i --force solutions_general.320XXXXXXX.rpm**"
- Installation of the wizard with the command "**rpm -i --force solution_enmon_wizard.3200XXXXXXX.rpm**"
- Perform reboot



Note:

The RPM package must be installed as superuser (root).

Input 'su - root' in an xterm or console and then the root password

6.2 Requirements and adjustments for list engineering

The solutions wizard must not necessarily be used to create a list engineering in the solutions generator. This will also be handled in this document. Some adjustments will be necessary if the project is not the solutions project.

These adjustments are listed in the following table:

Adjustment	Description
config.xml	The "config.xml" configuration file is in the "/home/engin/ENGIN/cnf/SolutionsGenerator/" directory. The "correct APROL version" must be specified in this file and eventually the "correct project" and the "correct template path". <pre> <?xml version="1.0" encoding="UTF-8" ?> <Config version="2" minAprolRel="4.0-10" configType="EnMon"> <!-- version :> version of this file. Generator checks this Versionnumber on startup, can be used for essential minAprolRel :> APROL Release that works with Generator --> <XmlDataConfig> <!-- mapping between identifier in xmlDataFile and column in spreadsheet --> <!-- <IOrow column="0" identifier="Slot"/> <IOrow column="1" identifier="Module"/> <IOrow column="2" identifier="ModuleID"/> <IOrow column="3" identifier="Channel"/> <IOrow column="4" identifier="Description"/> <IOrow column="5" identifier="Tagname"/> <IOrow column="6" identifier="Medium"/> <IOrow column="7" identifier="Template"/> <IOrow column="8" identifier="Group"/> <IOrow column="9" identifier="Unit"/> <IOrow column="10" identifier="Mbeg"/> <IOrow column="11" identifier="Mbeg"/> <IOrow column="12" identifier="Factor"/> <IOrow column="13" identifier="CostUnit"/> <IOrow column="14" identifier="ClimateCorrection" defaultValue="0"/> <IOrow column="15" identifier="Lvl17" isPath="1"/> <IOrow column="16" identifier="Lvl6" isPath="1"/> <IOrow column="17" identifier="Lvl5" isPath="1"/> <IOrow column="18" identifier="Lvl4" isPath="1"/> <IOrow column="19" identifier="Lvl3" isPath="1"/> <IOrow column="20" identifier="Lvl2" isPath="1"/> <IOrow column="21" identifier="Lvl1" isPath="1"/> <IOrow column="22" identifier="Lvl0" isPath="1"/> </XmlDataConfig> <Basics MaxNoOfOldFiles="2" EnMonMySQLFileName="EnMonTagData.sql" /> <Project projectNames="TrainingProject" pathStructure="0" templatePath="zzz Templates"> <!-- projectNames :> necessary, must exist in Caemanager pathStructure :> necessary, defines tree-structure for Caemanager 0 : <10x CTRLInstance><cfcSubPath><Site><Area><SubArea><Line><Tagname 1 : not defined templatePath :> necessary, Path to template cfc's in Project --> <Controller instance="C1" cTask="C1" selfId="c1" cfcPrefix="" cfcSubPath="CFC Plans" maxCfcInTasks="50" TK="1"/> <Controller instance="C2" cTask="C2" selfId="c2" cfcPrefix="" cfcSubPath="CFC Plans" maxCfcInTasks="50" TK="1"/> </Project> </pre> Figure 53: config.xml adjustment
config_standard.xml	The "config_standard.xml" configuration file is in the "/home/engin/ENGIN/cnf/SolutionsGenerator/" directory. The storage location of the "xlsx-Files" can be adjusted in this configuration file. <pre> <?xml version="1.0" encoding="UTF-8" ?> <Config version="2" minAprolRel="4.0-10" configType="Standard"> <!-- version :> version of this file. Generator checks this Versionnumber on startup, can be used for essential stru minAprolRel :> APROL Release that works with Generator configType :> Separation between EnMon Generator and SolutionGenerator --> <Basics MaxNoOfOldFiles="2" /> <Project projectNames="TrainingProject" pathStructure="0" templatePath="zzz Templates" ioType="CC+CTRL" fileName="C1/C1.xlsx"> <!-- projectNames :> necessary, must exist in Caemanager pathStructure :> necessary, defines tree-structure for Caemanager 0 : <10x CTRLInstance><cfcSubPath><Site><Area><SubArea><Line><Tagname 1 : not defined templatePath :> necessary, Path to template cfc's in Project ioType :> CC+CTRL COnly : to disable usage of controller checks fileName :> Spreadsheet filename if configType is Standard, located in spreadsheetPath --> </Project> </pre>

Figure 53: config.xml adjustment

Figure 54: config_standard.xml adjustments

In this way, it is possible to adjust the path and XLSX files to your own project's needs. The following parameters are of importance:

Necessary adjustments of the solution generator

Adjustment	Description	
	Parameter	Description
	minAprolRel	APROL release used (example 4.0-11)
	projectName	Name of the CAE project
	templatePath	CAE directory containing the CFC templates.
	fileName	File name of the Excel table. This is normally stored in the /home/<engineering system>/cnf/SolutionsGenerator/dataFiles/public directory.
	MaxNoOfOld-Files	Minimum number of the old import files

These adjustments make a list engineering with the solution generator possible. The procedure for this will be explained further in the document. A couple of additional adjustments are necessary for the creation with the wizard.

