

S7 Energy Efficiency Monitor for Machines

TIA Portal V16 / WinCC Comfort V16,
SIMATIC S7-1500, STEP 7 Professional V16

https://support.industry.siemens.com/cs/ww/en/view/109753230

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1 Introduction

1.1 Overview

Energy efficiency plays an important role in today's world. Using the S7 energy efficiency monitor (S7 EE-monitor for short), you can record and analyze the consumption of the media used (compressed air, electrical energy, or heating gas) by your machine with a SIMATIC controller. The S7 EE-monitor calculates the average power and actual value, the distribution of energy and the requirements of the media used per produced piece good for each machine state.

This enables you to detect potential for savings and to improve processes. By saving resources, you can save money and protect the environment.

This application example shows how to set up the S7 Energy Efficiency Monitor and display the evaluation on an HMI Operator Panel (9-inch or 12-inch).

1.2 Principle of Operation

The S7 EE Monitor consists of different blocks whose functions are explained below:

- The "EnS_EEm_Calc" block is responsible for recording and calculating state-related energy data.
- The "EnS_EEm_Report" block uses the measured values to generate an efficiency report for detailed evaluation and documentation. This is stored on the SIMATIC memory card of the controller.
- The "EnS_EEm_ComEnMPRO" block establishes the connection to the central energy management system SIMATIC Energy Manager PRO and transmits the status-related energy counters cyclically (1min).

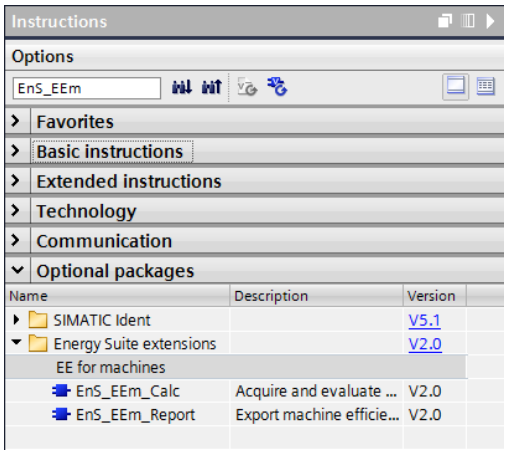
As of SIMATIC Energy Suite V15, the following blocks are available for recording energy efficiency:

- "EnS_EEm_Calc"
- "Ens_EEm_Report"

The blocks are available in the TIA Portal in the "Instructions" under the "Optional packages":

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Figure 1-1 Energy Efficiency blocks



Machine manufacturers can integrate this function into their machines to automate the generation of the energy and media requirements as an acceptance form in SIMATIC HMI and Excel.

The block "EnS_EEm_ComEnMPRO" can be found in the supplied project library.

Note The configuration of the individual blocks is done centrally. By concentrating the data in the block "EEM_Datablock_Overall", you only need to connect the inputs on this block. This is described in Sections 2.1 and 2.2.

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1.3 Components Used

The following hardware and software components were used to create this application example:

Table 1-1

Components	Quantity	Article number	Note
TIA Portal Step7 Professional V16	1	6ES7822-1AA06-0YA5	Min. update 2
WinCC Comfort V16	1	6AV2101-0AA06-0AA5	Min. update 2
TP 900 Comfort	1	6AV2124-0JC01-0AX0	
TP 1200 Comfort	1	6AV2124-0MC01-0AX0	optional
CPU 1516-3 PN/DP	1	6ES7516-3AN02-0AB0	also ET200SP CPU or S7-1200 possible
S7 EE monitor license	1	6AV2108-1CF00-0BB0	Download One license is required for each machine.

This application example consists of the following components:

Table 1-2

Components	File name	Note
Example project	109753230_EEM_Integration_AWB_V16.zip	Example project to test the S7 EE-monitor
Library	109753230_Lib_V16.zip	The library contains the visualization and the S7 blocks
Documentation	109753230_S7EEMonitor_Doc_de.pdf	This documentation

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2 Engineering

2.1 Interface Description

In the sample project, the data for the Energy Efficiency Monitor is concentrated in the "EEM_Datablock_Overall" block. This block carries out all further calculations so that only the inputs of this block must be interconnected.

The following blocks are accessed within the block:

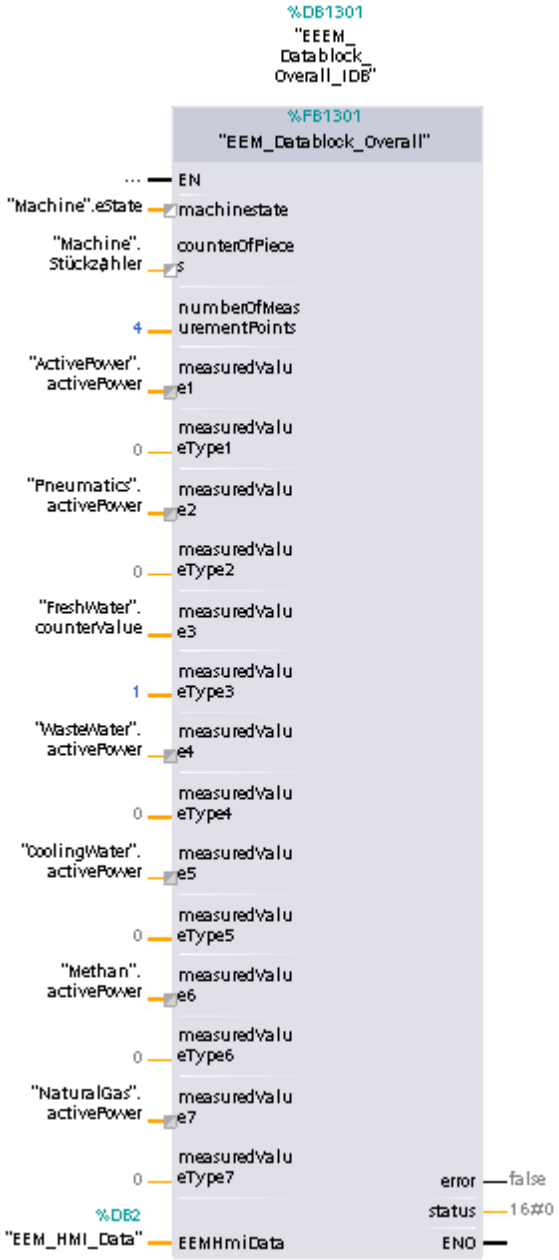
- "EnS_EEm_Calc"
- "EnS_EEm_Report"
- "EnS_EEm_ComEnMPRO"

As soon as you have connected the inputs of the "EEM_Datablock_Overall" block in the cyclic (100ms) OB1300, all blocks are active.

In the sample project, the block is called cyclically in OB1300 (100 ms) and is connected to simulated data (see Figure 2-1). The wiring of the inputs is described in detail in Section 2.2.

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Figure 2-1



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2.2 Integration into the user project

The configuration refers to the use of the project library, which you can download on the article page.

The sample project serves to illustrate the functionality.

2.2.1 Requirements

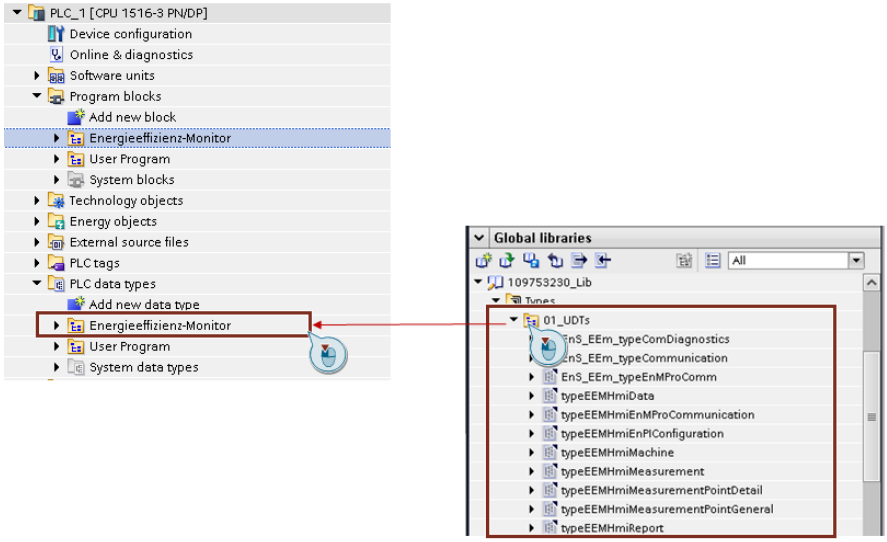
- SIMATIC CPU 1516 has been created
- HMI Comfort Panel TP900 is created and connected to the S7 controller.
- HMI Comfort Panel TP1200 is created and connected to the S7 controller (optional)
- The project library was downloaded from the article page and opened in the TIA Portal.

2.2.2 S7 program

Integrate necessary UDTs from the project library into the project

Drag & drop the required UDTs from the project library into the PLC data types of the S7 controller used (see Figure 2-2). You can create a folder named "Energy Efficiency Monitor" to give you a better overview for larger projects.

Figure 2-2

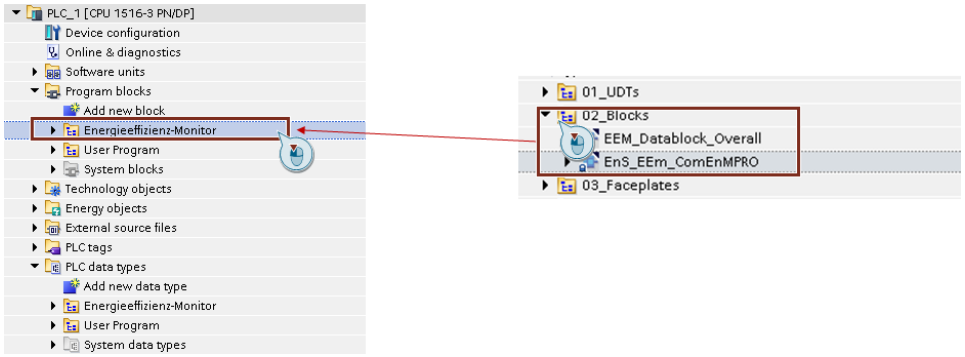


Integration of the "Blocks" folder from the project library into the project under "Program Blocks"

Drag & drop the "Blocks" folder of the Project Library into the previously created "Energy Efficiency Monitor" folder (see Figure 2-3)

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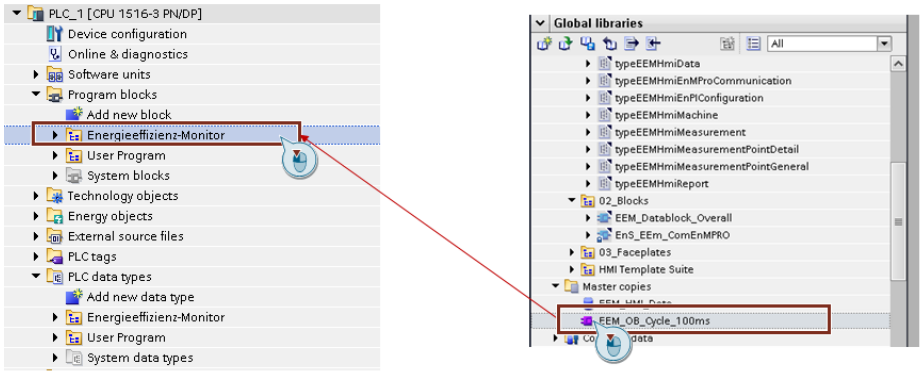
Figure 2-3



Creating a cyclic OB (100 ms)

Create a cyclic OB (100ms) or copy the OB "EEM_OB_Cycle_100ms" from the project library ("Master Copies") via drag & drop into the folder "Energy Efficiency Monitor". In this cyclic Ob, the block "EEEM_Datablock_Overall" is called.

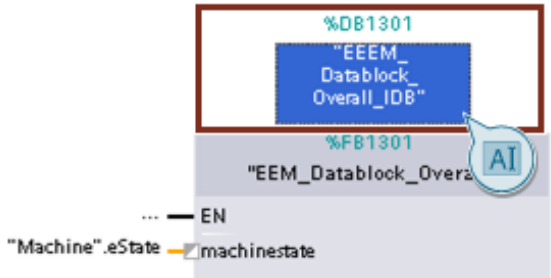
Figure 2-4



Creation of instance data block "EEEM_Datablock_Overall_IDB" for "EEM_Datablock_Overall"

Open the block "EEM_OB_Cycle_100ms" and create the instance data block with the name "EEEM_Datablock_Overall_IDB" for the FB "EEEM_Datablock_Overall" by entering the name as described in Figure 2-5.

Figure 2-5



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Connecting the inputs of the block with the system (S7 program)

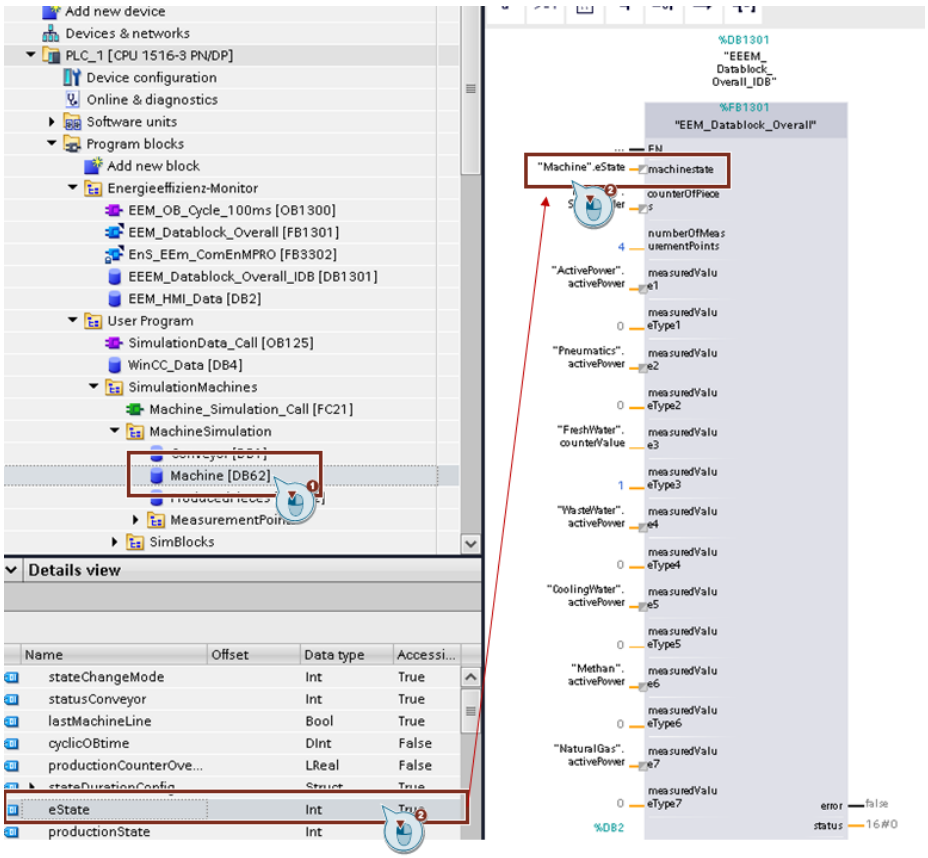
This step is user specific. In this application example, a simulated machine is examined in terms of energy efficiency. The data of the simulated machine is located in the sample project in "DB62". The machine has the following measuring point consumptions, which are connected (See Figure 2-7):

- "Active Power"
- "Pneumatics"
- "Fresh Water"
- "Cooling Water"

- Connecting the states of the simulated machine (see Figure 2-6)

1. Open the DB that contains the data of the machine (DB62).
2. Drag & drop the states ("eState") of the machine to the input "machinestate" of the FB "EEEM_Datablock_Overall".

Figure 2-6



- Switch the piece counter ("counterOfPieces")

3. Drag & drop the piece counter ("PieceCounter") of your machine (DB62) to the input "counterOfPieces" of the FB "EEEM_Datablock_Overall" (see Figure 2-7).

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Figure 2-7



- Number of measurement points

Enter the number of measurement points of your machine in the input "numberOfMeasurementPoints" of the FB "EEEM_Datablock_Overall". These can be, for example, 4 measurement points (see Figure 2-8).

Note In this application example, only 4 of the possible 7 measurement points ("MeasurementPoints") are connected.

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Figure 2-8



- Connecting the measurement points

Proceed as follows to connect the "ActivePower" measurement point (see Figure 2-9)

1. Click the DB of your measurement point, e.g. "ActivePower" (DB74), in the folder "Measurement Points".
2. Drag & Drop the tag "activePower" to the input "measuerdValue1" of the FB "EEEM_Datablock_Overall".

