Honeywell

PlantScape Controller Implementation

Lesson 1

Creating a Transfer SCM (SCM#_XFERA)

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Notes

Introduction

The purpose of this Lesson is to give you the knowledge to be able to configure Sequential Control Modules. Upon completion of this Lesson you will have Created, Activated and Operated the Tank A Transfer SCM.

Objectives

❶ Create a New SCM

❷ Add Steps and Transitions

❸ Wire Steps and Transitions

❹ Load, Activate and Operate the SCM

Creating a Transfer SCM (SCM#_XFERA)

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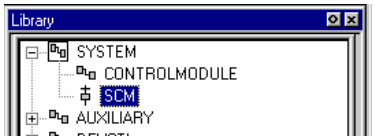
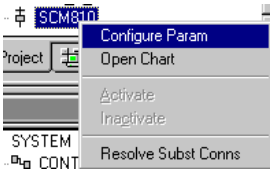
➢Create a New SCM

- 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#_XFERA**
  - Description **TANK A TRANSFER**
  - Key Word **A TRANSFER**



- Close SCM and Assign to **CEE0101**

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Notes

Tank A Transfer Description

The Tank A transfer SCM automates the transfer of Ingredient A to the Reactor.

The process is as follows

• The Tank A totalizer **CM#_ACCA.TOTAL_A** is stopped and reset, and a charge amount is entered

• The totalizer is started and the Tank A bottom valve **(CM#_FV101)** is opened

• The A transfer regulatory control valve **(CM#_FV101RC)** is opened to 50% and the A pump **(CM#_PMP101)**

is started

• The transfer flow is regulated to the required SP and continues until the target amount is reached

• The pump is stopped, the regulatory control valve is closed, and the bottom valve is closed

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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	**XFERA FLAG ON**		**CM#_FLAGS.XFER_A.PVFL**		**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 Conditions

There is one start condition for XFER_A. It looks at the **XFER_A** flag block in **CM#_FLAGS**. When the flag is on, the SCM starts.

Creating a Transfer SCM (SCM#_XFERA)

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➢Adding and Configuring a Step

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

Tab	Name		Description	
Main	**INITIALIZE_A**		**INITIALIZE A**	
	Wait Time	**0**	Active Time	**240**
	Description		Output Expression	
Out #1	**TOTALIZER A COMMAND MODE**		**CM#_ACCA.TOTAL_A.CMDATTR := 0**	
Out #2	**RESET TOTALIZER A**		**CM#_ACCA.TOTAL_A.COMMAND := 3**	
Out #3	**SET A TARGET AMOUNT**		**CM#_ACCA.TOTAL_A.ACCTV := SCM#_XFERA.RECTARGET[1]**	
Out #4	**CM#_FV101 MODEATTR TO PGM**		**CM#_FV101.DEVCTLA.MODEATTR := 2**	
Out #5	**CM#_PMP101 MODEATTR TO PGM**		**CM#_PMP101.DEVCTLA.MODEATTR := 2**	
Out #6	**STOP TOTALIZER**		**CM#_ACCA.TOTAL_A.COMMAND := 2**	

- Click **OK**
- Wire the **INVOKE_MAIN Transition** to the **INITIALIZE_A Step**

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Notes

Outputs to Totalizers

In order for a SCM to command a totalizer, the command attribute of the totalizer must be set to OPERATOR.

Here we Stop and Reset the totalizer, after setting its command attribute to OPERATOR. We then use SCM#_XFERA's first recipe value to store the required charge amount.

For more information on how to configure and use TOTALIZER function blocks refer to the *Control Builder Components Reference, Auxiliary Function, TOTALIZER Block.*

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➢Adding and Configuring a Transition

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

Tab	Name	Description		
Main	**CHECK_TOTALIZER**	**CHECK TOTALIZER**		
	Description	Condition Expression		Gate
Condition #1	**VERIFY TOTALIZER STOPPED**	**CM#_ACCA.TOTAL_A.STATE = 0**		**P1**
Condition #2	**VERIFY TOTALIZER RESET**	**CM#_ACCA.TOTAL_A.PV = 0.0**		**P1**
Condition #3	**VERIFY CM#_PMP101 MODEATTR**	**CM#_PMP101.DEVCTLA.MODEATTR = 2**		**P2**
Condition #4				
	Pri Gate (1)	Pri Gate (2)	Pri Gate (3)	Secondary Gate
Gates	**AND**	**CONNECT**		**AND**

