

Section 19

CREATING A FOUNDATION FIELDBUS STRATEGY BY USING DF62/DF63

Introduction

This section describes the strategy configuration by using the DF62 controller as bridge. The control loop is shown below:

PROJ_DF62

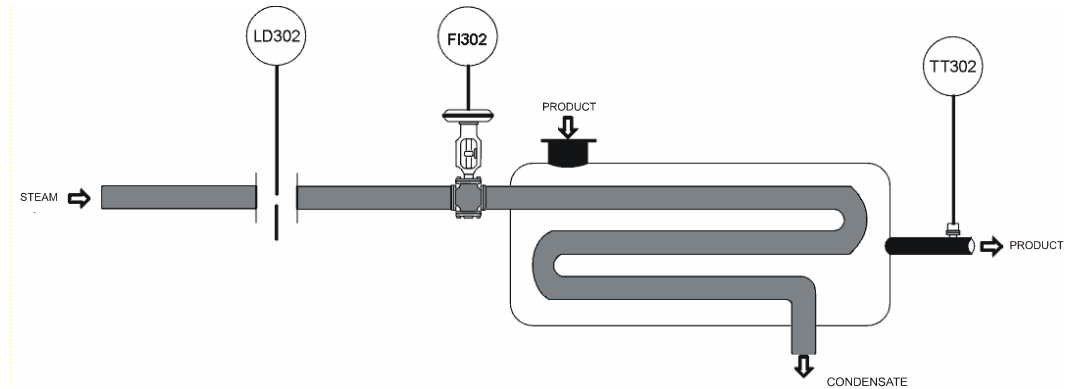


Figure 19. 1 - Example of temperature control process

The purpose of the process is to control the fluid output temperature (controlled variable) using steam flow rate (manipulated variable) to heat it. The fluid temperature will be sent to the master controller, where it will be compared to a temperature set point.

The master output would be the slave controller set point, which will control the steam flow rate to the heat exchanger.

NOTE

This strategy can also be done by using the DF63 controller.

Starting the Area

Step 1

It is possible to create, or edit, an area from the **Studio302**. In the **Studio302** interface select **Areas**. A window will appear listing all areas of database.

To create a new area from the **Studio302**, left-click inside the **Areas** window, then choose **New Area**.

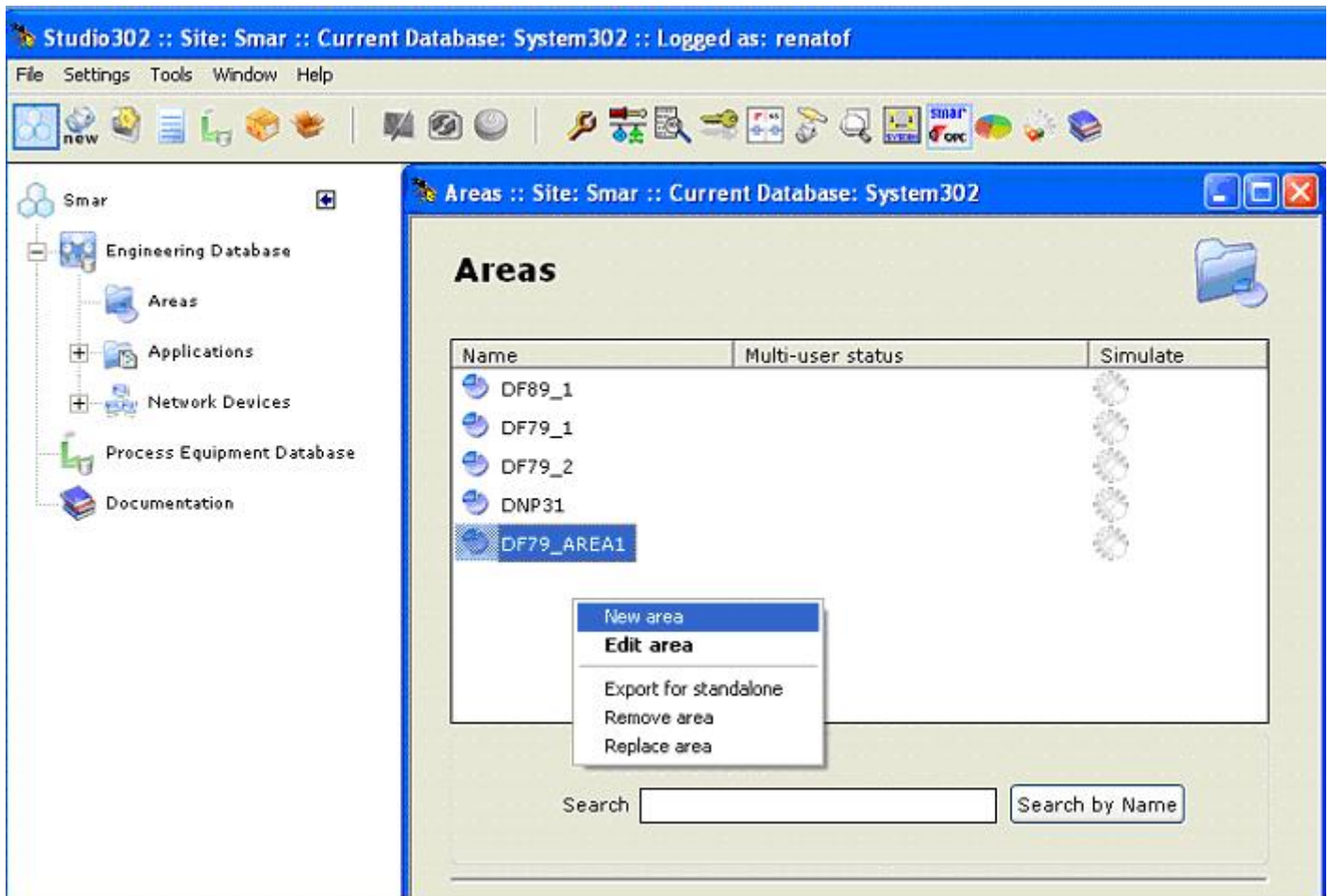



Figure 19.2 – Creating a new area

Another way to create a new area is from **Syscon**. Click the icon  in the **Studio302** toolbar.

To create a new area on **Syscon**, choose **File → New**, or through the toolbar, choose **New** button . The dialog box shows the areas options. Select **HSE Area** as shown in next figure:

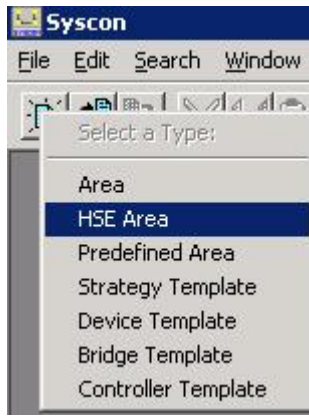


Figure 19. 3 – Options to create Syscon areas

After choosing the area type, it opens a window to the user give a name to the new area.



Figure 19. 4 – New area name

Type the name for the area in the **Area Name** box, and click **Ok**. For this example, it chooses **Proj_DF62** name.