6.3 Requirements and adjustments for list engineering with the wizard

In order to be able to use the wizard with another project than the solutions project, a couple of adjustments must be carried out.

Adjustments	Description
CallICM	The "CallICM" script is in the "/home/engin/scripts" directory. This script starts the CaeManager automatically from the wizard with the desired command line parameters. The project name in the script must be adjusted. <pre>#!/bin/bash . /etc/profile . profile . .profile; . .bashrc DISPLAYNUM=\$1 DISPLAYCHAR1=`echo \$1   cut -c 1-1` DISPLAYCHAR2=`echo \$1   cut -c 2-2` NAME=`uname -n` if [\$DISPLAYNUM = 0]; then export DISPLAY=:0.0 elif [\$DISPLAYCHAR1 = "X"]; then export DISPLAY=:SDISPLAYCHAR2.0 else export DISPLAY=\$NAME:\$DISPLAYNUM.0 fi SELC=`echo \$2` SELN=`echo \$2   cut -c 2-5` export TERM=xterm /opt/aprol/bin/CaeManager -tbpath "P/TrainingProject\PD/1\$ printf '%02d' \$SELN) \$SELC/200 \$SELC" 1>/dev/null 2>&1 & PID=\$! echo "{ \"state\": \"Ready\", \"pid\": \$PID }"</pre>

Figure 55: Changes in CallICM

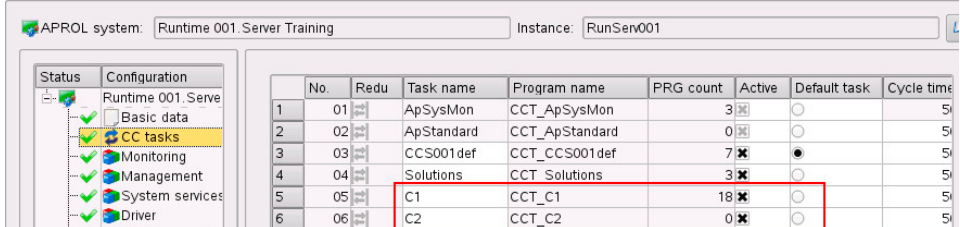
Project CC tasks	The solution wizard uses the "Default Runtime-System" of the project, amongst others, to realize the logic. One control computer task with the controller identifier (e.g. C1) is required for each controller here. 
------------------	---

Figure 56: CC tasks

Project C1 -C8 controller	Up to 8 controllers can be selected in the wizard. These must be available in the correct position in the project so that they can be used. They should be exported from the "original solutions project" and imported into the target project. in the best case, the entire controller directory is used (e.g. 101 C1, 102 C2, ...)
---------------------------	---

Necessary adjustments of the solution generator

Adjustments	Description

Figure 57: Necessary controller

zzz_Templates	The template function charts must also exist in the desired project. They can also be exported from the solutions project and imported into the target project.
Global.FileList	The "Global.FileList" file must be copied from "/home/aprol/ENGIN/cnf/SolutionGenerator/templates/" to "/home/engin/ENGIN/PROJECTS/<project name>.pgp/cnf/VM_Data/". The "VM_Data" directory must eventually be created. This file helps to adopt the AS data correctly for a subsequent list engineering.

Adjustments

Description

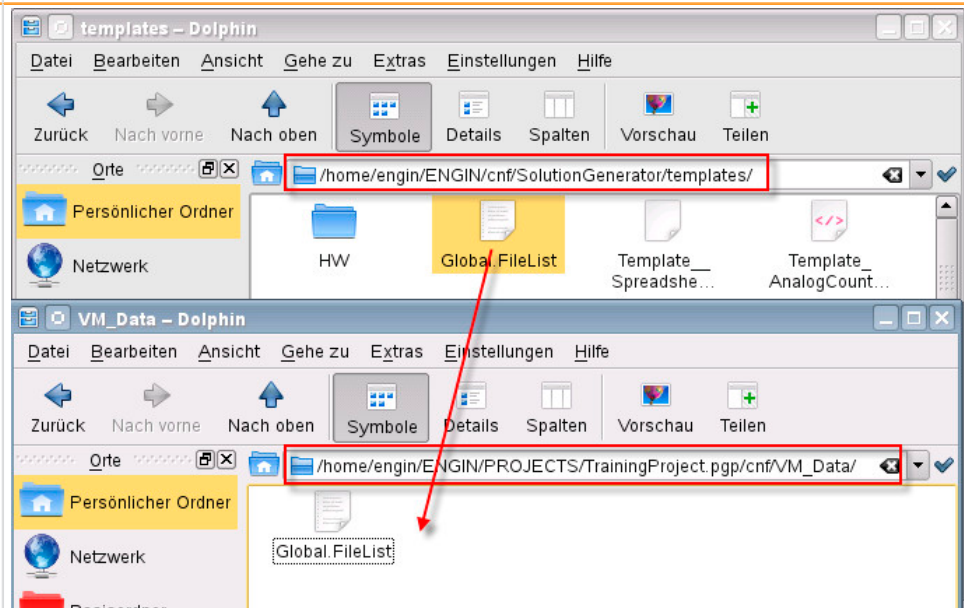


Figure 58: Global.FileList

Rates import

The CFCs and process graphics for configuring the rate and the 15 minute signal generation can be found in the solutions project. These functionalities must also be exported from the solutions project and imported into the target project. These are the **"000 Basic"** and **"010 Visualisation"** directories.

