Topic: Cascade PID with Two Secondaries

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Configure a Cascade PID CM with Two Secondaries

Practice

Objective

- Configure a Cascade Loop with one primary and two secondaries for T-100 bottom level control
- Configure a FANOUT block to connect the primary controller’s output to the setpoint of two secondary controllers
- Configure an Auxcalc function block to calculate the flow at the outlet of T-100

Prerequisites

- Experion PKS Server or a client machine with Experion PKS Engineering Tools loaded
- Debutanizer_123 graphic loaded on the Server (This is required at a later time to check the control strategy.)
- Control Builder running with one or two Project/Monitor tree windows open
- SIM-C200E/C200E or SIM-C300/C300 Controller and IOMs configured
- Excel Data Exchange open with the simulation spreadsheet loaded
Introduction

In this lab, the 11_FCU1 loop is added as a secondary to the 11_LC14 loop built in the previous lab. Similar considerations of operation apply; the loops require bumpless transfer from MAN to AUTO or CAS.

- In addition, the ratio of the flow of 11_FC17 and 11_FC18 is 70:30
- The Control Module built in the previous lab will be modified, downloaded, and tested
- The remaining Control Modules will then be imported into Project, downloaded and activated

The following CMs will be configured:

<table>
<thead>
<tr>
<th>CM Name</th>
<th>Action to be taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>11_LC14</td>
<td>Modify this CM to add a FANOUT block, used to connect the output to two secondary controllers and maintain a fixed flow ratio between the two controller outputs.</td>
</tr>
<tr>
<td>11_FC17</td>
<td>Connect parameter 11_LC14.FANOUTA.OP(1) to 11_FC17.PIDA.SP.</td>
</tr>
<tr>
<td>11_FC18</td>
<td>Copy and modify 11_FC17 as 11_FC18 and connect 11_LC14.FANOUTA.OP(2) to 11_FC18.PIDA.SP.  Add an Auxcalc block for adding the flow through 11_FC17 and 11_FC18.</td>
</tr>
<tr>
<td>11_AC12; 11_FC15; 11_FC19; 11_FC20; 11_LC16; 11_TC10</td>
<td>Import these CMs from: C:\Users\Public\Public Documents\Honeywell\Experion PKS\XPORT\Student_DB\Series_A (or _C)</td>
</tr>
</tbody>
</table>
Perform the following procedures in Control Builder.

**Create a Control Module (CM)**

<table>
<thead>
<tr>
<th>✓</th>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Open <strong>Control Builder</strong> from <strong>Configuration Studio</strong>, if not already open.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Double-click CM <strong>11_FC17</strong>, to open the chart view in the Project window.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Delete the wiring which connects <strong>11_LC14.PIDA.OP</strong> (Parameter Connector) to <strong>11_FC17.PIDA.SP</strong>. <strong>11_FC17</strong> will be as follows:</td>
<td></td>
</tr>
</tbody>
</table>

![Control Module Chart]

**ATTENTION**

This is to facilitate the connection of the FANOUT block to the **11_LC14.PIDA.OP**.

The AI and AO channel block might look different if you are using Series C I/O.
**Step** | **Action**
--- | ---
4 | **Save** and **Close** 11_FC17.
5 | From the Project tab, double-click 11_LC14 to open the Chart view.
6 | Select the **Library Tree** window.
7 | Add the following block to CM 11_LC14.
   | **Block Family** | **Block**
   | REGCTL | FANOUT
8 | Double-click the **FANOUTA** block.
   | Enter the following details in the **Main** tab:
   | **Name:** | **FANOUTA**
   | **Description:** | **T-100 Debutanizer bottoms**
   | **High Limit:** | **385**
   | **Normal Mode:** | **CAS**
   | **Mode:** | **CAS**
   | **Mode Attribute:** | **OPERATOR**
<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
</table>
| 9    | Click the **Individual Output** tab. Enter the following details:  
|      | Output #1 Gain: **0.7** (Op1 will be 70% of the input signal.)  
|      | Output #2 Gain: **0.3** (Op2 will be 30% of the input signal.)  
|      | Verify the **Enable Secondary Initialization Option** checkboxes are selected for Output #1 and Output #2.  
|      | Clear the checkboxes for all other outputs.  
|      | Click **OK**.  