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Figure 2-9



- Connection of the measurement point type ("measuredValueType1")

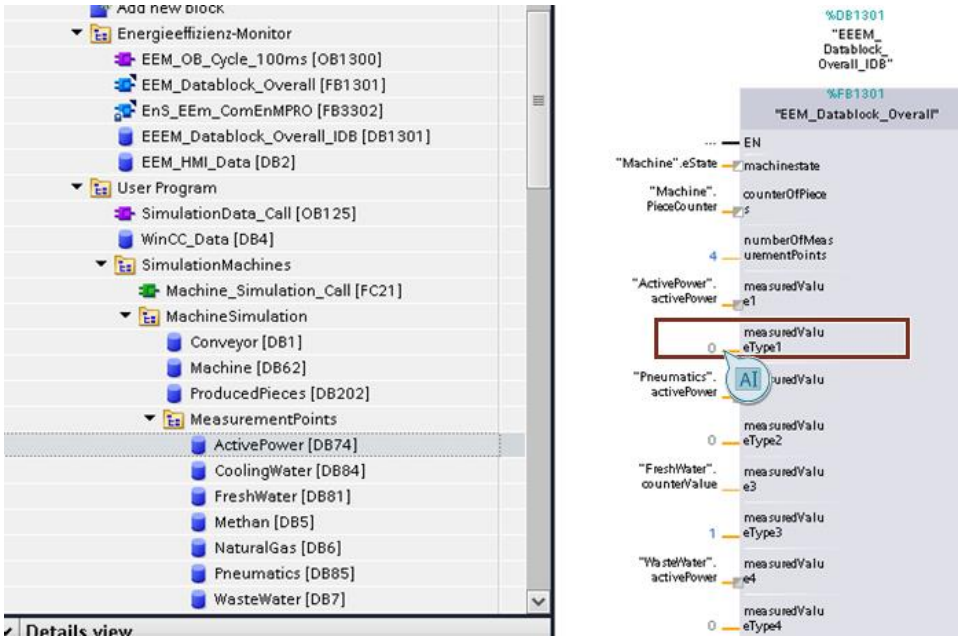
  The input "measuerdValue1" of the FB "EEEM_Datablock_Overall" can have the following values:

  - Actual value: 0
  - Counter value: 1

  Since in this example, the measurement point "ActivePower" is measured as actual value, the value 0 must be entered (see Figure 2-10).

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Figure 2-10



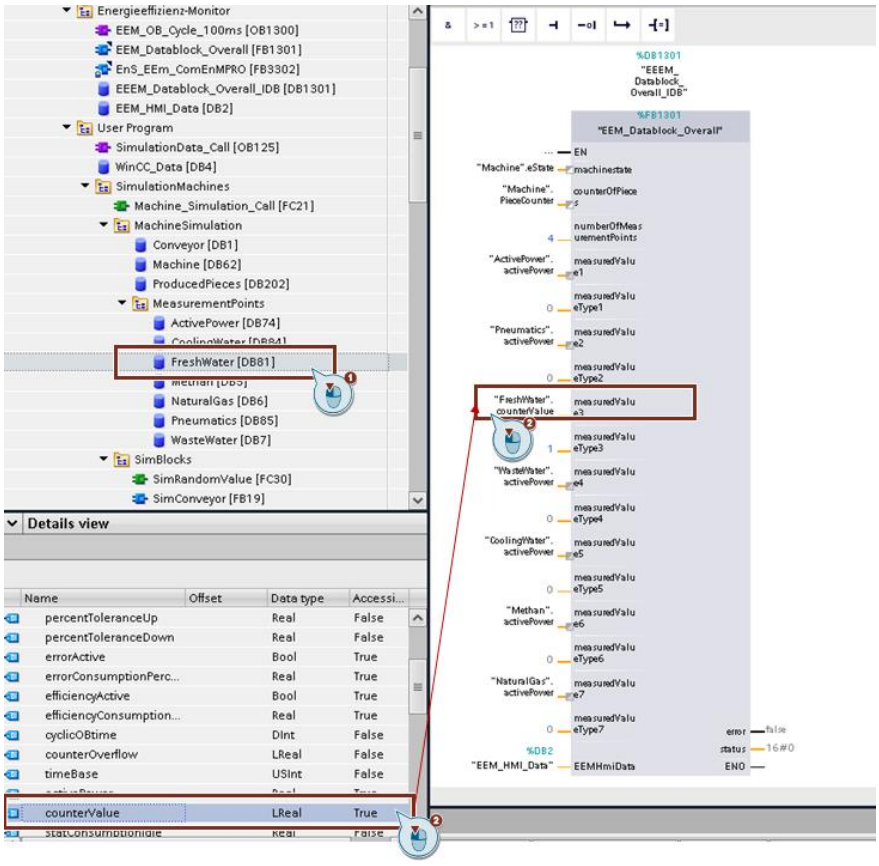
Now, as an additional example, the measurement point "FreshWater" is connected as a counter value.

Proceed as follows to connect the "FreshWater" measurement point (see Figure 2-11)

1. Click the DB of your measurement point e.g. "FreshWater" (DB85) in the folder "Measurement Points".
2. Drag & Drop the tag "counterValue" to the input "measuerdValue2" of the FB "EEEM_Datablock_Overall".

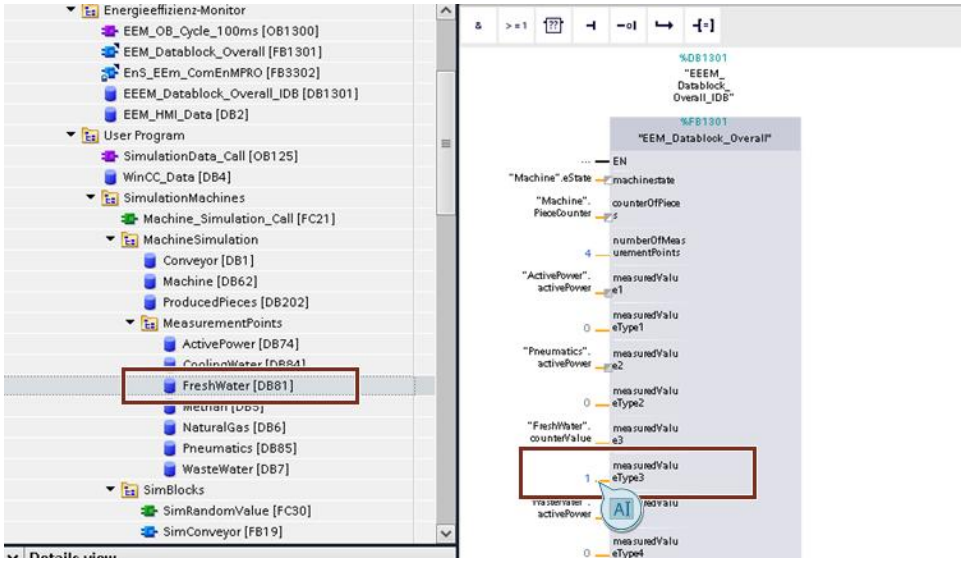
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Figure 2-11



Since, in this example, the measurement point "FreshWater" is measured as a counter value, the value "1" must be entered (see Figure 2-12).

Figure 2-12



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Creating a data block as HMI interface of the type "EEMHMIdata"

A DB of the type "EEMHMIdata" must be created as a standardized interface.

This way, the user can interact with the block via the machine's HMI. Therefore, for example, data can be read and measurements started.

This data block "EEM_HMI_Data" can be easily and quickly integrated from the project library under the "Master Copies" folder into the project in the "Energy Efficiency Monitor" folder of the program blocks via drag & drop (see Figure 2-13).

Figure 2-13

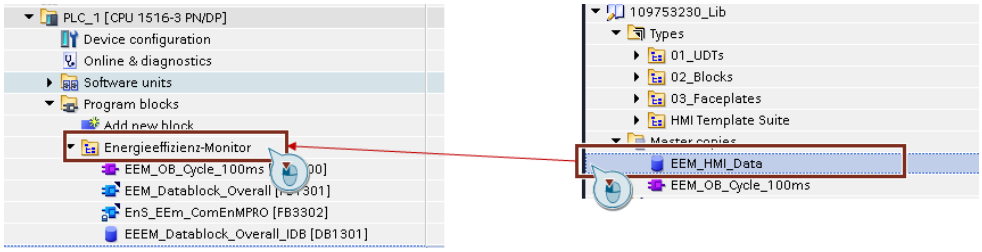
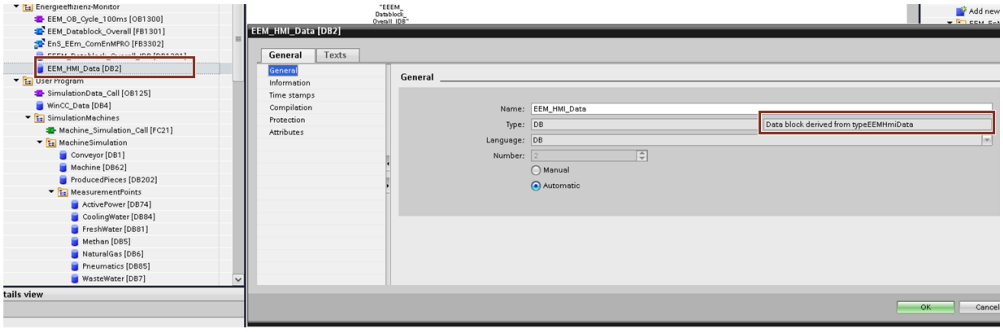


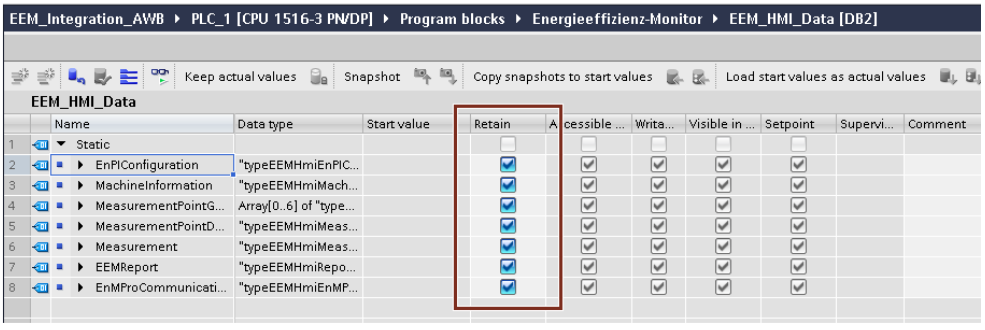
Figure 2-14 shows the properties of the interface DB "EEM_HMI_Data".

Figure 2-14



Note Ensure that the block's retentivity is activated (see Figure 2-15) so that counter values are retained in the event of a CPU failure.

Figure 2-15

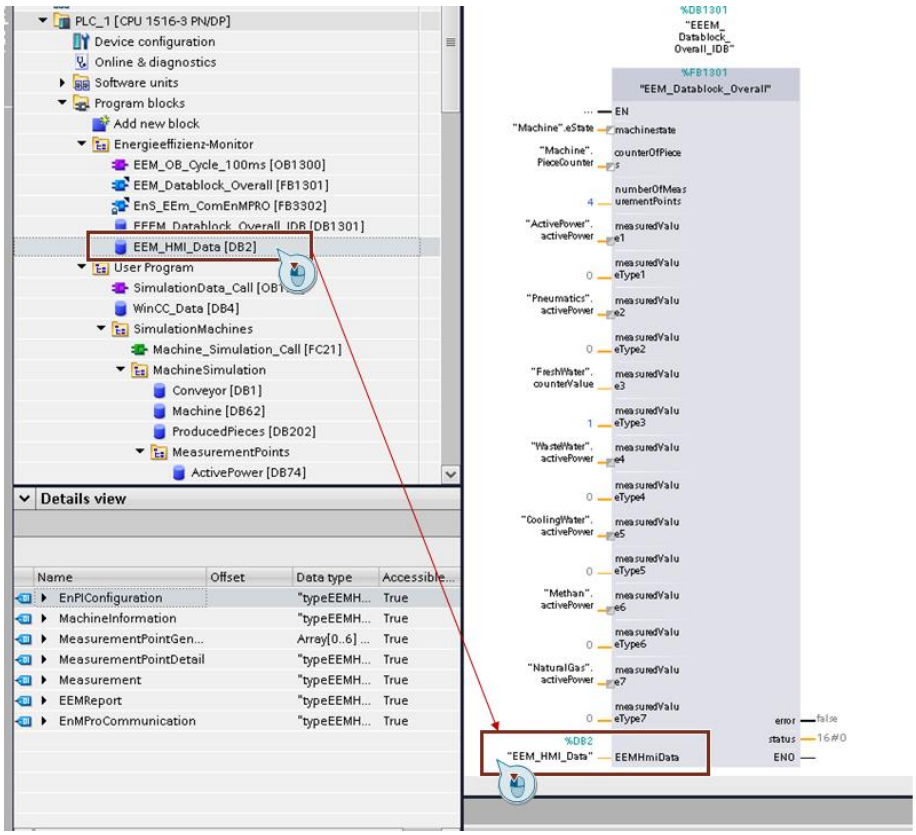


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Connecting the HMI interface DB "EEM_HMI_Data" in the OB "EEM_OB_Cycle_100ms" on the FB "EEM_Datablock_Overall"

Open the OB "EEM_OB_Cycle_100ms" and drag & drop the HMI interface DB "EEM_HMI_Data" to the input "EEMHmiData" of the FB "EEM_Datablock_Overall" (see Figure 2-16).

Figure 2-16



At this point, it is necessary to compile all blocks and load the controller.

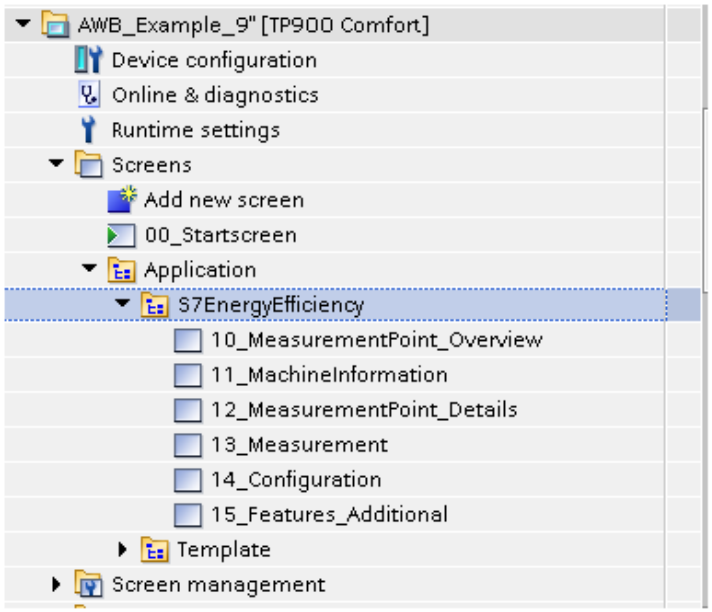
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2.2.3 Integrating the Visualization (9" Comfort Panel)

Requirement

- "empty" screens created under "Application" in the "S7EnergyEfficiency" folder (see Figure 2-17)
- Project library downloaded from SIOS and opened in the TIA Portal

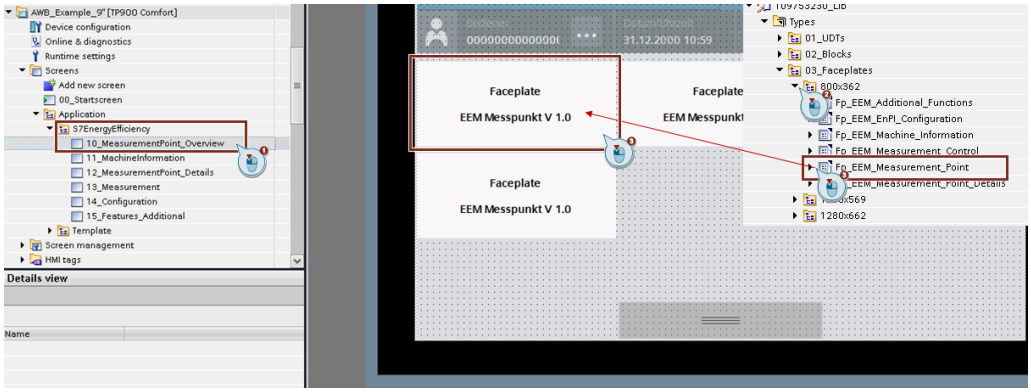
Figure 2-17



Measurement point overview screen ("10_MeasurementPoint_Overview")

1. Open the image for the measurement point overview
2. Open folder 800x362 of the faceplate in the project library
3. Drag the faceplate "Fp_EEM_Measurement_Point" into the Measuring Point Overview screen ("10_MeasurementPoint_Overview")

Figure 2-18



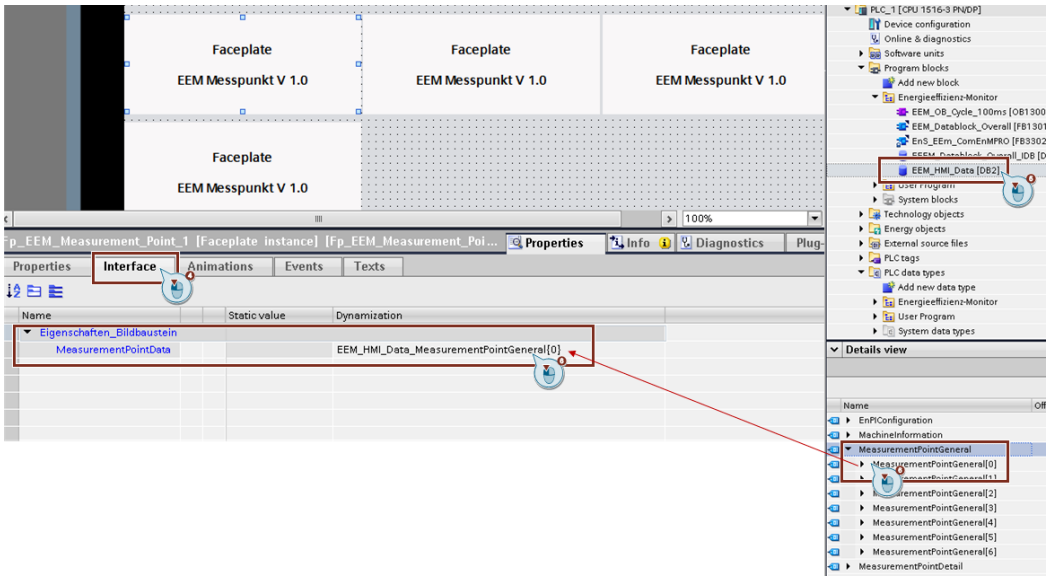
Now it is necessary to connect the interface of the faceplate (see Figure 2-19)

4. Open the interface of the added faceplate

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5. Click the HMI interface DB "EEM_HMI_Data"
6. Drag & drop the required structure "MeasurementPointGeneral{0}" onto the dynamization of "MeasurementPointData", therefore, the first measurement point is connected.