TrainingProject (V0.1.0+)			Projekt zu SEM830
000 Basic			Basic Project Data
Basic Calculation	✓✓✓		BasicCalc
Basic Energy Equivalent	✓✓✓		BasicEquiv
Basic Functions	✓✓✓		BasicFunc
000 Hardware	✓✓✓		Abbildung der gesamten Hardware der Anlage (CC und CTRL)
002 Software	✓✓✓		Anlagenlogik
003 Visualisierung	✓✓✓		Prozessbilder der Anlage
004 Training	✓✓✓		TrainingsProjekt
010 Visualisation			Prozessbilder, Übersicht
Rates	✓✓✓		rate
101 C1	✓✓✓		X20Cp1586
102 C2	✓✓✓		X20Cp1586
zzz Templates	✓✓✓		Vorlagen

Figure 59: Rates etc.

7 Extended list engineering

The solutions generator expects a CFC template and an Excel template in which the corresponding substitutions can be maintained. The CFCs which are to be imported are created from this combination, depending on the number of entries in the Excel list. This schema should illustrate this.

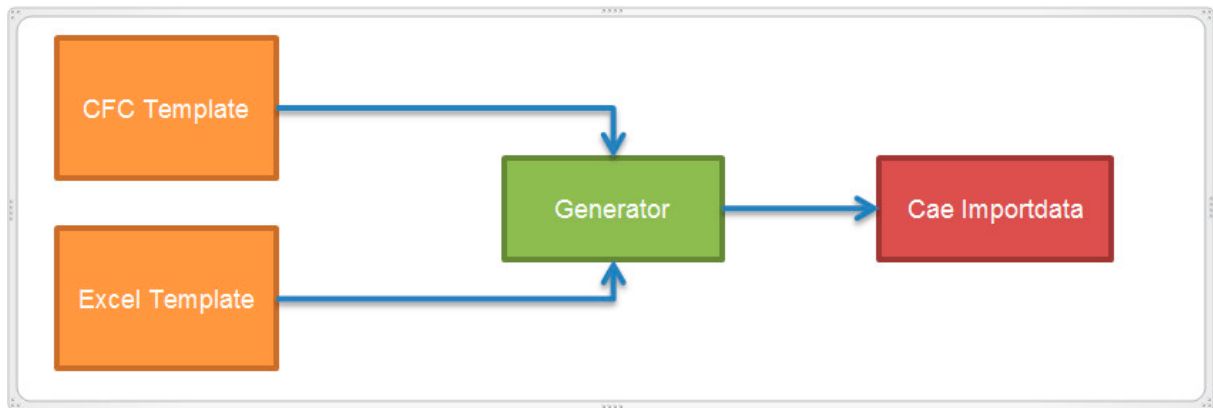


Figure 60: Method of operation

7.1 Template creation

7.1.1 Create CFC template

A new CFC can be created at any time in the **"templatePath"**. (This is the "zzz Templates" path in the solutions project) This CFC subsequently serves as a template for the solutions generator. The **name of the CFC** will also be used as the **name of the template**.

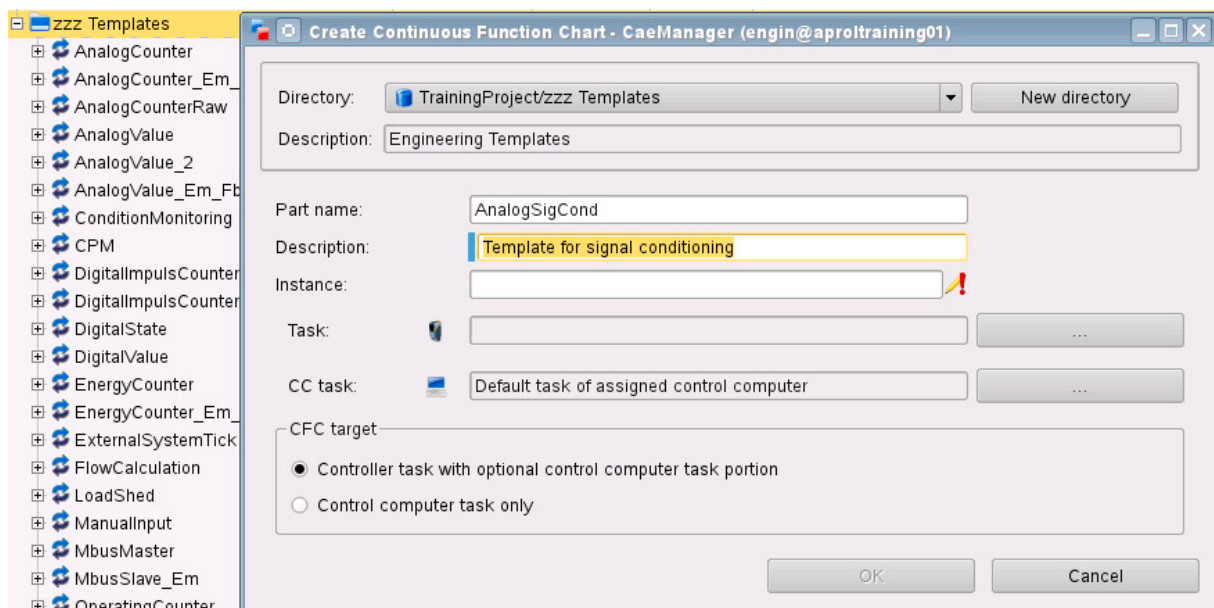


Figure 61: Creating a template CFC

7.1.2 Edit CFC

Any CFCs and variables can be placed in the CFC in order to realize the desired functionality. The following rules apply:

- Variables which are to be replaced must be created as **"template variables"**.
- Block parameters (mostly in hyper macros) which should be substituted must be modified in the CFC.

