Honeywell

PlantScape Controller Implementation

Lesson 3

Configuring a Supervisory SCM (SCM#_ REACTR)

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Notes

Introduction

The purpose of this Lesson is to give you the knowledge to be able to configure a Supervisory Sequential Control Module. Upon completion of this Lesson you will have Created a Supervisory SCM that will control other SCMs .

Objectives

❶ Create a New SCM

❷ Configure Steps and Transition

❸ Branch the SCM

❹ Use a Flag to allow automatic starting of the SCM

Configuring a Supervisory SCM (SCM#_REACTR)

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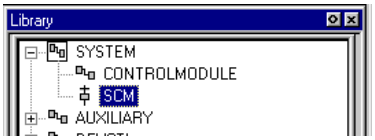
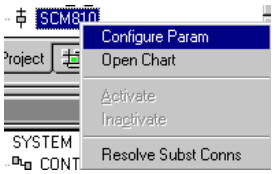
➢Create a New SCM

- Set up Control Builder with both the **Library** and **Project** views visible
- Click and expand the SYSTEM Library under the **Library** Tree View
- Drag a new SCM from the **Library** to the **Project** view



- Right-click on the SCM, and click on **Configure Param**
- Enter the following information on the Main tab
  - Name **SCM#_REACTR**
  - Description **REACTION SUPERVISORY**
  - KEY WORD **REACTION**



- Close SCM and Assign to **CEE0101**

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Notes

SCM_REACTOR Process Description

The SCM#_REACTR controls all other SCMs and CMs to make a complete batch.

In configuring a process it is helpful to flow chart the entire process. By doing this you will obtain an overall view of what you are trying to achieve.

The reactor Process is as follows:

• A Specified amount of Ingredient A is added to the Reactor utilizing the SCM#_XFERA. The Agitator is switched on to low speed when the level reaches a specified minimum

• After Ingredient A finishes, you will have the option of adding an amount of Ingredient B manually to the Reactor. The SCM#_REACTR is interrupted during this manual transfer, the agitator continues on low speed

• After Ingredient B finishes the Reactor is heated and cooled down (with the agitator on high speed) using the SCM#_TEMP

• The Reactor is drained with the agitator on low speed

• The amounts of Ingredient A, B and product are logged

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➢Start Conditions

- From the **Project** Tree View, double-click the **SCM** to open it
- Configure the following information on the Invoke **Transition**

Tab	Name		Description	
Main	**INVOKE_MAIN**		**INVOKE MAIN**	
	Description	Condition Expression		Gate
Condition #1	**MANUAL START FLAG**	**CM#_FLAGS.REACTION.PVFL = 1**		**P1**
Condition #2				
Condition #3				
Condition #4				
	Pri Gate (1)	Pri Gate (2)	Pri Gate (3)	Secondary Gate
Gates	**CONNECT**			**CONNECT**

- Click **OK**

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Notes

Start Up

An SCM can be commanded to start through Station. Here we add another method of starting the SCM, namely that if Flag **REACTION** is turned on, the SCM will start from the Idle State.

In **CM#_FLAGS** we configured a block called **REACTION** . The code above looks to that CM to see if the flag is on (1) or off (0). The flag in the Off state will not keep us from being able to start the SCM with a Start command in Station, it will just give us the option of using the flag also.

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➢Adding and Configuring a Step

- Scroll down in the **REACTR_SCM** to a fresh screen
- Drag and drop a Step from the **Library** tab into the SCM control drawing and position it under the **START_UP** Transition

Tab	Name		Description	
Main	**INITIALIZE**		**INITIALIZE**	
	Wait Time	**5**	Active Time	**240**
	Description		Output Expression	
Out #1	**COMMAND SCM#_XFERA TO START**		**SCM#_XFERA.COMMAND := 2**	
Out #2	**RESET REACTOR TOTALIZER**		**CM#_ACCA.TOTAL_REACTR.COMMAND := 3**	

- Click **OK**
- Wire the **START_UP Transition** to the **INITIALIZE Step**

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Notes

Starting SCM#_XFERA

In our Process the first thing we want to do is start the XFERA_SCM. In the first Step Output we give the command

SCM#_XFERA.COMMAND := 2

This statement tells the SCM to change it's state to 2 (Reference Page 7-23, SCM Commands).