Figure 2-19

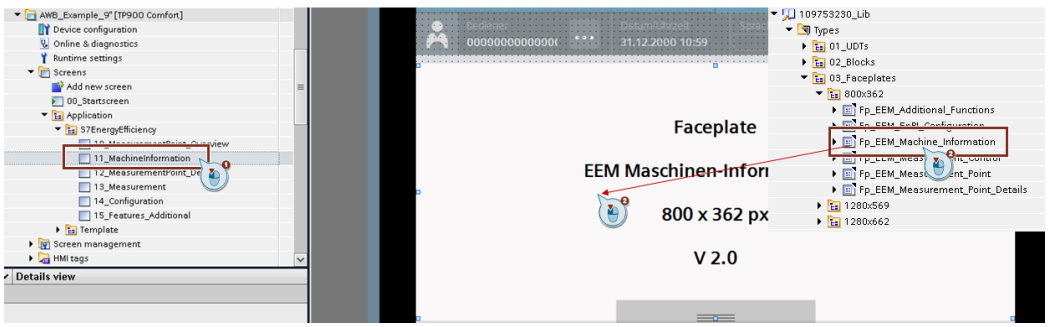


Note For the second measurement point, "MeasurementPointGeneral{1}" must be connected. Therefore, you can connect your additional measurement points.

Machine Information screen ("11_MachineInformation")

1. Open the image for the machine information
2. Drag the faceplate "Fp_EEM_Machine_Information" into the Machine Information screen ("11_MachineInformation")

Figure 2-20

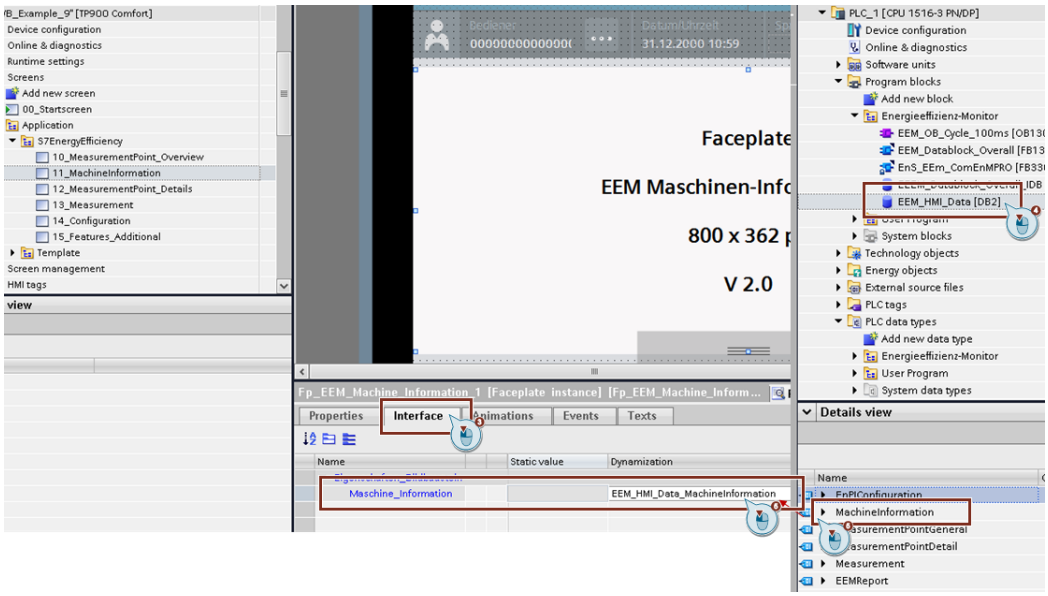


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Now it is necessary to connect the interface of the faceplate (see Figure 2-21):

3. Open the interface of the added faceplate
4. Click the HMI interface DB "EEM_HMI_Data"
5. Use drag & drop to drag the required "MachineInformation" structure onto the dynamization of "Machine_Information".

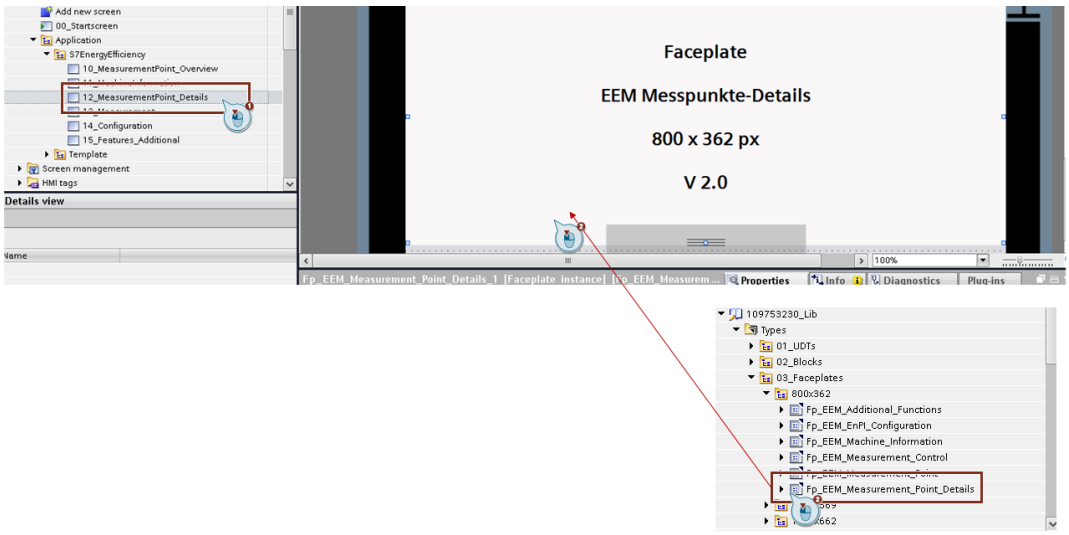
Figure 2-21



Measurement Point Details screen ("12_MeasurementPoint_Details")

1. Open the Measurement Point Details screen ("MeasurementPoint_Details")
2. Drag the faceplate "Fp_EEM_ Measurement_Point_Details " into the Measurement Point Details screen ("12_MeasurementPoint_Details")

Figure 2-22

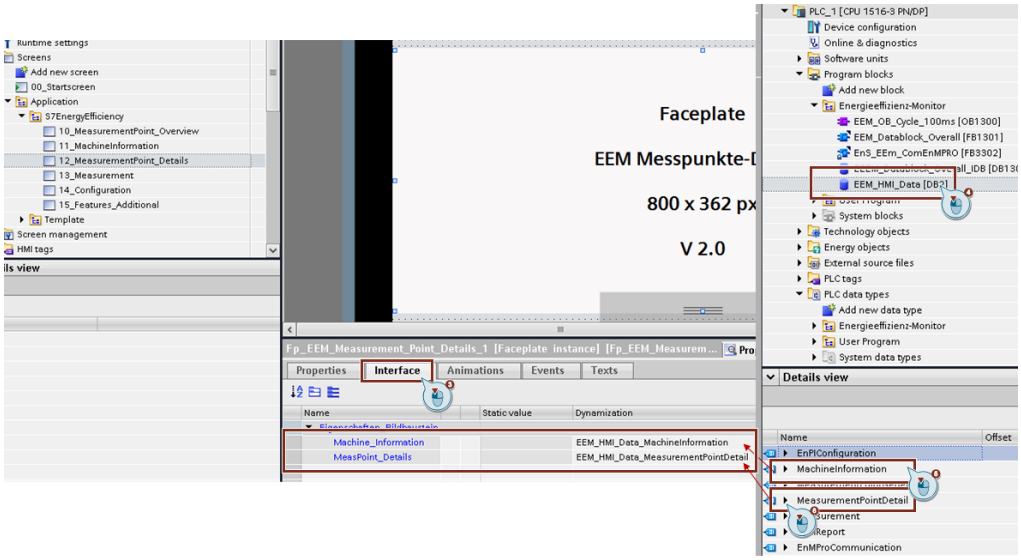


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Now it is necessary to connect the interface of the faceplate (see Figure 2-23):

3. Open the interface of the added faceplate
4. Click the HMI interface DB "EEM_HMI_Data"
5. Use drag & drop to drag the required "MachineInformation" structure onto the dynamization of "Machine_Information".
6. Drag & drop the required "MeasurementPointDetail" structure onto the dynamic modification of "MeasPoint_Details".

Figure 2-23

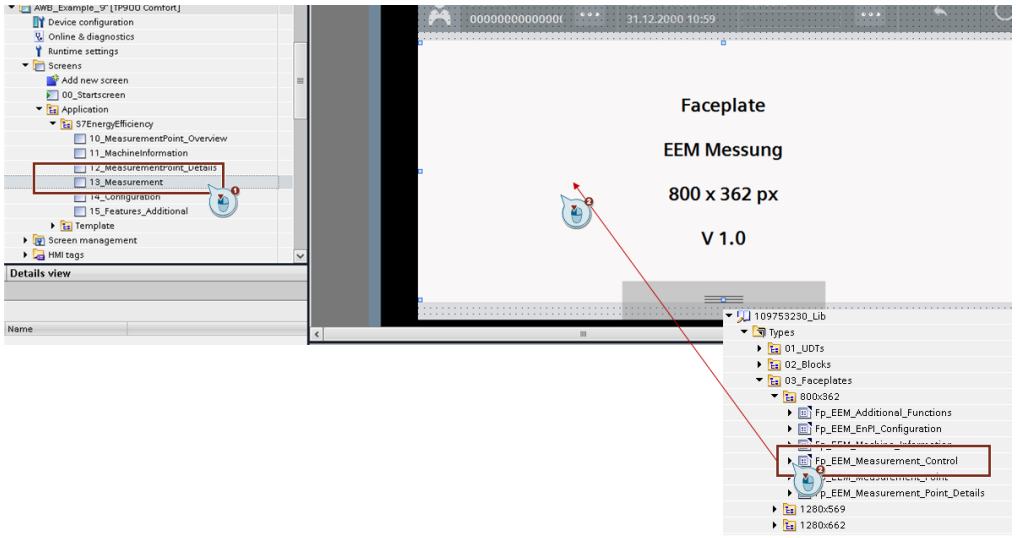


Measurement screen ("13_Measurement")

1. Open the Measurement screen ("13_Measurement")
2. Drag the faceplate "Fp_EEM_ Measurement_Control" into the Measurement screen ("13_Measurement")

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Figure 2-24



Now it is necessary to connect the interface of the faceplate (see Figure 2-25):

3. Open the interface of the added faceplate
4. Click the HMI interface DB "EEM_HMI_Data"
5. Use drag & drop to drag the required structure "Measurement" onto the dynamization of "Measurement".

Figure 2-25

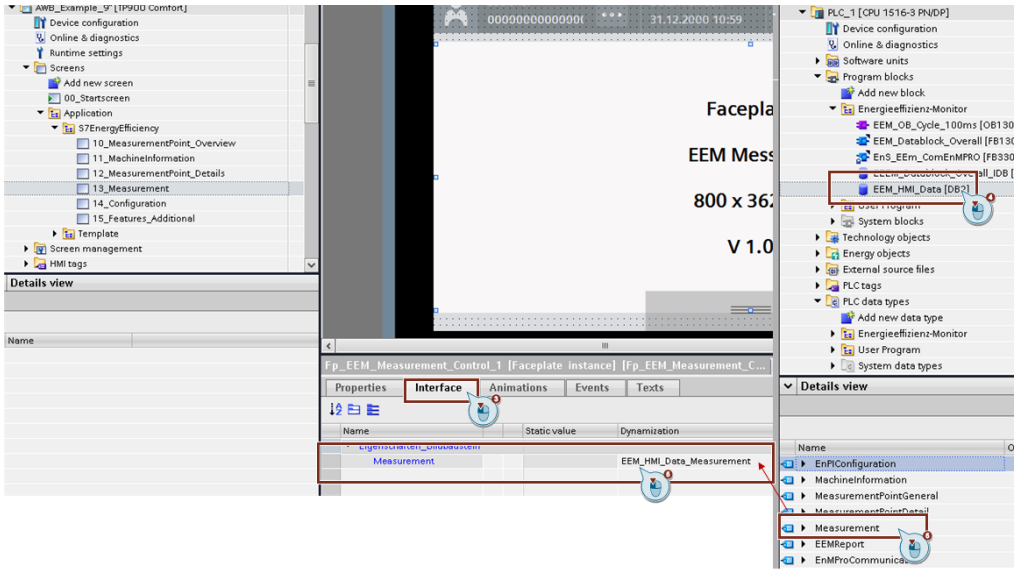
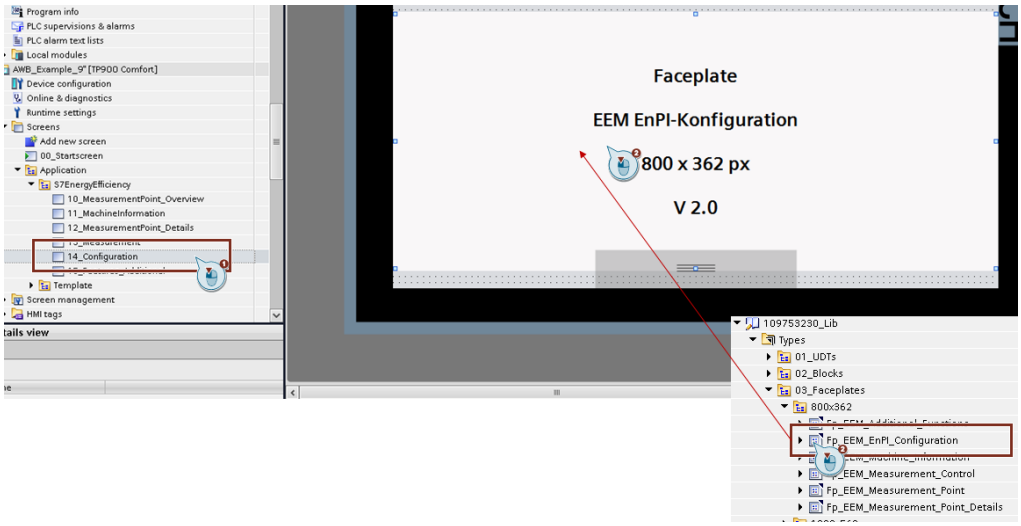


Figure ENPI configuration ("14_Configuration")

1. Open the ENPI configuration screen ("14_Configuration")
2. Drag the faceplate "Fp_EEM_ EnPi_Configuration" into the Measurement screen ("14_Configuration ")

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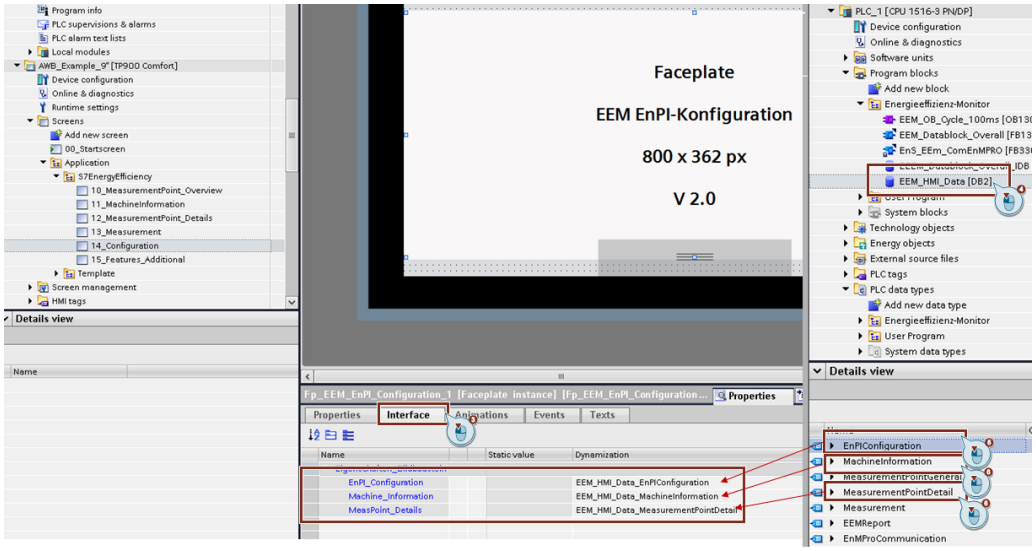
Figure 2-26



Now it is necessary to connect the interface of the faceplate (see Figure 2-27)

3. Open the interface of the added faceplate
4. Click the HMI interface DB "EEM_HMI_Data"
5. Use drag & drop to drag the required structure "EnPIConfiguration" onto the dynamization of "EnPI_Configuration".
6. Use drag & drop to drag the required structure "Machine_Information" onto the dynamization of "Machine_Information".
7. Drag & drop the required "MeasurementPointDetail" structure onto the dynamic modification of "MeasPoint_Details".