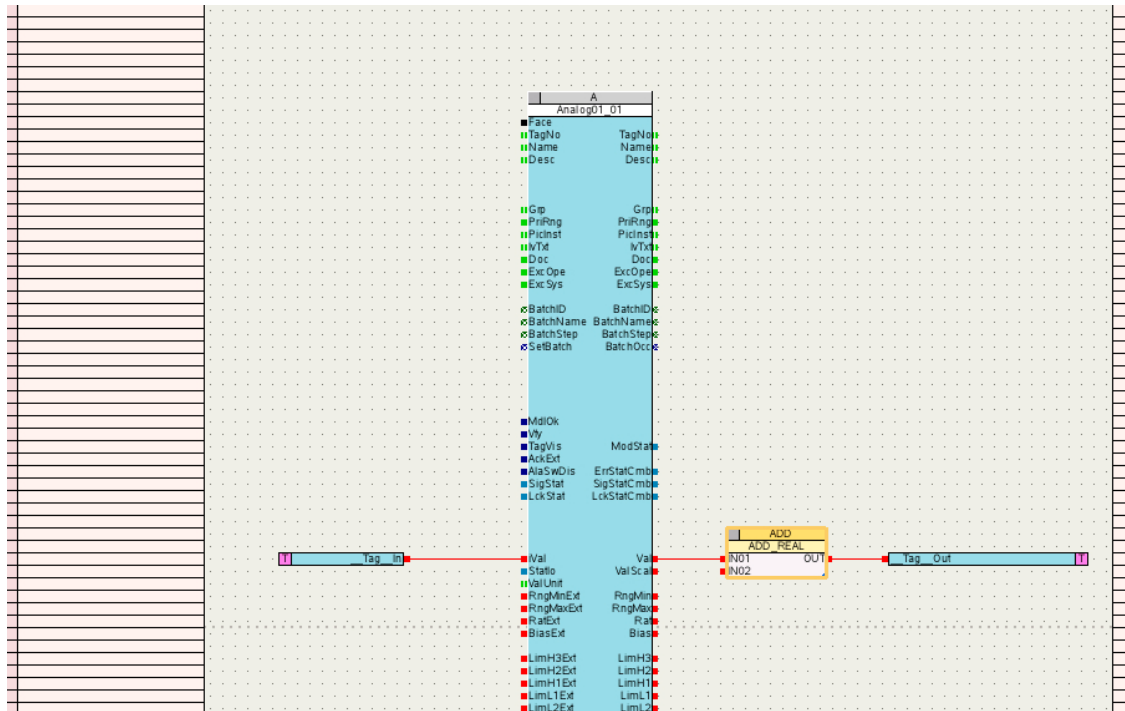


Figure 62: Example of an analog value signal conditioning



The following substitution parameters are reserved for extended I/O information and cannot be used for a normal replacement.

- _IOMSR_
- _IONAME_
- _IODESC_
- _IOUNIT_
- _IOMIN_
- _IOMAX_

7.1.3 Template version

A CFC text must be inserted, so that the generator can recognize a change of the CFC. This text consists of the name of the CFC and a version. Example: AnalogIn V0.0.1

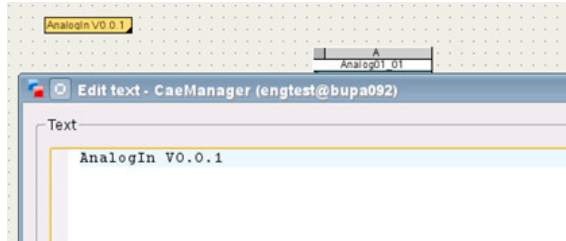


Figure 63: Template version

The solutions generator will recreate all CFCs if a version change is recognized. (you can make a "global" change in this way)

7.2 Creating a tab

Each template is shown as a table in the Excel file. The table must be named according with the syntax **CFC_Template_<template name>**. The content of **CFC_Template.xlsx** should be used as a template. All of the existing tables can be used as a template.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	APROL list engineering - CFC Template Templatenam														
2	V0.0 (Datum)														
3		CFC Settings										CFC Variables			Block Parameter
4	[ModifyFunction]	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	Border	Border	Border	Parameter
5	[ModifyType]	Set	Set	Set	Set	Set	Set	Set	Set	Set	Set	Replace	Replace	Replace	Set
6	[ModifyName]	path	name	desc049	desc001	CFC_inst	RuntimeSystem	CC_TASK	Controller	CTRL_Task		Tagio	TagioCm	Tagiofb	/TagNo
7															Parameter
8															Set
9	Don't edit above	Cae Path	CFC Name	Desc. Deutsch	Desc. English	CFC Instanz	Runtime System	ControlComputer Task	Controller Inst	Controller Task		Tag numb	Command	Feedback	Tag number
10															Name
11															

Figure 64: List to be filled out

The substitution rules are defined in the lines 4-6. These are not allowed to be moved. The configuration lines can faded out later. Line 9 can be used as a cell in the table header.

7.2.1 CFC properties

The global settings of the CFC are set in the CFC properties (green area).