A new window will appear. This window has:

- **Application** – Logical Plant. To insert control strategies into this part.
- **Fieldbus Networks** – Physical Plant. To add devices and function blocks to the area into this part.



Figure 19. 5 – Area divisions

Physical Plant Project

Step 2


In the main window, **Proj_DF62**, right-click the **Fieldbus Networks** icon, , to choose the Server. Choose **Communication Settings** option, or through the toolbar, choose **Communication→Settings**. The communication settings dialog box will open.



Figure 19.6 – Choosing the Server

Confirm if the **Smar.HSEOLEServer.0** option has already been selected. Otherwise, the user must select it, and then click **OK**.

Arranging the Fieldbus windows

Step 3


After selecting the Server for the area, click the  sign placed at left of the **New Fieldbus**. The HSE network will appear with a tag, for example, **HSE Network 1***. Right-click this item and choose **Expand** option. The Figure below shows the HSE network:



Figure 19.7 – Creating a HSE network

To arrange the screen, click the area window. So, choose **Window** menu on the **Syscon** toolbar, and then **Tile** option.

Adding the Bridge

Step 4

Right-clicking the **HSE Network 8**, it opens a dialog box to add new devices. Choosing **New** option, it is possible to select devices such as **Bridges**, **Controllers** and **Devices** for the area. For the aimed control, choose **Bridge** option. Confirm this choice observing the following figure.

* This number changes if another area was created before. When a new HSE area is created, this number increases.

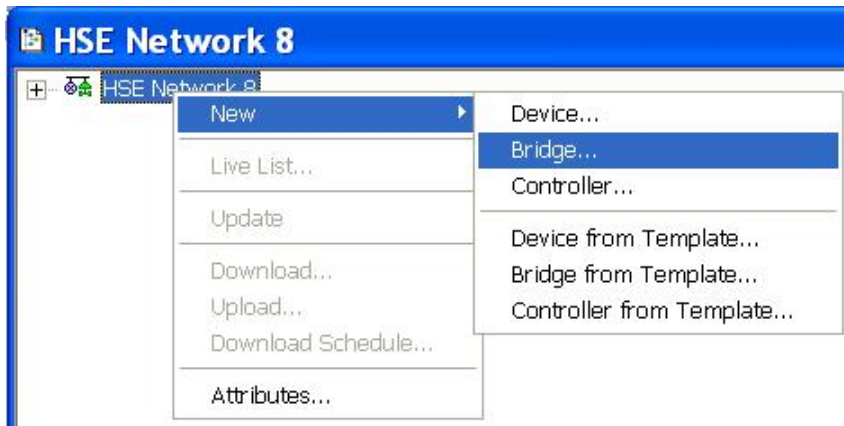


Figure 19. 8 – Choosing the Bridge

After selecting that option, it opens a window as shown in the next figure.

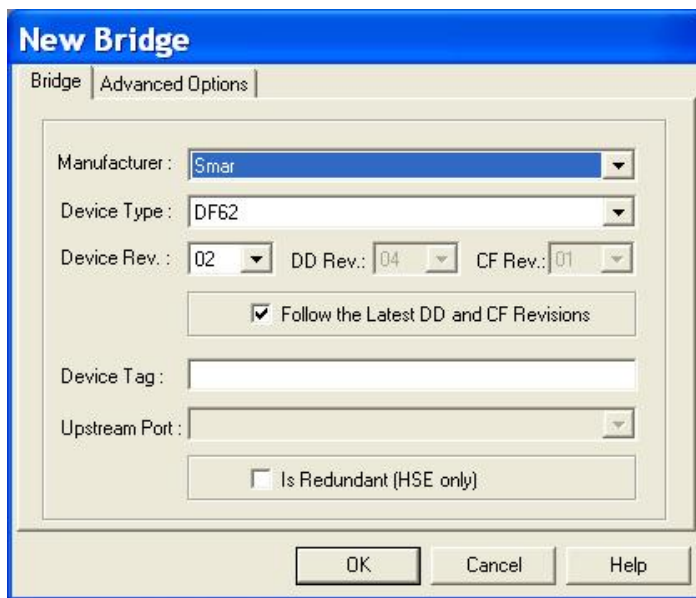


Figure 19. 9 – Setting the Bridge

Select the **DF62** device in the **Device Type** box. In the **Device Tag** box, enter **DF62** or another tag, and click **OK**.

IMPORTANT
<p>Not all characters are valid when naming the elements, so pay attention; The valid characters are: A-Z a-z 0-9 # { } [] () + -</p> <p>The invalid characters are: ~ ` ! @ # \$ % ^ & * = : ; , . < > ? / ' " \</p>

Return to the **HSE Network 8** window. Right-click the **Bridge** icon, **DF62**, and select **Attributes** item, as shown in the next figure:



Figure 19. 10 – Setting the bridge attributes

Thus, the bridge attributes can be seen and, if necessary, changes its tag. Click **Ok**. See the next figure.

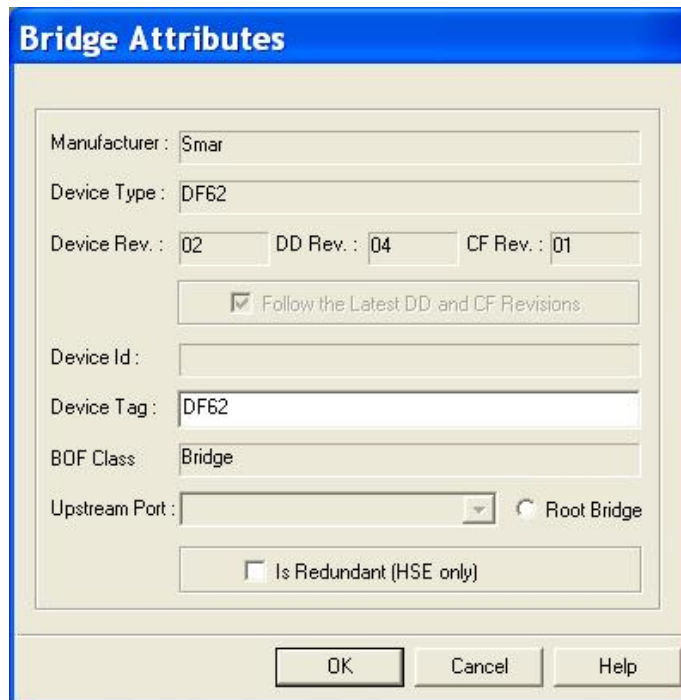


Figure 19. 11 – Bridge attributes

Adding Fieldbus Devices

Step 5

After adding the bridge, it is possible to insert the field devices. First, return to the **Proj_DF62** window and right-click the **DF62** bridge. To configure the DF62 channels, select **New Fieldbus** option. The following figure shows the Fieldbus channel creation:



Figure 19. 12 – Creating Fieldbus channels

When choosing **New Fieldbus** option, the dialog box to choose the channel type and name it with tags opens:

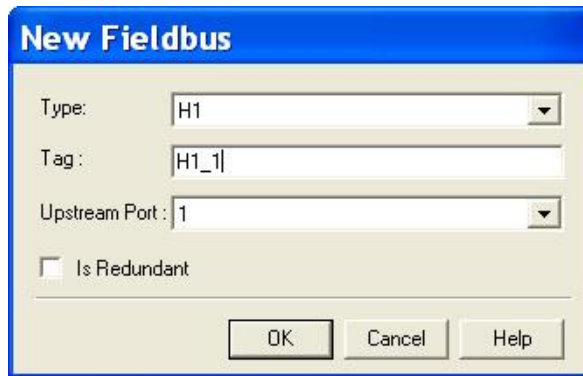


Figure 19. 13 – Attributing tags to the Fieldbus channels

Choose the fieldbus type and name it with a tag. If the user does not name it with a specific tag, the default tag will be *Fieldbus 1* (This number changes if another channel was created previously). To rename the fieldbus channel, right-click it, and then choose **Expand** item. When the Fieldbus window opens, right-click it and choose **Attributes** option. So, the user can rename the fieldbus channel.