Figure 2-27

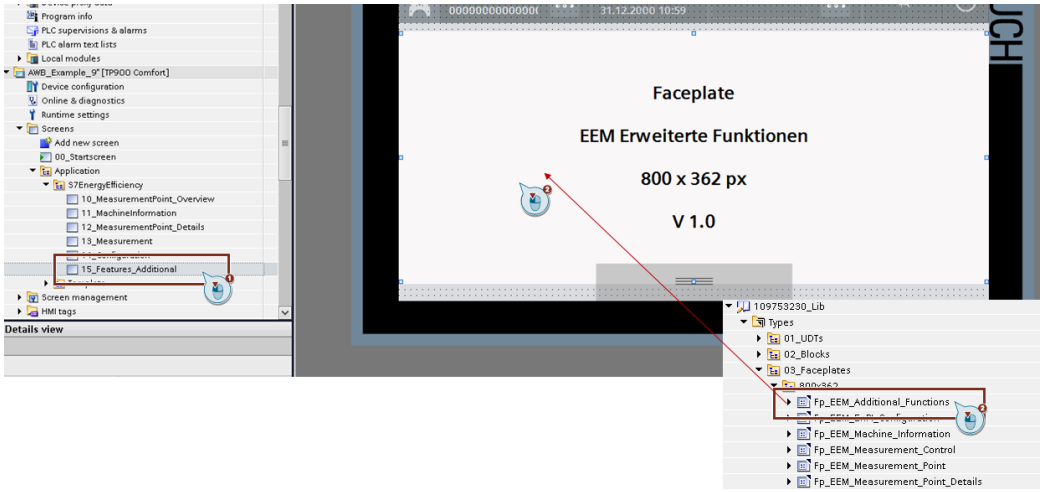


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Advanced Functions SCREEN (15_Features Additional)

1. Open the Advanced Functions screen ("15_Features Additional")
2. Drag the faceplate "Fp_EEM_ Additional_Functions " into the Advanced Functions screen ("15_Features Additional")

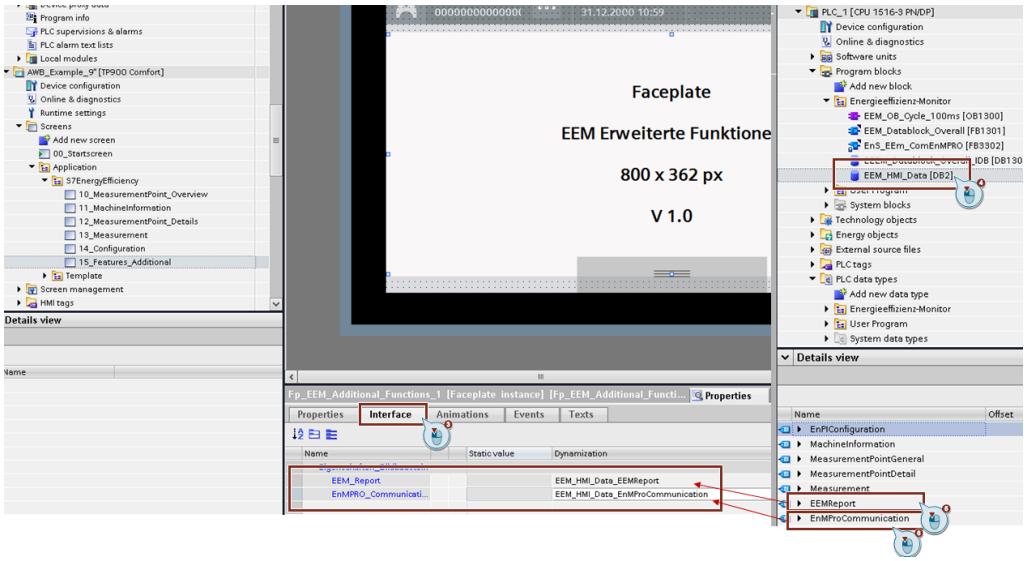
Figure 2-28



Now it is necessary to connect the interface of the faceplate (see Figure 2-29)

3. Open the interface of the added faceplate
4. Click the HMI interface DB "EEM_HMI_Data"
5. Use drag & drop to drag the required structure "EEMReport" onto the dynamization of "EEM_Report".
6. Use drag & drop to drag the required structure "EnMProCommunication" onto the dynamization of "EnMPro_Communication".

Figure 2-29



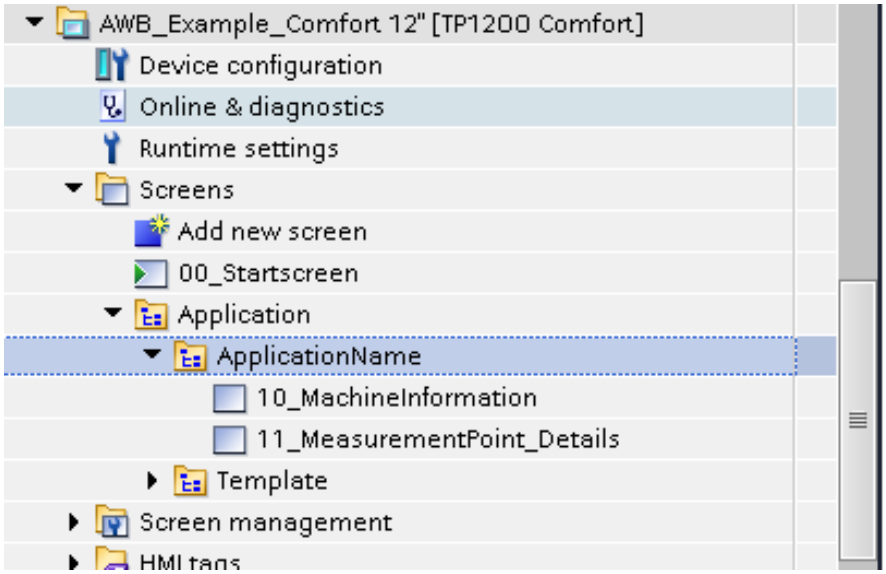
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2.2.4 Integrating the Visualization (12" Comfort Panel)

Requirement

- "Empty" screens named "10_MachineInformation" and "11_MeasurementPoint_Details" have been created (see Figure 2-30)
- Project library downloaded from SIOS and opened in the TIA Portal

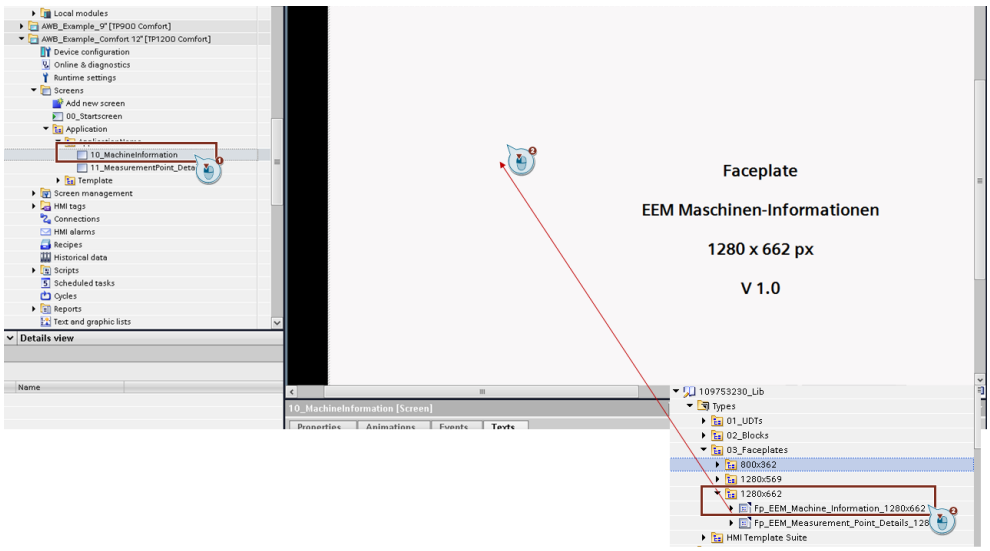
Figure 2-30



Machine Information screen ("10_MachineInformation")

1. Open the Machine Information screen ("10_MachineInformation").
2. Drag the faceplate "Fp_EEM_ Machine_Information_1280x662" from the Faceplates folder in the subfolder 1280x662 of the project library into the Machine Information screen ("10_MachineInformation").

Figure 2-31

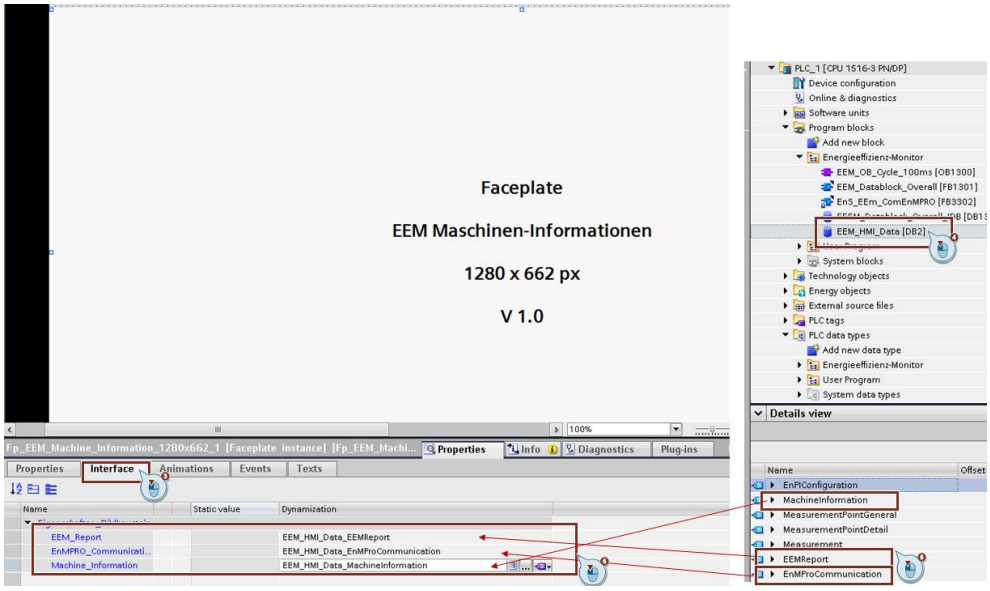


Now it is necessary to connect the interface of the faceplate:

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3. Open the interface of the added faceplate.
4. Click the HMI interface DB "EEM_HMI_Data".
5. Use drag & drop to drag the required structure "EEMReport" onto the dynamization of "EEM_Report", "EnMProCommunication" onto the dynamization of "EnMPro_Communication", and "MachineInformation" onto the dynamization of "Machine_Information".

Figure 2-32

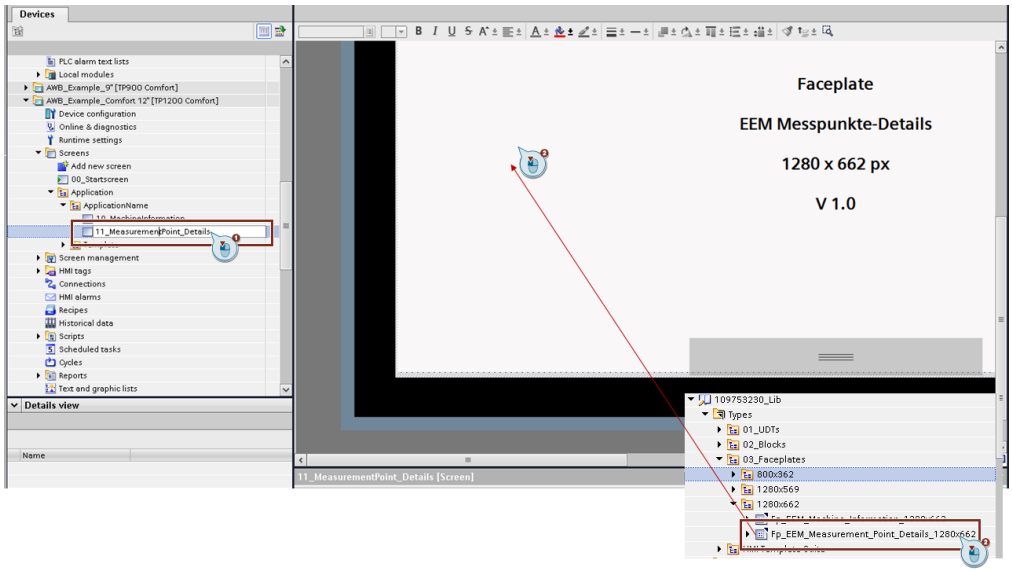


Measurement Point Details screen ("11_MeasurementPoint_Details").

1. Open the Measurement Point Details screen ("11_MeasurementPoint_Details").
2. Drag the faceplate "Fp_EEM_ Machine_Information_1280x662" from the Faceplates folder in the subfolder 1280x662 of the project library into the Measuring Point Details screen ("11_MeasurementPoint_Details").

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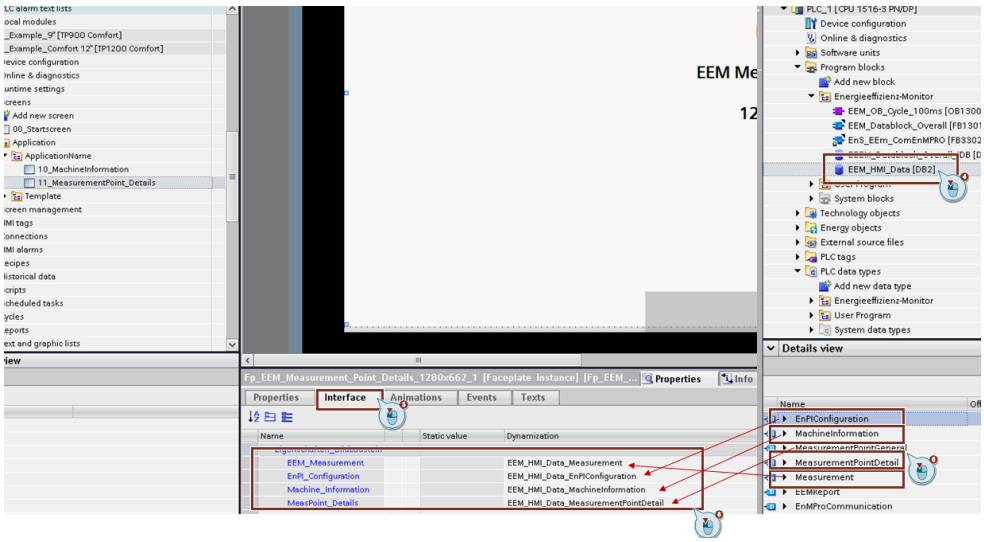
Figure 2-33



Now it is necessary to connect the interface of the faceplate:

3. Open the interface of the added faceplate.
4. Click the HMI interface DB "EEM_HMI_Data".
5. Drag and drop the required structure "Measurement" onto the dynamization of "EEM_ Measurement", "EnPIConfiguration" onto the dynamization of "EnPI_Configuration", "MeasurementPointDetail" onto the dynamization of "MeasPoint_Details", and "MachineInformation" onto the dynamization of "Machine_Information".