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➢Adding and Configuring a Transition

- Scroll down in the **REACTR_SCM** to a fresh screen
- Drag and drop a Transition from the **Library** tab into the SCM control drawing and position it under the **INITIALIZE** Step

Tab	Name	Description	
Main	**WAIT_MIN_LEVEL**	**WAIT MIN LEVEL**	
	Description	Condition Expression	Gate
Condition #1	**WAIT FOR MIN LEVEL**	**CM#_LVLA.LEVEL_REACTR.PV >= 25.0**	**P1**
Condition #2			
Condition #3			
Condition #4			

	Pri Gate (1)	Pri Gate (2)	Pri Gate (3)	Secondary Gate
Gates	**CONNECT**			**CONNECT**

- Click **OK**
- Wire the **INITIALIZE Step** to the **WAIT_MIN_LEVEL Transition**

Notes

Waiting For a Minimum Level

In this Transition we are telling the SCM#_REACTION to wait here until 25 Gallons of ingredient A has been transferred to the Reactor. In our process we do not start the Agitator in an empty Reactor, therefore we code the SCM to wait for a desired amount of product.

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➢Adding and Configuring a Step

- Scroll down to a fresh screen
- Drag and drop a Step from the **Library** tab into the SCM control drawing and position it under the **WAIT_MIN_LEVEL** Transition

Tab	Name		Description	
Main	**START_AGITATOR**		**START AGITATOR**	
	Wait Time	**0**	Active Time	**240**
	Description		Output Expression	
Out #1	**AGIT MODEATTR TO PGM**		**CM#_AGIT101.DEVCTLA.MODEATTR := 2**	
Out #2	**START AGITATOR LOW**		**CM#_AGIT101.DEVCTLA.GOP := 4**	
Out #3	**CM#_PMP103 TO PROGRAM**		**CM#_PMP103.DEVCTLA.MODEATTR := 2**	
Out #4	**CM#_FV103 TO PROGRAM**		**CM#_FV103.DEVCTLA.MODEATTR := 2**	

- Click **OK**
- Wire the **WAIT_MIN_LEVEL Transition** to the **START_AGITATOR Step**

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Notes

Starting the Agitator

Our Agitator is controlled by a Device Control Block. To start it we will need to place the Device Control Block in Program Mode Attribute.

CM#_AGIT101.DEVCTLA.MODEATTR := 2

This command tells the Device Control Block to change to Program Mode Attribute. All CMs and SCMs must be in Program Mode Attribute for an SCM to issue internal commands to it. Our next command is

CM#_AGIT101.DEVCTLA.GOP := 4

Using this command we are setting the Device Control Block to S0(Low).

(Reference 7-23, Device Control Block States GOP/GPV)

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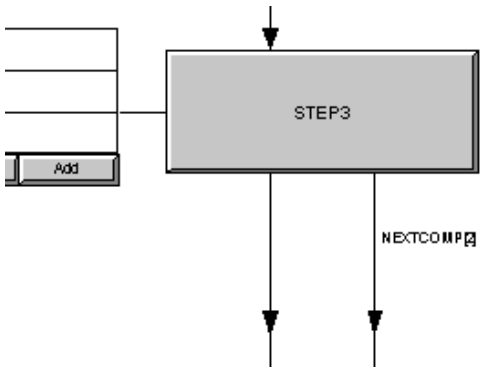
➢Branching

- Right Click on the **START_AGITATOR** Step and add the following pin
  - NEXTCOMP[2] **Out Bottom**
- We added a Pin to this Step called NEXTCOMP[2]. This Pin gives us the ability to Branch off to a second set of Steps and Transitions. In doing this we can configure two different sets of conditions in our SCM.



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Notes

Branching

Branching allows the SCM to take different paths based on different Transition Conditions being true. Here, we are giving the operator the option of interrupting the SCM to manually add Ingredient B if required. Branching always comes from a Step into a Transition. There can be a maximum of 10 branches coming out of a Step.