Return to the **Proj_DF62** window. Right-click the fieldbus channel created and choose **Expand** option on the popup menu. The figure below shows the fieldbus channel:



Figure 19. 14 – Creating the Fieldbus channel

In the **H1_1** window, right-click **H1_1** to choose **New→Device**. The next figure shows adding devices on the network:

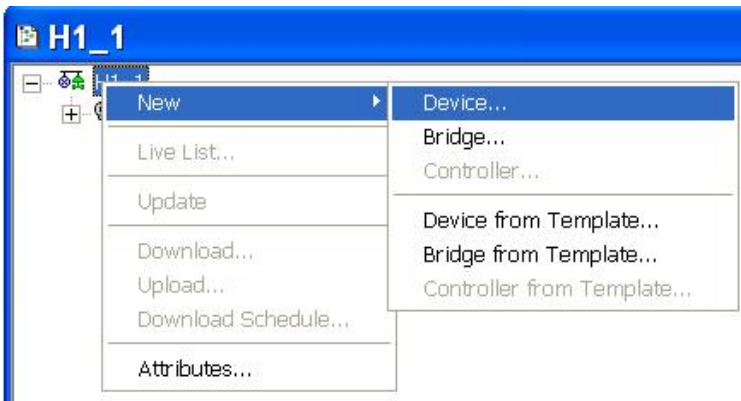


Figure 19. 15 – Adding devices in the Fieldbus channel

The dialog box to select and name the devices opens. Choose **SMAR** in the **Manufacturer** box, and then select **TT302** in the **Device Type** box. Name the device with a tag, and click **OK**:

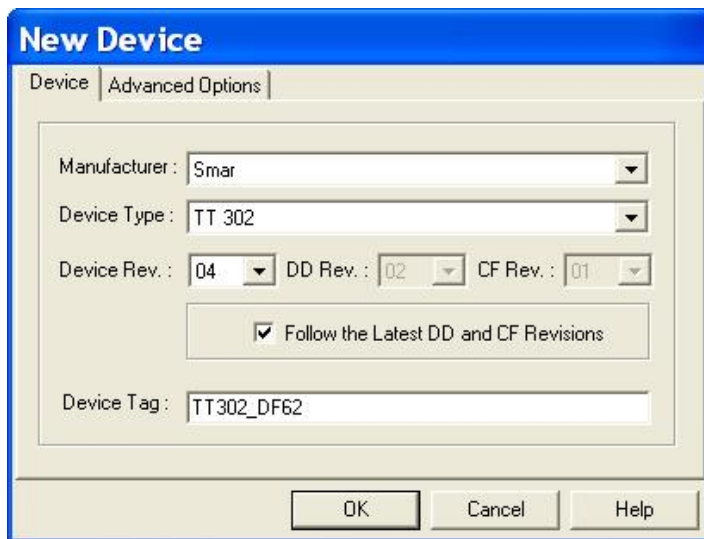


Figure 19. 16 – Setting the Fieldbus devices

Repeat this procedure to add a transmitter (LD302) and a converter (FI302) in the flow control.


After adding the devices to the area, the **H1_1** channel will be according to the following figure:



Figure 19. 17 – Devices added into the Fieldbus channel

Adding Function Blocks

Step 6

Now the user can add Function Blocks. To add a new Function Block (FB), click the  sign, and right-click the **Virtual Field Device** (FB VFD) icon. Choose **New Block** option.

The FB VFD is responsible for the data management.

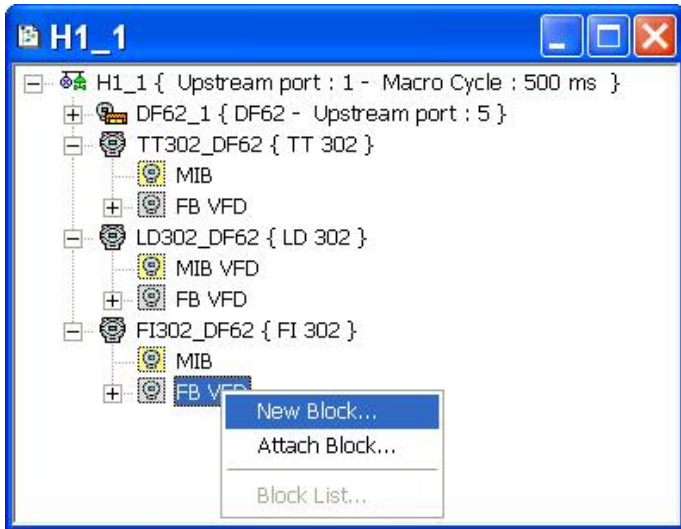


Figure 19. 18 – Choosing New Blocks

The **Function Block Characterization** dialog box will appear. The **Block Type** option shows the SMAR's FB.

Select the block in the **Block Type** box, and name it in the **Block Tag** box. The following figure shows adding the Analog Input function block.

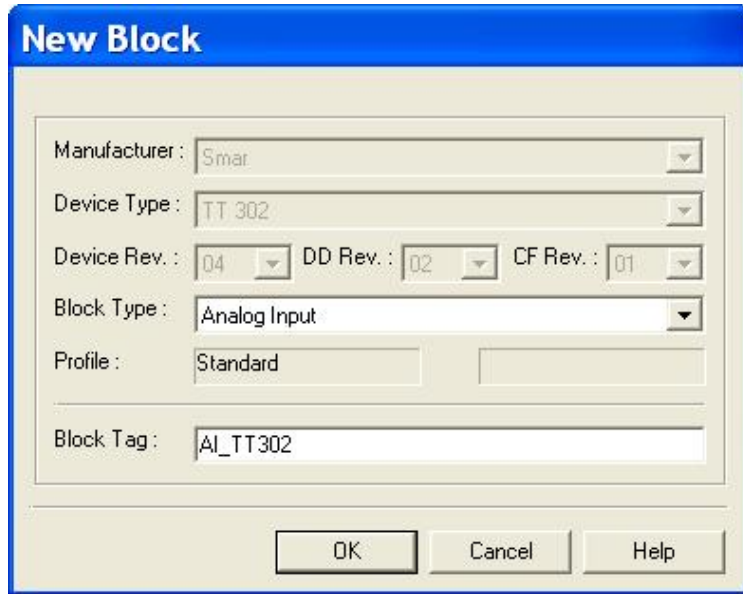


Figure 19. 19 – Adding function blocks

For this example, it is necessary to add AI, PID, and AO function blocks to build a cascade control configuration.