Properties	Description
path	Path in project. The project must not also be specified. If the path does not exist, it is created automatically. Example: /Logic/Instruments
name	Name of the CFC
desc049	Description German.
desc001	Description English.
CFC_Inst	Instance of the CFC.
Runtime system	Instance of the runtime system. [DEFAULT] for default runtime system.
CC_TASK	CC task of the CFC. The task must be created manually in the runtime system. [DEFAULT] assigns the CFC to the default task.
Controller	Instance of the controller (empty if a control computer CFC).
CTRL_Task	Controller task (empty if a control computer CFC). The task must be created manually in the controller.

Table 3: List all CFC properties

7.2.2 Variable (border)

Two different functions are available (yellow area) to substitute variables:

- **Set:** Searches for variables which match the value of the ModifyName and sets the new name (value in column).
- **Replace:** Searches for variables which contain the value of the ModifyName and replaces that part of the variable with the new value.



Example Replace:

Template **Variable:** _Taglo__Val, **ModifyName:** _Taglo_, **Value:** Tag01 => Tag01_Val

7.2.3 Block Parameter

The name of the constant is given with a leading slash (gray area).

Example: **Constant:** TagNo => **ModifyName:** /TagNo

The value in the template CFC must have been modified in order to overwrite the value and is not allowed to match the default value. Only the **Set Method** is available for constants. **Replace** is **not** supported.

7.3 Create the CFCs

7.3.1 Options

The CFCs are created with the shell command **"SolutionGenerator"** . The following generation options are available:

Command option	Description
--listTemplates	Lists all available templates and their versions.
--template	TEMPLATE: creates all CFCs of the type TEMPLATE (default: all).
--exportAllCfc	creates all CFCs (not only new/changed)
--debugLvl	Changes the output level during generation (default: 3 Max: 99)



Example call SolutionGenerator:

SolutionGenerator --template CFC_Template_AnalogIn

This call creates all CFCs of the type AnalogIn.

All of the SolutionGenrator options are output with the **"SolutionGenerator --help"** command.

```
engin@aproltraining01:~$ SolutionGenerator --help
usage: SolutionGenerator [-h] [--version] [--shortversion]
                        [--config CONFIGFILE] [--templatePath TEMPLATEPATH]
                        [--outputPath OUTPUTPATH]
                        [--internalPath INTERNALPATH]
                        [--spreadsheetPath SPREADSHEETPATH]
                        [--spreadsheetFilename SPREADSHEETFILENAME]
                        [--debugLvl DBGLVL] [--updateHw] [--gui]
                        [--forceUpdateCfc] [--exportAllCfc]
                        [--controller [CONTROLLER [CONTROLLER ...]]]
                        [--template [TEMPLATE [TEMPLATE ...]]]
                        [--listTemplates]

Generator for APROL import files. Generator uses Excel *.xlsx files as
datasource.

optional arguments:
  -h, --help            show this help message and exit
  --version             show program's version number and exit
  --shortversion        show program's version number and exit
  --config CONFIGFILE   Configuration file. (default:
                        /home/engin/ENGIN/cnf/SolutionGenerator/config.xml)
  --templatePath TEMPLATEPATH
                        Directory for APROL template files. (default:
                        /home/engin/ENGIN/cnf/SolutionGenerator/templates/)
  --outputPath OUTPUTPATH
                        Directory for APROL import files. (default:
                        /home/engin/ENGIN/EXCHANGE/)
  --internalPath INTERNALPATH
                        Directory for internal file handling. (default: /home/
                        engin/ENGIN/cnf/SolutionGenerator/dataFiles/internal/)
  --spreadsheetPath SPREADSHEETPATH
                        Directory for excel xlsx files. (default: /home/engin/
                        ENGIN/cnf/SolutionGenerator/dataFiles/public/)
  --spreadsheetFilename SPREADSHEETFILENAME
                        standard config only. Use this filename instead of
                        filename from config file.
  --debugLvl DBGLVL     Debuglevel (default: 3)
  --updateHw            Read AS hardware configuration and write xml file
  --gui                Start with GraphicUserInterface
  --forceUpdateCfc      create all cfc, force usage of templates for cfc
  --exportAllCfc        create all cfc, not only necessary
  --controller [CONTROLLER [CONTROLLER ...]]
                        Generate io-mapping and project parts only for this
                        controller(default: all)
  --template [TEMPLATE [TEMPLATE ...]]
                        standard config only. Generate project parts only for
                        this template (default: all)
  --listTemplates       standard config only. List all Templates from
                        spreadsheet and caedb.

Regarding any questions, contact local B&R Support.
```

Figure 65: Help output of the SolutionGenerator

7.3.2 Show delta

If the generator is restarted after CFCs have been imported, not all CFC will be created, but the difference compared with the current engineering state. Differences may be:

- New CFC
- Change of variables or parameters



Note:

This results in that only the "updated" CFCs will be in the import file.

7.3.3 Behavior upon CFC changes

Generated CFCs can be changed without problems after they have been imported (setting additional parameters, placing blocks, etc.).

The **CFC as basis** is used if regeneration is carried out. These manual changes are considered by the generator as long as the template version is not different to that of the CFC version.



Note:

If the template version changes (see Template settings / Template version) or there is no template version, all manual changes will be discarded.

