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Sequential Control

User's Guide

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Honeywell International

Process Solutions

2500 West Union Hills

Phoenix, AZ 85027

1-800 343-0228

About This Document

The Sequential Control User's Guide describes how to plan, configure, operate and troubleshoot Experion sequential and procedural control.

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References

The following list identifies all documents that may be sources of reference for material discussed in this publication.

Document Title

Contacts

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Location	Organization	Phone
United States and Canada	Honeywell IAC Solution Support Center	1-800-822-7673
Europe	Honeywell TAC-EMEA	+32-2-728-2704
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People's Republic of China	Honeywell Global TAC - China	+86-10-8458-3280 ext. 361
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Taiwan	Honeywell Global TAC - Taiwan	+886-7-323-5900
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Symbol Definitions

The following table lists those symbols used in this document to denote certain conditions.

Symbol	Definition
	**ATTENTION:** Identifies information that requires special consideration.
	**TIP:** Identifies advice or hints for the user, often in terms of performing a task.
	**REFERENCE -EXTERNAL:** Identifies an additional source of information outside of the bookset.
	**REFERENCE - INTERNAL:** Identifies an additional source of information within the bookset.
CAUTION	Indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process.
	**CAUTION**: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. **CAUTION** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
	**WARNING**: Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or death. **WARNING** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.

Symbol	Definition
	**WARNING, Risk of electrical shock**: Potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible.
	**ESD HAZARD:** Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices.
	**Protective Earth (PE) terminal**: Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	**Functional earth terminal**: Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national local electrical code requirements.
	**Earth Ground**: **Functional earth connection.** NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.
	**Chassis Ground**: Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.

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Planning Sequential and Procedural Control

Introduction - Sequential and Procedural Control

Controls in Experion can be designed to execute sequential and procedural process activities such as start up, shut down, react, and crystallize as well as other complex procedures. In all instances, controls interact with one or more control module, sequential control module, and/or recipe control module. Experion has a container called Control Module (CM) in which discrete and continuous devices are configured for specific control functionality. Control Modules can be configured to control a PID loop, discrete valves, accumulated flows, etc. A complete understanding of the control module functions for your process is a pre-requisite for creating effective sequential and procedural control strategies.

In Experion, Sequential Control Modules execute sequential control and Recipe Control Modules execute procedural control. The Sequential Control Modules and related function blocks are included in the standard Experion system.

The **Sequential Control Module (SCM)** and the **Recipe Control Module (RCM)** are containers composed of one or more Handler. Each SCM handler can contain transition, step, and/or synchronization blocks. Each RCM Handler can contain phase, transition, step, and/or synchronization blocks.

- A Transition block waits for specific process conditions to be true. When the logical statement formed by a transition's conditions and logic gates is true, the SCM and RCM executes the next step, phase or synchronization block.
- A Step block executes output expressions that change process parameters and/or provide instructions to the operator.
- A Synchronization block enables the SCM and RCM to execute parallel paths contained within the handler.
- A Phase block is used in an RCM procedure to monitor and control the execution of a linked Equipment Module that can be implemented as an SCM. The Phase block is unique to sequential and procedural control because it is instantiated from a user template for a Phase or a Phase block type that was created with the Parameter Definition Editor (PDE). The Phase block type is added to the Library tree of Control Builder and dragged into an RCM to instantiate a Phase block.

If no interrupt or abnormal conditions occur, a handler executes transitions, steps, and phases in sequential order until reaching the end of the module's program where the module is either completed or returned to start. Execution can be interrupted by predetermined conditions that can interrupt, stop, hold, or abort the SCM and/or RCM.

In the Level 1 Device approach to sequential control, the Control Module is configured to track the SCM that sends Control Request to it. Configuring a control module as a Level 1 Device allows for an operating philosophy in which Control Modules react to SCM state changes. Each user determines the approach to sequential control that aligns with their control philosophy.

In addition to sequential control programs, each SCM contains SCM recipe parameters and SCM history parameters. SCM Recipe parameters are used for setting process values. SCM History parameters are used for recording critical process data during sequence execution.

To execute procedural control programs, each RCM works in unison with a Unit Control Module (UCM). Implementation of the UCM requires additional licensing.

The UCM represents a defined set of manufacturing equipment where the procedural sequence executes as directed by the RCM. The functionality of the UCM is similar to the CM with the exception that the UCM contains no executable function blocks and the UCM has a built-in resource used to synchronize the execution of simultaneous RCMs.

How much Memory will be required for SCMs/RCMs?

Estimating the number of controllers required for a project is part of pre-project planning. For detailed information on Processing and Memory Resource Requirements refer to the Experion CEE-based Controller Specifications Data.

How does SCM/RCM scheduling affect the controller?

To provide the flexibility to “load balance” a controller, each SCM/RCM container has three parameters that enable the user to efficiently distribute the execution of SCMs/RCMs. Entering appropriate values for an execution period and phase will distribute tasks throughout the controller’s cycles/phases. In the case of a fully loaded controller, you can avoid cycle/phase overruns by planning execution timing. During a single cycle/phase, the controller will

- execute SCMs/RCMs
- execute CMs/UCMs
- service peer environment requests
- service user displays

Control Execution Environment (CEE) controllers execute tasks in 40 cycles or phases. Application Control Environment (ACE) supervisory controllers execute tasks in 120 cycles/phases.

When manually structuring execution, answer the following for each SCM/RCM.

- How frequently does the SCM/RCM need to execute?
- In which timing cycle should SCM/RCM execution start?

When an SCM is scheduled for a specific timing cycle/phase, the SCM's function blocks are executed in that timing cycle/phase.

The combination of parameters Execution Period and Execution Phase uniquely determine the set of cycles/phases in which the SCM/RCM executes.

The relative maximum speed of progression of steps/phases is independent of the execution period of the SCM. The SCM will always advance at most one step or phase/transition per thread in any execution cycle assuming all transition conditions within the transition block are true and do not block execution. If multiple transition blocks follow a step, all transition blocks connected to the same step will be computed in the same cycle. All threads will be processed in the same cycle. At most, one SYNC object per thread will be processed in one cycle.

Defining SCM/RCM execution period

The Execution Period of an SCM/RCM container is the amount of time between two consecutive executions of the SCM/RCM. If the process requires the SCM/RCM to execute twice every second, then the SCM/RCM Execution Period must equal 500 msec. Execution of the SCM/RCM implies execution of the function blocks within the SCM/RCM container. Valid execution period entries vary depending on the controller.

For the 50 ms base cycle CEE --
Valid periods: DEFAULT, 50, 100, 200, 500, 1000, 2000ms
DEFAULT value is converted to 1000 ms upon load to a 50 ms CEE.

For the 5 ms base cycle CEE --
Valid periods: DEFAULT, 5, 10, 20, 50, 100, 200ms
DEFAULT value is converted to 200 ms upon load to a 5 ms CEE.

For the 500 ms base cycle ACE --
Valid periods: DEFAULT, 500ms, 1s, 2s, 10s, 20s
DEFAULT value is converted to 2 second upon load to ACE
An SCM can not execute any slower than every 20s in ACE.

Defining SCM/RCM execution phase

The Execution Phase of an SCM/RCM container determines the cycles/phases in which the SCM/RCM executes. You can either allow the system to assign the phase automatically or you can define distribution of the block processing among load cycles.

The Execution Phase is the "starting point" for the module. Allowable Execution Phase values are dependent on the Execution Period entered. In all cases, the Default value is -1 which causes automatic balancing to occur.

For the 50 ms base cycle CEE -	
If Execution Period (ms)	**then valid Execution Phases**
50 ms	0
100 ms	0, 1
200 ms	0, 1, 2, 3
500 ms	0 through 9
1000 ms	0 through 19
2000 ms	0 through 39

For the 5 ms base cycle CEE -	
If Execution Period (ms)	**then valid Execution Phases**
5 ms	0
10 ms	0, 1
20 ms	0, 1, 2, 3
50 ms	0 through 9
100 ms	0 through 19
200 ms	1 through 39

For the 500 ms base cycle ACE –	
If Execution Period (ms)	**then valid Execution Phases**
500 ms	0

For the 500 ms base cycle ACE –	
If Execution Period (ms)	**then valid Execution Phases**
1 s	0, 1
2 s	0, 1, 2, 3
5 s	0 through 9
10 s	0 through 19
20 s	1 through 39

The slowest period for an SCM/RCM is 20 seconds. SCM/RCM's cannot use pre-fetch. SCM/RCM's cannot use process special.

If a Control Module does not execute entirely in a particular cycle/phase, it tries to catch up and complete.

Example: In a 50 ms CEE
SCM1 with Period = 200 MS; Phase = 2, SCM1 runs during phase 2, 6, 10… 38.
SCM2 with Period = 200 MS; Phase = 1, SCM2 runs during phase 1, 5, 9… 37.
SCM1 and SCM2 will never run during the same phase.

How is the SCM/RCM structured?

The SCM/RCM is a container composed of one or more handler. Every SCM/RCM must have at least one main handler, but it can have multiple main handlers and optional exception handlers. A handler is an empty space to which transitions, steps, and synchronization blocks are added then configured as an ordered set of actions designed to carry out the activity required by the process operation. While only one handler can be actively executing, exception handlers can be waiting for specified process conditions. When the specified process condition occurs, the Main Handler's process actions cease execution and the exception handler (Abort, Stop, Hold, and Interrupt) begins its ordered set of process actions.

Evaluation of process conditions occurs in the following order:

- Invoke transition of Abort handler
- Invoke transition of Stop handler
- Invoke transition of Hold handler
- Invoke transition of Interrupt handler

- Current transitions of Main handler. When there are multiple branches (maximum 10) from one step of the handler, the transitions are evaluated from left to right.

The total number of steps, transitions, handlers and phases loaded in a controller is also limited by the available memory. It depends on the configuration of the SCMs/RCMs and the controller model and configuration, whether the Processing Units or the available memory will be the limiting factor for a particular configuration.

The maximum number of tested and qualified steps, phases, and transitions for all handlers in an SCM/RCM is 400; therefore, on large processes, planning the distribution of process actions throughout multiple SCM/RCMs is critical. In actuality, the total number of step, phase, transition, and synchronization blocks as well as the total number of SCMs and RCMs executing in a controller is dependent on all other functions being implemented in the controller and directly relates to the use of Processing Units per Control Cycle. The number of SCMs and RCMs allowable in the controller counts towards the common limit of control modules. Consult the controller's Specification document.

Role of the Handler in an SCM/RCM

A Handler contains a sequence of process actions executed in transitions and steps. There is no limit to the number of handlers in an SCM/RCM but maximum number of tested and qualified steps and transitions for all handlers in an SCM/RCM is 400. Only one handler can be active at a given time.

Configurable Handlers fall into the following categories:

- Check for normal exception handling and execution of normal process actions prior to Main (SCM/RCM Check Handler)
- Main for primary process actions (SCM/RCM Main Handler)
- Interrupt for normal exception handling and processing of Interrupt process actions (SCM Interrupt Handler)
- Hold for abnormal exception handling and processing of Hold process actions (SCM/RCM Hold Handler)
- Restart for normal exception handling and execution on return from SCM/RCM Hold (SCM/RCM Restart Handler)
- Stop for abnormal exception handling and processing of Stop process actions (SCM/RCM Stop Handler)
- Abort for abnormal exception handling and processing of Abort process actions (SCM/RCM Abort Handler)

The two non-configurable handlers are the SCM/RCM Null Handler and the SCM/RCM Edit Handler.

Handlers are prioritized from Main to Abort. Main is the lowest priority; Abort has the highest priority. If the Main handler is active and the Hold conditions become true, the Hold handler becomes the active handler. If at the same instance, conditions for the Abort handler become true, the Abort handler becomes the active handler.

Handler execution occurs when:

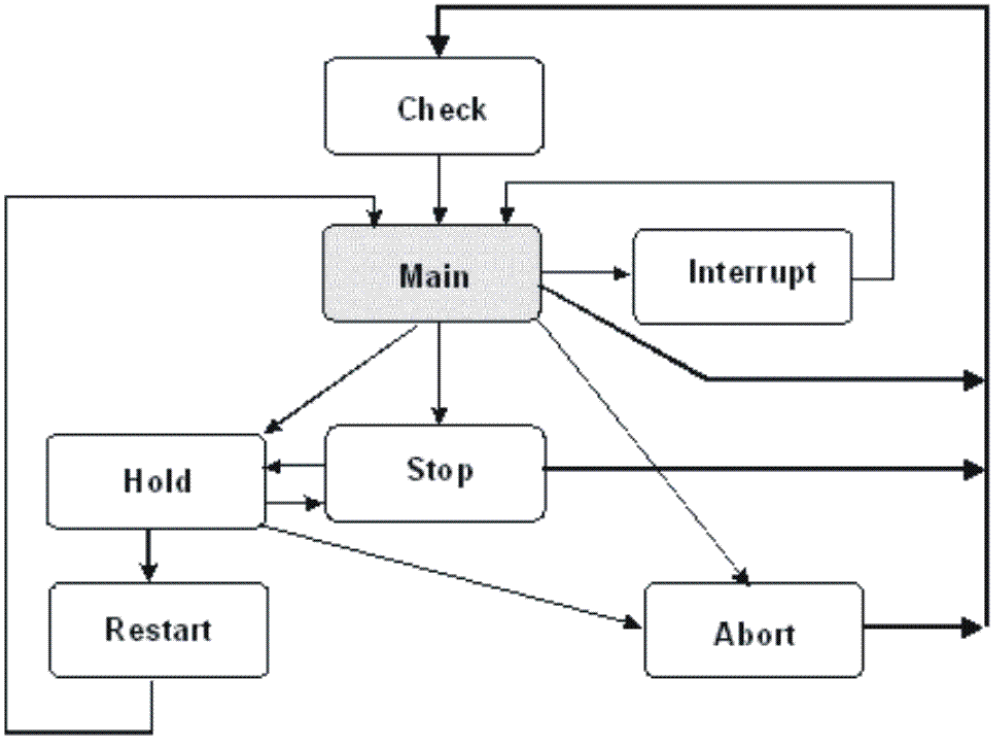
- The Handler Command (HOLD, STOP, ABORT, etc.) is set on by either an operator , an SCM/RCM, or a third party application

  OR

- The Handler is enabled (ENBHANDLER[1...8]=ON) AND the Handler's invoke transition conditions are true.

The Handler Diagram below illustrates the paths forward available for each handler type. For instance, while in the Hold Handler, the SCM/RCM can proceed to Stop, Restart, or Abort.

Note: The Interrupt handler applies to the SCM only.



SCM/RCM Check Handler

Check Handler is a normal exception handler which can be configured to initialize process equipment and/or reset values in order to setup and verify the base conditions required for the SCM/RCM to execute properly. No other handler is enabled when the Check Handler is executing. The Check Handler executes when

- SCM/RCM is initially entered after activation
- After a RESET command
- Conditions for the Check Handler are met after Stop Handler, Main Handler, Check Handler, or Abort Handler is complete

SCM/RCM Main Handler

Main Handler contains the primary sequential activities of the process. An SCM can have multiple Main handlers while an RCM can have only one Main handler.

The Main Handler executes

- Automatically when Main Handler is enabled and Main Handler's Invoke Transition conditions are true
- Manually when Main Handler is enabled and the operator sets SCM/RCM Command to START

SCM Interrupt Handler

Interrupt Handler is a normal exception handler that interrupts the activity of the Main Handler acting like a subroutine. The Interrupt Handler executes when

- The active Step's interrupt conditions are met
- Operator sets command to Interrupt
- For the SCM only, when the Interrupt Handler is enabled and its Invoke Transition conditions are met

When the Interrupt Handler completes, the program activity returns to the last Step in the Main Handler that had the Update Restart address Option ON if the Future Restart Address was not specifically modified. Restart address Option updates the SCM Restart address Future parameter.