NOTE

From the **Syscon** version 6.00, it is not necessary to configure the Transducer (TRD), Resource Block (RES), Diagnostics (DIAG) and Display (DSP) blocks, because they are preinstantiated in the devices.

The channel configuration with all function blocks and devices is presented in the next figure. For better identification of the Transducer, Resource and Diagnostics function blocks name them with specific tags.

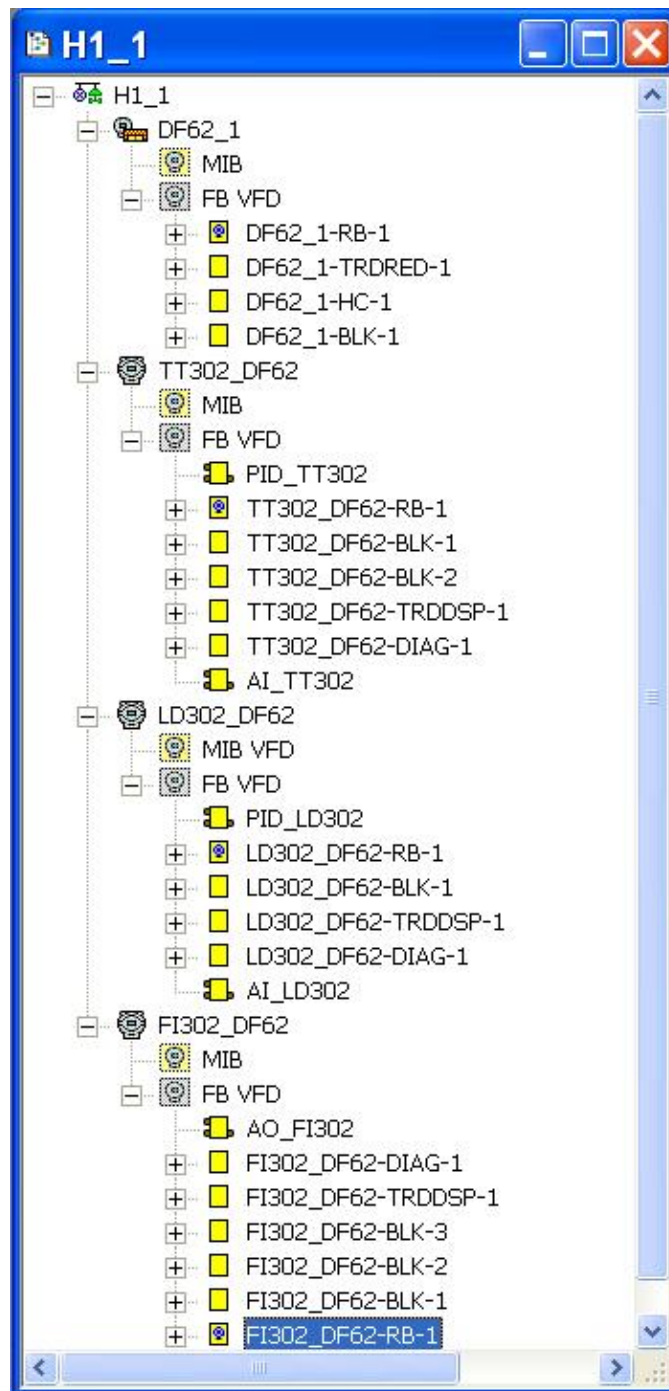


Figure 19.20 – Fieldbus channel composition

Now the strategy area Application (Logical Plant) can be developed. First it is necessary to establish a new process cell.

Creating New Process Cells

Step 7

The **Logical Plant** can be divided in several process cells, according to the plant.

To create a new Process Cell, right-click the **Application** icon, and select **New Process Cell** item.

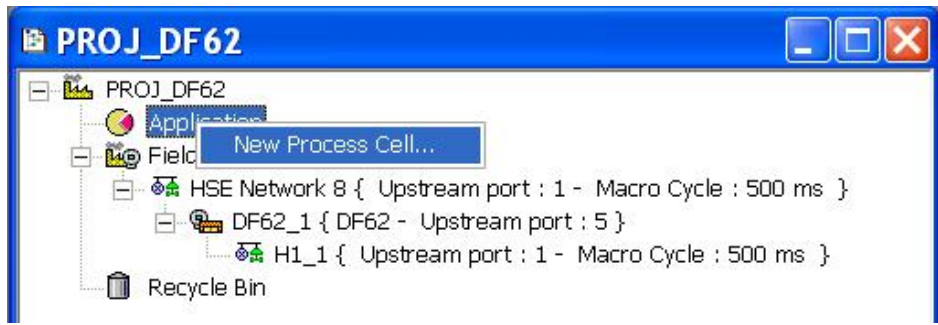


Figure 19. 21 – Inserting the Process Cell

The dialog box to name the **Process Cell** will open:

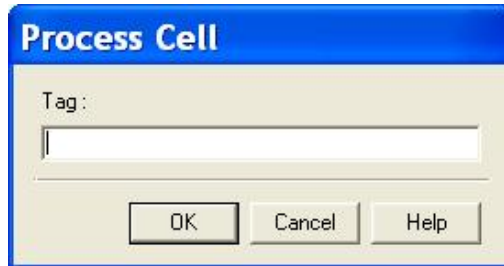


Figure 19. 22 –Attributing tag to the Process Cell

If the user needs name the Process Cell with a specific tag. Enter it in the **Tag** box, and click **OK**. To create more process cells, the procedure above can be repeated.

After inserting the Process Cell, the **Proj_DF62** window will be according to the next figure:

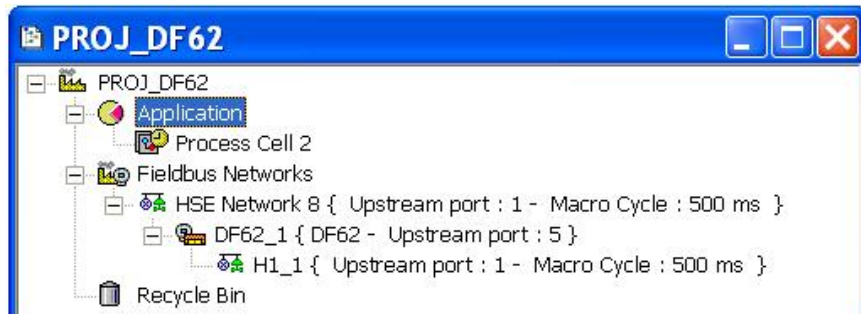


Figure 19. 23 – Area window after inserting the Process Cell

NOTE

The user must remember that **Application** is a virtual division. It only divides a large plant. For example: if the plant has two networks, they can be **Process Cells** in the **Syscon**. One **Application** can have several **Process Cells**, but a **Process Cell** cannot be in more than one **Application**.

Creating a Control Module

Step 8

Now the user can create a Control Module in the Application section.

Right-click the **Process Cell2** icon, and choose **Expand** item.