- Click **OK**
- Wire the **INITIALIZE_A Step** to the **CHECK_TOTALIZER Transition**

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Notes

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➢Adding and Configuring a Step

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

Tab	Name		Description	
Main	**OPEN _CM#_FV101**		**OPEN CM#_FV101**	
	Wait Time	**15**	Active Time	**240**
	Description		Output Expression	
Out #1	**START TOTALIZER**		**CM#_ACCA.TOTAL_A.COMMAND := 1**	
Out #2	**OPEN CM#_FV101**		**CM#_FV101.DEVCTLA.GOP := 5**	
Out #3				
Out #4				

- Click **OK**
- Wire the **CHECK_TOTALIZER Transition** to the **OPEN _CM#_FV101 Step**

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Notes

Controlling a Device Control Block

The parameter used to control a device control block from a SCM is **GOP**, Generic Output. Its counterpart for monitoring status is **GPV,** Generic Process Variable.

As we saw when we configured device control blocks, the states of a two-state device have ordinal values of 0 and 1. Those of a three-state have 0, 1, and 2. The ordinal values cannot be referenced directly from the SCM as they represent enumerated states.

That is why the Generic parameters were developed. If you look up GOP and GPV in the Knowledge Builder Parameter Reference, you will see that the GOP and GPV value that corresponds to ordinal 0 is 4. For ordinal 1, it is 5 and for ordinal 2, it is 6.

Here we set GOP for **CM#_FV101** to 5, corresponding to ordinal 1, which opens the valve.

For more information on how to configure and use Device Control function blocks refer to the *Control Builder Parameter Reference, GOP / GPV*.

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➢Adding and Configuring a Transition

- Scroll down in the **SCM#_XFERA** to a fresh screen
- Drag and drop a Transition from the **Library** tab into the SCM control drawing and position it under the **OPEN_CM#_FV101** Step

Tab	Name	Description		
Main	**CK_FV101_OPEN**	**CHECK FV101 OPEN**		
	Description	Condition Expression	Gate	
Condition #1	**CHECK CM#_FV101 OPEN**	**CM#_FV101.DEVCTLA.GPV = 5**		**P1**
Condition #2	**VERIFY TOTALIZER RUNNING**	**CM#_ACCA.TOTAL_A.STATE = 1**	**P1**	
Condition #3				
Condition #4				
	Pri Gate (1)	Pri Gate (2)	Pri Gate (3)	Secondary Gate
Gates	**AND**			**CONNECT**

- Click **OK**
- Wire the **OPEN_CM#_FV101** to the **CHECK_FV101_OPEN Transition**

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➢Adding and Configuring a Step

- Scroll down in the **SCM#_XFERA** to a fresh screen
- Drag and drop a Step from the **Library** tab into the SCM control drawing and position it under the **CHECK_FV101_OPEN** Transition

Tab	Name		Description	
Main	**OPEN _FV101RC**		**OPEN FV101RC**	
	Wait Time	**5**	Active Time	**240**
	Description		Output Expression	
Out #1	**CM#_FV101RC MODEATTR TO PGM**		**CM#_ FV101RC.PIDA.MODEATTR := 2**	
Out #2	**CM#_ FV101RC MODE TO MAN**		**CM#_ FV101RC.PIDA.MODE := 0**	
Out #3	**CM#_ FV101RC OP TO 50%**		**CM#_ FV101RC.PIDA.OP := 50.0**	
Out #4	**START CM#_PMP101**		**CM#_PMP101.DEVCTLA.GOP := 5**	

- Click **OK**
- Wire the **CHECK_FV101_OPEN Transition** to the **OPEN _CM#_FV101RC Step**

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Notes

Step Times

Each step can have two time values configured, the Min Wait Time and the Max Active Time. Each has a different purpose.

The wait time is used to add a specific time period to the process. It is expressed in SCM cycles. For example, if the process requires a 10 second delay and the SCM was running on a half second cycle, you would enter a wait time of 20. The step would then take its configured actions and then start the timer. After 10 seconds, the next transition would become active.

The active time is used to set an alarm if the SCM is stuck at a particular step. It is also expressed in SCM cycles. If the step is active for longer than the specified active time, the SCM will cause a process alarm to sound.