![Individual Output Tab](image)

**ATTENTION**

Output Gain values are not accessible through graphics. If they need an online change, use the Monitoring mode in Control Builder. This is explained later in this module.
<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
</table>
• CM 11_LC14 should appear similar to the one shown below  
• Change the Block pin positions, if required |

**ATTENTION**  
In this picture the GEA and Numeric block are not shown.

<p>| 11   | Save and Close the CM. |
| 12   | Double-click 11_FC17 to open the Chart view. |</p>
<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Wire parameter 11_LC14.FANOUTA.OP[1] to 11_FC17.PIDA.SP with the parameter connector, as shown below:</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>14</td>
<td><strong>Save and Close</strong> 11_FC17.</td>
</tr>
<tr>
<td>15</td>
<td>Right-click 11_FC17 in the Project tab and select <strong>copy</strong>.</td>
</tr>
<tr>
<td></td>
<td>• Enter the Destination Tagname 11_FC18 and Destination Item Names 11_FC18_Item</td>
</tr>
<tr>
<td></td>
<td>• Click the Next button.</td>
</tr>
<tr>
<td></td>
<td>• Copying retains all the function blocks and parameters except the Input and Output channel assignments (you may get a dialog box indicating the “Non-Retained items”).</td>
</tr>
<tr>
<td></td>
<td>• If the following error appears, Click Close.</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Error" /></td>
</tr>
<tr>
<td>Step</td>
<td>Action</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
</tr>
</tbody>
</table>
| 16   | Assign 11.FC18 to CEESCEFB61 (or SIM_CEEC300).  

ATTENTION  
When copying a CM, the new CM gets put in 'Unassigned'. |
| 17   | Open chart view for 11.FC18. |
| 18   | **Configure the AIChannel block.**  
Double-click the AIChannel named FT  
Enter following details:  
Channel Name: FI |
| 19   | Refer to the appropriate (C200E or C300) table at the end of Appendix to determine the correct module and channel for 11.FC18.FI.  
**For C200E:**  
Assign 11.FC18.FI to the appropriate module and channel.  
Close the properties of the FI block.  
**For C300:**  
Close the properties of the FI block.  
Assign 11.FC18.FI to the appropriate module and channel. |
| 20   | **Configure the AOChannel block.**  
Double-click the AOChannel named FY  
Enter following details:  
Channel Name: FV |
| 21   | Refer to the appropriate (C200E or C300) table at the end of Appendix to determine the correct module and channel for 11.FC18.FV.  
**For C200E:**  
Assign 11.FC18.FV to the appropriate module and channel.  
Close the properties of the FV block.  
**For C300:**  
Close the properties of the FV block.  
Assign 11.FC18.FV to the appropriate module and channel. |
Cascade PID with Two Secondaries
Configure a Cascade PID CM with Two Secondaries

<table>
<thead>
<tr>
<th>✓</th>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Modify the PID block.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>In the Algorithm tab, change T1 to 0.9 and the Overall Gain to 0.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accept the defaults for any remaining parameters.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Click OK.</td>
<td></td>
</tr>
</tbody>
</table>

![PID Block Configuration](image1)

<table>
<thead>
<tr>
<th>23</th>
<th>Wire the parameter 11_LC14.FANOUTA.OP [2] to 11_FC18.PIDA.SP with a parameter connector, as shown below.</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2" alt="Parameter Wiring" /></td>
<td></td>
</tr>
</tbody>
</table>

| 24 | Click icon to Save 11_FC18 CM. |

<p>| 25 | Add an AUXCALC block to 11_FC18. |
| | Select the Library tab and add the following function block. |
| Block Family | Block |
| AUXILIARY | AUXCALC |</p>
<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
</table>
| 26   | Double-click the **AUXCALCA** block. Enter following details:  
  Name: **FLOW CALC**  
  Description: **T-100 Bottom Flow**  
  Engr Units: **m3/hr**  
  Assignable Outputs PV Selection: **C[1]**  
  Accept the defaults for any remaining parameters on this tab. |
**ATTENTION**

The AUXCALC block evaluates user-defined expressions and conditions for calculations. You can write up to eight expressions. Each expression can contain any valid combination of inputs, operators and functions, and may perform arithmetic or logic operations. Optionally, the AUXCALC can accept up to six inputs. In this lab, the block provides a total flow value.
<table>
<thead>
<tr>
<th>✓</th>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
</table>
| 28 | Add the following parameter connectors to the Flow_Calc block. <br>11_FC17.DACA.PV to P[1] pin. <br>11_FC18.DACA.PV to P[2] pin. | ![Diagram showing parameter connectors to Flow_Calc block.]<br>**ATTENTION**<br>The AUXCALC block has access to all parameters for all points, so the above two parameters were not needed as inputs to the AUXCALC Block. The parameters could have been referenced directly by the expression. The inputs were added only so they would be visible from the chart.
### Step 29

**Add expressions to the block.**

Double-click **Flow_CALC**.