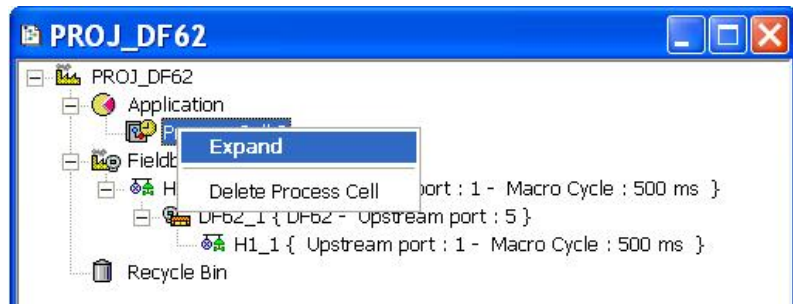


Figure 19.24 – Creating the Control Module

To arrange the screen, click the area window. So, choose **Window** menu on the **Syscon** toolbar, and then **Tile** option.

As following, return to the **Process Cell2** window. Right-click the **Process Cell2** item, and choose **New Control Module**. The figure below shows creating the New Control Module.

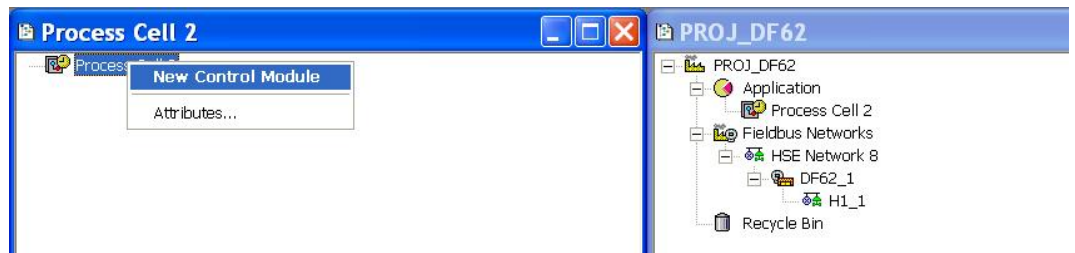


Figure 19.25 – Creating the New Control Module

The **New Control Module** dialog box will appear. Name it with the tag related to the application. To continue, click **OK**.

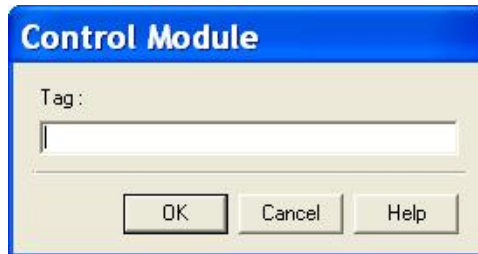


Figure 19.26 – Attributing tag to the Control Module

IMPORTANT

Remember that not all characters are valid when naming the elements with tags.

Inserting Blocks in the Control Module

Step 9

Now the user can add function blocks for the devices in the **Logical Plant**. Right-click the **Control Module 2** item, and choose **Attach Block** option, as shown in the next figure:

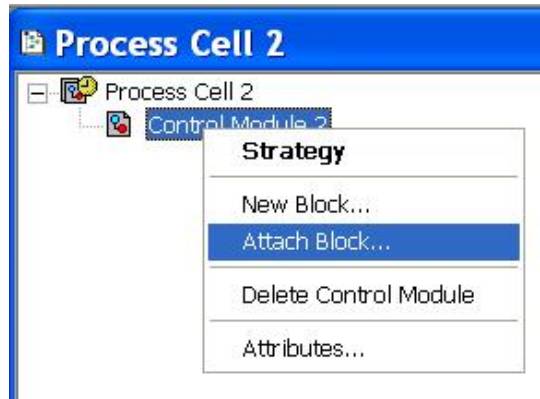


Figure 19. 27 – Adding new functions blocks to the FBAP

The **Attach Block** dialog box will open as shown below:



Figure 19. 28 – Attaching blocks to the Control Module

The available function blocks for the application are showed in the **Attach Block** box. For the aimed control, the function blocks that must be inserted will appear in the box. So, select them one by one, and click the **OK** button.

When the Attach Block process ends, the application will be as shown in the following figure:

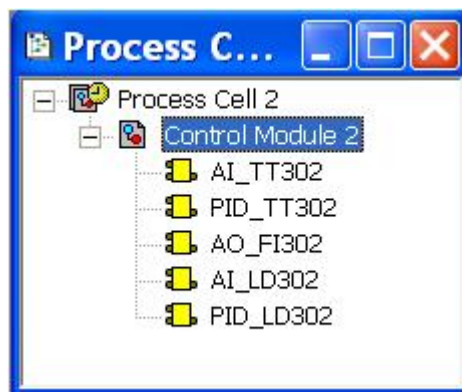


Figure 19. 29 – Blocks added to the Control Module

Another way to attach the blocks is left-clicking the element and drop it to the window.

A new tag can be done to the **Control Module** right-clicking it, and selecting **Attributes**. For the aimed example will be attributed **Estrategia_ProjDF62**.

Configuring the Control Strategy

Step 10

Now the user is ready to develop the control strategy.

First, right-click the **Estrategia_ProjDF62** icon, and select **Strategy**. The **Strategy** window will appear as shown in the following figure.

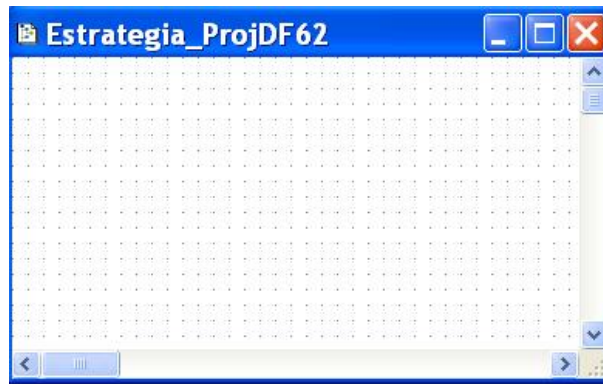


Figure 19. 30 – Strategy window

At this moment there are 3 or 4 windows opened in the **Syscon**. Minimize the **H1_1** window. Click the **Proj_DF62** window. On the toolbar, choose **Window → Tile**.


If the user does not have a monitor upper than 17", it is recommended to minimize the strategy window. Thus, it is possible to see the whole area.

The strategy window offers several tools for drawing. Refer to the **Syscon** manual for further details.

Adding Blocks to the Strategy window

Step 11

Now the function blocks can be added to the **Estrategia_Proj_DF62** window.

In order, click the first block,  AI_TT302, and drop it into the strategy window. A function block will be created automatically.