For more information on how to configure and use Steps refer to the *Control Builder Components Theory, Sequential Control, STEP Block.*

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➢Adding and Configuring a Transition

- Scroll down in the **SCM#_XFERA** to a fresh screen
- Drag and drop a Transition from the **Library** tab into the SCM control drawing and position it under the **OPEN _CM#_FV101RC** Step

Tab	Name	Description		
Main	**CK_TRANSFER**	**CHECK TRANSFER**		
	Description	Condition Expression		Gate
Condition #1	**CHECK CM#_PMP101 ON**	**CM#_PMP101.DEVCTLA.GPV = 5**		**P1**
Condition #2	**CHECK CM#_FV101RC FLOW**	**CM#_FV101RC.PIDA.PV > 35.0**		**P2**
Condition #3				
Condition #4				
	Pri Gate (1)	Pri Gate (2)	Pri Gate (3)	Secondary Gate
Gates	**CONNECT**	**CONNECT**		**AND**

- Click **OK**
- Wire the **OPEN _CM#_FV101RC Step** to the **CHECK_TRANSFER Transition**

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Notes

Transitions to Verify Step Outputs

Through out the SCM we use transitions to verify that step outputs have taken effect. This ensures that the SCM is doing its intended job.

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➢Adding and Configuring a Step

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

Tab	Name		Description	
Main	**REGULATE_FLOW**		**REGULATE FLOW**	
	Wait Time	**0**	Active Time	**240**
	Description		Output Expression	
Out #1	**CM#_FV101RC MODE TO AUTO**		**CM#_FV101RC.PIDA.MODE := 1**	
Out #2	**SET FLOW RATE**		**CM#_FV101RC.PIDA.SP :=SCM#_ XFERA. RECTARGET[2]**	
Out #3				
Out #4				

- Click **OK**
- Wire the **CHECK_TRANSFER Transition** to the **REGULATE_FLOW Step**

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Notes

Regulating Flow

To allow flexibility in the flow of Ingredient A, we are using the second **SCM#_XFERA** recipe parameter to store the flow set point. An operator or another SCM can therefore change the flow rate as required.

Creating a Transfer SCM (SCM#_XFERA)

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➢Adding and Configuring a Transition

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

Tab	Name	Description		
Main	**WAIT_TOTALIZER**	**WAIT TOTALIZER**		
	Description	Condition Expression		Gate
Condition #1	**WAIT FOR TOTALIZER**	**CM#_ACCA.TOTAL_A.ACCTVFL = 1**		**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 **REGULATE_FLOW Step** to the **WAIT_TOTALIZER Transition**

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Notes

Totalizer Functionality

The totalizer sets a flag when it reaches its target amount. This flag can be used in SCMs or in interlocks to close valves, stop pumps, etc.

The parameter used to monitor this flag is ACCTVFL

For more information on how to configure and use TOTALIZER function blocks refer to the *Control Builder Components Theory, Auxiliary Function, TOTALIZER Block.*

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➢Adding and Configuring a Step

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

Tab	Name		Description	
Main	**STOP_PUMP**		**STOP PUMP**	
	Wait Time	**0**	Active Time	**240**
	Description		Output Expression	
Out #1	**ENSURE PMP MODEATTR IS PGM**		**CM#_PMP101.DEVCTLA.MODEATTR := 2**	
Out #2	**STOP PUMP**		**CM#_PMP101.DEVCTLA.GOP := 4**	
Out #3				
Out #4				

- Click **OK**
- Wire the **WAIT_TOTALIZER Transition** to the **STOP_PUMP Step**

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Notes

Interlocks vs SCM Outputs

CM#_PMP101 is interlocked to stop when **CM#_FV101** is closed or when **CM#_ FV101RC** is closed. If the configured interlocks meet the process requirements, then no SCM output is necessary. The action will be handled by the interlock.

Here we are stopping the pump prior to the valves closing and therefore we include the step output to stop the pump.

In the upcoming SCM to control Tank B transfer and Reactor draining, we will allow process overrides to control the corresponding pumps.

Creating a Transfer SCM (SCM#_XFERA)

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➢Adding and Configuring a Transition

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

Tab	Name	Description		
Main	**CHECK_PUMP_OFF**	**CHECK PUMP OFF**		
	Description	Condition Expression		Gate
Condition #1	**CHECK CM#_PMP101 IS OFF**	**CM#_PMP101.DEVCTLA.GPV = 4**		**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 **STOP_PUMP Step** to the **CHECK_PUMP_OFF Transition**

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Creating a Transfer SCM (SCM#_XFERA)

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➢Adding and Configuring a Step

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

Tab	Name		Description	
Main	**CLOSE_RCVLV**		**CLOSE CM#_RCVLV**	
	Wait Time	**0**	Active Time	**240**
	Description		Output Expression	
Out #1	**CM#_FV101RC MODEATTR PGM**			
Out #2	**CM#_FV101RC MODE TO MANUAL**			
Out #3	**CM#_FV101RC OP TO ZERO**			
Out #4	**CM#_FV101RC MODEATTR TO OPER**			

- Click **OK**
- Wire the **CHECK_PUMP_OFF Transition** to the **CLOSE_CM#_FV101RC Step**

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Notes

SCMs

From this point forward you will only be given the Descriptions, you will configure the Expression. Solutions are on page 19.