In this case, a warning is output during the generation:

```
engtest@bupa092:~/ENGINE/cnf/SolutionGenerator> SolutionGenerator --template CFC_Template_AnalogIn
09/10/15 08:55:53 : Start ...
09/10/15 08:55:54 : Found CFC_Template configuration for Template: AnalogIn in Spreadsheet.
09/10/15 08:55:54 : Process Sheet AnalogIn...
09/10/15 08:55:54 : Process Row 10 Sheet AnalogIn...
09/10/15 08:55:54 : WARNING : Ana01: New version of cfc template. New template will be used : AnalogIn
09/10/15 08:55:54 : Export project parts ....
09/10/15 08:55:54 : Export CFC for Project GeneratorTest
09/10/15 08:55:54 : Number of new or changed parts: 1
09/10/15 08:55:54 : Done.
```

Figure 66: Message "New version" from template

7.4 Example

Creation of the „**AnalogIn**“ template for an analog input signal.

Create CFC:

Create a CFC in the template directory and name it „**AnalogIn**“ .

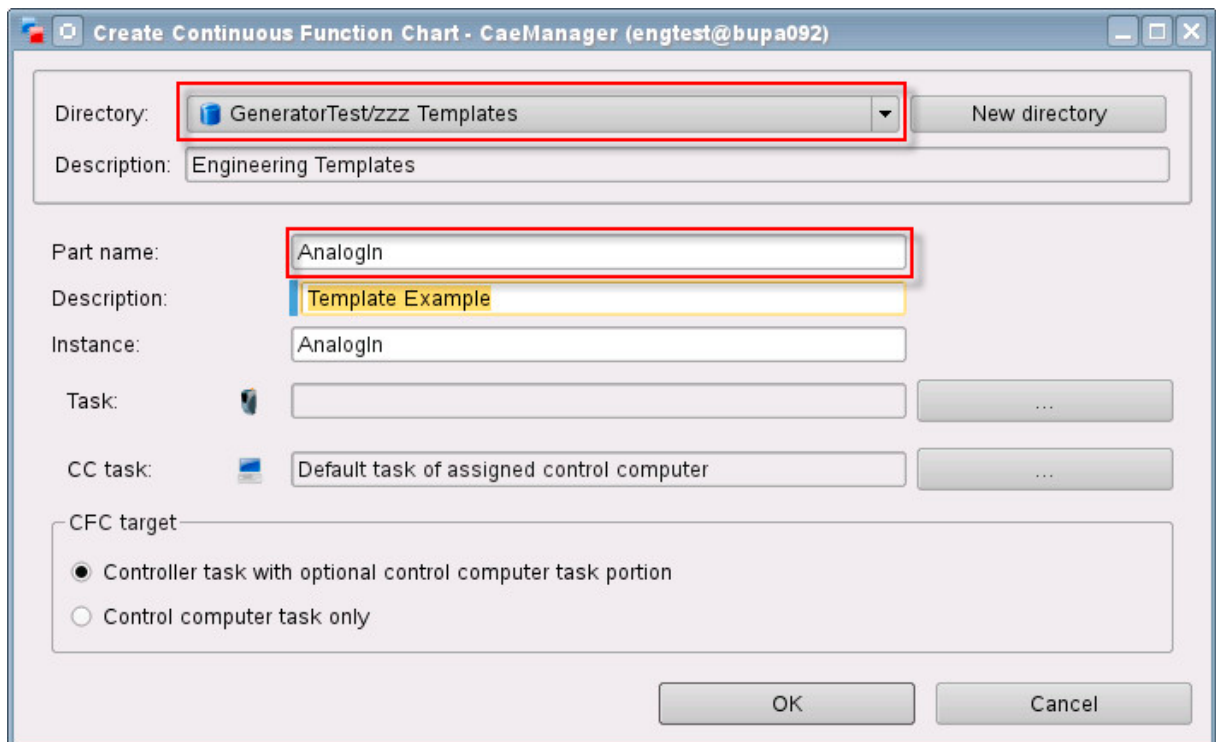


Figure 67: Creation of a CFC template

Along with the CFC, a new tab with the name **"CFC_Template_AnalogIn"** is created in the Excel file. The CFC properties are put into the Excel file.

[illegible]

Place block

The Analog01 hyper macro is placed in the CFC and an instance is assigned. This instance cannot be changed via the list engineering.

Create template variable

Template variables are created for the variable substitution. We want to exchange **_Tag_** for hardware I/Os and **_ADD_** for a connector.