The next figure shows the function block added to the strategy window:

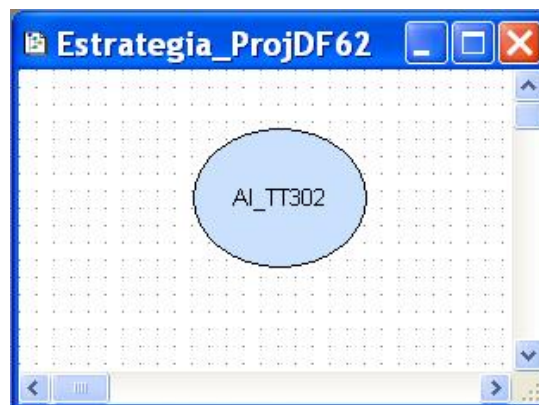


Figure 19. 31 – Block inserted into the strategy window

Repeat the drag-and-drop procedure for the other blocks such as AI_LD302, PID_LD302, PID_TT302, and AO_FI302.

Linking the Blocks

Step 12

There is a specific tool to link the blocks, the **Link** button,  on the **Strategy** toolbar.

Click this button on the toolbar, and then in the TT302_AI function block. The dialog box for linking the input and output parameters will appear. Select **OUT**, and then click the **OK** button as shown in the following figure.

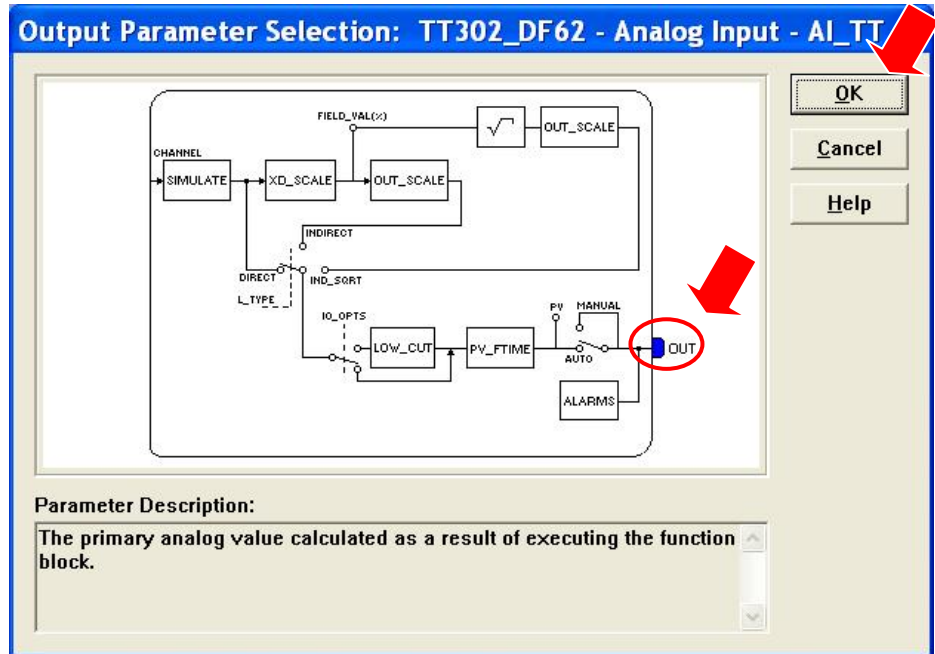


Figure 19.32 – Linking the Function Blocks

Move the mouse cursor up to the block that will be linked.

The user also does the fast link procedure just right-clicking the function block. The links necessary for this strategy are:

Direct Links:

- OUT(AI_TT302) → IN(PID_TT302)
- OUT(PID_TT302) → IN(PID_LD302)
- OUT(PID_LD302) → CAS_IN(AO_FI302)
- OUT(AI_LD302) → CAS_IN(PID_LD302)

Back Links:

- BKCAL_OUT(PID_LD302) → CAS_IN(PID_TT302)
- BKCAL_OUT(AO_FI302) → BKCAL_IN(PID_LD302)

After linking the parameters specified above, the strategy window will be as shown in the following figure:

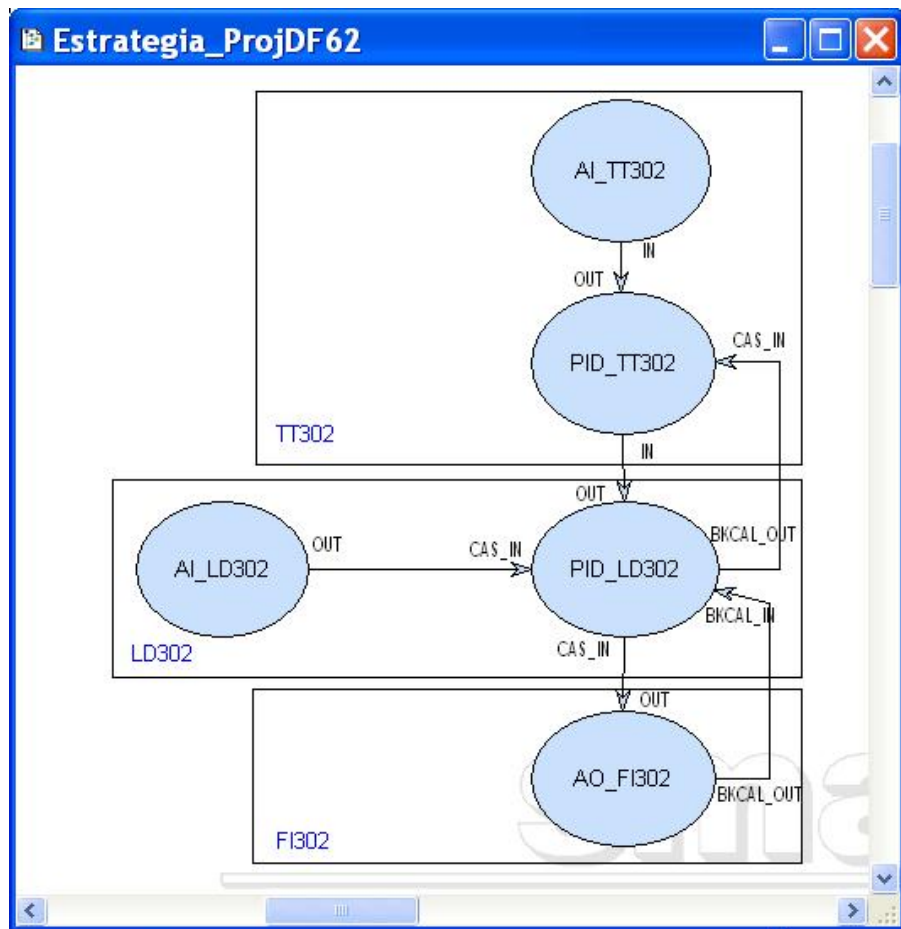


Figure 19. 33 – Links between the Function Blocks

Function Block Characterization

Step 13

The function blocks that are in the strategy must be set according to the application for them. So, it is necessary to do the block characterization.

The online and offline modes are possible for the block characterization. In the offline mode, the parameters are set before starting the communication between the devices. The online characterization is executed directly in the devices when the plant is already communicating.