Figure 2-34



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2.3 Operation and Explanation of Faceplates

2.3.1 Faceplate "Fp_EEM_Measurement_Point"

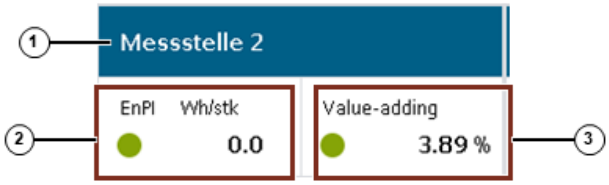
The screen component for the measurement points overview can be configured once for each measurement point used. It gives a short overview of the key figures of the measurement point and their relation to the previously configured reference value using a colored indicator.

Properties of the faceplate

- Size (W x H): 264 x 111 pixels
- Interface:
  - MeasurementPointData (typeEEMHmiMeasurementPointDataGeneral)

Screen description

Figure 2-35 Measurement point overview



(1) Name of measurement point

(2) Energy Performance Indicator of the measurement point, including the unit. Color change of the indicator:

   a. Gray: Current EnPI > Reference value ➔ Worse energy efficiency than planned

   b. Green: Current EnPI < Reference value ➔ Measurement point runs more energy-efficiently than planned

(3) Percentage of value-added energy as a proportion of total consumption. Color change of the indicator:

   a. Gray: Current value < Reference value ➔ Less energy is consumed in a value-adding manner than planned.

   b. Green: Current value > Reference value ➔ More energy is consumed in a value-adding manner than planned.

2.3.2 Faceplate "Fp_EEM_Machine_Information"

The faceplate gives an overview of the current state and displays some key figures of the overall machine. In addition, the faceplate offers the possibility to edit the machine information afterwards and, therefore, adapt it to the application used. The faceplate therefore has two different views that can be switched using the navigation bar on the left-hand side.

Properties of the faceplate

- Size (W x H): 264 x 111 pixels

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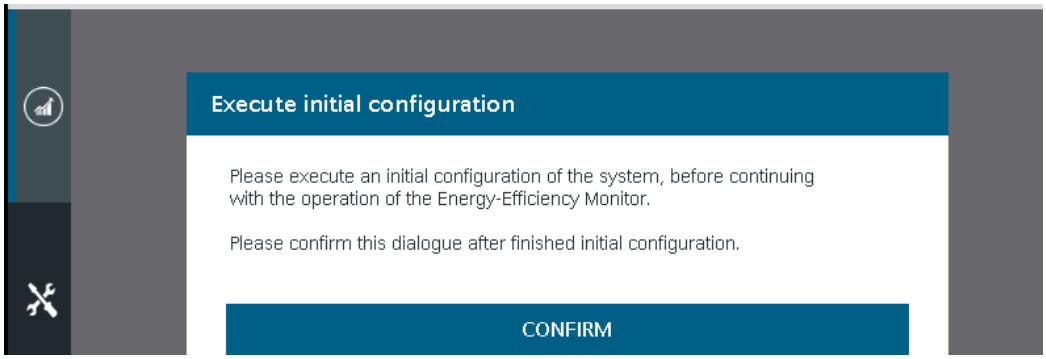
- Interface:
  - Machine_Information (typeEEMHmiMachine)

Screen description

Before using the application or the visualization, an initial configuration of the machine and all measurement points must be carried out and then confirmed in the following dialog to view the machine data. Until the dialog is confirmed, the machine data are not visible.

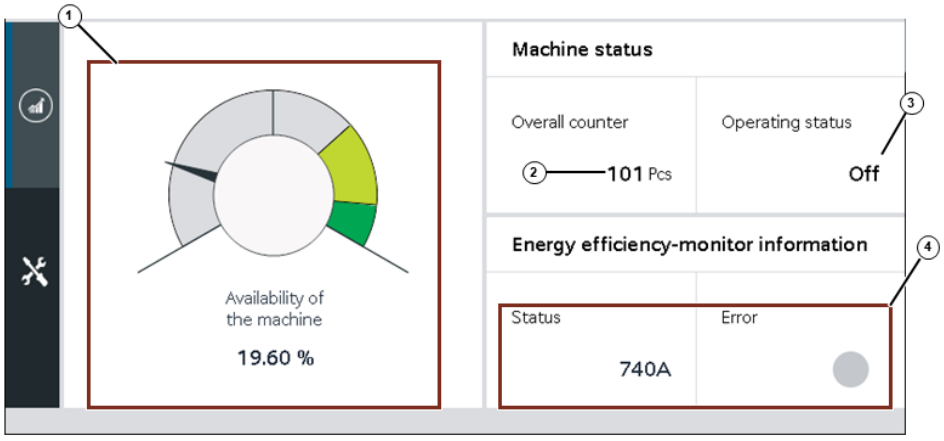
Visualization of the machine data

Figure 2-36 Machine data before initial configuration



After confirming the initial configuration, the envelope module executes its cyclic functions and the energy efficiency monitor block is called. The visualization of the machine data is then available.

Figure 2-37 Overview of global machine data



(1) Machine availability in percentage. Availability in this case means the time the machine spends in a productive state. The states taken into account are marked in the faceplate of the EnPI configuration. Example: 19.60% ➔ The machine is in a productive state for 19.60% of its time. For about 80% of the time, the machine is in an unproductive state (e.g. "stop").

(2) The total piece counter

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(3) The operating state of the machine. The states are displayed according to the configuration in the following faceplate.

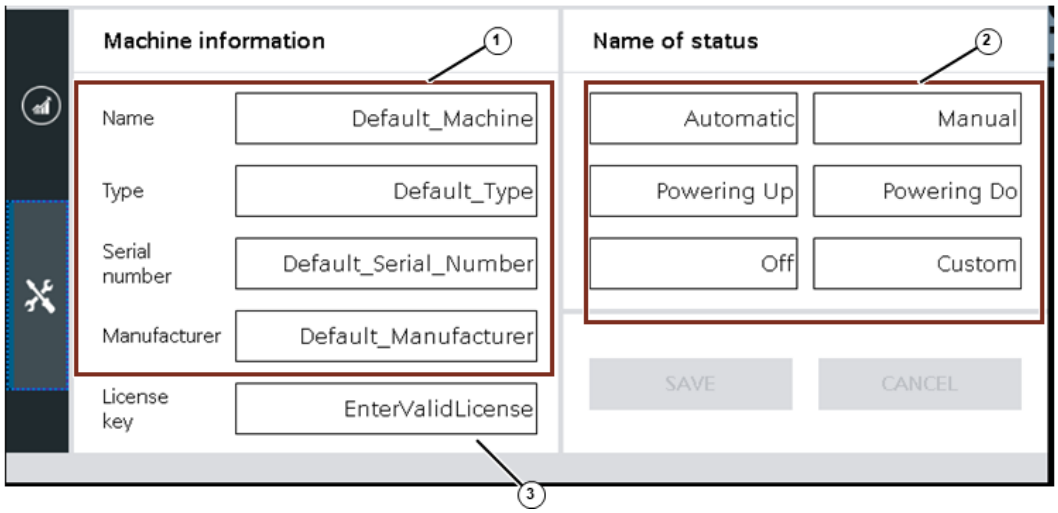
(4) The state of the energy efficiency monitor module.

a. State = 740A ➔ No valid license stored, device is in demo mode for four hours and then stopped.

b. Error = Red ➔ There is an error in the block. The state provides more detailed information about the cause of the error.

Configuration of the machine information

Figure 2-38 Overview of machine information



(1) General information about the machine. Used only for visualization or identification in EEM reports. Changes, as well as the standard values, have no influence on the functioning of the EEM.

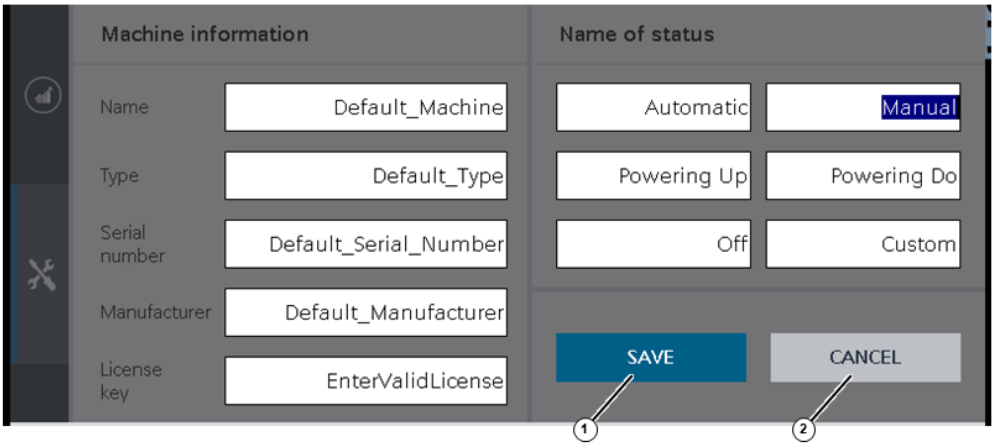
(2) The names of the individual operating states. Also serve exclusively for visualization. The states are based on different numerical values, which can be understood in the following order in this visualization:
1 – 2
3 – 4
5 – 6

(3) To switch the demo mode in the Energy Efficiency Monitor, the license key must be entered in plain text in this field.

As soon as the entry in one of the I/O fields is completed, an overlay is displayed. This only allows input into other I/O fields. Afterwards, the changes made can either be saved or deleted.

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Figure 2-39 Configuration of the machine information



(1) The entered changes are saved in the EEM and the previously existing values are overwritten.

(2) The processing is cancelled and the previous values are restored.

2.3.3 Faceplate "Fp_EEM_Measurement_Control"

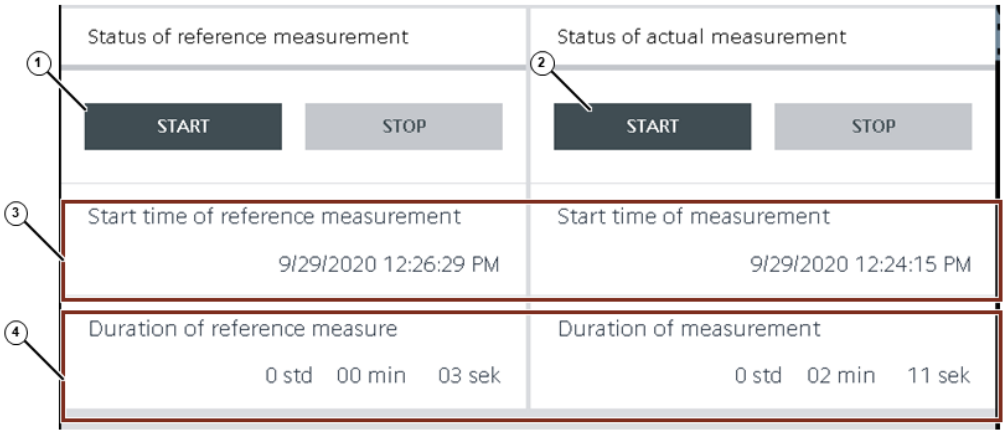
In the Energy Efficiency monitor, it is possible to record the average consumption of the machine per state over a certain period of time and then compare it with a reference measurement carried out beforehand. This allows the early detection of excess consumption in the machine or a need for maintenance and the verification of efficiency measures. With the following faceplate, these measurements can be checked.

Properties of the faceplate

- Size (W x H): 800 x 342 pixels
- Interface:
  - EEM_Measurement (typeEEMHmiMeasurement)

Faceplate without active measurement

Figure 2-40 "Fp_EEM_Measurement_Control" without active measurement



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(1) When the button is pressed, a new reference measurement is started and the data of the previous reference and actual measurement are deleted.

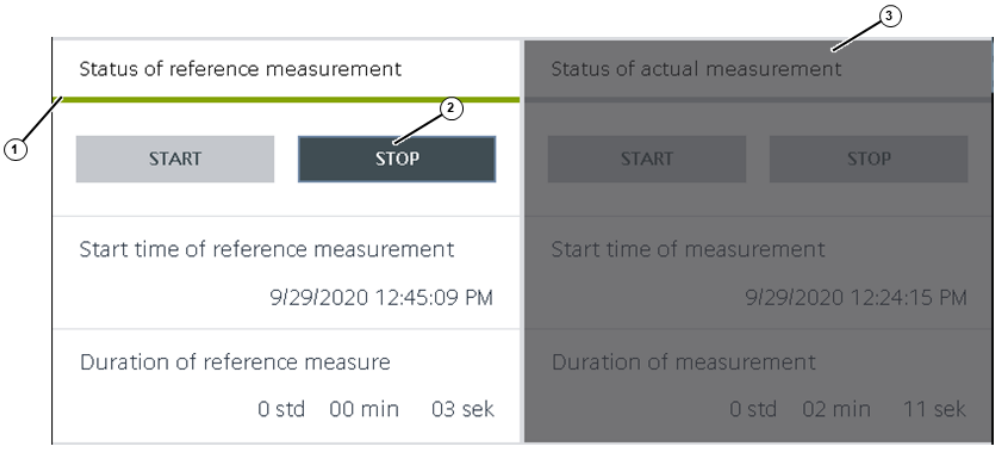
(2) When the button is pressed, a new actual measurement is started. Only the values of the previous values are deleted, the values of the reference measurement remain unchanged.

(3) Start times of the reference measurement and the last actual measurement

(4) Duration of the reference measurement and the last actual measurement

Faceplate with active reference measurement

Figure 2-41 "Fp_EEM_Measurement_Control" with active reference measurement



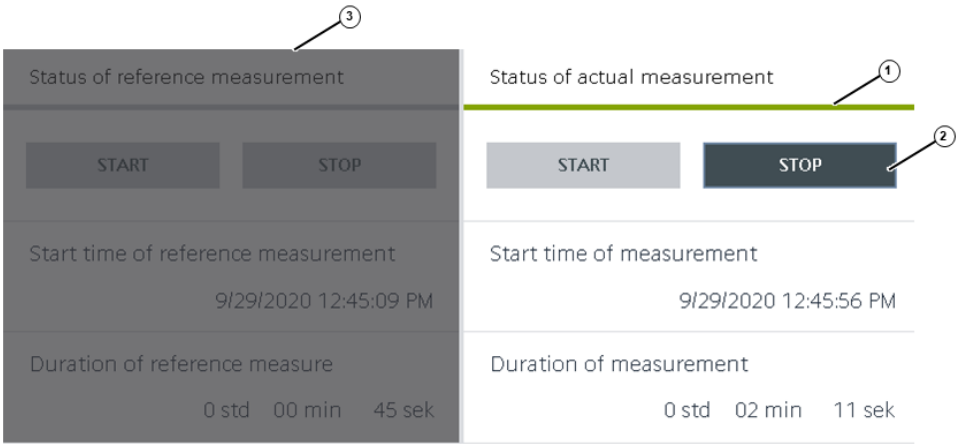
(1) The green bar indicates an active reference measurement. If the measurement is not active, it turns gray.

(2) When the button is pressed, the reference measurement is stopped and the recorded data is available.

(3) The transparent overlay appears when the reference measurement is active.

Faceplate with active actual measurement

Figure 2-42 "Fp_EEM_Measurement_Control" with active actual measurement



(1) The green bar indicates an active actual measurement. If the measurement is not active, it turns gray.

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(2) When the button is pressed, the actual measurement is stopped and the recorded data is available.

(3) The transparent overlay appears when the actual measurement is active.

2.3.4 Faceplate "Fp_EEM_Measurement_Point_Details"

In order to obtain dedicated information on the individual measurement points, it is possible to display them with the aid of a faceplate. In order to keep the number of HMI power tags used within limits, the tags required to display the relevant information were mapped only once in WinCC. Using the navigation bar at the bottom of the faceplate, it is possible to switch the displayed measurement point. The structure is then multiplexed in the PLC program.

Three different views can be selected in the faceplate:

- Results of the last actual and reference measurement or their difference
- Energy efficiency information of the measurement point, e.g. EnPI (Energy Performance Indicator), actual value, counter value, etc.
- Subsequent configuration of the measurement point

The different views can be switched using the left navigation bar.