SCM/RCM Hold Handler

Hold Handler is an abnormal exception handler that preempts the activity of the Main and/or Interrupt Handlers. The Hold Handler executes when

- Operator sets command to Hold. In this case, the entry conditions to the Handler are skipped and the Handler starts execution at the first Step.
- Another program sets command to Hold. In this case, the entry conditions to the Handler are skipped and the Handler start execution at the first Step.
- For the SCM only, when the Hold Handler is enabled and its Invoke Transition conditions are met.

When the Hold Handler completes, the SCM/RCM waits for a restart command to return to the last processing Main Handler Step with Update Restart address Option ON. If special processing or sequence operations are required to return the process to an

appropriate state before continuing, execute a Restart Handler. For the RCM, the Hold handler may contain only an Invoke transition facilitating the automatic state change of the RCM.

If a Restart Handler is used, the last block in the Hold Handler should be a Transition configured to be True only when the Hold Handler's Invoke transition conditions are not True. If this is not done, it is possible for a Restart Handler to execute its first Step while the Hold Invoke conditions are still True. In this case, the SCM/RCM returns to the Hold Handler when the first Step of the Restart Handler has already been executed.

SCM/RCM Restart Handler

Restart Handler is a normal exception handler that can only be initiated from the Held state and is executed on a transition from Held to Running state if configured and enabled. There is no monitored invoke condition for a Restart Handler. A Restart Command must be issued. The Restart Handler returns the activity to the Main Handler at the Step designated in the Restart address. For the RCM, the Restart handler may contain only an Invoke transition facilitating the automatic state change of the RCM.

SCM/RCM Stop Handler

Stop Handler is an abnormal exception handler that preempts the activity of the Main, Interrupt, Restart, or Hold Handler. A Stop Handler is usually designed to execute when the process needs to be driven to fail-safe state. The Stop Handler executes when

- Operator sets command to Stop. In this case, the entry conditions to the Handler are skipped and the Handler start execution at the first Step.
- Another program sets command to Stop. In this case, the entry conditions to the Handler are skipped and the Handler start execution at the first Step.
- For the SCM only, when the Stop Handler is enabled and its Invoke Transition conditions are met

From the Stop Handler, the SCM/RCM can go automatically to the Abort or Check Handler, by command to the Hold Handler, or when the Stopped State Option parameter = Terminal to a termination state. For the RCM, the Stop handler may contain only an Invoke transition facilitating the automatic state change of the RCM.

SCM/RCM Abort Handler

Abort Handler is an abnormal exception handler that preempts the activity of the Main, Interrupt, Restart, Hold or Stop Handler. The Abort Handler cannot be preempted. The Abort Handler executes when

- Operator sets command to Abort. In this case, the entry conditions to the Handler are skipped and the Handler start execution at the first Step.
- Another program sets command to Abort. In this case, the entry conditions to the Handler are skipped and the Handler start execution at the first Step.
- For the SCM only, when the Abort Handler is enabled and its Invoke Transition conditions are met

From the Abort Handler, the SCM/RCM returns to the Check Handler when

- Conditions of the Check Handler are met
- Operator sets command to Reset

An RCM constructed with parallel phases will remain in an 'ABORTING' state until all of the parallel phases have completed execution. Then and only then, will the RCM change its state to 'ABORTED'. For the RCM, the Abort handler may contain only an Invoke transition facilitating the automatic state change of the RCM.

SCM/RCM Null Handler

Null Handler is not configurable. The system uses the Null Handler when a Check, Interrupt, Hold, Restart, Stop, or Abort is commanded by the operator and not configured. Example: When a Main Handler is complete, it returns to Idle through the Check Handler. When there is no Check Handler configured, the Null Handler is used.

SCM/RCM Edit Handler

Edit Handler is not configurable. The Edit Handler is executed when the SCM/RCM is Inactive. The Edit Handler completes initialization activities and SCM/RCM validation. SCM/RCM validation looks for and identifies configuration errors in all Handlers, Steps, and Transitions of the SCM/RCM. When the SCM/RCM is in the validated state, the user should check the configuration status of the SCM/RCM and its components before starting the SCM/RCM.

Returning to specific step in the SCM/RCM Main Handler

When using exception handlers, it is necessary to plan the reentry point into the Main Handler once the exception handler is complete. The three parameters involved in configuring the reentry are Restart address Option, Restart address, and Restart address Future. The Restart address and Restart address Future determine the step to which the SCM/RCM will return to in the Main or Interrupt Handler. When the Restart address Option = ON, Restart address Future is update with the location associated with the Restart address Option.

The Restart address Number and Restart address Future Number parameters can be changed by an Output expression in an SCM/RCM. The SCM/RCM Component Number parameter can be used to modify the Restart address Number or Restart address Future Number using only statements that refer directly or indirectly to the Step, such as STEP_X.NUM.

If you are in the Main or Interrupt Handler and want to change the return location, then set the Restart address Future. If you are in any other Handler and want to change the return location, then set the Restart address. When you leave the Main or Interrupt Handler, the Restart address is set equal to the Restart address Future. For example, if the Interrupt Handler preempts the Main Handler, the Restart address is set equal to the Restart address Future and the Restart address Future is updated according to each Step's update Restart address option in the Interrupt Handler. If the Interrupt Handler is preempted, the Restart address is set equal to Restart address Future, and on Restart, the SCM/RCM will return to this Step in the Interrupt Handler.

Retaining Instruction Status on Return to SCM/RCM Main Handler

The Boolean Retain Instruction Status (RETAINISTS) parameter provides a mechanism to control what happens to the Instruction completion status of the Step in the Main handler that is returned to from an Interrupt, Restart, or Hold handler. On return to the Main handler, the SCM/RCM State becomes Running. The summary Instruction completion status of the Step (INSTRUCTCOMP) and of the individual Step Outputs (OP[].INSTRUCTCOMP) is the specific information that is retained or not.

RETAINISTS can only be used when the SCM/RCM REEXECPOLICY parameter is set to AlwaysReExecute. Store errors will result on attempts to store to RETAINISTS parameter when the SCM/RCM REEXECPOLICY parameter is set to Flexible.

RETAINISTS values of Off and On provide the following SCM/RCM FB behaviors.

RETAINISTS of Off – Instruction Status of the Step in Main Returned To is **not** retained, which means that any confirmable Instructions of the Step will have to be confirmed again, even if already confirmed prior to leaving the Main handler.

RETAINISTS of On – Instruction Status of the Step in Main returned to is retained, which means that any confirmable Instructions of the Step that have already been confirmed will not need to be confirmed again.

RETAINISTS has no effect on the Output Expressions of a Step. All Output Expressions (with or without Delays) of the Step are re-executed when the Step in Main is returned to, regardless of the value of RETAINISTS.

RETAINISTS can be set to On by the Interrupt, Restart, or Hold handler as required before returning to the Main handler. The value of RETAINISTS that is set in a Hold

handler is used on the next return to the Main handler. If a user configured Restart handler is defined and selected, it can choose to write a new value to RETAINISTS or not before the return to Main is actually executed. The value of RETAINISTS at the time of the return to Main will drive the SCM/RCM behavior.

After the return to Main handler is completed, RETAINISTS will always be set to Off. RETAINISTS must be set to On again for the next return to the Main handler if retaining the Instruction Status is desired again.

The single RETAINISTS parameter applies to all parallel Steps. A RETAINISTS option per parallel Step is not available.

Role of the Transition Function Block in an SCM/RCM

The transition function block is essentially a ‘wait’ statement. A transition can contain a maximum of 10 conditions with logic gates. The combined transition statement must be logically TRUE (=1) before the SCM/RCM will continue execution. Conditions are logically connected using three primary logic gates and one secondary gate. It is not required that all logic gates are used.

SCM/RCM Invoke Transition

Every handler starts with an invoke transition. To enforce this rule, all new handlers are opened with a default invoke transition in place. The default transition is a ‘null’ transition because it is configured with 0 conditions and all logic gates as none. When you use the default invoke transition as provided, the handler requires a start command either from the operator or from another SCM/RCM every time the SCM/RCM executes from the beginning of the sequence - the invoke transition.

If you want the handler to continuously re-execute (loop), the invoke transition must contain a statement that is always true and the last Step must be wired back to the Invoke Transition of the SCM/RCM. The simplest bypassable ‘always true’ condition has an expression with an integer constant of 1 and a 'Connect' or 'And' in the P1 and S logic gates. To disable automatic execution of the SCM/RCM when you use an always true Invoke transition, set the Force Permit parameter On and the Force Request Off; this sets the always true condition to false.

The transition name can be up to 16 characters and must be unique within the SCM/RCM block inclusive of all handlers. The transition description can be up to 39 characters. Refer to the parameters NAME and DESC.

SCM/RCM Transition Condition Expression

A condition expression can be no longer than 255 characters and can reference no more than 6 parameters. Parameters can be referenced as long as the container and function

block is already defined in the system database. Therefore, if an SCM/RCM references a Control Module parameter, the CM must be built with that parameter prior to building the SCM/RCM expression. Condition expressions can also reference the solution to another condition expression.

The expression operators for use in a condition expression are:

Operator	Type
+, -	Unary
+, -, *, /, ^ (exponent)	Binary arithmetic
<, >, <=, >=, =, <>	Relational
AND, OR, NOT	Logical
: ?:	Conditional (Example- X?Y:Z; similar to IF, THEN, ELSE)
( )	Parenthesis
[ ]	Array Syntax
+ (with string)	Concatenation

The three data types supported for time are:

Absolute Time - stored as a 64-bit integer representing the number of tenths of milliseconds since 1/1/1972; entered MM/DD/YYY hh:mm:ss:uuuu, where uuuu is milliseconds

Delta Time - stored as a 64-bit integer representing an Absolute time difference in tenths of milliseconds; entered as hh:mm:ss:uuuu where uuuu is milliseconds

Time of Day – an unsigned 32-bit integer that represents a time of day in tenths of milliseconds; entered as hh:mm:ss:uuuu where uuuu is milliseconds

The expression operators for use in a condition expression with TIME are:

Operator	Type
+	If both operands are of the same time data type the result is the same time data type. Delta time or Time of Day can be added to an Absolute Time, which results in an Absolute Time. Time of day can be added to Delta Time, which results in Delta Time.

Operator	Type
*	One operand can be delta time or time of day data type and the second must be a number. The result is a delta time data type.
-	Absolute time can be subtracted from Absolute Time, which results in Delta time. Delta time or Time of Day can be subtracted from Absolute Time, which results in Absolute time. Time of day can be subtracted from Delta Time, which results in a Delta Time.
=; <>, <=, >=, <, >	Compares two operands of type time. Both operands must be of the same time data type.
DAYS	Takes operand and returns equivalent delta time value.
HOURS	Takes operand and returns equivalent delta time value.
MINS	Takes operand and returns equivalent delta time value.
SECS	Takes operand and returns equivalent delta time value.

The functions for use in a condition expression are:

Function	Description
ABS	absolute value
ATN	arc tangent
SIN	Sine
COS	cosine
TAN	tangent
LOG	common logarithm of a number
LN	natural logarithm of a number
MOD	modulo; x MOD y
SQR	square of a number
SQRT	square root of a number
EXP	exponential

Function	Description
INT	integer; INT(2.3)=2
ISFIN	is finite
ISNAN	is not a number; ISNAN(2.3)=0(false); ISNAN(Nan)=1(true)
RND	round value; RND(3.7)=4
SGN	sign of a value; SGN(-3)=-1; SGN(2.4)=1; SGN(0)=0
TIMNUM	time to number; takes absolute TIME data type and returns a 64-bit float representing the total number of milliseconds since Jan 1, 1972
NUMTIM	number to time; takes a 64-bit float representing the number of milliseconds since Jan 1, 1972 and converts it to absolute TIME data type
DTIMNUM	Delta time number; takes a delta TIME data type and returns a 64-bit float representing the number of milliseconds
NUMDTIM	Number delta time; takes a 64-bit float representing some number in milliseconds and converts it to a delta TIME data type
STRTIM	String time; takes a string input parameter and converts it to an Absolute time. The string must be in the same format as an Absolute time constant
ABSTOD	Absolute time of day; takes an absolute time data type and strips off the year and date and returns a 64-bit float representing the time of day in milliseconds
TOD	Time of day; returns the current local time of day as Time of Day data type
UTCTOD	returns the current UTC time of day as the Time of Day data type
NOW	returns the current local date and time as an absolute time data type
UTCNOW	returns the current UTC date and time of day as an absolute time data type
PERIOD	Returns a FLOAT64 representing the parent Control Module’s period in seconds.
LEN	Returns the integer length of a string

Function	Description
STRNUM	Takes the input parameter and converts it to a float64
NUMSTR	Takes the input parameter, casts it to a float64 and converts it to a string
MID	Takes a string, an integer starting position and an integer length. Returns the specified portion of the original string

Multiple Argument Function	Description
MIN	minimum value of n arguments – ignore bad values
MAX	maximum value of n arguments – ignore bad values
AVG	average of n arguments
MID	median value of n arguments
MUL	product of n arguments
SUM	sum of n arguments

All functions operating with floating point numbers behave according to the rules defined by IEEE 745.

Condition expressions support String, Time, Enumeration, and Boolean data types. Enumeration and Boolean values must be entered as integers. Mode for example cannot be entered as Manual, Auto, Cascade; it must be entered as 0, 1, 2 where 0=Man; 1=Auto; 2=Cascade.

SCM/RCM Transition Condition Logic Gates

The logic gates that accept the condition expression values (1 = true or 0 = false) are structured with 3 primary gates (P1, P2, and P3) that feed into a single secondary gate (S). Gates P1, P2, and P3 can have a variable number of inputs as long as the total for the three does not exceed 10 (the transition condition limit). Three maximum inputs are allowed into the secondary gate S.

The selectable logic functions for the gates include NONE, ON, OFF, CONNECT, NOT, OR, NOR, AND, NAND, and XOR.

NONE, ON, and OFF have no inputs.
CONNECT and NOT have one input.
XOR must have two inputs. The XOR gate adheres to the IEC DID 61131-3 standard.

SCM/RCM Transition Condition Bypass/Force requests

A single condition can be forced to On or Off when the Force Permit flag is on. Force Permit can be used when you want to override a false condition you know to be true or to stop SCM/RCM execution when your invoke transitions is always true and the SCM/RCM is designed in a continually executing loop.

When the Transition Force Permit/Force Request is canceled or cleared, it is set at the SCM/RCM configuration level with the parameter Bypass Cancel Option (BYPCANCELOPT). The configured Bypass Cancel Option applies to all Transitions of all Handlers contained in the SCM/RCM. The configured Bypass Cancel Option can be changed while the SCM/RCM is executing.