To change the Function Block parameters, consider the following topics:

1. In the Strategy window

Select the block to characterize. Right-click it, and select the **Off Line Characterization** option, or double-click it. The following figure shows the block that is being done the offline characterization:

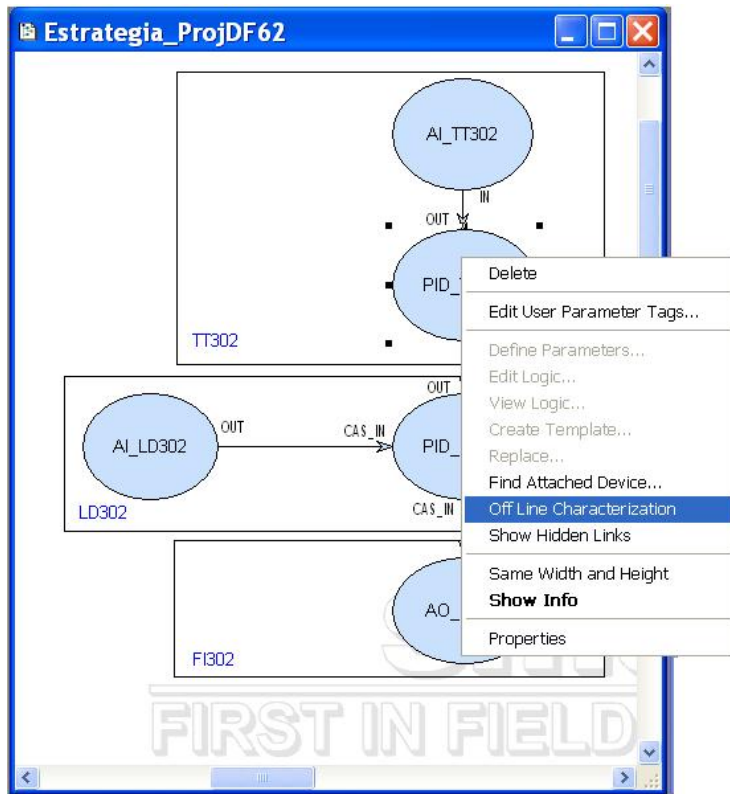


Figure 19. 34 – Offline characterization in the Strategy window

2. In the H1_1 window

Another way to do the offline characterization is right-clicking the function block, and then selecting the **Off Line Characterization** option, as shown in the following figure:

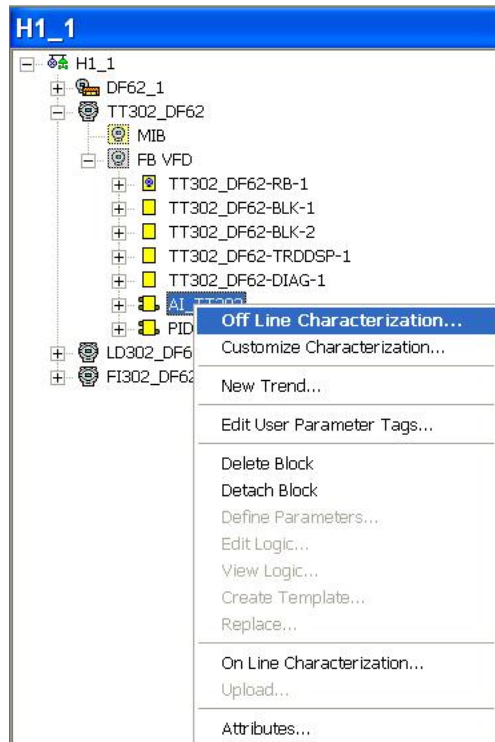


Figure 19. 35 – Offline characterization in the Fieldbus channel window

For both situations, the **Off Line Characterization** dialog box will appear:

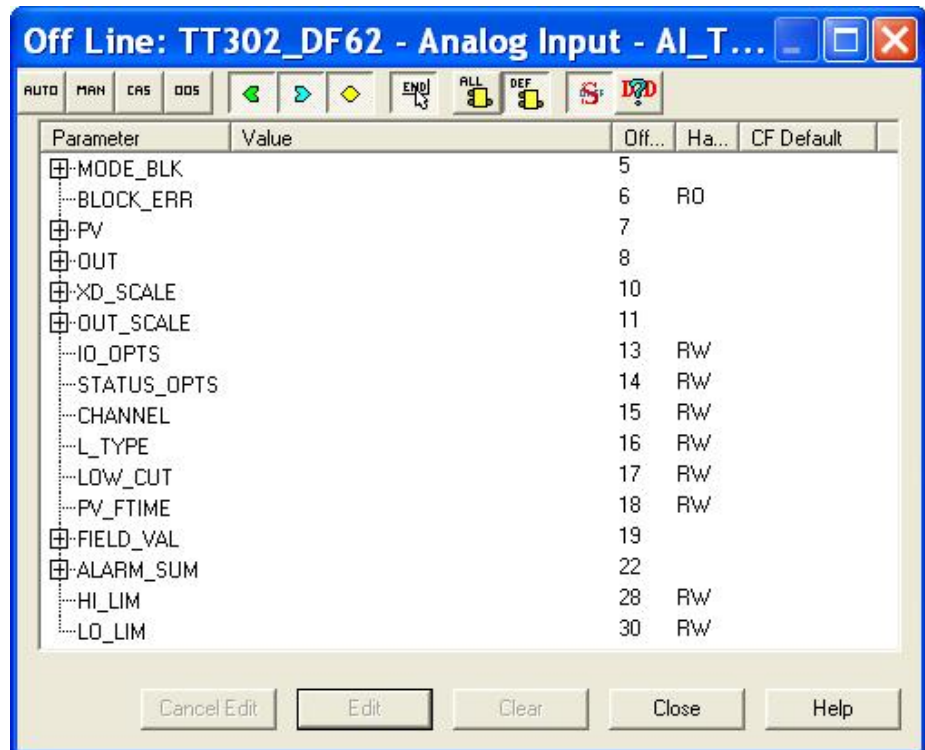


Figure 19. 36 – Function Block Characterization dialog box

Double-click at the right side of the parameter to change it. Another option is click it once, and then in **Edit** to start editing the parameter value. At the ending, click **End Edit**.

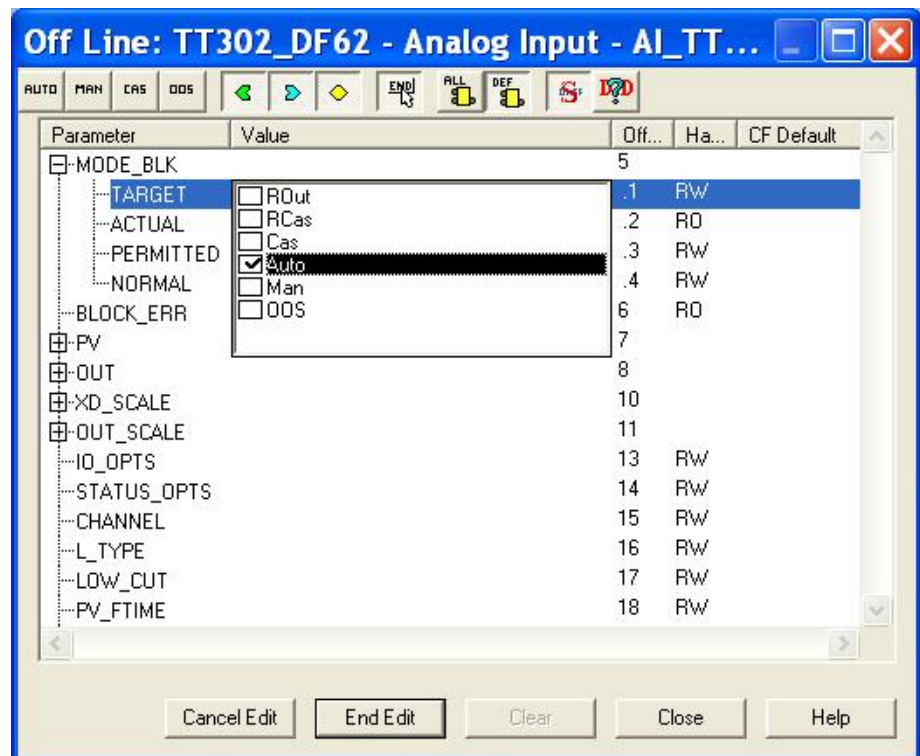


Figure 19. 37 – Editing the parameter in the Function Block Characterization box


The list below shows the parameters that must be set for this area:

DEVICE	TAG	BLOCK	PARAMETER
LD302	LD302_DF62	TR	MODE_BLK.Target = AUTO
		RS	MODE_BLK.Target = AUTO
		DSP	MODE_BLK.Target = AUTO
			BLOCK_TAG_PARAM_1= FT101_AI
			INDEX_RELATIVE_1 = 8
			MNEMONIC_1 = VAZAO
			ACCESS_1 = MONITORING
			ALPHA_NUM_1 = MNEMONIC
			DISPLAY_REFRESH = UPDATE DISPLAY
		AI_LD302	MODE_BLK.Target = AUTO
			XD_SCALE.EU_100 = 100
			XD_SCALE.EU_0 = 0
			XD_SCALE.UNITS_INDEX = inH2O(4°C)
			OUT_SCALE.EU_100 = 100
			OUT_SCALE.EU_0 = 0
			OUT_SCALE.UNITS_INDEX = %
		CHANNEL = 1	
		L_TYPE = INDIRECT	
		PID_LD302	MODE_BLK.Target = AUTO
			PV-SCALE.EU_100 = 100
PV-SCALE.EU_0 = 0			
PV-SCALE.UNITS_INDEX = %			
OUT_SCALE.EU_100 = 100			
OUT_SCALE.EU_0 = 0			
OUT_SCALE.UNITS_INDEX = %			
GAIN = 0.5			
RESET = 1			
RATE = 0			

DEVICE	TAG	BLOCK	PARAMETER
TT302	TT302_DF62	TR	MODE_BLK.Target = AUTO
			SENSOR_TYPE = PT100IEC
			SENSOR_CONNECTION = THREE WIRES
			SENSOR_TRANSDUCER_NUMBER = 1
		RS	MODE_BLK.Target = AUTO
			MODE_BLK.Target = AUTO
		DSP	BLOCK_TAG_PARAM_1 = TT100_AI
			INDEX_RELATIVE_1 = 8
			MNEMONIC_1 = TEMP
			ACCESS_1 = MONITORING
			ALPHA_NUM_1 = MNEMONIC
			DISPLAY_REFRESH = UPDATE DISPLAY
			MODE_BLK.Target = AUTO
		AI_TT302	XD_SCALE.EU_100 = 500
			XD_SCALE.EU_0 = 0
			XD_SCALE.UNITS_INDEX = °C
			OUT_SCALE.EU_100 = 100
			OUT_SCALE.EU_0 = 0
			OUT_SCALE.UNITS_INDEX = %
			CHANNEL = 1
L_TYPE = INDIRECT			
PID_TT302	MODE_BLK.Target = AUTO		
	PV_SCALE.EU_100 = 100		
	PV_SCALE.EU_0 = 0		
	PV_SCALE.UNITS_INDEX = %		
	SP = 50		
	GAIN = 0.5		
	RESET = 1		
RATE = 0			

DEVICE	TAG	BLOCK	PARAMETER
FI302	FI302_DF62	TR	MODE_BLK.Target = AUTO
			TERMINAL_NUMBER = 1
		RS	MODE_BLK.Target = AUTO
			MODE_BLK.Target = AUTO
		DSP	MODE_BLK.Target = AUTO
			BLOCK_TAG_PARAM_1 = FCV102_AO
			INDEX_RELATIVE_1 = 9
			MNEMONIC_1 = VALVULA
			ACCESS_1 = MONITORING
			ALPHA_NUM_1 = MNEMONIC
		AO_FI302	DISPLAY_REFRESH = UPDATE DISPLAY
			MODE_BLK.Target = AUTO
			PV_SCALE.EU_100 = 100
			PV_SCALE.EU_0 = 0
			PV_SCALE.UNITS_INDEX = %
XD_SCALE.EU_100 = 20			
XD_SCALE.EU_0 = 4			
XD_SCALE.UNITS_INDEX = mA			

After the parameter setting, the user can start the device communication. It is necessary commissioning the devices to attribute the tags, IDs, and device addresses properly. If this procedure is not executed, the **Syscon** will detect the not commissioned device and the download for this device will be aborted. Finishing the device commissioning, the download process can start. The download process can be executed, for example, returning to the **Proj_DF62** window, right-

clicking the **Fieldbus Networks** icon,  , and selecting the **Download** option. For further details about the available download types, refer to the **Syscon** manual.

Macrocycle for the H1 Channel

The macrocycle for each channel depends on the configuration, but can be estimated by using data such as quantity of links, field devices and quantity of blocks. The following examples show this calculation.

Data for configuration 1, with high traffic:

- 50 object links in the H1 network H1 (30 ms per link)
- 8 field devices per channel
- 4 function blocks per device
- Supervision of one dynamic view per block

Background time

For the “background traffic”, time related to the supervision and asynchronous messages, is necessary at least 960 ms ($8 \times 4 = 32$ views, 30 ms for each one). For the “foreground traffic”, time related to links and control, is necessary at least 1500 ms (50 links and 30 ms for each one). So, the minimum macrocycle is 2460 ms. Therefore, a security extra time is added, about 20%, and the macrocycle will be equal to 3 s. The quantity of dynamic views per second is 10 (32 views/ 3s) and the publish/subscribe time is 3 s (equals to the macrocycle).

Data for configuration 2, with low traffic:

- 4 object links in the H1 network (30 ms per link)
- 8 field devices per channel
- 2 function blocks per device
- Supervision of one dynamic view per block

Calculating the limits:

- Background traffic: 480 ms ($8 \times 2 = 16$ views, 30 ms for each one)
- Foreground traffic: 120 ms (4 links and 30 ms for each one)
- Macrocycle: 720ms (600 ms + 20% security extra time)
- Quantity of dynamic views per second: 22 (16 views/ 0.720 s)
- Publish/subscribe time: 720 ms (macrocycle)

So, the macrocycle can be estimated:

- Macrocycle = (Background traffic + Foreground traffic)*1.2
- Background traffic = Quantity of views*30 ms
- Foreground traffic = Quantity of links*30 ms

The time equals to 30 ms is an average value estimated for the calculations above, and it is used for the most of situations.