Branching is not a parallel execution. The branches are evaluated in order. NEXTCOMP[1] to NEXTCOMP[2], and the first one to have true conditions is the branch that is executed.

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➢Branching …*continued*

- Branch Conditions (Below is an explanation of the Steps and Transitions to be constructed in the next few pages)
  - The first Branch Transition checks for the following to be true
    - **CM#_AGIT101** is on low
    - **SCM#_XFERA** is complete
    - Checks to see if **ING_B** flag is off (No Ingredient B will be added)
  - The second Branch Transition checks for the following to be true
    - **CM#_AGIT101** is on low
    - **SCM#_XFERA** is complete
    - Checks to see if **ING_B** flag is on (Ingredient B will be added)
- We will configure the second transition next

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Notes

Branching

An SCM can have multiple endings, i.e. branches do not need to come back together. Then the SCM code ends in which ever branch is active, and goes to a completed status.

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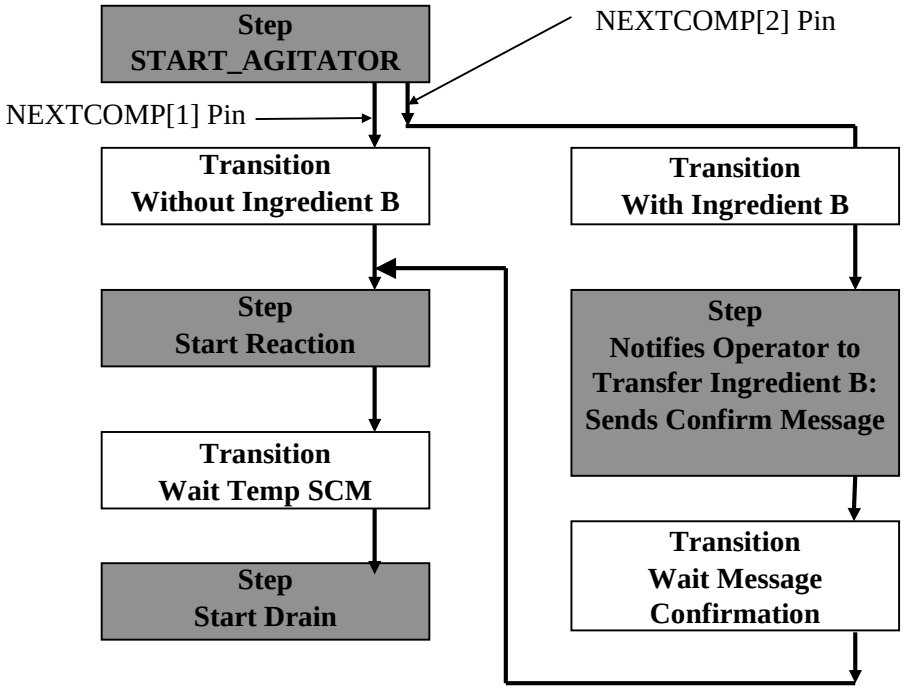
➢Branching …*continued*

- Below is a drawing of the SCM development



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Notes

Configuring a Supervisory SCM (SCM#_REACTR)

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➢Adding and Configuring a Transition (With Ingredient B)

- Scroll down **and** to the **right** to a fresh screen
- Drag and drop a Transition from the **Library** tab into the SCM control drawing and position it under and to the right of the **START_AGITATOR** Step

Tab	Name	Description		
Main	**WITH_ING_B**	**WITH INGREDIENT B**		
	Description	Condition Expression		Gate
Condition #1	**WAIT FOR AGITATOR ON LOW**	**CM#_AGIT101.DEVCTLA.GPV = 4**		**P1**
Condition #2	**WAIT FOR SCM#_XFERA COMPLETE**	**SCM#_XFERA.STATE = 5**		**P2**
Condition #3	**YES ING B (FLAG ON)**	**CM#_FLAGS.ING_B.PVFL = 1**		**P3**
Condition #4				
	Pri Gate (1)	Pri Gate (2)	Pri Gate (3)	Secondary Gate
Gates	**CONNECT**	**CONNECT**	**CONNECT**	**AND**

- Click **OK**
- Wire the **START_AGITATOR Step (NEXTCOMP[2] pin)** to the **WITH_ING_B Transition**

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Notes

With Ingredient B

The with Ingredient B branch will be taken if the ING_B flag is on. This transition will wait for the Agitator to be on low and the SCM#_XFERA to complete. Once both are true and the flag is in the on position

CM#_FLAGS.ING_B.PVFL = 1

the branch will then continue.