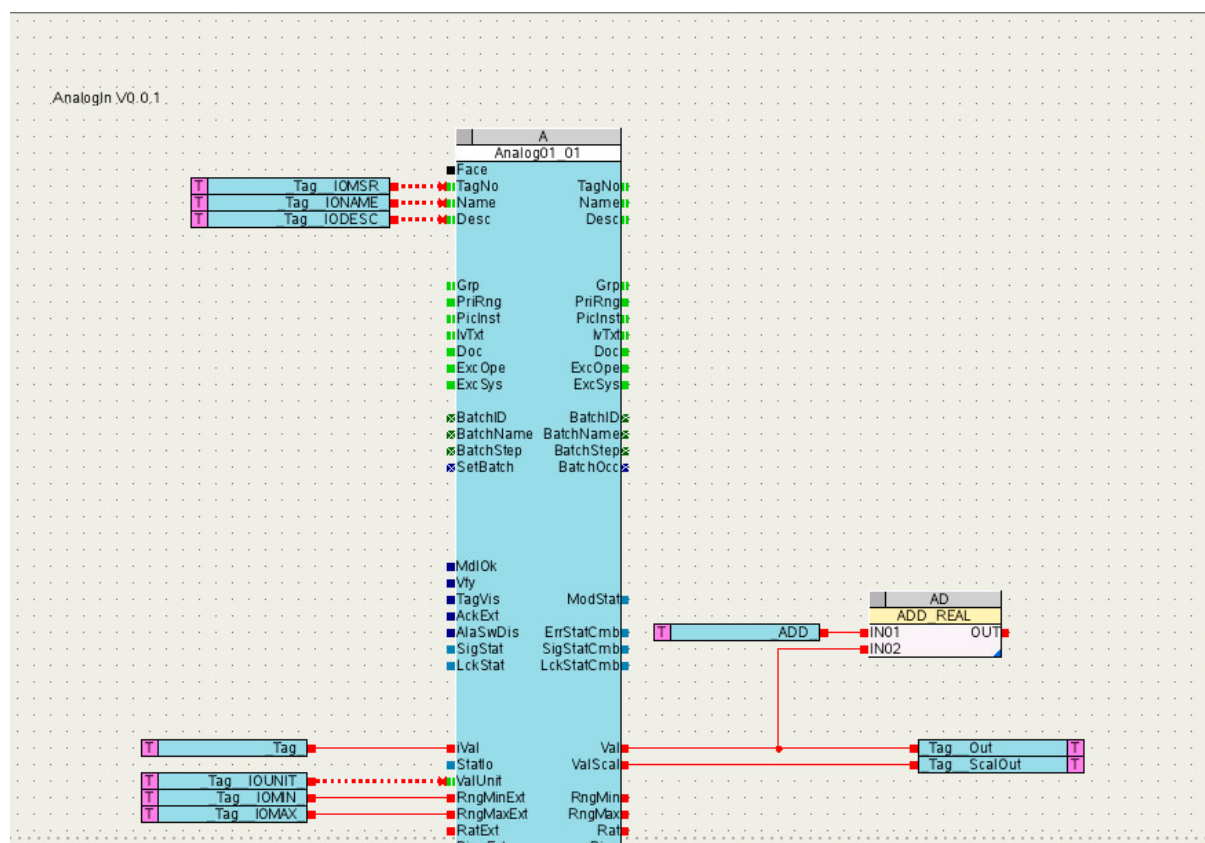


Figure 69: Create template variables

Substitution rules are created for both variables in the Excel table.

Replace all **_Tag_** with the „**Replace**“ function

Replace **_ADD_** with the „**Set**“ function

3	CFC Settings	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC Variables	Border	Border
4	[ModifyFunction]	Set	Set	Set	Set	Set	Set	Set	Set	Set	Replace	Set	
5	[ModifyType]	Path	Name	desc049	desc001	CFC_Inst	RuntimeSyst	CC_TASK	Controller	CTRL_TASK	Tag	ADD	
6	[ModifyName]												
7													
8													
9	Don't edit above this line!	Cae Path	CFC Name	Desc. Deutsch	Desc. English	CFC Instanz	Runtime Sys	ControlCom	Controller	In Controller Task	Tag number	Command 0	
10		/Logic/Instruments	Analog01	Beschreibung	Description	Ana01	[DEFAULT]	[DEFAULT]	Ctrl01	ApStandard	Ti001	Var001	

Figure 70: Template variable in Excel list

Define parameters

It should be possible to deactivate alarms of the analog hyper macro and to set a group. The default value of the parameters are changed because of this.