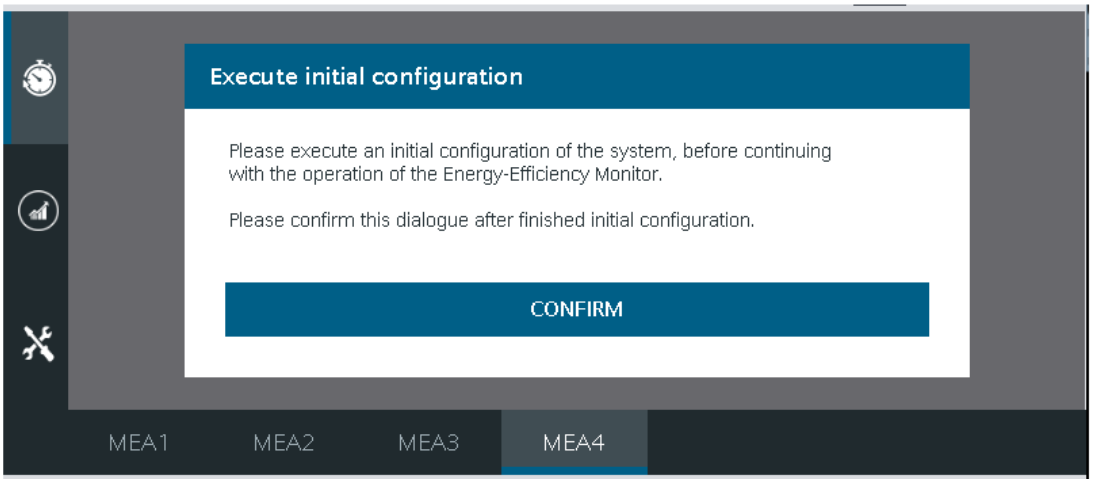
Properties of the faceplate

- Size (W x H): 800 x 342 pixels
- Interface:
  - Machine_Information (typeEEMHmiMachine)
  - MeasurementPoints_Details (typeEEMHmiMeasurementPointsDetails)

Faceplate before initialization

Before the first configuration, the information of all measurement points must be configured initially. Once this configuration has been carried out, the dialog shown below can be confirmed and the internal functions of the EEM envelope block start working.

Figure 2-43 "Fp_EEM_Measurement_Point_Details" before initial configuration



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Faceplate with activated measurement result view

After the data has been saved using the Faceplate "Fp_EEM_Measurement_Control", a reference and an actual measurement was carried out, the results can then be viewed here. The results are shown for the operating states 1 – 6, the measurement points can be switched as described using the navigation bar at the bottom of the screen.

Figure 2-44 "Fp_EEM_Measurement_Point_Details" with active measurement result view



(1) The names of the states ascending from 1 – 6, as configured in the Faceplate "Fp_EEM_Machine_Information".

(2) Graphical representation of the differences between the last actual and reference measurement. Differences greater than one percent are highlighted.

   a. Green ➔ The difference between reference and actual measurement is negative. This means that the average consumption of the measurement point in this state has decreased.

   b. Orange ➔ The difference between reference and actual measurement is positive. This means that the average consumption of the measurement point in this state has increased.

(3) The numerical values of the average consumption of the last reference and actual measurement per state.

(4) The numerical value of the difference between the last actual and reference measurement. Differences greater than one percent are highlighted (as described in 2).

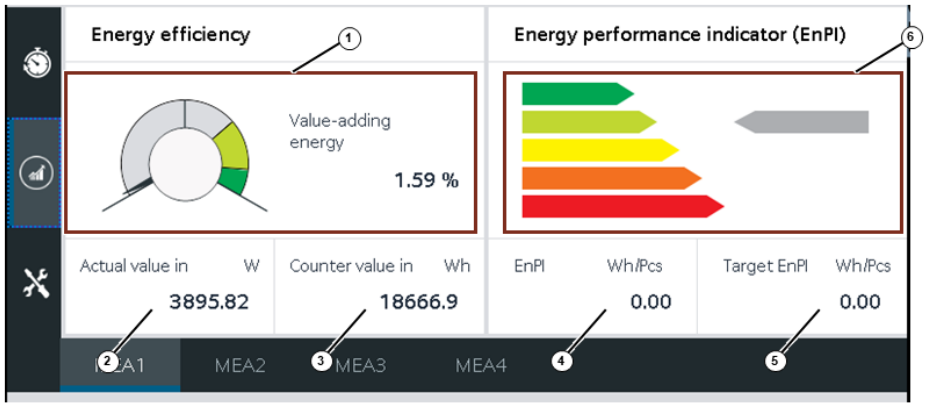
(5) With this value, the scale of the bar chart can be adjusted.

Faceplate with active Energy Efficiency view

Each measurement point contains additional information on energy efficiency. These values are continuous and do not depend on the results of the actual and reference measurements.

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Figure 2-45 "Fp_EEM_Measurement_Point_Details" with active Energy Efficiency view



(1) The percentage of consumption that is consumed in value-adding operating states. The allocation of which states should be included in the calculation can be configured in the Faceplate "Fp_EEM_EnPI_Configuration" .

(2) The actual value of the measurement point.

(3) The counter value of the measurement point.

(4) The EnPI (Energy Performance Indicator) of the measurement point. This is calculated in consumption per piece produced. As already described for the proportion of value-added energy, the states whose consumption must be considered in the calculation can be configured in the Faceplate "Fp_EEM_EnPI_Configuration" .

(5) The user's specification or expectation for the consumption per unit of this metering point. This value is used as a reference for the Energy Efficiency display shown in 6. The value can be set in the Faceplate "Fp_EEM_EnPI_Configuration" can be configured.

(6) Graphical representation of the relationship between current EnPI and target EnPI. The gray indicator shows the ratio in a percentage (current EnPI / target EnPI). The color scale on the left side can be read as follows:

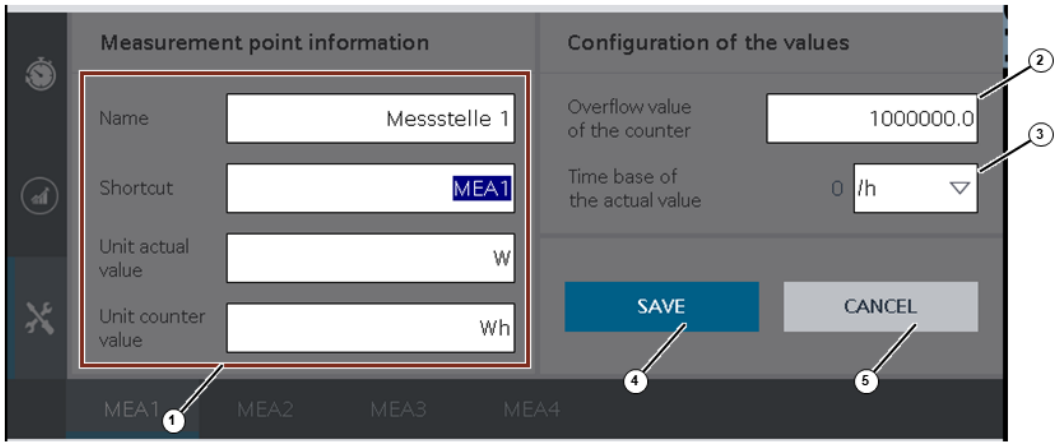
a. Dark green <= 90% ➔ current EnPI is better than specified in the target
b. Light green = 100% ➔ current and target EnPI identical
c. Yellow = 110% ➔ current EnPI is worse than expected
d. Orange = 120%
e. Red >= 130%

Faceplate with active view measurement point configuration

In order to make the application configurable and adaptable at runtime, the faceplate "Fp_EEM_Measurement_Point_Details" provides a view for subsequent configuration of the measurement points. This configuration should be carried out initially before starting the application (confirmation of the initial dialog for initial configuration).

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Figure 2-46 "Fp_EEM_Measurement_Point_Details" with active configuration view



(1) Configuration for nomenclature of the measurement points as plain text. These values have no effect on the calculations in the EEM and are only used for visualization purposes.

(2) Value for an internal counter overflow. As soon as this value is reached in the counter, it starts counting again from the beginning.

(3) Time base on which the actual value should be calculated. Examples:

   a. Watt ➔ Hourly basis (/h)

   b. L/min ➔ Minute basis (/min)

(4) The entered changes are saved in the EEM and the previously existing values are overwritten.

(5) The processing is cancelled and the previous values are restored.

2.3.5 Faceplate "Fp_EEM_EnPI_Configuration"

In order to be able to adapt the calculations of the energy indicators individually to the application, it is possible to select the operating states of the system relevant for the calculation separately. The user can select the states for the calculations separately:

- Relevant states for the calculation of the EnPI
- Relevant states for the calculation of the availability of the machine as well as the share of the value-added energy of the measurement points

In addition, it is possible to store reference values for the EnPI and the share of value-added energy per metering point. In the visualization, these serve as a reference point for the user to compare the planned performance with the current performance of the machine (see Faceplate "Fp_EEM_Measurement_Point_Details")

Key faceplate figures

- Size (W x H): 800 x 342 pixels
- Interface:
  - EnPI_Configuration (typeEEMHmiEnPIConfiguration)
  - Machine_Information (typeEEMHmiMachine)

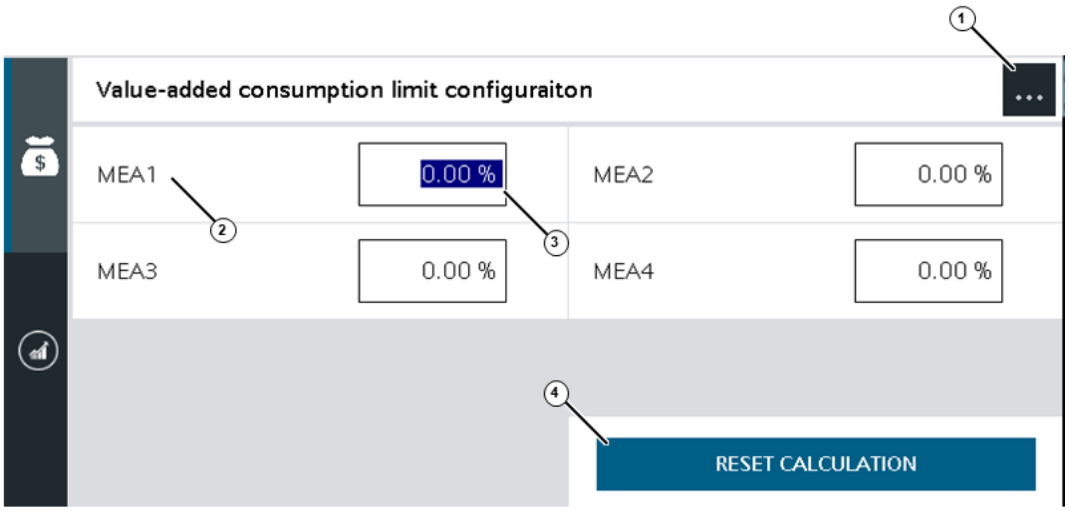
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- MeasurementPoints_Detail (typeEEMHmiMeasurementPointsDetail)

Faceplate for configuring the target values for EnPI or for the share of value-added energy and availability

The faceplate offers the user two views: one for configuring the calculation for the EnPIs and the other for the share of value-added energy. Switching between views is done using the navigation bar on the left side of the screen. Only the measurement points that are stored in the PLC are displayed.

Figure 2-47 "Fp_EEM_EnPI_Configuration" to configure the target values



(1) Depending on the activated view, the dialog for selecting the relevant operating states is displayed when pressed.

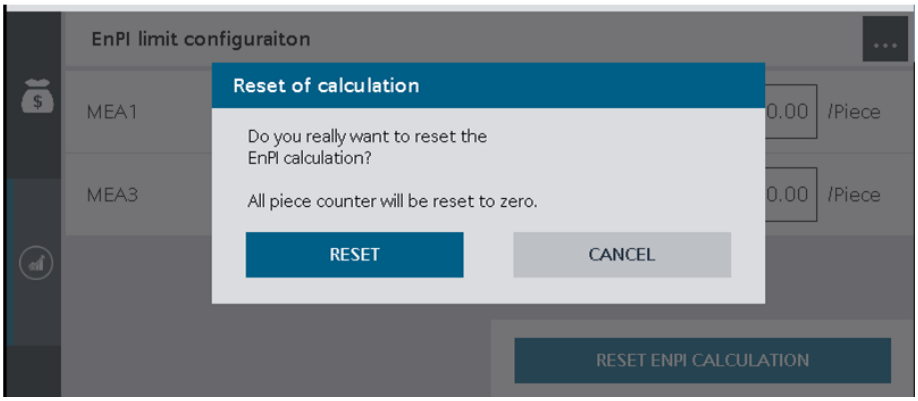
(2) Abbreviation of the measurement point name.

(3) Setting a reference value either for the EnPI or the share of value-added energy in total consumption.

(4) Opens the dialog for resetting the EnPI values or the energy meters, depending on the activated view. After resetting the respective value, the current values are taken as new reference values. This enables the user to compare in retrospect whether the machine has improved or deteriorated in the long term in terms of the EnPI or the proportion of value-added energy.

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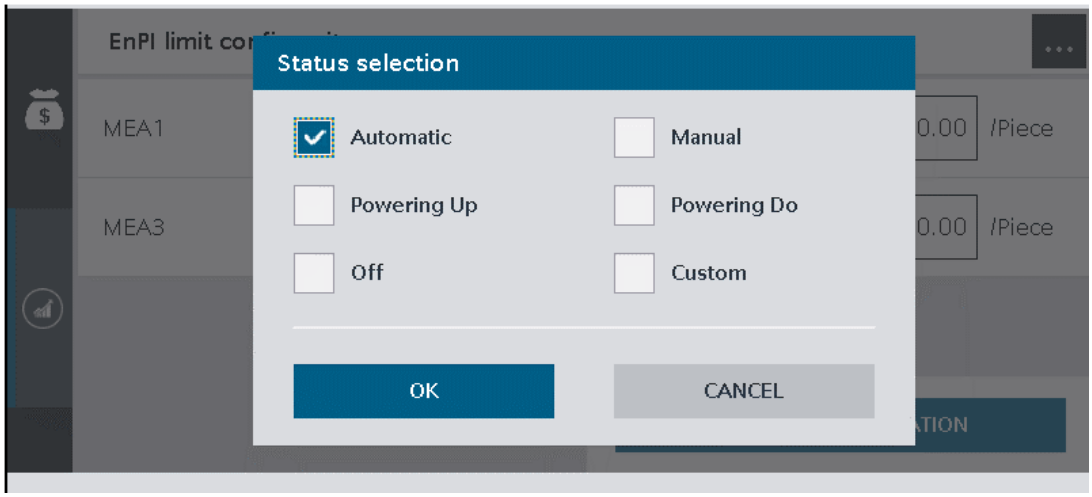
Figure 2-48 "Fp_EEM_EnPI_Configuration" with dialog for resetting the values



Dialog for selecting the relevant states for the calculation

The following Figure shows the dialog for selecting the operating states. When opening the dialog, the currently selected states are marked in the checkboxes. To select or deselect an operating state, the respective checkbox must be activated. The selection is then confirmed with the "OK" button or cancelled with the "Cancel" button.

Figure 2-49 "Fp_EEM_EnPI_Configuration" with dialog for selecting the relevant operating states



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2.3.6 Faceplate "Fp_EEM_Additional_Information"

The Energy Efficiency monitor offers additional functions which the user can activate and configure as required using a projected faceplate. These functionalities are:

- Creation of a CSV file (reports), which exports the results of the last reference and actual measurement per measurement point
- Establish a connection to an Energy Manager PRO instance, which can retrieve and display the relevant data from the PLC regarding the EEM.