Select the **EXPRN #1** tab.

Enter the following expression, using the Points button, to open the Point Selection dialog:

\[ 11\_FC17\_DACA\_PV + 11\_FC18\_DACA\_PV \]

Click **OK**.

![Expression Details](image)

### Step 30

**Save and Close** the CM.
Step | Action
--- | ---
31 | Download and activate 11_FC17, 11_FC18 and 11_LC14.
32 | In the Monitoring tab, open chart view for 11_LC14.
33 | Double click on the FANOUTA block to open the parameter configuration form and verify that the gain values under the Individual Output tab are as shown:
   - Output#1 = 0.7
   - Output#2 = 0.3
   If not, change the values as above.
   Click OK.

![Parameter Configuration Form](image-url)
<table>
<thead>
<tr>
<th>✓</th>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
</table>
| 34 | Open the **Debutanizer_123** graphic on the Station. If it is already open, refresh the display by clicking the **Reload Page** button at the top of the Station application window. Find the T-100 bottom level control loop and valves.  
  ![Diagram](image)
  - Set the **11_LC14** controller to NORMAL mode.  
  - Set **11_LC14 SP = 60**. After stabilizing (about 5 minutes), **11_LC14** is controlling the level of T-100.  
  - In the above example, the SP of **11_FC17** is 119.78 and the SP value of **11_FC18** is 51.33.  
    
    $\begin{align*}
    119.78 + 51.33 & = 171.11 \\
    119.78 / 171.11 & = 0.7 \\
    51.33 / 171.11 & = 0.3
    \end{align*}$
  
  Click the SP value of **11_LC14** to call up the faceplate.  
  Double click on **11_LC14** faceplate to open the detail display.  
  Click on the **Chart** tab to see the CM logic.  
  Observe the PIDA.OP value. |

**ATTENTION**

The **Tie_Back_New** excel sheet should be open to observe the values for PV, SP.  
If the values are not updating then restart the **Tie_Back_New** excel sheet. This sheet is used for simulation purposes.
## Step 35
- In the display shown below, the Output of 11_LC14.PIDA.OP is 44.4559 and OP[1] is 31.1204 and OP[2] is 13.3368.

![Diagram](image1)

## Step 36
- In either Station (detail display) or Control Builder Monitoring tab, open the chart view for 11_FC17 and observe the SP as shown below:

![Diagram](image2)

- In the above example, the SP is 119.7865, which is 70% of the required flow 169.0143.
### 37
- Similarly, observe the details of the **11_FC18** controller as shown below.

![Controller Diagram](image1.png)

- In this example, the SP is 51.3326, which is approximately **30%** of the required flow 169.0143.

### 38
- Change the SP of **11_LC14** to 62 and observe the effects on the three controllers as shown below.

![Controller Diagram](image2.png)
<table>
<thead>
<tr>
<th>√</th>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>39</td>
<td><strong>Import</strong> (with CEE assignment), <strong>download</strong>, and <strong>activate</strong> the following CMs:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11_AC12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11_FC15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11_FC19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11_FC20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11_LC16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11_TC10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• These CMs are the remaining “pre-built” Cascade Loops shown on the Debutanizer_123 graphic. They can be imported from the following location: C:\Users\Public\Public Documents\Honeywell\Experion PKS\IXPORT\Student_DB\Series_A (or _C)</td>
</tr>
</tbody>
</table>

**ATTENTION**

Follow the procedures in the Import/Export Lab, if you need a refresher.

If you are Using SIMC200E/C200E the path for Database is

C:\Users\Public\Public Documents\Honeywell\Experion PKS\IXPORT\Student_DB\Series_A

If you are Using SIMC300/C300 the path for Database is

C:\Users\Public\Public Documents\Honeywell\Experion PKS\IXPORT\Student_DB\Series_C