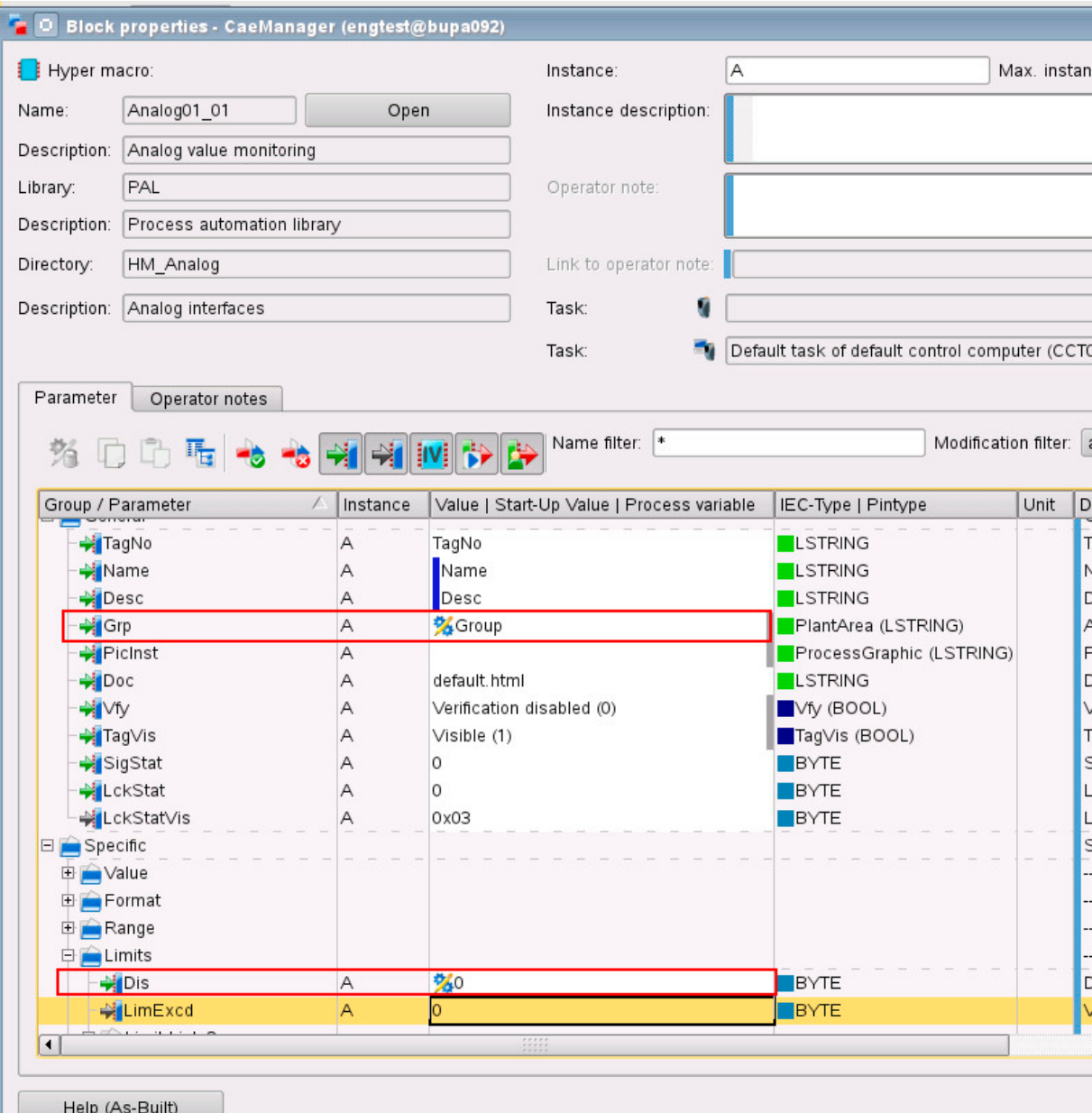


Figure 71: Modification in the HM properties

Substitution rules are also created for the parameters in the Excel file (/Grp and /Dis).

	CFC Settings										CFC Variables		Block Parameter	
[ModifyFunction]	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	CFC_Property	Border	Border	Parameter	Parameter
[ModifyType]	Set	Set	Set	Set	Set	Set	Set	Set	Set	Set	Replace	Set	Set	Set
[ModifyName]	Path	Name	desc049	desc001	CFC_Inst	RuntimeSyst	CC_TASK	Controller	CTRL_TASK		Tag_	_ADD_	/Grp	/Dis
Don't edit above this line!														
	Cae Path	CFC Name	Desc. Deutsch	Desc. Englis	CFC Instanz	Runtime Sys	ControlCom	Controller	In Controller	Task	Tag number	Add Val	Group	Name
	/Logic/Instruments	Analog01	Beschreibung	Description	Ana01	[DEFAULT]	[DEFAULT]	Ctrl01	ApStandard		Tl001	Var001	Group1	128

Figure 72: HM parameter

Create import file

The generator creates the CFCs from the newly created template with the **SolutionGenerator --template CFC_Template_AnalogIn** command.

```
engtest@bupa092:~/ENGINE/EXCHANGE> SolutionGenerator --template CFC_Template_AnalogIn
09/16/15 14:43:55 : Start ...
09/16/15 14:43:55 : Found CFC_Template configuration for Template: AnalogIn in Spreadsheet.
09/16/15 14:43:55 : Process Sheet AnalogIn...
09/16/15 14:43:55 : Process Row 10 Sheet AnalogIn...
09/16/15 14:43:56 : Process Row 11 Sheet AnalogIn...
09/16/15 14:43:56 : Process Row 12 Sheet AnalogIn...
09/16/15 14:43:56 : Process Row 13 Sheet AnalogIn...
09/16/15 14:43:56 : Process Row 14 Sheet AnalogIn...
09/16/15 14:43:56 : Process Row 15 Sheet AnalogIn...
09/16/15 14:43:56 : Process Row 16 Sheet AnalogIn...
09/16/15 14:43:56 : Process Row 17 Sheet AnalogIn...
09/16/15 14:43:56 : Process Row 18 Sheet AnalogIn...
09/16/15 14:43:56 : Process Row 19 Sheet AnalogIn...
09/16/15 14:43:56 : Process Row 20 Sheet AnalogIn...
09/16/15 14:43:56 : Process Row 21 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 22 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 23 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 24 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 25 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 26 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 27 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 28 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 29 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 30 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 31 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 32 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 33 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 34 Sheet AnalogIn...
09/16/15 14:43:57 : Process Row 35 Sheet AnalogIn...
09/16/15 14:43:58 : Process Row 36 Sheet AnalogIn...
09/16/15 14:43:58 : Process Row 37 Sheet AnalogIn...
09/16/15 14:43:58 : Export project parts ....
09/16/15 14:43:58 : Export CFC for Project GeneratorTest
09/16/15 14:43:58 : Number of new or changed parts: 28
09/16/15 14:43:58 : Done.
```

Figure 73: Solution generator output

The project parts can then be imported into the CaeManager using the normal import mechanism.



Task:

Realize your own templates and administer them in them in the Excel list. Configure the signal conditioning of your AI and DI channels in this way.

8 Summary

We are now able to carry out a list engineering with predefined templates and have saved a great amount of time for the workflow. The APROL solutions can be implemented in an intuitive manner by using these templates.



Figure 74: Example Solution Energy Monitoring

We also have the possibility to create our own templates and deploy them in the list engineering. In case logic repeats itself in a project part, it should be mandatory to use this template mechanism.

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