BYPCANCELOPT supports the following values:

None – Bypassed/forced Transition Conditions are not canceled/cleared

OnSCM/RCMReset – Bypassed/forced Transition Conditions are canceled/cleared on SCM/RCM Reset command

OnTransEnd – Bypassed/forced Transition Conditions are canceled/cleared when the Transition evaluation finishes (Transition changed from Enabled to Disabled state)

When a SCM/RCM Transition Condition Fails

The possible failure handling situations for a TRANSITION input condition are:

If . . .	Then,
an error occurs during the evaluation of a TRANSITION Input Condition	The condition's C.EXECSTS = Fail, the condition's SCM/RCM EXECSTS = Fail, the condition's C.EXECCODE = actual error. The SCM/RCM waits for the TRANSITION to become satisfied so it can make the next STEP active.
the evaluation of the Failed TRANSITION input condition continues	Failure recovery may occur in one of the following ways: Problem is fixed and the failed input condition is successfully evaluated. Condition’s status flag (C.FL) is recomputed

If . . .	Then,
	The condition's C.EXECSTS = OK, the SCM/RCM's EXECSTS = OK. The operator forces the input condition, which causes the following: Condition's C.EXECSTS = Bypass, which may in turn change the SCM/RCM EXECSTS to Bypass. Condition status flag (C.FL) = On or Off. Bypasses evaluation of the input condition to allow the TRANSITION = True and next STEP becomes active. Condition's C.EXECSTS = OK, which in turn changes the SCM/RCM EXECSTS = OK, depending on the successful evaluation of the TRANSITION following the activated STEP.

Role of the Step Function Block in an SCM/RCM

A Step contains up to 16 executable output expressions and/or instructions. Output expressions control and track process activities by changing CM or SCM/RCM parameters, recording SCM/RCM events, providing Comments, Warnings, Notes, and/or Output Instructions to facilitate interactive control operations. Steps are not commonly used in an RCM although it is an acceptable practice.

The step name can be up to 16 characters and must be unique within the SCM/RCM block inclusive of all handlers. The transition description can be up to 39 characters. Refer to the parameter NAME and DESC.

Each step has two time related parameters, MINTIME and MAXTIME. Minimum wait time (MINTIME) specifies how long to delay evaluation of the succeeding transition block after all the step's outputs are stored. Maximum active time (MAXTIME) specifies how long the step can remain active before setting the step time out alarm flag and tripping the step timeout alarm, if an alarm priority > NONE has been configured. MAXTIME does not affect the step execution in any way. MINTIME and MAXTIME are measured in execution cycles, that means that their values will only correspond to seconds if PERIOD = 1000 ms.

Each step has an update restart address option parameter (UPDRESOPT) which enables the step to be specified as a Restart address. The Restart address option ON marks the step as a return point after an exception handler during its normal execution has

preempted the SCM/RCM execution. For example, if the SCM/RCM were in a mix phase of the process, it would be necessary to restart at a different step than if the SCM/RCM were in a charge or heat phase. Planning exception handling and restart steps in advance will enable efficient use of the SCM/RCM functionality.

Each step has a stop condition option (SC.OPT) and an interrupt condition option (IC.OPT). When the stop condition option is set on and the configured stop condition is true, the SCM/RCM automatically begins to execute the Stop Handler. When the interrupt condition option is set on and the configured interrupt condition is true, the SCM/RCM automatically begins to execute the Stop Handler.

SCM/RCM Step Level Support Features

Other supporting features of a step to consider for optimal control of your sequential process are:

Feature	Description
Warning	Can be configured using the HTML Editor. The Warning is shown on the Table View when the Step is selected, The Warning can be used to present critical information to the Operator throughout the execution of the Step.
Note	Can be configured using the HTML Editor. The Note is shown on the Table View when the Step is selected. The Note, which is lower priority compared to the Warning, can be used to present important information to the Operator throughout the execution of the Step.
Enforce Sequential Order	Can be configured to enforce either the confirm order of the Step's confirmable Instructions or the execution order of all Outputs of the Step. When enforced, the required order is from Output #1, #2 … up to Output #N. Possible values for Enforce Sequential Order are None – all output executions are started in the same cycle, in the order specified. Different delays may lead toa different effective order. Step active time cannot be smaller than the largest output delay. CnfmInstrs – order of confirmable instructions is enforced, all other outputs are started at the same time. Step active time cannot be smaller than the largest output delay. AllOutputs – order of all Outputs is enforced, any output is executed only after the previous output has completed execution including delays and instruction confirmations. Step

Feature	Description
	active time cannot be smaller than the total sum of all output delays. Outputs are always executed in the order specified. There will be no difference of execution for “conventional” outputs using expressions for NULL-type, S-type, or NS-type stores. This parameter will only make a difference if output delays or instructions are used.
Step-level Confirmation of Instructions Enable	Specifies whether a Step-level confirmation of all confirmable Instructions is enabled for the Step. Step-level confirmation will be possible only when this option is On and when the Enforce Sequential Order option is not equal to AllOutputs.
Current Value Identification	A parameter can be chosen as the Current Value of the Step. This parameter is monitored and shown on the SCM/RCM Table View when the Step is selected. Current value can be used to keep an important process value in front of the operator throughout the execution of the Step. For instance, while executing a Heatup phase it may be beneficial to display the actual temperature on the SCM/RCM table.
Monitoring Task Result Identification	a parameter can be chosen to represent the result of a Monitoring task associated with the Step. The parameter is monitored and displayed on the SCM/RCM Table View when the Step is selected. A “Monitoring Task” is a control strategy that evaluates a process condition for which the result is normally True/On or False/Off.
Instruction Status	The Step Function Block supports Boolean Instruction Status parameters: Instruction Pending and Instruction Complete. Instruction Status provides information on whether the Step currently has Instructions pending or if the Step’s Instructions have all been completed.
Step Timeout alarms	Report Step Timeout alarms
Start and completion events	Report start and completion events to the Server event journal
Loop count	Provide loop count
Step start time	Provide step start time
Step completion time	Provide step completion time

SCM/RCM Step Outputs

Each of the 16 Step Outputs has three elements to its configuration:

Step Output Elements	Purpose	Configuration Rules
Description	132-character string descriptor	Optional, but essential if using SCM/RCM Table View for operations
Expression	Specification of automatic control action	Optional, but must be configured for an automatic control action
Instruction	Formatted text that provides instructions to the operator	Optional, but must be configured for an Interactive Instruction

An Output can have any combination of the three elements Description, Expression, and Instruction configured. The SCM/RCM Step Output behavior is relative to which of the three elements is configured. A notable case is when both an Instruction and Expression exist. In this case, priority is given to the Expression, which is executed, while the Instruction is ignored. The operator cannot interact with the Instruction in the same way it can when an Instruction exists without an Expression. In this case, the Instruction can be used as an additional/extended Description.

Step Output Elements Configured			Step Output Execution Behavior
Description	**Expression**	**Instruction**	
Don’t care	No	No	This configuration is a “Null” output and does nothing. An error is reported.
Don’t care	No	Yes	An Instruction is provided to the operator and requested feedback is awaited.
Don’t care	Yes	No	Automatic control action is executed.
Don’t care	Yes	Yes	When an Expression and Instruction are in the same step output, the Expression takes priority and the automatic control action specified by the Expression is executed first. In this case, the Instruction is used as an additional or an extended Description of the step. Operator interaction with the Instruction does not take place in the same way as when an Instruction exists without

Step Output Elements Configured			Step Output Execution Behavior
Description	**Expression**	**Instruction**	
			an Expression. Requested feedback is not available.

There are no restrictions on how many of a Step's Outputs can be Expressions or Instructions. A Step can have any combination of Expressions and Instructions.

The step output Expression supports one and only one assignment when changing a CM or SCM/RCM parameter to execute automatic control action. Both sides of the assignment must be a statement/calculation that results in a single value. The Step Output Expression operators and functions listed for Transition Condition expressions apply to Output Expressions with the exception of the symbol :=. To set a CM or SCM/RCM parameter value in an output expression, use := as equal assignment operator. The data type of the expression must agree with the data type of the reference.

The processing of outputs includes:

- Storing the source value to the destination for all outputs
- Collecting stored status response for each output
- Providing separate output execution status for each of the possible 16 outputs. The output execution status can be:
  OK – output stored successfully
  Warning – output stored but may be some constraint (e.g., value clamping occurred at the destination parameter)
  Fail – store failed due to a cause identified in the Output Execution Code
- On a Reset Command to the SCM/RCM, the Output Execution Status and the Output Execution Code are initialized to OK.

The Step Output Instruction is configured with the HTML Editor. There are two types of Instructions: Informational and Confirmable. An Informational Instruction does not require operator confirmation. A Confirmable Instruction does require operator confirmation. When the Step Output has an Instruction pending, the parameter Step Output Instruction Pending is true. When the Step Output Instruction has been completed, the parameter Step Output Instruction Complete is true. The parameters Step Output Instruction Pending and Step Output Instruction Complete are similar to those available on the SCM/RCM and Step Levels.

SCM/RCM Step Output Execution

With or without Step Output delays configured, all Output Expressions of the Step are executed as soon as the Step becomes active, even if unconfirmed confirmable Instructions exist in between the Output Expressions.

Example – SCM/RCM Step Mixture of Expressions & Instructions (ENFORCESEQ=CnfmInstrs)

A mixture of Output Expressions, Instructions, and Sequential Order enforced for confirmable Instructions of the Step.

When the Step becomes active, the Expressions for Output #1, #3, and #5 are executed immediately. The interleaved Instructions are also immediately available for operator confirmation, but the execution of the Output #3 Expression does not wait for the Output #2 Instruction to be confirmed. The selection to enforce the order of Instruction confirmation does not affect how the Expressions are executed. Choosing to enforce the confirmation order of the Instructions does however require that Output #2's Instruction be confirmed prior to Output #4.

Element	Content
Number of Outputs	5
Enforce Sequential Order (ENFORCESEQ)	= CnfmInstrs (Sequential Order is enforced for confirmable Instructions of Step)
Output #1	Expression (no Output delay)
Output #2	Confirmable Instruction
Output #3	Expression (no Output delay)
Output #4	Confirmable Instruction
Output #5	Expression (no Output delay)

Example: Step Mixture of Expressions & Instructions (ENFORCESEQ=AllOutputs)

A Mixture of Expressions, Instructions, and Sequential Order is enforced for all Outputs of the Step.

Output #N+1 will only be executed when Output #N is complete. The confirmable Instruction of Output #2 can only be confirmed when Output #1 has been successfully completed. The Expression of Output #3 will not execute until the confirmable Instruction of Output #2 has been confirmed, and so on.

Element	Content
Number of Outputs	5
Enforce Sequential Order (ENFORCESEQ)	= AllOutputs (Sequential Order is enforced for all Outputs of Step)
Output #1	Expression (no Output delay)
Output #2	Confirmable Instruction
Output #3	Expression (no Output delay)
Output #4	Confirmable Instruction
Output #5	Expression (no Output delay)

SCM/RCM Pseudo Step

In the situation where the sequence requires the connection of two transitions, a pseudo step can be implemented to stand between two transitions. A pseudo step is one with no outputs therefore no action is taken and the sequence continues to the next transition without any process activity. The pseudo step will always be active for at least one execution cycle.

A pseudo step can be useful when implementing parallel paths using the Synchronization block since inputs to and outputs from the SYNC block must be all steps or all transitions.

SCM/RCM Step Output Additional Support

Similar to the Step level, the Step Output provides additional support features. Though related to Instructions, the following support features can be used with an Output that has an Expression but not with an Output that has an Instruction.

Feature	Description
Note	Step Output Note can be configured using the HTML Editor and is displayed on the SCM/RCM Table View when the Step Output is selected. The Note, which is lower priority compared to the Warning, can be used to present important information to the Operator throughout the execution of the Step Output.
Target Value Identification	A parameter can be configured as the Target Value of the Step Output and displayed on the associated SCM/RCM's Table View when the Step Output is selected. The Target Value of

Feature	Description
	the Step Output can be changed by: the operator when the operator change option is selected - the change option only applies to the SCM/RCM Table View user interface; or by an Output Expression. The Target Value can be used to display to the operator the intended result for the Output's Instruction.
Current Value Identification	A parameter can be configured as the Current Value of the Step Output and displayed on the associated SCM/RCM's Table View when the Step Output is selected. The Current Value can be used to keep an important process value visible to the operator throughout the execution of the Step Output.
Entry Value Identification	A parameter can be configured as the Entry Value of the Step Output and displayed on the associated SCM/RCM's Table View when the Step Output is selected. The Entry Value can be used for the Operator to store a value to this parameter as the result of the Step Output's Instruction. The Entry Value is probably most useful when the Current Value is not instrumented in the control system. In this scenario, a "current" value is obtained by an operator through some manual reading and then can be provided to the control system by using the Entry Value.
Monitoring Task Result Identification	A parameter can be configured to represent the result of a Monitoring task associated with the Step Output and displayed on the associated SCM/RCM Table View when the Step Output is selected. A Monitoring Task is a control strategy that evaluates a process condition for which the result is normally True/On or False/Off.

SCM/RCM Step Output Delay Time

Independent of the Step's Minimum Delay Time (MINTIME), an Output Delay Time is provided to allow timing of a Step's Outputs without the need for additional Transitions or extra logic.

The Output Delay Time is applicable to Expressions only. A non-zero Step Output Delay Time for an Output with only an Instruction configured will have no effect. The parameters provided in support of this feature are:

OP[1..16].DELAYTIME - Output Delay Time specifies the number of seconds that an Output will delay/pause before its expression execution

OP[1..16].DELAYTIMEREM - Output Delay Time Remaining provides the number of seconds remaining in the current Output delay/pause in progress

The Output Delays interact with the Step Enforce Sequential Order (ENFORCESEQ) parameter as follows:

ENFORCESEQ of None or CnfmInstrs – all Outputs begin execution when the Step becomes Active. Delays configured in multiple Outputs will be counting down in parallel.

ENFORCESEQ of AllOutputs – Outputs are executed one at a time with the next Output only executed once the previous Output has completed. Delays configured in multiple Outputs will be counted down in series.

Example: SCM/RCM Step Output Delays in Parallel

The table below shows a Step configuration that results in the output actions of Outputs 1 through 5 occurring 2 seconds apart while executing in parallel.

Element	Content
Number of Outputs	5
Enforce Sequential Order	ENFORCESEQ = None
Output #1	Expression; Output delay of 2 seconds
Output #2	Expression; Output delay of 4 seconds
Output #3	Expression; Output delay of 6 seconds
Output #4	Expression; Output delay of 8 seconds
Output #5	Expression; Output delay of 10 seconds

Example: SCM/RCM Step Output Delays in Series

The table below shows a Step configuration that results in the output actions of Outputs 1 through 5 occurring 2 seconds apart and executing in series.

Element	Content
Number of Outputs	5
Enforce Sequential Order	ENFORCESEQ = AllOutputs

Element	Content
Output #1	Expression; Output delay of 2 seconds
Output #2	Expression; Output delay of 2 seconds
Output #3	Expression; Output delay of 2 seconds
Output #4	Expression; Output delay of 2 seconds
Output #5	Expression; Output delay of 2 seconds

SCM/RCM Step Output Bypass

The ability to bypass an incomplete Step Output is supported by the OP[1..16].BYPREQ parameter with the values

None	Bypass is not requested (has no effect when commanded).
Skip	Bypass of the output is requested. When Skip is commanded, the effect depends on the state of the output processing as follows: If the Step Output is not active, the command is ignored. If the Step Output has been processed already, the command is ignored. If the Step Output is incomplete (in error or in middle of a delay), the Output will be advanced to the state of 'Complete'. All attempts of completing the store to the Output destination are abandoned. The Skip value has one-shot semantics. Skip is never returned as a parameter value upon read back. If a particular Output of a particular Step is re-executed at some future time a previously commanded Skip will not be remembered and will have no impact.

The access level required to write STEP.OP[1..16].BYPREQ is determined by the value of the SCM/RCM parameter CONTROLLOCK.