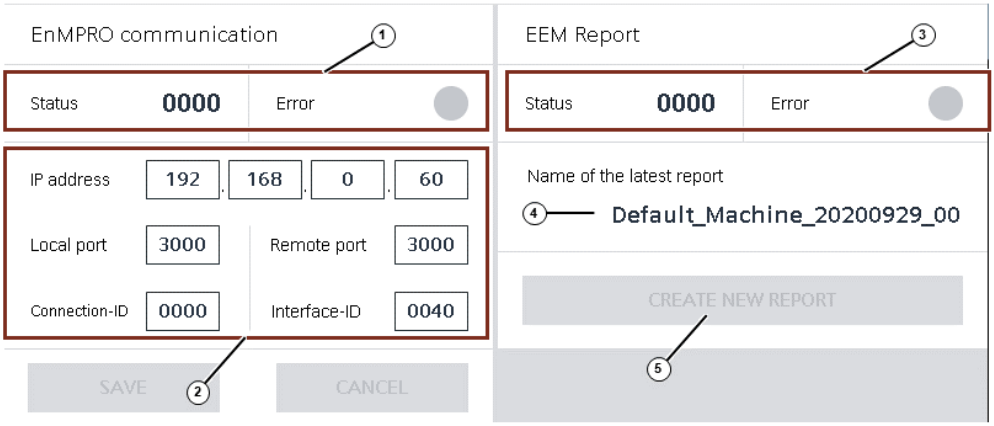
Properties of the faceplate

- Size (W x H): 800 x 342 pixels
- Interface:

- EEM_Report (typeEEMHmiReport)
- EnMPRO_Communication (typeEEMHmiEnMProCommunication)

Faceplate "Fp_EEM_Additional_Information" for configuration of the additional functions of the energy efficiency monitor

Figure 2-50 "Fp_EEM_Additional_Information" for configuring the additional functions of the EEM



(1) State output and error indicator of the internally called block "EnS_EEm_ComEnMPRO" for data exchange between the EEM instance and the Energy Manager PRO.

(2) Connection settings for the connection between EEM and Energy Manager PRO. When the input into one of the EA fields is completed, an overlay is activated (see screenshot below). The exact values for configuration can be looked up in the documentation of the "EnS_EEm_ComEnMPRO" block.

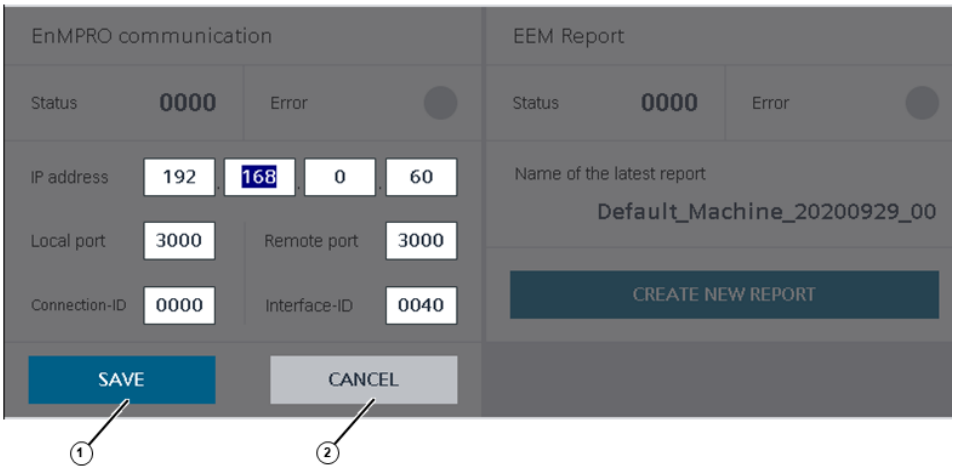
(3) State output and error indicator of the internally called block "EnS_EEm_Report" for creating an energy efficiency report.

(4) Name of the last EEM report created. The nomenclature is made up as follows: Machine name + time stamp + sequential number per day

(5) When pressed, a new energy efficiency report is generated with the currently available information.

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Figure 2-51 "Fp_EEM_Additioanl_Information" with activated overlay



(1) The entered changes are saved in the EEM and the previously existing values are overwritten.

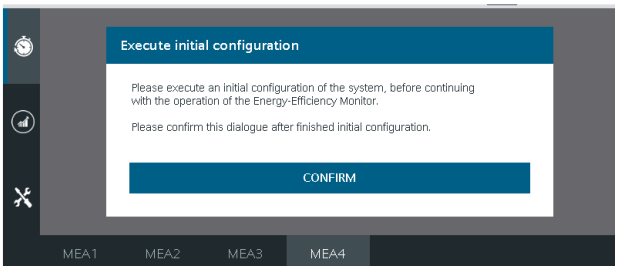
(2) The processing is cancelled and the previous values are restored.

2.4 Initial Configuration

2.4.1 Initial Configuration 9"

As with Runtimestart when opening the "Measuring Point Details" or the "Machine Information", an initial configuration of the system must first be made before the dialog (see Figure 2-52) is confirmed. With the confirmation, the calculation of the energy efficiency of the program starts.

Figure 2-52



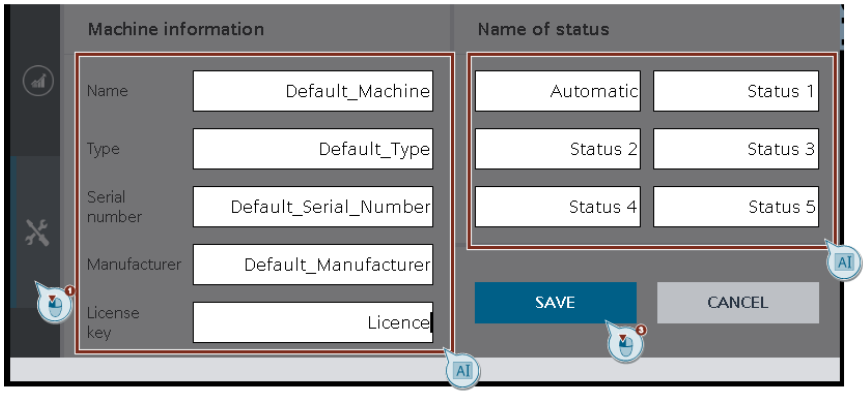
Machine initial configuration

Proceed as follows for the initial configuration. To do this, open the "MachineInformation" image in which the faceplate "Fp_EEM_Machine_Information" is located (see Figure 2-53):

1. Click the symbol.
2. Enter the machine information and state names.
3. Confirm this with Save.

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Figure 2-53

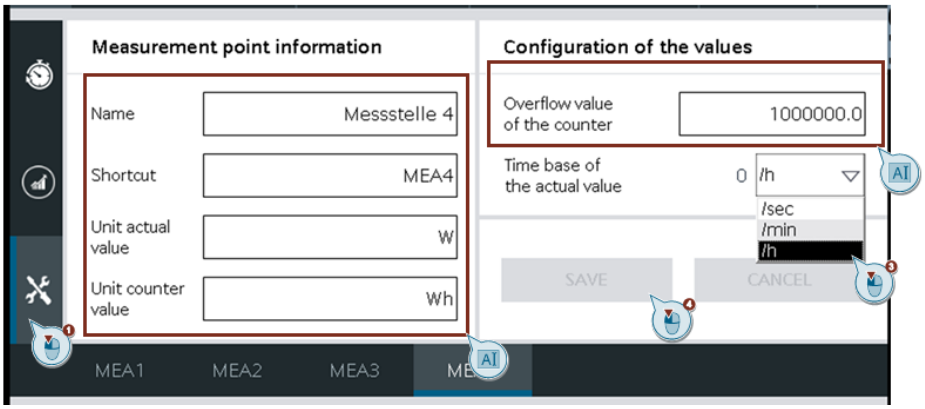


Initial configuration of measurement points

Proceed as follows for the initial configuration. To do this, open the image "MeasurementPoint_Details" where the faceplate "Fp_EEM_Measurement_Point_Details" is located (see Figure 2-54):

1. Click the symbol.
2. Enter the measurement points information and overflow value for the counter.
3. Enter the time base of the actual value.
4. Confirm these values with Save.

Figure 2-54



Note Repeat the configuration for all further measurement points.

Initial configuration of value-added energy

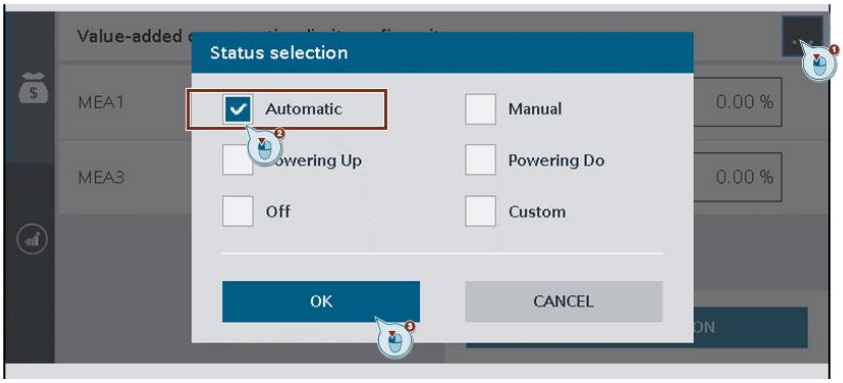
Check the states that are responsible for productive energy of the machine. In most cases, this is user-specific. In this application example, the state "Automatic" is selected as the productive state.

1. Click the symbol under "Configuration".

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2. Select the productive state of your machine ("Automatic").
3. Confirm your selection with "OK".

Figure 2-55

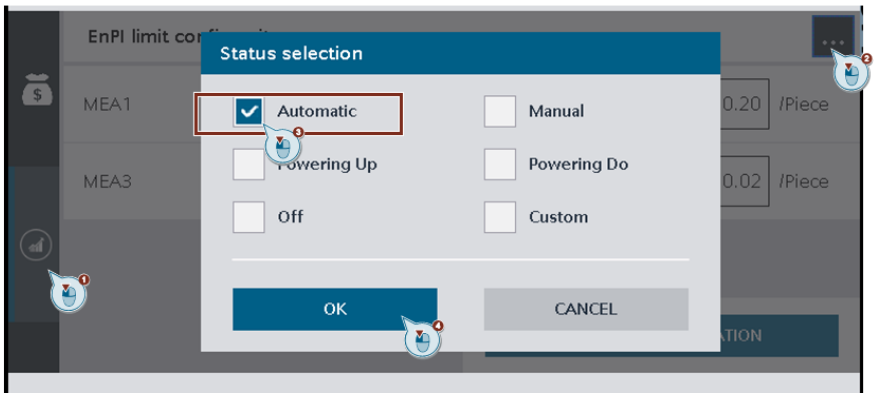


Initial configuration of EnPI

Check the states that are responsible for productive EnPI of the machine. In most cases, this is user-specific. In this application example, the "Automatic" state is selected as the productive state (see Figure 2-56).

1. Click the icon to go to the EnPI configuration.
2. Click the symbol.
3. Select the productive state of your machine ("Automatic").
4. Confirm your selection with "OK".

Figure 2-56



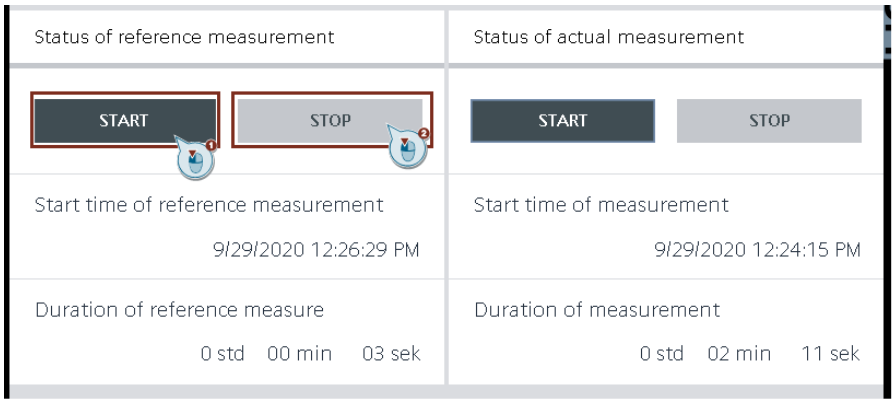
Performing reference measurement

When the machine is completely set up, a reference measurement can first be made in the "Measurement" screen (see Figure 2-57).

1. Click on "Start".
2. After a certain time, click "Stop" to end the reference measurement.

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Figure 2-57

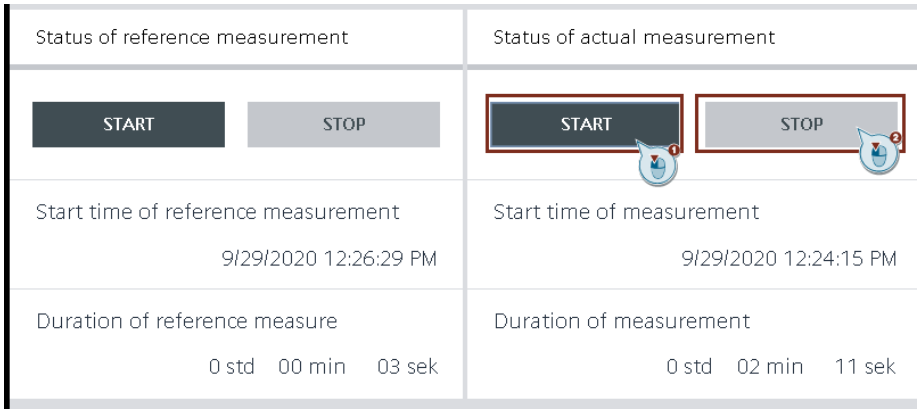


Performing actual measurement

Once a reference measurement has been made, an actual measurement can be made in the "Measurement" screen (see Figure 2-58).

1. Click on "Start".
2. After a reasonable time, click "Stop" to end the reference measurement.

Figure 2-58



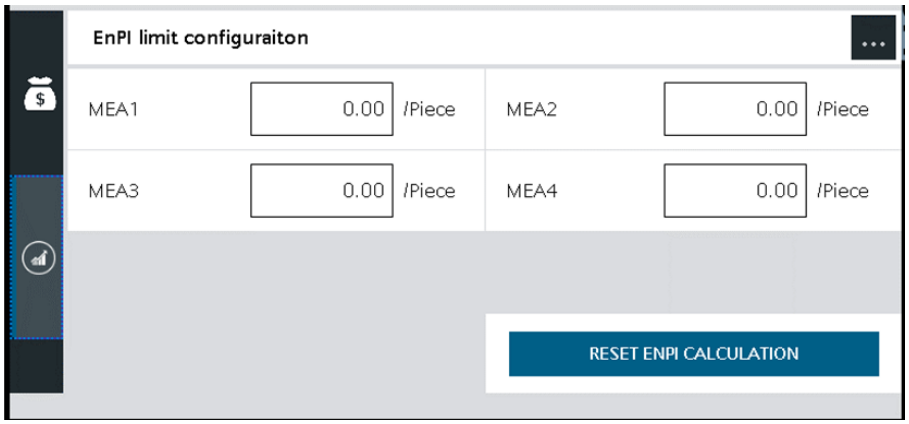
EnPI limit configuration

If the machine has been running for a certain time and the EnPI has narrowed down to a value, it is useful to reset the EnPI. When resetting, the piece counters are reset and the current EnPI values are used as reference (see Figure 2-59).

This means that when resetting ("Reset Calculation"), the current values are transferred to the I/O fields. Now a comparison can be made in the "Details" screen under the symbol.

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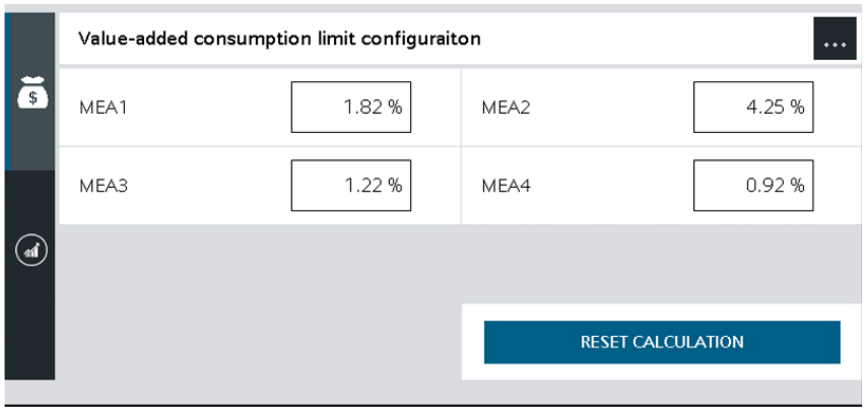
Figure 2-59



Value-added energy limit configuration

After setting up the machine, it is advisable to reset the value-adding energy. When resetting, the energy and cycle counters are reset to zero and the current values are used as target values (see Figure 2-60) This means that when resetting ("Reset Calculation"), the current values are transferred to the I/O fields.

Figure 2-60



The configured values have an effect on the faceplate "Fp_EEM_Measurement_Point" and can be followed in the overview.

2.4.2 Initial Configuration 12"

As is shown in Runtimestart when the "Machine Information" screen is opened (see Figure 2-61), an initial configuration of the system must first be made before the dialog is confirmed. With the confirmation, the calculation of the energy efficiency of the program starts.