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➢Adding and Configuring a Step

- Scroll down to a fresh screen
- Drag and drop a Step from the **Library** tab into the SCM control drawing and position it under the **WITH_ING_B** Transition

Tab	Name		Description	
Main	**MANUALLY_ADD_B**		**MANUALLY ADD B**	
	Wait Time	**0**	Active Time	**240**
	Description		Output Expression	
Out #1	**MESSAGE TO CHARGE B**		**CM#_MESSAGES.XFERB.SENDFL[2] := 1**	
Out #2				
Out #3				
Out #4				

- Click **OK**
- Wire the **WITH_ING_B Transition** to the **MANUALLY_ADD_B Step**

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Notes

Signal to the Operator

Here we are adding a message for the operator. We added a Confirm message to **CM#_MESSAGES** in the **XFERB** block to tell the operator to charge Ingredient B. The operator will manually charge B and then confirm the message.

The SCM waits for the confirmation flag before it proceeds.

Configuring a Supervisory SCM (SCM#_REACTR)

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➢Adding and Configuring a Transition

- Scroll down to a fresh screen
- Drag and drop a Transition from the **Library** tab into the SCM control drawing and position it under the **MANUALLY_ADD_B** Step

Tab	Name	Description	
Main	**MSSG_ CNFRM**	**WAIT MSSG CONFIRM**	
	Description	Condition Expression	Gate
Condition #1	**WAIT CONFIRMATION**	**CM#_MESSAGES.XFERB .CONFIRMED[2]**	**P1**
Condition #2			
Condition #3			
Condition #4			

	Pri Gate (1)	Pri Gate (2)	Pri Gate (3)	Secondary Gate
Gates	**CONNECT**			**CONNECT**

- Click **OK**
- Wire the **MANUALLY_ADD_B Step** to the **MSSG_ CNFRM Transition**

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Notes

Required Transition

In order for a Confirm Message to pause a SCM, a Transition condition must wait for the message's Confirm flag to go true. This happens when the message is confirmed in the Station Message Summary page.

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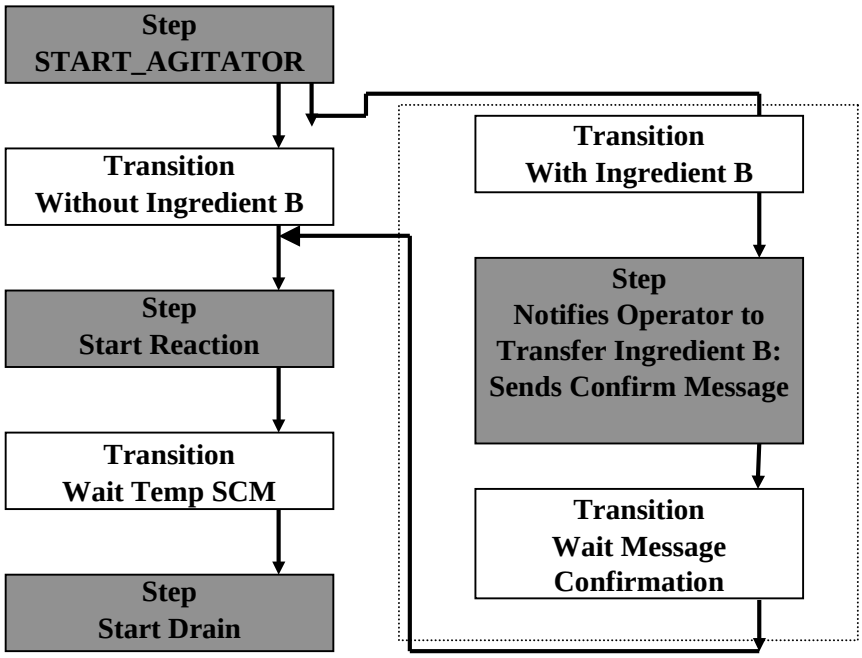
➢Branching …*continued*