Role of the Synchronization (SYNC) Block in an SCM/RCM

The SYNC block enables the SCM/RCM to simultaneously execute up to 10 parallel paths of steps, phases and transitions. The SYNC block synchronizes the start and end of a parallel section of SCM/RCM.

The start of a set of parallel paths is synchronized to ensure that all the steps or transitions forking out of the SYNC block begin executing during the same execution cycle. Execution of all threads is initiated at the same time.

The end of a set of parallel paths is synchronized by monitoring the execution status of each parallel path and continuing only when the execution of all paths has completed. When all the preceding parallel paths complete execution, the SYNC Block starts the thread(s) forking out of the SYNC block.

Nested Synchronization blocks are permitted. The number of nested levels is limited to 9 due to the limit of 10 threads per SYNC block.

The four simple rules for SYNC block implementation are:

1	The SYNC block is transparent to the basic rule that Steps and Transitions must alternate.
2	Inputs to SYNC block have to be either all Steps or all Transitions.
3	Outputs from SYNC block have to be either all Steps or all Transitions.
4	Two SYNC blocks cannot be connected together.

The connection rules are:

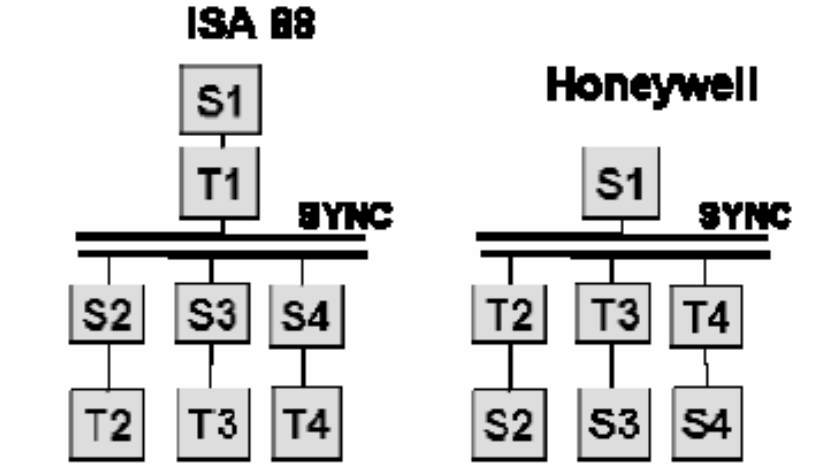
1	Multiple wires can be connected to the input pin (up to ten).
2	Each output pin can only be connected to one output wire.
3	To add more outputs (up to ten), use the Block Pins parameter configuration tab of the Sync block.

SYNC Block and ISA S88 Standard

Honeywell has implemented the SCM/RCMs to support all legal ISA S88 and IEC 61131 configurations of parallel steps but Experion does not prevent configuration of other sequential strategies. In cases that have no precedent or expected behavior in the S88 standard, Honeywell has defined them to work as follows.

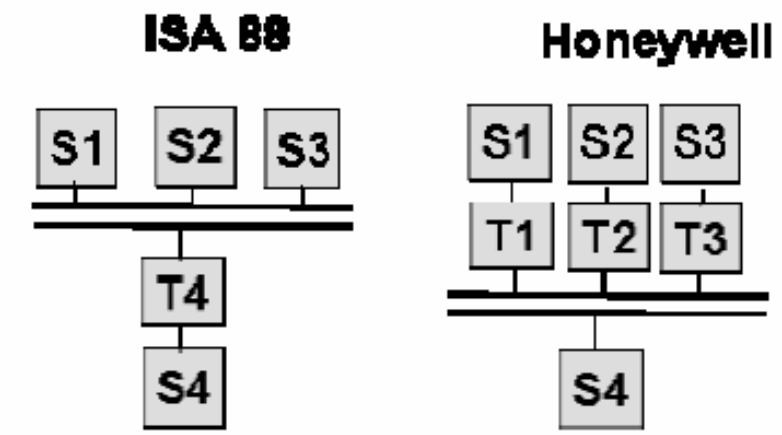
Starting a Parallel Section

In the drawings below, Honeywell Experion treats the three transitions following the SYNC block as part of the SYNC block. None of the steps S2, S3, or S4 will start until all three transitions T2, T3, and T4 are true.



Ending a Parallel Section

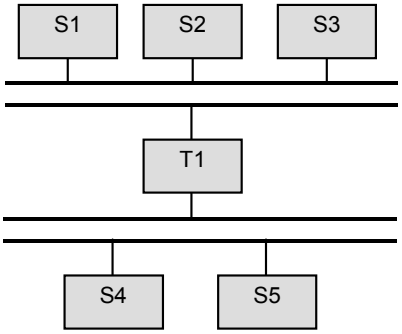
In the drawings below, the ISA 88 standard recommends ending a parallel with steps going into the SYNC block and using a single Transition to commence the next non-parallel section. Control Builder does not enforce this, and allows an engineer to end a parallel section with either steps or transitions. All transitions above the SYNC block must be true before it will proceed.



Consecutive Parallel Sections

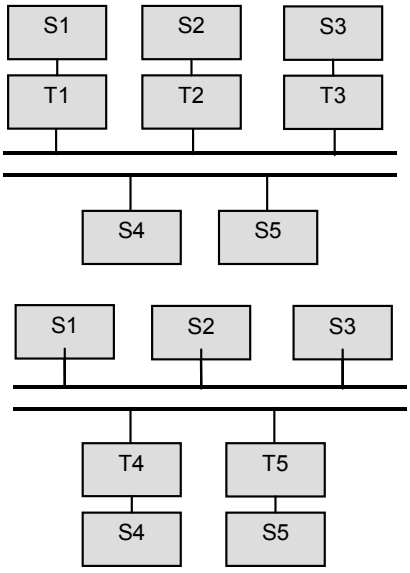
In the drawings below, the SYNC block can be used as a 'multiple in, multiple out' block. Configuring in accordance with the S88 standard requires a transition T1 between the end of one parallel section and the beginning of another.

ISA recommends:



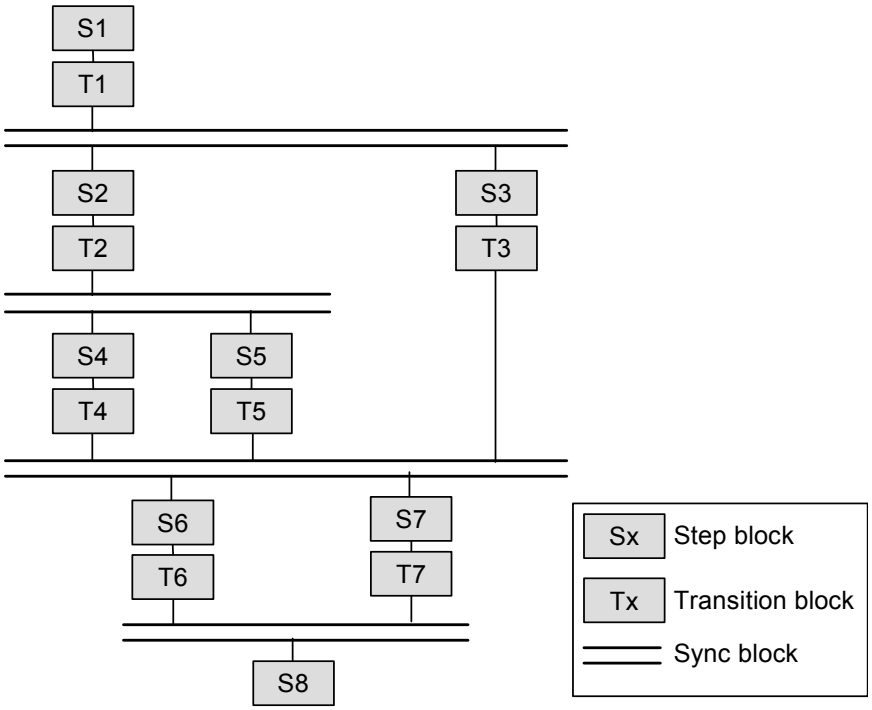
Note: T1 must exist – even if it is an "always TRUE" transition

Honeywell supported:



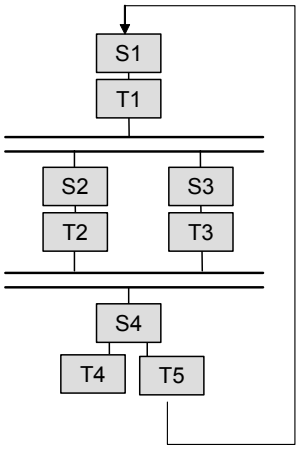
OR:

Example: SYNC Block Strategy in an SCM



Example – Loop Back Strategy with SYNC Block in an SCM

This example is an acceptable loop back strategy because the start and destination of the loop back are both non-parallel sections.



SCM/RCM SYNC Block and Single Step Mode

Runtime problems can occur with single step mode. For example, single step mode allows you to specify multiple target steps. This presents the potential for an operator to specify multiple target steps that in any normal operation of the SCM/RCM would never run in parallel.

In the example above, it is acceptable to put the SCM/RCM in single step mode and specify the target steps to be S2 and S3 because they are in parallel sections. Commanding the SCM/RCM to Resume would make both steps active and it would be impossible for the SCM/RCM strategy to continue from there.

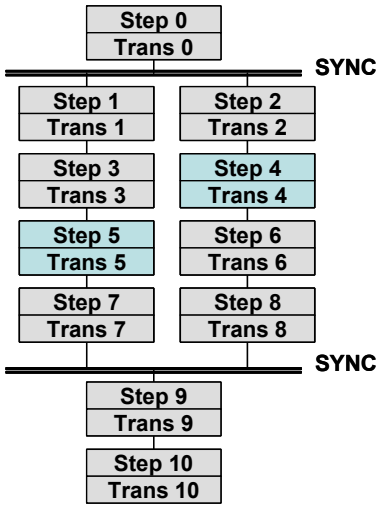
SCM/RCM SYNC Block and Restarting

Runtime problems seen with the loop back topologies can also occur with restart address option on the step blocks. Each step can be configured to specify whether it should update the restart address in the event that execution transfers to a different handler. After returning from the other handler, the SCM/RCM execution would continue where it left off based on the last restart address updated.

The restart address option is configurable for each step. There is the potential for an engineer to specify the restart address options in such a way that on return from a handler, two or more steps are made active is such a way that any normal operation of the SCM/RCM would never run in parallel. In the previous example, it is possible that an engineer could uncheck the restart address option on the S3 step. If the SCM/RCM were to switch to a different handler in the parallel section and return, instead of S2 and S3 being active, steps S2 and S1 would be active. This is a version of the problem above where two steps never intended to run in parallel are attempting to run in parallel.

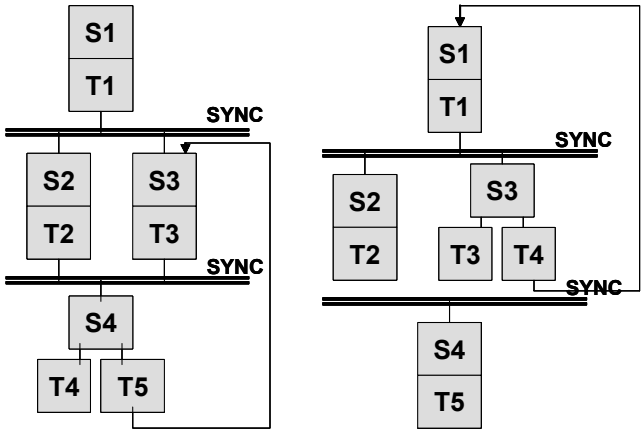
Example: SCM SYNC Block and Restarting

In a sequence designed as displayed below, the Restart addresses are updated in Steps 4 and 5 then the sequence goes into Hold. When the sequence returns to Main, it will begin execution at Steps 4 and 5. If the sequence requires a restart in the middle of parallel sections, ensure that each parallel path has an Update Restart address option enabled on a Step within the path. A stall condition will occur when a Restart occurs within a parallel section and all paths are not restarted.



Example – Incorrect Loop Back Strategies with SCM SYNC Block

Both strategies shown below are incorrect. The first is incorrect because it is configured to loop back into a parallel section from the non-parallel section. In the second example, the connection is from within the parallel section back to a non-parallel section. In both examples, a stall situation may occur.



In the first example above, the worst that occurs is that because the Sync block will wait for both previous transitions T2 and T3 to complete, a situation where the SCM/RCM never finishes may be created.

In the second example above, depending on how the strategy operated at run time, you could get into a situation where after loop back and completion of step S1 and transition T1:

- S2 could still be active and now it is about to be activated a second time without completing the first time; or
- T2 could still be waiting, only to have its previous step S2 try to activate for a second time; or
- With S2 and T2 already completed, the SCM/RCM could restart S2 and S3 but finish the parallel section prematurely.

The second example above also provides the seed for endless creation of threads. If both S2 and S3 are replaced with a long sequence of sequential steps (S2a, S2b, S2c, etc. and S3a, S3b, S3c, etc.) and transitions then all the transitions are true except for T2 and T3. Ultimately all steps S2a, S2b, S2c, etc. and S3a, S3b, S3c, etc. can become active until an

implementation limit is reached. The SCM/RCM will generate an error in ExecSts, ExecCode, and ExecDesc if the maximum number of threads allowed would be exceeded in the next execution. However due to the relatively high implementation limit of 10 threads for most applications, the SCM/RCM will block before this situation occurs. It is more appropriate to use the step time out alarm to ensure against most bad topologies.

It is not that hard to create very complicated scenarios by misapplying a loop back condition with parallel SCM/RCM sections. In the worst case, when the sequence attempts to make a step active twice by two different threads, the SCM/RCM will get stuck in a particular step. The best way to get out of such a state is to either stop or abort the SCM/RCM or if you can work through the problem - enter single step mode and Resume.

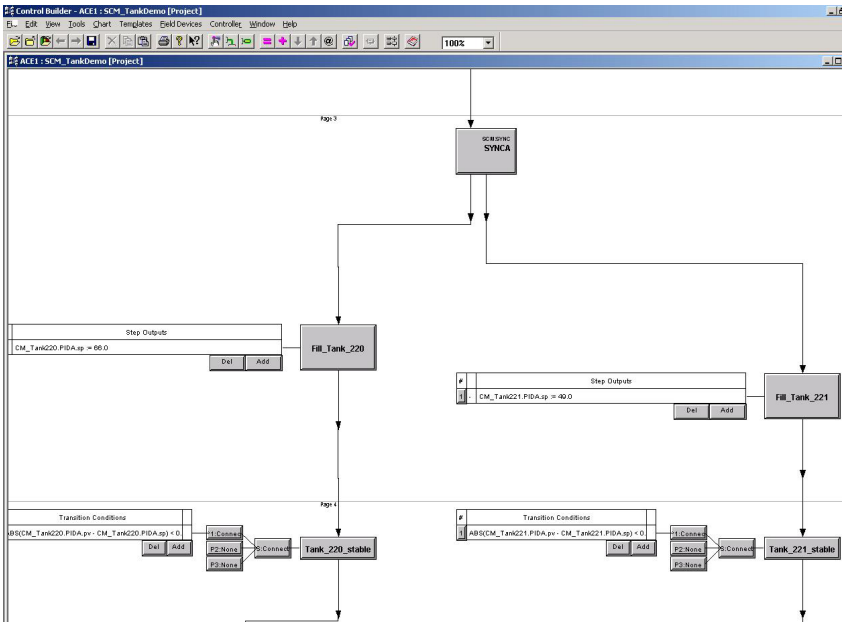
SCM/RCM Support for Detecting Bad Topologies

Unsafe and potentially blocking algorithms cannot be detected at configuration time. SCM/RCMs provide some features to detect some, not all, problem situations.