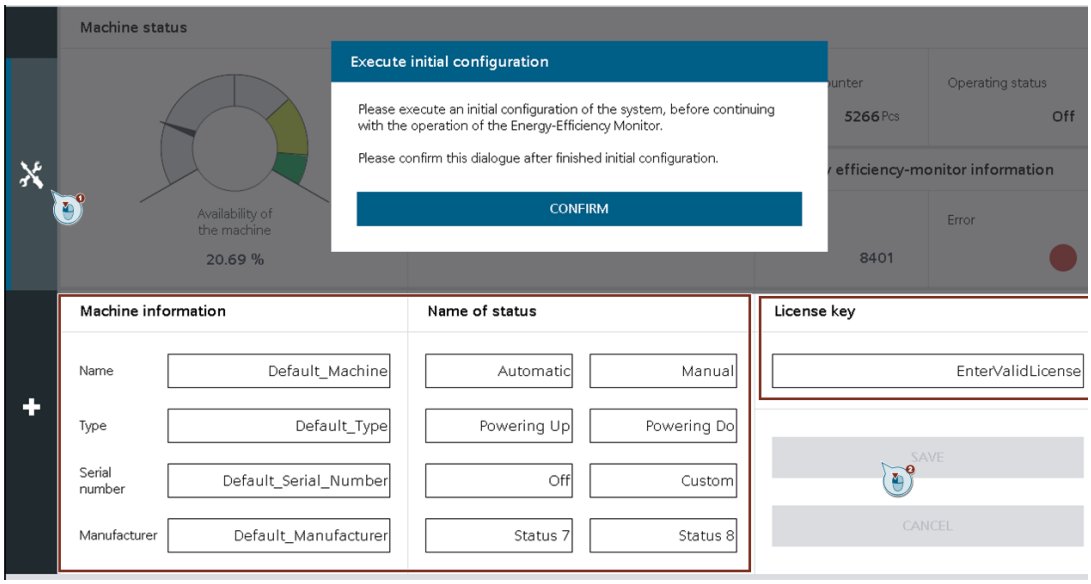
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Machine initial configuration

Proceed as follows for the initial configuration. To do this, open the "Machine Information" screen, which contains the faceplate "Fp_EEM_Machine_Information_1280x662":

1. Click the icon and enter the machine information, state name, and license key.
2. Confirm this with Save.

Figure 2-61



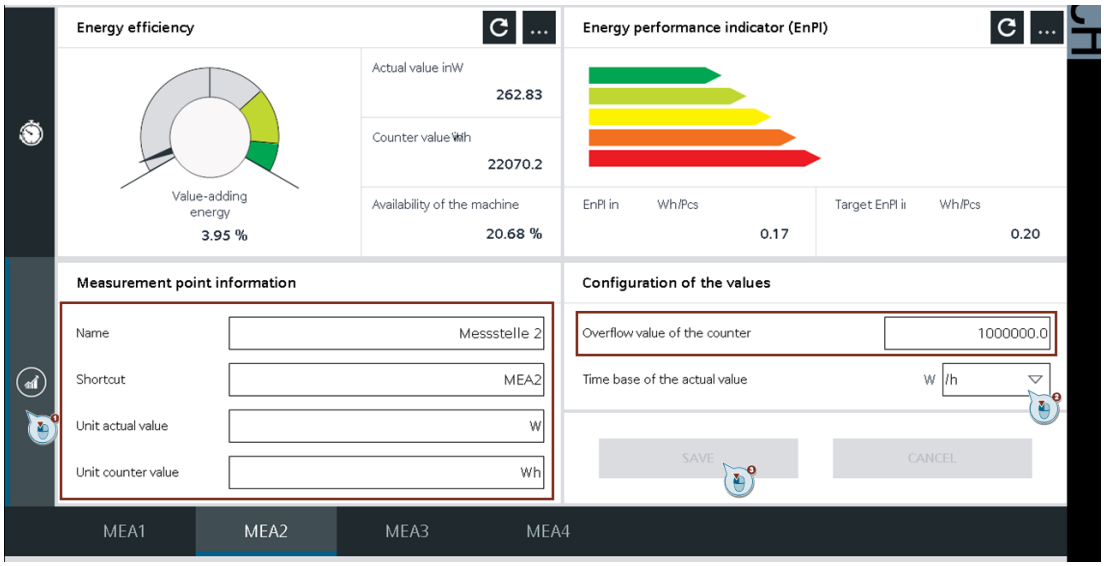
Initial configuration of measurement points

Proceed as follows for the initial configuration. To do this, open the screen "MeasurementPoint_Details", which contains the faceplate "Fp_EEM_Measurement_Point_Details_1280x662" (see Figure 2-62):

1. Click the icon and enter the measurement points information and overflow value for the meter.
2. Select the time base of the actual value.
3. Confirm these values with Save.

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Figure 2-62



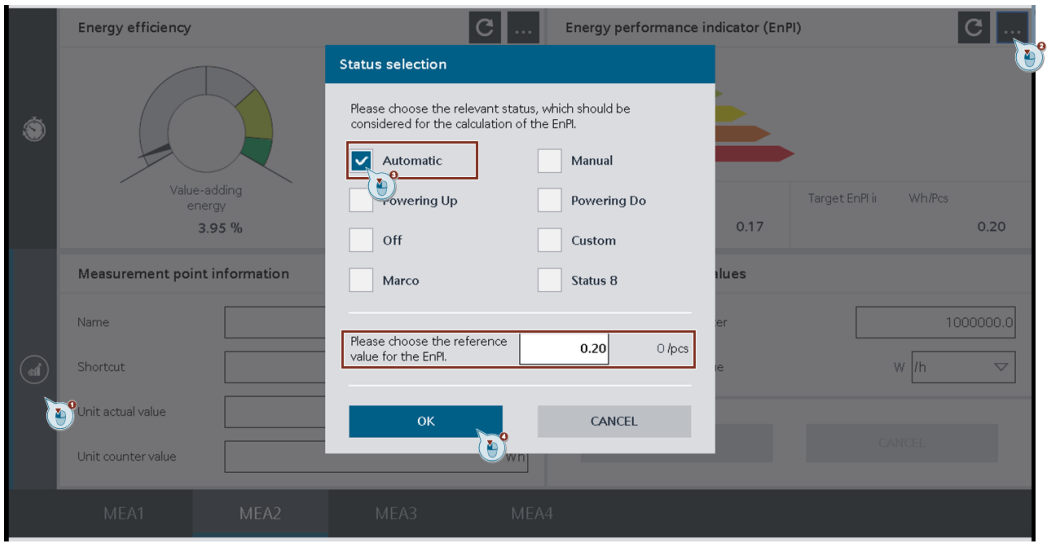
Initial configuration of EnPI

At this point, it is necessary to check the states that are responsible for productive EnPI of the machine. In most cases, this is user-specific. In this application example, the state "Automatic" is selected as the productive state (see Figure 2-63).

1. Click the icon to go to the EnPI configuration.
2. Click the ... symbol.
3. Select the production state of your machine ("Automatic") and enter a reference value for the EnPI if required.
4. Confirm your selection with "OK".

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Figure 2-63



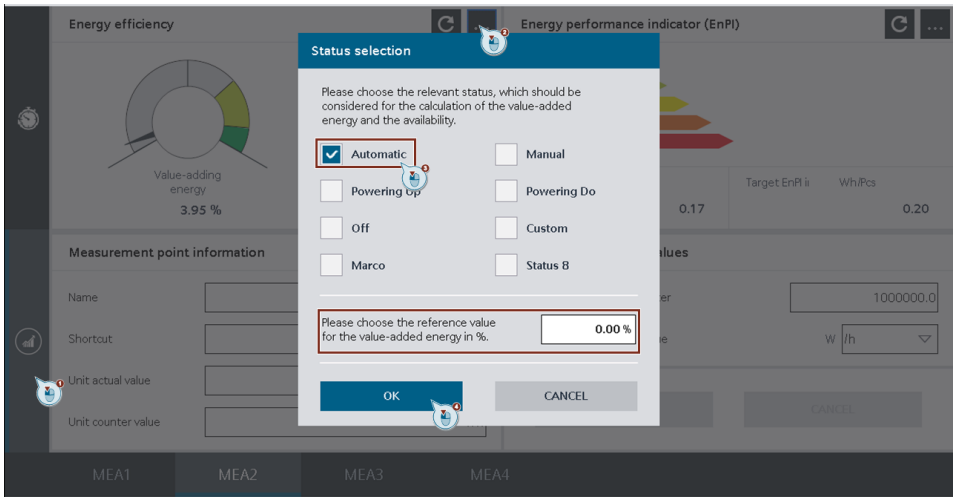
Value-added energy configuration

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At this point, it is necessary to checkmark the states that are responsible for value-adding energy of the machine. In most cases, this is user-specific. In this application example, the "Automatic" state is selected as the productive state (see Figure 2-64).

1. Click the icon to go to the configuration.
2. Click the ... symbol.
3. Select the productive state of your machine ("Automatic") and enter a reference value for the EnPI if required.
4. Confirm your selection with "OK".

Figure 2-64



Performing reference measurement

When the machine is completely set up, a reference measurement ("Reference Measurement") can first be made in the "Measurement_Point_Details" screen by clicking the icon (see Figure 2-65).

1. Click on "Start".
2. After a reasonable time, click "Stop" to end the reference measurement.

Figure 2-65



Performing actual measurement

If a reference measurement has been made, an actual measurement can be made in the "Measurement_Point_Details" screen by clicking the icon (see Figure 2-66).

1. Click on "Start".
2. After a reasonable time, click "Stop" to end the reference measurement.

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Figure 2-66

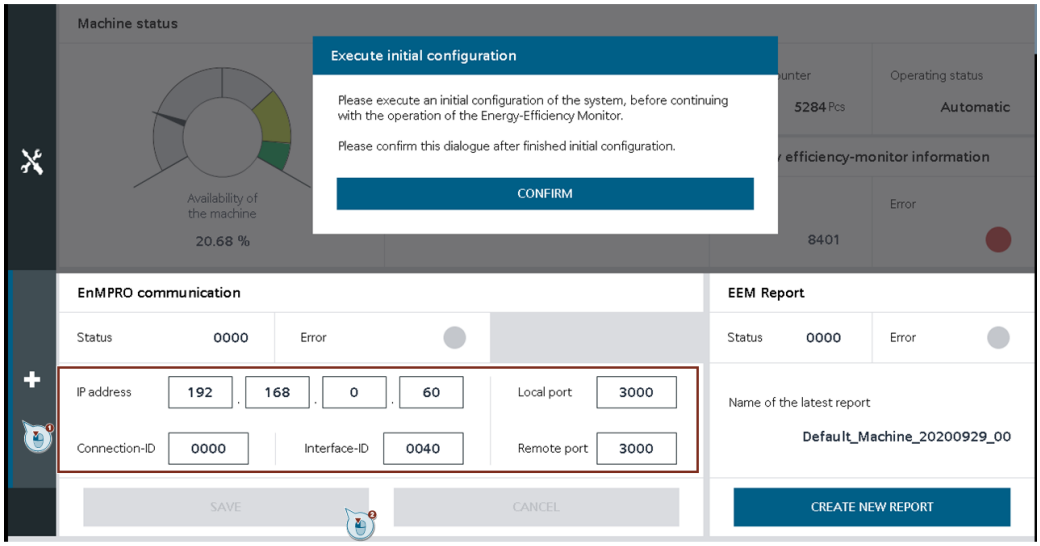


EnMPRO connection

If you want to connect the Energy Manager Pro to your application, proceed as follows (see Figure 2-67):

1. In the "Machine Information" screen ("Fp_EEM_Machine_Information_1200x662"), click the ✚ symbol and enter the necessary connection information.
2. Confirm the connection configuration to the EnMPro with "Save".

Figure 2-67



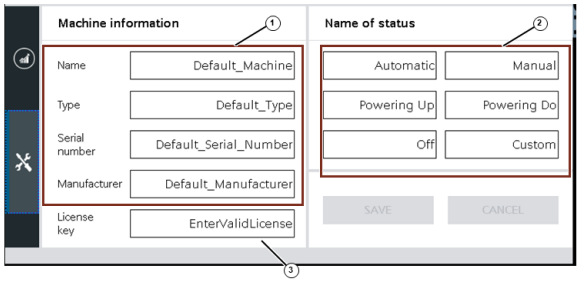
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2.5 Error Handling

Check the following points in case of errors:

- Valid license under license key (3) (see Figure 2-68)

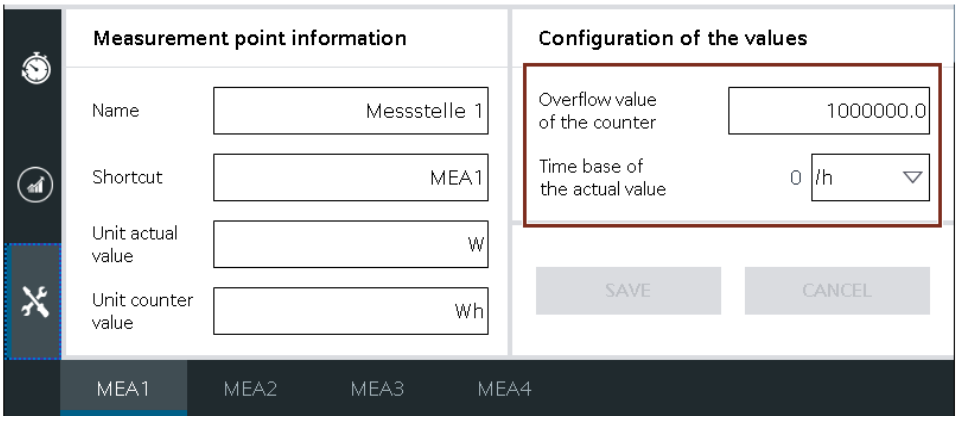
Figure 2-68



Note If no valid license key was entered, the block with the code "740A" is in demo mode and the CPU must be restarted after 4h.

- Correct overflow value and correct time base entered (see Figure 2-69)

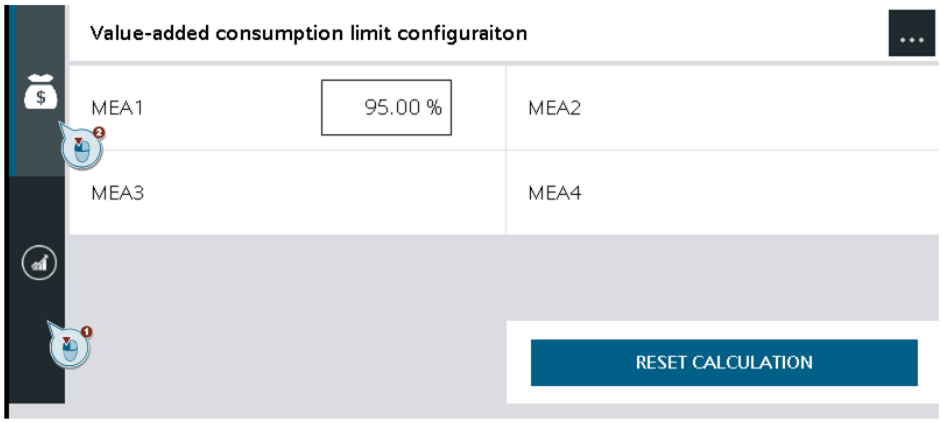
Figure 2-69



If the EA fields for the measurement points are not displayed, make a short page change as described in Figure 2-70.

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Figure 2-70



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3 Using the Sample Project

3.1 Requirements

- SIMATIC CPU 1516 is available
- SIMATIC HMI Comfort Panel TP900 is created and connected to the S7 controller.
- If necessary: SIMATIC HMI Comfort Panel TP1200 is connected to the S7 controller.
- The sample project was downloaded from the article page and opened in the TIA Portal.

3.2 S7 Controller

Compile the SIMATIC CPU 1516 and load the project into the PLC.

3.3 9" Comfort Panel

Compile the Comfort Panel and load the project onto the panel.

3.3.1 Operation

Click the lower middle part of the screen.

Now you can use the "Slide In Navigation Bar" to navigate to the different faceplates (see Figure 3-1).

Figure 3-1



3.4 12" Comfort Panel

Compile the Comfort Panel and load the project onto the panel.

3.4.1 Operation

Click the lower middle part of the screen.

Now you can use the "Slide In navigation bar" to navigate to the different faceplates (see Figure 3-2).

Figure 3-2



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4 Appendix

4.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

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support.industry.siemens.com

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- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts

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Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for iOS and Android:

support.industry.siemens.com/cs/ww/en/sc/2067

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4.2 Industry Mall



The Siemens Industry Mall is the platform on which the entire siemens Industry product portfolio is accessible. From the selection of products to the order and the delivery tracking, the Industry Mall enables the complete purchasing processing – directly and independently of time and location:
mall.industry.siemens.com

4.3 Links and literature

Table 4-1

No.	Subject
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to the article page of the application example https://support.industry.siemens.com/cs/ww/en/view/109753230

4.4 Change documentation

Table 4-2

Version	Date	Change
V1.0	10/2020	First edition

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