- Now you have completed the ***with Ingredient B*** branch. From this point we will return our configuration to the ***without ingredient B*** Transition.
- The Without B Transition and Start Reaction Step must be in place to make the wiring connections



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Notes

Configuring a Supervisory SCM (SCM#_REACTR)

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➢Adding and Configuring a Transition

- Scroll up and **left** to a fresh screen
- Drag and drop a Transition from the **Library** tab into the SCM control drawing and position it under the **START_AGITATOR** Step

Tab	Name		Description	
Main	**NO_ING_B**		**NO INGREDIENT B**	
	Description		Condition Expression	Gate
Condition #1	**WAIT FOR AGITATOR ON LOW**		**CM#_AGIT101.DEVCTLA.GPV = 4**	**P1**
Condition #2	**WAIT FOR SCM#_XFERA COMPLETE**		**SCM#_XFERA.STATE = 5**	**P2**
Condition #3	**NO INGR B (FLAG OFF)**		**CM#_FLAGS.ING_B.PVFL = 0**	**P3**
Condition #4				
	Pri Gate (1)	Pri Gate (2)	Pri Gate (3)	Secondary Gate
Gates	**CONNECT**	**CONNECT**	**CONNECT**	**AND**

- Click **OK**
- Wire the **START_AGITATOR Step** to the **NO_ING_B Transition**

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Notes

Without Ingredient B

The without Ingredient B branch will be taken if the ING_B flag is in the off position. This transition will wait for the Agitator to be on low and SCM#_XFERA to complete. Once both are true and the flag is in the off position:

CM#_FLAGS.ING_B.PVFL = 0

the branch will then continue.

Configuring a Supervisory SCM (SCM#_REACTR)

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➢Adding and Configuring a Step

- Scroll down in the **REACTR_SCM** to a fresh screen
- Drag and drop a Step from the **Library** tab into the SCM control drawing and position it under the **NO_ING_B** Transition

Tab	Name		Description	
Main	**START_REACTION**		**START REACTION**	
	Wait Time	**0**	Active Time	**240**
	Description		Output Expression	
Out #1	**RESET XFERA**		**SCM#_XFERA.COMMAND := 3**	
Out #2	**AGITATOR TO HIGH SPEED**		**CM#_AGIT101.DEVCTLA.GOP := 5**	
Out #3	**START TEMPERATURE SCM**		**SCM#_TEMP.COMMAND := 2**	
Out #4				

- Click **OK**
- Wire the **NO_ING_B Transition** to the **START REACTION Step**
- Wire the **REQUIRED_TRANSITION Transition** to the **START REACTION Step**

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Notes

Start Reaction

Here we are creating the reaction in our Reactor. Our Step Output #1 is designed to return our Tank A Transfer SCM to the Idle state. This is important in preparing the SCM for later use.

The wiring is more complicated in this step. Here we are making the return connection from our second branch. To better understand how the connection is to be made refer to the diagram on 8-43.

Configuring a Supervisory SCM (SCM#_REACTR)

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➢Adding and Configuring a Transition

- Scroll down in the **REACTR_SCM** to a fresh screen
- Drag and drop a Transition from the **Library** tab into the SCM control drawing and position it under the **START REACTION** Step

Tab	Name		Description	
Main	**WAIT_TEMP**		**WAIT TEMP**	
	Description	Condition Expression		Gate
Condition #1	**WAIT TEMP_SCM COMPLETE**	**SCM#_TEMP.STATE = 5**		**P1**
Condition #2	**WAIT TEMP_SCM ABORTED**	**SCM#_TEMP.STATE = 17**		**P1**
Condition #3				
Condition #4				
	Pri Gate (1)	Pri Gate (2)	Pri Gate (3)	Secondary Gate
Gates	**OR**			**CONNECT**

- Click **OK**
- Wire the **START REACTION Step** to the **WAIT_TEMP Transition**

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Notes

TEMP_SCM Complete or Aborted

Here we wait for the SCM#_TEMP to either go to Completed (normal operation) or to Aborted (abnormal operation). Later we will add an Abort Handler to to the SCM#_TEMP.