The step time out alarm can be used effectively to detect blocking algorithms. Step time out alarming, when configured for a step, can only be used if the normal process passes a step within a known maximum time. When this occurs, step time out alarming will detect unknown process failures and blocking algorithms.

To use step time out alarming, it is not necessary to know the maximum time at configuration or load time. SCM/RCMs can be configured such that the maximum time allowed depends on recipe parameters and / or other values.

Example – SCM/RCM SYNC Block starting a Parallel Section



Branching Options in an SCM/RCM

Transitions and Steps can be arranged for non-branching, alternate path branching, or parallel branching execution.

The non-branching execution is the simplest form. Non-branching is a sequential ordering of Transition and Step blocks where execution continues through one path until the last Step is executed. When the last step of the Main Handler is executed, the SCM/RCM state is Complete.

Alternate path branching is similar to a sequence of If-Else statements, where only one branch will be executed. When a Step block diverts into four branches with a Transition block at the start of each branch, the Transition blocks of all the branches are evaluated from left to right until one of them becomes true. Then the branch that starts with the true Transition becomes the active branch and its Steps and Transitions are executed to completion. Multiple paths can end independently or rejoin into a single branch later in the SCM/RCM.

Parallel branching is made possible by the addition of the Synchronization (SYNC) function block. The SYNC block enables the SCM/RCM to simultaneously execute up to

10 parallel paths of steps, phases and transitions. See section on ‘Role of the Synchronization (SYNC) Block in an SCM/RCM’ for further details.

Looping in an SCM/RCM

Looping constructs are permissible as long as every transition is followed by a step; steps can be wired to each other. Loop back by wiring out of one function block up to the input of another function block.

Recommended methods of looping:

- End with a Transition then loop back into a Step/Phase

Not recommended:

- Loop from a Step/Phase back to an always true Invoke Transition. This is not recommended because the only way to stop the SCM/RCM from looping is to go through Abort, Reset, and Idle.
- Loop back to the default Invoke Transition. This is not recommended because an operator will be required to start the SCM/RCM each time it reaches the start of the SCM/RCM.
- Loop from a parallel section to a non-parallel section
- Loop from a non-parallel section to a parallel section
- Configure the last Step Output of the SCM/RCM as a Reset command to itself

Role of the Phase Block (RCM only)

The Phase function block is a type block for use only in a Recipe Control Module.

The Phase function block is used to initiate and monitor execution of the associated Equipment Module (SCM). The Phase function block can also be used to acquire the Equipment Module, such as SCM, for another Phase block. The Phase parameter ‘equipment’ specifies which Equipment Module the Phase is linked to. The Phase block typically acquires the shared or dedicated SCM before controlling it. If the Phase block is configured to execute the SCM, it loads its formula parameters to the SCM and issues a START command to the SCM as soon as the SCM is acquired.

While the SCM is running, the Phase block

- Monitors the status of the SCM

- Projects SCM execution information - SCM State, SCM ExecStatus, Mode, and ActiveStep(s) - enabling SCM execution to be monitored through the Phase block.
- Commands the SCM to upload the Phase's report parameters once SCM execution is completed

Configuration determines whether

- A Phase waits or does not wait for the completion of the SCM execution to complete Phase execution
- A Phase block releases or does not release the SCM at the end of Phase execution

If a Phase block does not wait for Terminal state, the RCM procedure can proceed to the following phases and steps depending on the conditions in the transitions.

Creating the Phase function block

Unlike Step, Transition, and Synchronization function blocks which are native blocks in the Experion Library, the Phase Function Block is based on a Phase Block Type or User Template for a Phase. A Phase Block Type is created in the Parameter Definition Editor (PDE) and added to the Library. Phase is a block type similar to the Custom Data Block and Custom Algorithm Block since it supports fixed and custom parameters. The Phase block's formula parameters and report parameters are custom parameters. The Phase block does not support custom algorithms.

After a Phase Block Type has been created and saved in the Experion Engineering Repository Data Base, the Phase Block Type appears in the Control Builder Library in a user specified library. The Phase Block Type is instantiated on the project side of Control Builder by dragging it from the Library to an RCM chart. Once in the RCM, the Phase Block is configured.

The fully qualified name for a Phase Block Type consists of the concatenation of the library name with the block type name. This means that different Phase types can be given the same name within different libraries.

Parameter Definition Editor

The Parameter Definition Editor allows definition of the dynamic parameters in the Phase Block type. The Phase block has dynamic parameter groups for:

- Phase Formula parameters
- Phase Report parameters

The attributes, parameters, and nested parameters shown and entered in the Parameter Definition Editor and/or the Phase Block form are:

Attribute Name	Attribute Type	Used in Formula Parameter	Used in Report Parameter
Name	String	Yes (Read only)	Yes (Read only)
Description	String	Yes (Read only)	Yes (Read only)
Parameter reference	Reference	Yes	Yes
Data type	Enumeration	Yes (Read only)	Yes (Read only)
Default value	Any	Yes	Yes
Minimum reference	Reference	No	No
Maximum reference	Reference	No	No
Minimum value	Any	Yes for numeric	Yes for numeric
Maximum value	Any	Yes for numeric	Yes for numeric
Value reference	Reference	Yes	No
Use value reference	Boolean	Yes	No
Enabled	Boolean	Yes	Yes
Size	String	Yes	Yes For string (read only)
Engineering unit	String	Yes	Yes
Scalable	Boolean	Yes	No
Access lock	Enumeration	Yes (Read only)	No
Trend	Boolean	No	Yes
Order on form	Integer	For row selection	For row selection
Input	Boolean	True	False
Output	Boolean	False	True

Phase execution

Tasks performed by the Phase block during execution include:

- Acquiring SCM as an Equipment Module (if configured)
- Setting SCM Mode Attribute and State
- Downloading phase formula parameters
- Commanding SCM (if configured)
- Uploading phase report parameters
- Releasing SCM (if configured)
- Send the Reset command to the SCM

Task	Activity
RCM Phase acquires SCM	Upon startup of the execution, the Phase block acquires the SCM if the ACQUIREOPT flag = ON and it is not already acquired, and waits for the status of the arbitration request to be returned. If the arbitration request status is FAIL, the execution status of the Phase will be FAIL. The Phase block will reissue the arbitration request when the previous attempt fails. When the arbitration request status is ACQUIRING, the Phase ExecStatus = OK, the Phase State = ACQUIRING, and the Phase block waits for the SCM to be available to continue the execution. Once the SCM is acquired, the phase execution proceeds in the next task.
RCM Phase sets SCM Mode Attribute and State	Before Phase starts manipulating the SCM, it checks that the EXECUTEOPT flag is checked and the mode attribute of the SCM. If the SCM Mode Attribute = Program, the Phase block will check the state of the SCM. Once the SCM Mode Attribute = Program, the phase execution proceeds in the next task.
RCM Phase downloads formula parameters	Before the formula parameters are downloaded, the formula parameter configuration options must be completed: – Formula parameters with USE Flag = ON (enabled) are stored to the configured target

Task	Activity
	parameter reference (if not NULL). – If the formula parameter value is a reference (User Value Reference = ON), the reference parameter will be read before store. – Scaling is applied to parameters for which scaling is configured. Parameter scaling is based on the ratio between the current batch size and default batch size defined for the RCM. – Processing starts for all parameters in the same cycle in the order in which they are configured. – If all parameters are stored in the same CEE and no errors occur, all the formula parameters will be stored to the target parameters in the same execution cycle. – If references are peer-to-peer (either for read or write), processing of the parameters may complete in a different order than specified and may take multiple cycles. The store attempts are repeated six times waiting ten execution cycles between repeats.
RCM Phase commands SCM	When all formula parameters are successfully downloaded, the Phase sends the START command to the SCM. The SCM starts executing after receiving the Start command from the Phase. When the SCM state is in an abnormal state, the following occurs: – If the SCM state is HELD, the Phase will reissue a RESTART command to the SCM – If the SCM state is non-terminal STOPPED, the Phase will issue a HOLD command to the SCM – If the SCM state is running, the Phase will give no command to the SCM but start project SCM parameter and event processing – If the SCM state is terminal state COMPLETE, ABORTED, or terminal STOPPED, the Phase will wait until the SCM is Reset
RCM Phase uploads report	All report parameters with the Use Flag = ON

Task	Activity
parameters	(enabled) are read from the configured source reference (if not NULL). Processing starts for all parameters in the same cycle in the order configured. If references are peer-to-peer, processing of the parameters may complete in different order than specified and may take multiple cycles. ProcReset state will be reached only if all parameter processing is completed successfully. The Phase block has the ability to propagate its parent RCM state to the SCM it links to if the option is configured.
RCM Phase releasing the SCM	Releasing the RCM is conditional to the value of the RELEASEOPT flag.

RCM Null Phase Function Block

A Null Phase function block is used to carry recipe level formula and report parameters. It does not link to any Equipment Module and does not perform any phase control functionality. The Null Phase is placed in the RCM and connected to other blocks in the procedure like any other phase. The Null Phase Block may also be used to satisfy the topology rules of the RCM.

"The Null Phase" is used to store recipe level parameters either in Formula Parameters or Report Parameters. It is a normal phase where all 4 Equipment Module flags are OFF (ACQUIREOPT, EXECUTEOPT, TERMSTATEOPT, and RELEASEOPT)."

What are SCM Recipe Parameters?

Each SCM container supports up to 50 Recipe Parameters. Each Recipe parameter has a Descriptor, Engineering Units Descriptor, Target Value, Target Hi, Target Lo, Material Code, and Scale option. Other than the Descriptor and Scale option, all entries are real number data.

An operator, another SCM/RCM, and an upper level Batch Package can set recipe parameters.

The state of the SCM does not restrict access to Recipe Target values. The SCM accepts stores of recipe targets while it is running not just when in Checking or Idle. SCM state transitions have no effect on the Recipe Parameter data.

Recipe parameters for the RCM are defined as part of the Phases that are dropped into the RCM chart. Typically the Formula parameters of a Phase Block are connected to the

Recipe parameters of an SCM and their values are used throughout the SCM execution. Recipe values can be used as local variable without any connection to phase parameters.

What are SCM History Parameters?

Each SCM container supports up to 50 History Parameters. Each History parameter has a Descriptor, Engineering Unit Descriptor, Parameter Type, and Parameter Value. History parameters can be used to upload actual values after completion of the SCM execution. History data can be used by the operator, an upper level Batch package or compiled into a report.

The state of the SCM does not restrict access to History Parameter values. The SCM accepts stores of history data while it is running not just when in Checking or Idle. SCM state transitions have no effect on History data. A Reset command has no effect on the history parameter values since they are preserved from one execution to the next.

Typically the Report parameters of a Phase block are connected to the History parameters of an SCM and their values are updated during SCM execution and uploaded from the SCM to the phase after the execution. History values can be used as local variable without any connection to phase parameters.

Dynamic Fetch in an SCM/RCM

When SCM/RCMs are configured, loaded and executed all their connections in transition condition expressions and step output expressions are built and executed on the foundation of global availability of all data within the same ControlNet or FTE. For data from peer-controllers within the same Controlnet or FTE this is provided by transparent Peer-to-Peer within the platform and Release specific limits. Additional communications from the server to the controller and from controllers outside the Controlnet or FTE can be established using other techniques such as secondary or back-bone Controlnet or FTE, Profibus, dedicated I/O, server algorithms like OPC integrator, etc. This behavior of SCM/RCM has the advantages ease of use and simple engineering especially in small and medium sized installations. Reassignment of SCM/RCMs from one controller to another does not need any modifications of the SCM/RCM.

With the availability of multiple platforms for SCM/RCM execution and in larger installations allowed by increased limits of number of controllers per Controlnet or FTE, some negative aspects of global availability may overshadow its advantages. The SCM/RCM always establishes permanent communication for ALL parameters configured in the transition condition expressions and step output expressions of ALL steps and transitions in ALL handlers potentially resulting in a very large number of remote connections. The term ‘remote’ stands for both peer-to-peer-connections between controllers and off-node connections from ACE to controllers. The result is a communication overload which violates the relevant specifications causing unreliable or

failed communication without an easy way for the user to comply with the specifications while still implementing the strategies to solve the automation problem at hand.

It lies in the nature of communication overload situations that it is detected in the late phases of projects or during or after expansion of existing plants. In both cases, there is little room to make fundamental changes to the hardware architecture including distribution of I/O or allow a major reengineering of the control strategies. For this reason, the dynamic fetch algorithm is incorporated into SCM/RCM functionality.

Dynamic Fetch adds the SCM/RCM capability to establish remote communication when or before it is needed and to terminate remote communication when it is not needed anymore. A basic Dynamic Fetch algorithm reduces remote communication to an amount close to the theoretic minimum. The basic Dynamic Fetch algorithm does not require any engineering other than enabling it. The basic Dynamic Fetch algorithm may cause delays in the execution of the SCM/RCM due to the fact that the SCM/RCM may have to wait, until the data has been transported from the remote data owner to the SCM/RCM. Additional parameters allow the engineer to overwrite the basic algorithm to avoid the delays in critical steps and transitions of the SCM/RCMs. This in turn will increase communication load on the communication paths used including ControlNet, FTE, TPN, and the PM I/O backplane. Dynamic Fetch may not solve the engineering problem but it provides a tool to find a suitable compromise between communication load and execution speed of SCM/RCMs without requiring any changes to hardware or design of control strategies making it suitable for late project changes, migrations, and expansions of existing plants.

If a system is being upgrading and the Qualification and Version Control System is licensed on the system, new downloads to SCM/RCMs generated by changes in the Dynamic Fetch feature will require signoffs, checkin, check out, etc. and SCM/RCM version numbers will be incremented.

When the Dynamic Fetch algorithm is enabled (PEERALGOPT ≠ NONE) no remote communication will be enabled when and after the SCM/RCM is downloaded. The SCM/RCM will not cause any remote communication while STATE = INACTIVE, LOADING, or LOADED. When the SCM/RCM is commanded COMMAND = ACTIVE the SCM/RCM determines what communication is necessary for the current scope of execution. As long as the SCM/RCM is in any STATE greater than INACTIVE, the evaluation of needed communication will be repeated any time that the SCM/RCM executes. This evaluation will result in establishing new communication (subscription), keeping remote communication, and terminating remote communication (un-subscription).

Remote communication is managed with the granularity of SCM/RCM handlers, steps, transitions and SYNC blocks. When it is determined that a single remote connection of

an SCM/RCM function block is needed, all remote connections for the function block are enabled at the same time. The same holds true for termination of remote communication.

SCM/RCM Handlers and Dynamic Fetch

Handlers will not cause any remote communication by themselves. The number or types of handlers do not influence the dynamic fetch algorithm. The handlers, steps, transitions and SYNC blocks contained within handlers need to be considered.

SCM/RCM SYNC blocks and Dynamic Fetch

SYNC blocks will not cause any remote communication by themselves. The number of Sync objects or their presence does not directly influence the algorithm. The presence of SYNC blocks is an indicator to possible increased communication load due to multiple steps being active at the same time.