Creating a Transfer SCM (SCM#_XFERA)

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➢Adding and Configuring a Transition

- Scroll down in the **SCM#_XFERA** to a fresh screen
- Drag and drop a Transition from the **Library** tab into the SCM control drawing and position it under the **CLOSE_FV101RC** Step

Tab	Name		Description	
Main	**CK_RCVLV_CLSD**		**CK CM#_FV101RC CLSD**	
	Description	Condition Expression		Gate
Condition #1	**CHECK CM#_FV101RC CLOSED**	**(Ensure the PV is <= 3)**		**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 **CLOSE_CM#_FV101RC Step** to the **CHECK_RCVLV_CLSD Transition**

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➢Adding and Configuring a Step

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

Tab	Name		Description	
Main	**CLOSE_CM#_FV101**		**CLOSE CM#_FV101**	
	Wait Time	**0**	Active Time	**240**
	Description		Output Expression	
Out #1	**ENSURE MODEATTR PGM**			
Out #2	**CLOSE CM#_FV101**			
Out #3				
Out #4				

- Click **OK**
- Wire the **CHECK_FV101RC_CLOSED Transition** to the **CLOSE_CM#_FV101 Step**

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➢Adding and Configuring a Transition

- Scroll down in the **SCM#_XFERA** to a fresh screen
- Drag and drop a Transition from the **Library** tab into the SCM control drawing and position it under the **CLOSE_CM#_FV101** Step

Tab	Name		Description	
Main	**CK_FV_CLOSED**		**CHECK FV101 CLOSED**	
	Description	Condition Expression		Gate
Condition #1	**CHECK CM#_FV101 CLOSED**			**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 **CLOSE_CM#_FV101 Step** to the **CHECK_FV_CLOSED Transition**

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Notes

Solutions to expressions

Step CLOSE_CM#_FV101RC:CM#_FV101RC.PIDA.MODEATTR := 2
CM#_ FV101RC.PIDA.MODE := 0
CM#_ FV101RC.PIDA.OP := 0.0
CM#_ FV101RC.PIDA.MODEATTR := 1

Transition CK_CM#_FV101RC_CLSD: CM#_FV101RC.PIDA.PV <= 3.0

Step CLOSE_ CM#_ FV101: CM#_ FV101.DEVCTLA.MODEATTR := 2
CM#_ FV101.DEVCTLA.GOP := 4

Transition CK_ CM#_ FV101_CLOSED: CM#_FV101.DEVCTLA.GPV = 4

Creating a Transfer SCM (SCM#_XFERA)

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➢Configuring Recipe Values

- Double click on empty space and click on the **Recipes** tab
- Enter the following information on the **Recipes** tab*

	PARAMETER DESCRIPTION	Value	HI	LO
– **1)**	**TOTAL_A TARGET**	**90**	**150**	**10**
– **2)**	**CM#_FV101RC FLOW TARGET**	**80**	**100**	**30**

- **Close** the SCM and **Save** changes
- Load and Activate **SCM#_XFERA**
- Open Station and configure **SCM#_XFERA** into Group #3 Slot 4
- Start **SCM#_XFERA** by turning on Flag **XFER_A** (Group #2 or #4, **CM#_FLAGS**)
- Monitor from Group #3 and from Control Builder as Ingredient A is transferred to the reactor

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Notes

Configuring Recipe Values

We used Recipe Values #1 and #2 in Steps **INITIALIZE_A and REGULATE_FLOW** respectively. Here we will configure those Recipe values. To configure Recipe values, you highlight the value you wish to input. This places the recipe parameters in the parameter entry port.

* As you type in the data, use the <Tab> key to move between entry ports, and to enter the completed value into the list. Only press the <Enter> key when you are finished with all Recipe Value configuration.

Note that we are entering initial values. These can be modified on-line by operators, SCMs, and Batch Packages.

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This completes….

PlantScape Controller Implementation

Lesson 1

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Notes