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➢Adding and Configuring a Step

- Scroll down in the **REACTR_SCM** to a fresh screen
- Drag and drop a Step from the **Library** tab into the SCM control drawing and position it under the **WAIT_TEMP** Transition

Tab	Name		Description	
Main	**START_DRAIN**		**START DRAIN**	
	Wait Time	**0**	Active Time	**240**
	Description		Output Expression	
Out #1	**AGITATOR TO LOW**		**CM#_AGIT101.DEVCTLA.GOP := 4**	
Out #2	**STOP DRAIN TOTALIZER**		**CM#_ACCA.TOTAL_REACTR.COMMAND := 2**	
Out #3	**RESET DRAIN TOTALIZER**		**CM#_ACCA.TOTAL_REACTR.COMMAND := 3**	
Out #4	**SET DRAIN TARGET = REACTR LVL**		**CM#_ACCA.TOTAL_REACTR.ACCTV := CM#_LVLA.LEVEL_REACTR.PV**	
Out #5	**START DRAIN TOTALIZER**		**CM#_ACCA.TOTAL_REACTR.COMMAND := 1**	
Out #6	**OPEN DRAIN VALVE**		**CM#_FV103.DEVCTLA.GOP := 5**	

- Click **OK**
- Wire the **WAIT_TEMP Transition** to the **START_DRAIN Step**

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Notes

Configuring a Supervisory SCM (SCM#_REACTR)

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➢Adding and Configuring a Transition

- Scroll down in the **REACTR_SCM** to a fresh screen
- Drag and drop a Transition from the **Library** tab into the SCM control drawing and position it under the **START_DRAIN** Step

Tab	Name		Description		
Main	**WAIT_DRAIN_OPEN**		**WAIT DRAIN OPEN**		
	Description		Condition Expression		Gate
Condition #1	**WAIT DRAIN OPEN**		**CM#_FV103.DEVCTLA.GPV = 5**		**P1**
Condition #2					
Condition #3					
Condition #4					
	Pri Gate (1)	Pri Gate (2)	Pri Gate (3)	Secondary Gate	
Gates	**CONNECT**			**CONNECT**	

- Click **OK**
- Wire the **START_DRAIN Step** to the **WAIT_DRAIN_OPEN Transition**

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Notes

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➢Adding and Configuring a Step

- Scroll down in the **REACTR_SCM** to a fresh screen
- Drag and drop a Step from the **Library** tab into the SCM control drawing and position it under the **WAIT_DRAIN_OPEN** Transition

Tab	Name		Description	
Main	**START_DRN_PUMP**		**START DRAIN PUMP**	
	Wait Time	**0**	Active Time	**240**
	Description		Output Expression	
Out #1	**START DRAIN PUMP**		**CM#_PMP103.DEVCTLA.GOP := 5**	
Out #2	**RESET SCM#_TEMP**		**SCM#_TEMP.COMMAND := 3**	
Out #3	**STOP AGITATOR**		**CM#_AGIT101.DEVCTLA.GOP := 6**	
Out #4				

- Click **OK**
- Wire the **WAIT_DRAIN_OPEN Transition** to the **START_DRN_PUMP Step**

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Notes

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➢Adding and Configuring a Transition

- Scroll down in the **REACTR_SCM** to a fresh screen
- Drag and drop a Transition from the **Library** tab into the SCM control drawing and position it under the **START_DRN_PUMP** Step

Tab	Name	Description	
Main	**WAIT_DRAIN**	**WAIT DRAIN**	
	Description	Condition Expression	Gate
Condition #1	**WAIT REACTOR EMPTY**	**CM#_LVLA.LEVEL_REACTR.PV <= 0.0**	**P1**
Condition #2			
Condition #3			
Condition #4			

	Pri Gate (1)	Pri Gate (2)	Pri Gate (3)	Secondary Gate
Gates	**CONNECT**			**CONNECT**

- Click **OK**
- Wire the **START_DRN_PUMP Step** to the **WAIT_DRAIN Transition**

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Notes

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This completes….

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