SCM/RCM Step blocks and Dynamic Fetch

Step function blocks can have remote connections in step out expressions and exception condition expressions. Steps with remote connections will cause subscription to remote data if and when:

- the step is active (its outputs are executing)
- FORCEREADREQ=Enabled
- When one of the parameters IC.FL or SC.FL is being read by another function block in the same CEE, ControlNet or FTE
- When one of the parameters IC.FL or SC.FL is being read by the server

SCM/RCM Transition blocks and Dynamic Fetch

Transition function blocks can have remote connections in condition expressions. Transitions with remote connections will cause subscription to remote data if and when:

- the transition is enabled (being evaluated)
- FORCEREADREQ=Enabled
- The transition is the invoke transition of a handler
- When one of the parameters C[ ].FL , G[ ].SO or SO is being read by another function block in the same CEE, ControlNet, or FTE
- When one of the parameters C[ ].FL , G[ ].SO or SO is being read by the server

SCM/RCM Alias Table and Dynamic Fetch

Although the alias table may contain many remote connections, the alias table itself will not cause any remote connection to be established. The alias table fields are subject to the rules documented in the two previous sections for steps and transitions. The remote connection will always only be established for parameters in the column selected by the current value of INSTSELECT. If INSTSELECT changes, while remote connections are enabled, remote communication will be disabled for the previously selected columns and enabled for the newly selected column. In all cases communication will only be established for rows determined by the rules for Steps and transitions.

Management of SCM/RCM remote connections with Dynamic Fetch

The dynamic fetch algorithm is executed in 3 distinct execution stages:

SCM/RCM Stage	Remote connection management
At Activation	During activation all steps and transitions requiring remote communication are determined according the previously mentioned criteria. If any of the criteria is met, a reference of the function block is entered into an internal remote subscription table and subscription to all remote data of the function block is requested from the underlying communication subsystem. Subscription will take place with the configured period applicable for that connection.
During Active Execution	During each execution cycle of SCM/RCM the following actions are performed: – If any function block not being in the internal remote subscription table meets one of the previously defined criteria, its reference is added to the table and remote data for this function block is subscribed to. – If for any function block in the table, no criteria for remote connections is met, its age time in the internal remote subscription table is incremented.(RTABLE[ ].TIME) If for any function block in the table, no criteria for remote connections is met for a prolonged time (RTABLE[ ].TIME > PEERAGETIME) the function block reference is purged from the internal remote subscription table and all remote data for this function block is un-subscribed.
At Deactivation	During deactivation all remote communication is terminated. **Warning note:** (especially for migrated systems): While the SCM/RCM is inactive (STATE=INACTIVE) the parameters

SCM/RCM Stage	Remote connection management
	STEP.IC.FL, STEP.SC.FL, TRANS.C[ ].FL, TRANS.G[ ].SO and TRANS.SO will not return correct values, if PEERALGOPT ≠ NONE and the computation of those values depends on remote parameters. Because all systems migrated will have PEERALGOPT = NONE, this effect can only occur after explicit changes to the SCM/RCM.

SCM/RCM Backward compatibility and Dynamic Fetch

The default value for all new and migrated SCM/RCMs PEERALGOPT = NONE will provide the current behavior of all previous Releases supporting SCM/RCMs.

SCM/RCM Memory considerations with Dynamic Fetch

SCM/RCMs with PEERALGOPT ≠ NONE will require additional memory to be allocated for the management of remote connections. PEERALGOPT = AUTO will allocate a sufficient amount of memory according to automatic estimates for this SCM/RCM. In rare occasions, it is possible that a runtime error will occur, because not all objects fit into the table (table is full). In this case, the engineer needs to apply PEERALGOPT = MAX which allocates memory for the worst case scenario. PEERALGOPT = MAX may also be used in conservative project engineering when the communication needs are not clear yet and risk of memory tightness exists.

Caution: Customer acceptance testing and operation qualification shall be exercised with the final setting for PEERALGOPT, because a change of this value may change the timing characteristics of the SCM/RCM.

Overriding the Dynamic Fetch algorithm in an SCM/RCM: FORCEREADREQ

The parameter FORCEREADREQ exists at transitions and steps. If it is found that the SCM/RCM execution is delayed because data is not available in time (e.g. large subscription period) it is possible to set FORCEREADREQ=ON. This forces the SCM/RCM to enable remote connections for this function block at all times that the SCM/RCM is not inactive.

Note: Setting FORCEREADREQ=ON in a majority of function blocks (>50%) is possible, but not recommended. If this occurs the engineer should review the SCM/RCM configuration and consider one of the two following recommendations:

- Set PEERALGOPT = NONE for this SCM/RCM and optimize communication for other SCM/RCMs. This will save CPU and memory.
- Increase PEERAGETIME so that reuse of objects in the internal remote subscription table occurs more often, without losing the smartness of the algorithm.

FORCEREADREQ shall also be used on so-called “stand alone” transitions (an engineering trick to make use of the transition gate logic instead of using individual logic Function Blocks).

Tuning the Dynamic Fetch algorithm in an SCM/RCM: PEERAGETIME

The default value for PEERAGETIME will be sufficient for many configurations. If tight loops occur very often or the same handler is invoked frequently (e.g. interrupt handler) it is possible to use FORCEREADREQ to avoid possible delays. Instead of using FORCEREADREQ on individual objects (which may require many parameter changes) increasing PEERAGETIME requires less engineering effort and may provide sufficient improvement while limiting memory usage.

What are the States of an SCM/RCM?

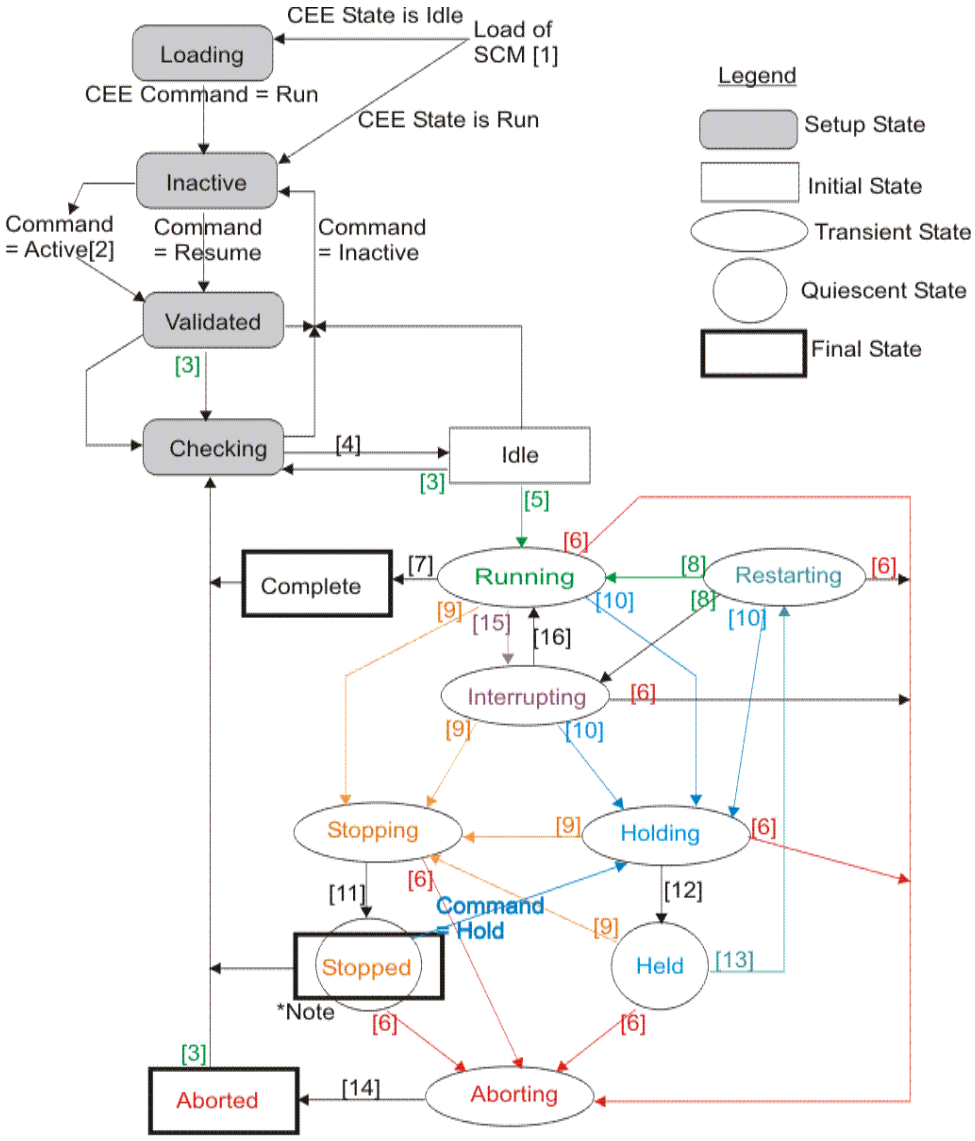
The state of an SCM/RCM is directly related to current Handler activity as demonstrated in the following table.

SCM/RCM State	Handler Activity
Checking	Check Handler executing
Idle	Check Handler complete
Running	Main Handler executing
Complete	Main Handler complete
Holding	Hold Handler executing
Held	Hole Handler complete
Interrupting	Interrupt Handler executing
Interrupted	Interrupt Handle complete
Restarting	Restart Handler executing
Restarted	Restart Handler complete
Stopping	Stop Handler executing
Stopped	Stop Handler complete
Aborting	Abort Handler executing
Aborted	Abort Handler complete
Inactive	Edit Handler executing
Validated	Edit Handler complete with errors identified

SCM/RCM State / Command Interaction

Understanding the SCM/RCM states and the conventions for transitioning from one state to another is critical to the proper planning of sequential control in Experion. The following figure illustrates the conventions for transitioning between states and the interaction between SCM/RCM STATE and the SCM/RCM COMMAND parameter. COMMAND changes the SCM/RCM from one STATE to another.

Diagram of SCM/RCM State - Command Interaction



*Note - Stopped State Option
Not Terminal - can return to Running from Stopped
Terminal - only Command allowed is Reset

Where a "COMMAND =" is shown in the diagram, the transition must be commanded. The explanations for the notes [ ] in the Overview diagram of SCM/RCM State and Command interaction are as follows.

Note	Explanation
[1]	SCM/RCM STATE after load depends on the CEE STATE.
[2]	Active command is a macro command that internally issues Resume and Reset commands.
[3]	Transition to Checking is by Reset Command or Invoke Condition.
[4]	Transition to Idle is on completion of Check Handler.
[5]	Transition to Running is by Start Command or Invoke Condition.
[6]	Transition to Aborting is by Abort Command or Invoke Condition
[7]	Transition to Complete is on completion of Main Handler
[8]	Transition to Running/Interrupting is on completion of Restart Handler
[9]	Transition to Stopping is by Stop Command or Invoke Condition
[10]	Transition to Holding is by Hold Command or Invoke Condition
[11]	Transition to Stopped is on completion of Stop Handler
[12]	Transition to Held is on completion of Hold Handler
[13]	Transition to Restarting is by Restart Command or Invoke Condition
[14]	Transition to Aborted is on completion of Abort Handler.
[15]	Transition to Interrupting is by Interrupt Command or Invoke Condition
[16]	Transition to Running is on completion of Interrupt Handler.

SCM/RCM Failure and Abnormal State association

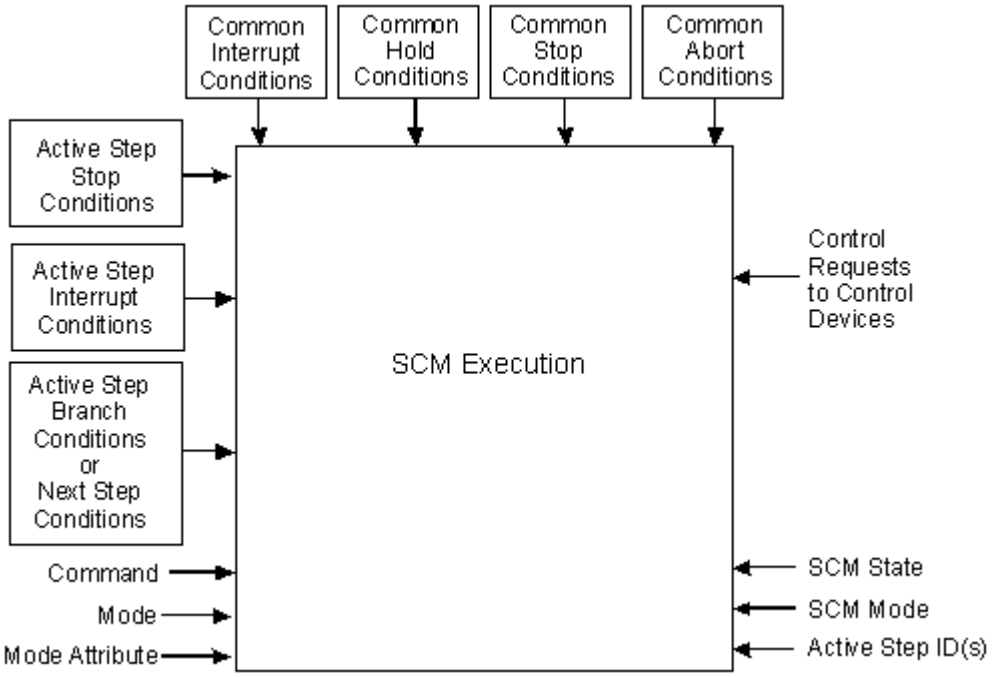
An SCM/RCM execution failure may cause the SCM to enter an abnormal state. The Abnormal state can also cause the SCM execution status to fail. The following sections describe the association between the SCM failure status and abnormal states.

SCM/RCM execution

Each cycle, the SCM/RCM's main activities are:

- Send control requests to Control Devices (Step Output expressions)
- Send instructions to users (Step Outputs)
- Send control requests to SCMs (Phase execution)
- Evaluate exception Invoke Transition conditions of the enabled/monitored Exception Handlers (Interrupt, Hold, Stop, Abort)
- Evaluate active Step Stop and Step Interrupt conditions if configured
- Evaluate active Branch Conditions or next Transition Conditions
- Evaluate confirmable instruction replies

The diagram below graphically summarizes the main activities associated with the execution of an SCM/RCM.


Common Interrupt Conditions
Common Hold Conditions
Common Stop Conditions
Common Abort Conditions
Active Step Stop Conditions
Active Step Interrupt Conditions
Active Step Branch Conditions or Next Step Conditions
Command
Mode
Mode Attribute
SCM Execution
Control Requests to Control Devices
SCM State
SCM Mode
Active Step ID(s)

The scope of execution changes as sequential activity progresses through an SCM/RCM. The following rules are used to apply the scope of execution to the management of SCM/RCM execution status, state, and alarm data.

1	Current execution status of an SCM/RCM is a composite of all lower level status in the present scope of execution. Status from the previous scope has no influence on the current status.
2	Current execution status is continually updated as the SCM/RCM progresses and the present scope of execution changes. As progress occurs, new lower level status influences the execution status of the SCM/RCM. For example, a Transition with bypassed conditions in the previous scope of execution caused the SCM/RCM Execution Status to equal Bypass. If in the present scope of execution, all operations are OK and the bypassed conditions no longer influence the SCM/RCM Execution Status; the SCM/RCM Execution Status will equal OK.
3	Execution status of an SCM/RCM remains OK as long as the Transition with Status = Bypass is not in the present scope of execution. When the transition with Status = Bypass is in the present scope of execution, the SCM/RCM's Execution Status = Bypass.
4	The SCM/RCM State equals Complete when a Main Handler completes executing. The SCM/RCM State equals Idle when an SCM/RCM in the Idle State. When an SCM/RCM is started again, SCM/RCM State goes from Idle to Running.
5	When the SCM/RCM execution status becomes Fail, an SCM/RCM Fail alarm is generated, if the Fail alarm priority is other than None.
6	The Transition and Step status is made up of its lower level attributes.

Parameter values for SCM/RCM State and SCM/RCM Execution Status are:

Parameter	Values
SCM/RCM State (SCM/RCMSTATE)	Loading (0) Loaded (1) Validated (3) Running (4) Complete (5) Checking (6) Idle (7) Interrupting (8) Interrupted (9) Restarting (10) Restarted (11)

Parameter	Values
	Holding (12) Held (13) Stopping (14) Stopped (15) Aborting (16) Aborted (17) CommErr (18)
Execution Status (EXECSTS)	OK (0) Bypass (1) Info (2) Warning (3) Fail (4) Error (5) OKPaused (6) BypassPaused (7) InfoPaused (8) WarnPaused (9) FailPaused (10) ErrorPaused (11) ProcessFail (12)

An Execution Status of OK or Info does not require special attention. An Execution Status of Warning may indicate a problem but execution is still possible with some constraints. An Execution Status of Fail will indicate a temporary or permanent technical problem resulting from communication failures or engineering mistakes. An Execution Status of Error may indicate an internal firmware problem. Both Fail and Error will not allow execution as expected and need attention. In any case of Execution Status other than OK, the parameters EXECCODE and EXECDESC will contain extended diagnostic information.

What are the Modes of an SCM/RCM?

SCM/RCM mode determines the degree of automatic execution.

Mode	Description
None (0)	Mode is not defined.
Automatic (1)	Normal mode of operation. SCM/RCM executes without operator intervention.
Semi-Automatic (2)	Use during debugging, for stepping through the SCM/RCM without bypassing Transition conditions. The Step executes. The SCM/RCM does not advance even if the next transition is true. SCM/RCM execution pauses after the Transition is satisfied and before the next Step becomes the active Step. All internal timers continue to run while SCM/RCM is in Pause. The Resume command causes the next Step – Transition to execute.
SingleStep (3)	Use during maintenance for working around failure situations. Operators can step through a single handler of an SCM/RCM without constraint of Transition conditions. SCM/RCM execution pauses after executing Step outputs for the active Step. Execution State remains unchanged. The Transition preceding the next Step is monitored for display only but satisfying the Transition conditions is not required to make the next Step active. All internal timers continue to run while SCM/RCM is in Pause. Target Step can be used to choose the next Step to execute, enabling the operator to jump around and bypass Steps. The Resume command causes the next Step to execute.
Manual (4)	Halts execution of the SCM/RCM. SCM/RCM stays at the last preemption point and continues monitoring abnormal handler exception conditions. SCM/RCM Execution Status and SCM/RCM State remain

Mode	Description
	unchanged. All internal timers freeze. The devices reset all not-stored requests from the active Step. Set Mode to Auto, Semi-Auto, or SingleStep AND enter the Resume command to continue SCM/RCM execution continues from the last preemption point.
Normal (5)	Normal mode is configured to enable a single button operation for setting the mode. When the NORM button on the operator pane is pressed, the content of Normal Mode is copied to Mode. Possible values are: Automatic, Semi-Automatic, SingleStep, or Manual. Changing Mode will not change Normal Mode.

How does MODE ATTRIBUTE affect SCM/RCM operation?

The SCM/RCM Mode Attribute parameter determines whether the operator or another program controls the SCM/RCM.

Mode Attribute	Description
None (0)	Mode attribute is not defined.
Operator (1)	Operator only can change SCM/RCM Mode and Command based on the configured SCM/RCM access locks. Operator can change loaded recipe data. Actual values and target values for recipe variables can still be written to by the SCM/RCM.
Program (2)	A third party application or another SCM/RCM can change SCM/RCM Mode, Command, and recipe variables. Operator is locked out from control.
Normal (3)	Normal mode attribute is configured to enable a single button operation for setting the mode attribute. When the NORM button on the operator pane is pressed, the content of Normal Mode Attribute is copied to Mode Attribute. Possible values are: None, Operator, or Program.

Mode Attribute	Description
	Changing the Mode Attribute will not change Normal Mode Attribute.

Mode Attribute has no effect on SCM/RCM execution itself. A change of MODEATTR will never cause a SCM/RCM command or state change or other visible effect if no user-defined logic reacts on MODEATTR.

SCM/RCM Mode Tracking Option on a Control Module

The SCM/RCM Mode Tracking Option is available on some Control Module function blocks to identify when the operator can take over control of the device from the Sequential Control Module (SCM/RCM). Mode Tracking is used by the Control Module function block to determine its Mode Attribute based upon the Mode, State, or Step of the SCM/RCM configured in the containing Control Module. Mode tracking options are:

Mode Tracking Option	Description
None (0)	When SCM/RCM Mode changes from Manual to Auto, Semi-Auto to Single Step, - Mode Attribute not changed. When SCM/RCM mode changed back to Manual, - No action taken.
One Shot (1) - Default	When SCM/RCM Mode changes from Manual to Auto, Semi-Auto to Single Step or when SCM/RCM State changes from Idle to Running, - Mode Attribute changed to Program, but can still be changed by the operator. When SCM/RCM mode changed back to Manual, - Mode Attribute changed to Operator.
Semi-Continuous (2)	When SCM/RCM Mode changes from Manual to Auto, Semi-Auto to Single Step, SCM/RCM State changes from Idle to Running, or when any of the SCM/RCMASTEP[i] changes while SCM/RCM Mode is in Auto, - Mode Attribute changed to Program, but can still be changed by the operator. When SCM/RCM mode changed back to Manual, - Mode Attribute changed to Operator.
Continuous with Return	When SCM/RCM Mode changes from Manual to Auto,

Mode Tracking Option	Description
(3)	Semi-Auto to Single Step or when SCM/RCM State changes from Idle to Running, - Mode Attribute changed to Program and can **not** be changed by the operator as long as SCM/RCM is in Auto. When SCM/RCM mode changed back to Manual, - Mode Attribute changed to Operator.
Continuous (4)	When SCM/RCM Mode changes from Manual to Auto, Semi-Auto to Single Step, - Mode Attribute changed to Program, but can **not** still be changed by the operator as long as SCM/RCM is in Auto. When SCM/RCM mode changed back to Manual, - Mode Attribute is **not** changed but the operator can overwrite it.

What is SCM/RCM MODE behavior after Download?

The following tables describe the behavior of the SCM/RCM Mode assuming no other commands are given to the SCM/RCM or that no invoke transitions induce additional changes on the SCM/RCM. In complex scenarios, the mode specified may be visible for one execution cycle.

SCM/RCM Mode Behavior without CHECK_HANDLER

The mode specified in the third column of the table is the mode in the first cycle of the execution of the SCM/RCM when State IDLE has been reached. Further execution depends on the SCM/RCM configuration (EXCMODEOPT, Invoke Transition of other handlers, etc.)

MODE in SCM/RCM Project	MODE after SCM/RCM download SCM/RCM State INACTIVE	MODE after SCM/RCM activation SCM/RCM State IDLE
AUTO	AUTO	AUTO
SEMIAUTO	AUTO	SEMIAUTO
SINGLESTEP	AUTO	SINGLESTEP
MANUAL	AUTO	MANUAL

SCM/RCM Mode Behavior with CHECK_HANDLER

The mode specified in the third column of the table is the mode in the first cycle of the execution of the Check_Handler. Further execution depends on the SCM/RCM configuration (EXCMODEOPT, Invoke Transition of other handlers, etc.)

MODE in SCM/RCM Project	MODE after SCM/RCM download SCM/RCM State INACTIVE	MODE after SCM/RCM activation SCM/RCM State IDLE
AUTO	AUTO	AUTO
SEMIAUTO	AUTO	SEMIAUTO
SINGLESTEP	AUTO	SINGLESTEP
MANUAL	AUTO	MANUAL

What is SCM/RCM MODE behavior after Checkpoint Restore?

The following tables describe the behavior of the SCM/RCM Mode assuming no other commands are given to the SCM/RCM or that no invoke transitions induce additional changes on the SCM/RCM. In complex scenarios, the mode specified may be visible for one execution cycle.

SCM/RCM Mode Behavior without CHECK_HANDLER

The mode specified in the third column of the table is the mode after CEE Start. Impact by further execution depends on the SCM/RCM configuration (EXCMODEOPT, Invoke Transition of other handlers, etc.)

MODE checkpointed	MODE after Restore CEE IDLE	MODE after CEE COLDSTART
AUTO	AUTO	MANUAL
SEMIAUTO	AUTO	MANUAL
SINGLESTEP	AUTO	MANUAL
MANUAL	AUTO	MANUAL

MODE checkpointed	MODE after Restore CEE IDLE	MODE after CEE WARMSTART
AUTO	AUTO	AUTO

MODE checkpointed	MODE after Restore CEE IDLE	MODE after CEE WARMSTART
SEMIAUTO	AUTO	SEMIAUTO
SINGLESTEP	AUTO	SINGLESTEP
MANUAL	AUTO	MANUAL

SCM/RCM Mode Behavior with CHECK_HANDLER

The mode specified in the third column of the table is the mode after CEE Start. Impact by further execution depends on the SCM/RCM configuration (EXCMODEOPT, Invoke Transition of other handlers, etc.)

MODE checkpointed	MODE after Restore CEE IDLE	MODE after CEE COLDSTART SCM/RCM State Checking
AUTO	AUTO	MANUAL
SEMIAUTO	AUTO	MANUAL
SINGLESTEP	AUTO	MANUAL
MANUAL	AUTO	MANUAL

MODE checkpointed	MODE after Restore CEE IDLE	MODE after CEE WARMSTART SCM/RCM State Checking
AUTO	AUTO	AUTO
SEMIAUTO	AUTO	SEMIAUTO
SINGLESTEP	AUTO	SINGLESTEP
MANUAL	AUTO	MANUAL

What is a Common SCM?

Some processes have sequential operations that are exact replicas of each other running in an area of the plant on different equipment at different times. To facilitate implementation, testing and maintenance it is convenient if design can maintain repeatability by writing one set of code in an SCM that can be applied to different sets of equipment as needed. The Common SCM provides this functionality in Experion.

A Common SCM is an SCM that be configured to control several equipment units but only one at a time. To enable this functionality, the Alias Table of an SCM is defined. The Alias Table is a matrix that associates the user-defined alias names with user-selected instance parameters that the aliases are to resolve at run-time.

The Alias Table sits between the client block and the data owner/destination block. A client block can be a Step or Transition block in a Common SCM, and the data owner/destination block can be any function block in a configured Control Module in the Control Strategy. The Alias Table acts as a switch to connect the client block to different destination blocks as defined through user selected instance parameters at run-time. This gives the Common SCM the ability to control different equipment each time it runs. Once defined in the Alias Table, the aliases can be referenced by an SCM expression.

At run-time the user chooses a column of references, or an instance, from the Alias Table, to tie the aliases to the parameters of specific piece of equipment. Once the alias reference is selected, the SCM is assigned to the equipment referred to by the selected instance. The SCM then commands this selected equipment.

All of the Read and Write requests generated by the SCM Step output / Transition condition expressions, which reference the aliases in the SCM, will be re-directed to the currently selected equipment. Once the SCM is done with the selected equipment, the user can choose another instance in the Alias Table, causing the SCM to control another piece of equipment. All of the commands that the SCM sends to the alias will now be sent to the newly selected equipment.

Binding using SCM Alias Table

There are two levels of connections between the client block and the data owner/destination block in the communication path.

- The first level connection is between the client blocks and the aliases.
- The second level connection is between the aliases and the data owner/destination blocks.

The Alias Table sits in between the client block and the data owner/destination block. Since one alias has many instance parameters, one connection can provide multiple communication paths between the client block and the data owner/destination block through the second level connection, but only one can be used at a time. The alias acts as a switch to connect the client block to different data owner/destination blocks.

The process by which the Alias Table owner connects the data owner/reference destination blocks to the aliases at load time or at run-time is called binding. The Binding process results in the creation of two sets of connections:

- The connection between the client block (i.e. an SCM Step Output or Transition block) and the aliases, and
- The connection between the aliases and the data owner/reference destination blocks.

The connection types to the aliases are determined at load time by the SCM Step Output and/or the Transition Condition Expression. If an alias is referenced by a Step Output expression as the destination for a store, the connection of this alias will be created as a "Store" connection. If an alias is referenced by a Transition Condition expression, the connection of this alias will be created as a "Get" connection. If an alias is referenced by both, the connection will be created as Get and Store connection. For the aliases that have remote references, if they are not referenced by SCM Step Output or Transition Condition expression, the memory resource for the remote Get access will not be allocated, and that alias can not be accessed by clients, such as the Server Display, at run-time.

Activity	Description
First level connection - Binding Between the Client Blocks and the Aliases	Binding between client blocks, i.e. SCM step or transition blocks, and the aliases is performed at load time when loading the connection configuration to the client blocks. This process will always succeed because alias table configuration and connection references are loaded prior to connection configuration for contained components.
Second level connection - Binding Between the Aliases and the Reference Destination Block	Loading of connection configuration to a client block results in creation of connections between aliases and owner/destination blocks represented by the instance parameters. During this process, alias table requests the binding **for all of its instance parameters**. If the instance parameters of an alias represent parameters of devices on remote controllers, and the alias is referenced as a Get reference, memory will be allocated for all of the instance parameters of the alias for the remote get access as the result of binding. If there is not enough

Activity	Description
	memory resource, a severe error will be returned, and load of the SCM will be aborted. In the case of REF before DEF or DEF deleted, memory for remote get access will still be located, and load will continue. However the situation will be reflected by Binding Status. The Fail-Safe value will be used before CDA can successfully collect data from the DEF block. Because of the "Full Binding At Load" approach, memory resource will be allocated for all of the remote instance parameters of an alias, if the alias is used as a Get reference, even though only one instance parameter (the selected instance parameter) is used at a time. **The application engineer should be aware of this fact, and manage the peer to peer resource properly when configuring the Alias Table**.
Binding at Run-Time	Run-time binding is needed if the binding fails at load time because of REF before DEF or DEF block is deleted. The client block upon the first access to the alias initiates the run-time binding.

Binding process results in the binding status being set. Binding status (STATUS) represents the status of binding for the selected instance column. STATUS is an enumeration with values:

Binding Status Value	Description
Null (0)	The instance parameter is not configured (null instance parameter)
OK (1)	Data owner/reference destination block of an alias is successfully located
Binding (2)	Data owner/reference destination block of an alias can not be located Failure to bind is caused by any of the following situations: • The data owner/reference destination block is not loaded • The data owner/reference destination block is deleted.

Instance Selection using SCM Alias Table

Instance selection determines which references the aliases are resolved to at run-time. It ties the aliases to the reference parameters that the selected instance represents. The instance may be selected at configuration time, and changed at run-time. Normally, the aliases are bound to all of their instance parameters at load time. So changing instance selection at run-time should not affect the data fetching from the aliases if the instance parameters of the aliases are on remote nodes. The user should not see the delay in fetching data when the instance selection changes.

The instance selection may be changed in the following ways at run-time:

- Change the instance selection from display
- Store to INSTSELEC from Total Plant Batch
- Store to INSTSELEC from an SCM Step Output

Activity	Description
Store to the Aliases	A step output block of an SCM can store to an alias by referring to the SCM name.alias name, i.e. SCMA.FV_A_OP, in the expression. When a store request is made to an alias, the Alias Table owner forwards the request to the reference destination block, based on the currently selected instance parameter for that alias. The reference destination block completes the store and returns the status to the Alias Table owner. The Alias Table owner then passes the status to the step output block. If the reference destination block is on a remote controller, the Alias Table owner will issue a peer store request to Control Data Access. The "Pending" status will be returned since the store can not be completed in one controller cycle. In this case, the step output block will have to check the status with the Alias Table owner every cycle, until the request is completely processed. **SCM step output blocks are the only clients that can store to the aliases**.
Monitoring Alias Values	Read requests specified using an alias name return the value of the current instance parameter for that alias. A client (i.e. a transition block of an SCM) can access an alias by referencing the SCM name.alias name, i.e. SCMA.FV_A_OP. Two levels of access are involved in this type of access. The read request for the alias comes to the Alias Table owner, and then gets re-directed to the data owner block by the Alias Table owner, based on which

Activity	Description
	instance parameter is currently selected for the alias. The data owner block processes the request, and return the value and status to the Alias Table owner. The Alias Table owner then returns the value and status to the client. If the data owner block is on a remote controller, the alias value can be monitored by the Server Display only if the SCM Step Output or Transition Condition expression has read access to the alias. This is the only way that the memory resource for remote Get access can be allocated.
Monitoring Alias Binding Status	The user can monitor the binding status of an alias through SCM name.alias name.STATUS i.e. SCMA.FV_A_OP.STATUS. The request comes to the owner of the Alias Table, i.e. SCMA. The owner of the Alias Table gets the binding status for the selected instance from the alias reference connector and returns the value to the client. Binding status is owned by the owner of the Alias Table, so there is no second level of access involved.
Monitoring Expressions	When a Control Builder chart is monitoring an expression, the alias names will be displayed.

Common SCM and Batch Level 1 Function

Common SCM and Batch Level 1 function can not be used on the same device. The Common SCM making stores with OPTYPE = NOTSTORED/SET to the device (DevCtl and RegCtl blocks) cannot be used, if the CM is referenced by the SCM's Alias Table. The combination of the two functions causes unpredictable device behavior at run-time, when the SCM enters an abnormal handler.

Configuration of the two-function combination is prevented at the configuration time.

- When an instance parameter is configured, the SCM Option of the Control Module that the instance parameter references is evaluated. If the Control Module has Batch Level 1 relationship with the SCM that the Alias Table belongs to, the value of the instance parameter will be rejected, and an error message is returned to the user.
- When configuring the Control Module's Batch Level 1 relationship with an SCM, the Alias Table Option of the SCM that the Control Module is connected to is checked. If the Alias Table Option is enabled, all the instance parameters of the Alias Table will be checked. If the Control Module is referenced by any of the instance parameters in the SCM's Alias Table, the Control Module will not be allowed to have batch Level 1 relationship with the SCM. An error message will be returned to the user. The user can

either configure the Control Module's Batch Level 1 relationship with another SCM, or remove the references to the CM from the SCM's Alias Table, and re-configure the Batch Level 1 relationship with that SCM.

Why configure a Control Module as a Level 1 device?

Control Modules can be designed to monitor a specific SCM's state and change its Control Module Function Block parameters to pre-configured values based on the SCM states. When this device level exception control is implemented, the Control Module is referred to as a Level 1 device.

The major benefits available via SCM Control Requests and Level 1 Devices implementation are:

- Device level abnormal handling
- Built in housekeeping action
- NotStored SCM Output for Device Control points
- RegCtl control requests are multiple action commands
- Control requests are in the device and acted upon when possible without interlocks, initialization, etc. blocking the request

Note: Control Module as Level 1 device configuration does not work with RCMs.

When planning implementation of Level 1 devices, determine:

Step	Action
1	The specific SCM that will be monitored by the Control Module
2	For a Device Control function block, the desired state (None or Safe Output) when the monitored SCM state is - Checking, Idle, or Complete (Start Option) - Stopping or Stopped, Aborting or Aborted (Stop Option) - Holding or Held (Hold Option) NONE- No action is taken with the following exception: If the Output Request Type Option (OPTYPE) is Not Stored, then the Requested Output (OPREQ) is set to the configured Safe Output (SAFEOP) and OPTYPE is set to the default value NONE. SAFEOP - Requested Output State (OPREQ) is automatically set to the configured Safe Output State (SAFEOP) and the Requested Output Option

Step	Action
	(OPTYPE) is set to the default value (that is, NONE).
3	For a Device Control function block, the desired state (None or Last Request) when the monitored SCM state returns to Restarting or Running (Restart Option) NONE- The Device Control block takes no action -- if state changes are desired, use a separate Restart Handler sequence in which its Step Outputs command the Device Control block. Last Request - If Last Output Type = Type Set, then the values of Last Output Request and Last Output Type are used to set Output Request and Output Type. If Last Output Type = Type Not Stored, and if Last Step = ASTEPID, the value of Output Request is restored to Last Output Request and Output Type is restored to Last Output Type, else Output Request is set to Safe Output and Output Type is set to Default. If Last Output Type = Default, the Device Control block sets Output Request to Safe Output and Output Type is set to Default. Note: The values of Last Output Request and Last Output Type are displayed whenever SCM State is in an abnormal state and the Restart State Option is Last Request.
4	For all Regulatory Control function blocks, the desired action that should be taken when the monitored SCM state is - Checking, Idle, or Complete (Start Option) - Stopping or Stopped, Aborting or Aborted (Stop Option) - Holding or Held (Hold Option) NONE - No action is taken. NONE is the default. MAN - Regulatory Control block Requested Mode = Manual AUTO - Regulatory Control block Requested Mode = Automatic CAS - Regulatory Control block Requested Mode = Cascade FIXEDOP - Regulatory Control block Requested Output value = configured Fixed Output. (Does not apply to Override Selector or Position Proportional blocks.)

Step	Action
	HOLDPV - Hold the Process Variable by setting the Regulatory Control block Requested Setpoint value = PV (Does not apply to Override Selector blocks.) FIXEDSP - Fix the setpoint by setting the Regulatory Control block Requested Setpoint value = configured fixed setpoint and requested setpoint rate = Nan. (Does not apply to Override Selector blocks.) RAMPEDSP - Ramp the setpoint by setting the Regulatory Control block Requested Setpoint Target Value = configured value and the requested setpoint rate = configured value. (Does not apply to Override Selector blocks.)
5	For all Regulatory Control function block, the desired state (None or Last Request) when the monitored SCM state returns to Restarting or Running (Restart Option). NONE - No action is taken by the Regulatory Control block -- if state changes are desired, use a separate Restart Handler sequence in which its Step Outputs command the Regulatory Control block. Last Request - If Last Output Type = Type Set, then the values of Last Output Request and Last Output Type are used to set Output Request and Output Type. If Last Output Type = Default, the Regulatory Control block sets Output Request to Safe Output and Output Type is set to Default. Note: The values of Last Output Request and Last Output Type are displayed whenever SCM State is in an abnormal state and the Restart State Option is Last Request.

The Start, Stop, and Hold State Option(s) should be disabled when sequencing actions are required as part of Start, Stop, or Hold handling. In this case, the SCM's abnormal Handler should be implemented.

An SCM Control Request to a Control Module's control device is rejected when:

The device level abnormal handling options (Start Option, Hold Option, Stop Option) are enabled,

The Control Module copy of SCM State is in a state which requires a Control Module's abnormal handler option to be active, AND

One of the following is true:

If SCM State = Checking, Idle or Complete and the Control Module Block Start Option is enabled.
If SCM State = Stopping or Stopped, Aborting or Aborted and the Stop Option is enabled.
If SCM State = Holding or Held and the Hold Option is enabled.

The Control Module device driver has precedence over the SCM Exception Handler when both commands are present at the same time. This situation is possible since the abnormal handling option could be enabled on the control device at the same time as the SCM Handler is commanding the device. Avoid this situation by disabling the device option for the devices the Exception Handler is commanding, when the SCM needs to execute an Exception Handler. The SCM can disable the Start, Stop, or Hold State Option.

What are SCM/RCM Events?

An Event Journaling Option exists at three levels, the CEE level, the SCM/RCM level and the SCM/RCM Step and Phase level. Enabling the Event Journaling option allows the reporting of journal level events to the Server.

At the CEE level, the user defines how much memory is allocated for the events and enables or disables all batch events or selected categories. The categories are:

- RCM/SCM Execution
- Execution Details
- Formula/Recipe Parameters
- Recipe Header
- Recipe Resource Allocation
- Report/History Parameters

The SCM events that can be added to the journal are:

- SCM/RCM Execution Start
- SCM/RCM Execution Termination State
- SCM/RCM Step Start
- SCM/RCM Step Complete
- RCM Phase Start
- RCM Phase Complete
- SCM Recipe Parameter Download (one event per recipe parameter)
- SCM History Parameter Upload (one event per history parameter)
- RCM Formula Parameter Download (one event per parameter)
- RCM Report Parameter Upload (one event per parameter)

The overall SCM/RCM event enable parameter (SCM/RCM.EVTOPT) turns the entire SCM/RCM event reporting on or off; by default it is off. Event parameters are grayed out when the SCM/RCM Overall Event Option parameter is off.

When Event Journaling is enabled, the operator has the option of adding a Comment(s) associated with Step and Phase Start events. As a minimum, the SCM/RCM Step Start event must be reported in order to use the SCM/RCM comments feature.

Scenario – Engineer debugging SCM/RCM enables SCM/RCM Events

Paul, an engineer, is debugging an SCM/RCM and would like to see when the SCM/RCM starts, completes, and when each Step of the SCM/RCM starts.

Step	Action
1	Open the SCM/RCM's Alarm and Event Parameters tab. Enable the SCM/RCM Overall Event option.
2	From the SCM/RCM's Alarm and Event Parameters tab, enable the SCM/RCM Start Event Option and the SCM/RCM Terminal State Event Option.
3	Open each Step's Alarm and Event Parameters tab, enable the Step Start Event Option and the Step Complete Event Option.
4	Save and download the SCM/RCM.

Scenario – After debugging, disable SCM/RCM Events

Paul has finished his debugging and does not want to report the SCM/RCM events anymore. He also does not want to have to open every Step to disable the events.

Step	Action
1	Open the SCM/RCM's Alarm and Event Parameters tab. Disable the SCM/RCM Overall Event option.
2	Save and download the SCM/RCM.

Scenario – Enable specific SCM/RCM Step Events for operator commenting

Paul wants Wendy, an operator, to be able to add her comments to individual steps in an SCM/RCM as they execute.

Step	Action
1	Open the SCM/RCM's Alarm and Event Parameters tab. Enable the SCM/RCM Overall Event option.
2	Open the individual Step's Alarm and Event Parameters tab.

Step	Action
	Enable the Step Start Event option parameter.
3	Save and download the SCM/RCM.

How do Cold and Warm Restart in CEE affect an SCM/RCM?

Restart of CEE occurs as the value of CEESTATE changes from idle to run either after the CEE function block has been created and the initial configuration loaded, or after Restore of a Checkpoint when the database is loaded from Control Builder.

Cold Restart -	Assumes that much of the state data is stale. Live data derived directly from the process is wiped out while much of the operational data captured in the saved checkpoint is reinitialized. All configuration data is saved across Cold Restart.
Warm Restart -	Differs from Cold Restart in choosing data to preserve and data to initialize. Warm Restart of the CEE preserves all data that Cold Restart preserves plus additional operational data.

SCM/RCM behavior upon CEE Restart varies depending on SCM/RCM configuration and the CEE Start command issued by the operator.

The SCM/RCM configuration parameter CEESTARTOPT provides three options for SCM/RCM behavior on CEE Restart. For all options - if the SCM/RCM has a configured Check Handler, execution of the SCM/RCM will depend on the contents of the Check Handler. CEESTARTOPT has an access lock of Engineer. The CEESTARTOPT configuration options are:

SCM/RCM parameter CEESTARTOPT value	Description
FOLLOWCEE (default)	Follow the CEE restart command When CEE Cold Restart has been configured, the SCM/RCM is set Active (same behavior as if COMMAND = ACTIVE), SCM/RCM Mode is set Manual after activation of SCM/RCM, and other parameters such as Mode Attribute and Recipe Parameters (RECTARGET[]) are left unchanged.

SCM/RCM parameter CEESTARTOPT value	Description
	When CEE Warm Restart has been configured, the SCM/RCM is set Active (COMMAND = ACTIVE), the previous Mode of the SCM/RCM is maintained, and other parameters such as Mode Attribute and Recipe Parameters (RECTARGET[]) are left unchanged.
ALWAYSCOLD	Execute cold start behavior regardless of CEE Restart command; SCM/RCM set ACTIVE (same behavior as if COMMAND = ACTIVE), Mode set MANUAL after activation of SCM/RCM, other parameters such as MODEATTR and Recipe Parameters (RECTARGET[]) are left unchanged.
ALWAYSWARM	Execute warm start behavior regardless of CEE Restart command; SCM/RCM set ACTIVE (same behavior as if COMMAND = ACTIVE), previous MODE maintained, other parameters such as MODEATTR and Recipe Parameters (RECTARGET[]) are left unchanged.

Important Note: Under all circumstances, the SCM/RCMs that have been inactive will remain inactive unless specifically activated by a user or by a user-defined control strategy. The SCM/RCM's state will not be affected by CEE Restarts without Checkpoints. If a checkpoint restore results in inactive SCM/RCMs because they were saved in the inactive state, those SCM/RCMs will remain inactive after CEE restart.

In both Cold and Warm Restart, the SCM/RCM starts executing at the top of the selected Check Handler unless the operator commands execution to start at a different handler.

SCM/RCM RESTART has pulse semantics. The manner in which RESTART is reset to NONE after initial execution is as follows.

- If a Check handler is the first handler executed after SCM/RCM restart then parameter RESTART is set to NONE after the Check handler finishes. Under this scenario the value of parameter RESTART would be read within the Check handler.
- If a handler other than the Check handler is the first to execute after SCM/RCM restart then parameter RESTART is set to NONE after the first execution cycle of the SCM/RCM. Under this scenario the value of parameter RESTART would have be read in Interrupt, Hold, Stop or Abort handlers as appropriate to the planned configuration and usage.

The SCM/RCM parameter RESTART provides the last type of restart that occurred on the SCM/RCM and is available as read only. The readable values of this parameter are:

SCM/RCM RESTART value	Description
None (0)	No restart transitions since the last execution of the SCM/RCM
CEESWITCH (1)	Controller hosting the CEE which contains the SCM/RCM has gone through a redundancy switchover since the last execution of the SCM/RCM
CEEWARM (2)	CEE containing the SCM/RCM has gone through a warm restart since the last execution of the SCM/RCM
CEECOLD (3)	CEE containing the SCM/RCM has gone through a cold restart since the last execution of the SCM/RCM
CMACTIVE (4)	SCM/RCM has been stopped and reset since its last execution
CMLOAD (5)	SCM/RCM has been loaded since its last execution. This value also applies the first time an SCM/RCM is executed.

There is an implicit priority to the values of RESTART that insures that the condition requiring the strongest initialization can always be seen. This allows SCM/RCM expressions to be written so that they may always do the strongest initialization necessary. The priority is CMLOAD > CMACTIVE > CEECOLD > CEEWARM > CEESWITCH > NONE.

Checkpoint Recommendations for SCM/RCM

SCM/RCMs are the most memory consuming control modules in ExperionPKS execution environments. Therefore, checkpoint data cannot be captured between two execution cycles. Saving the checkpoint of an SCM/RCM may take a long time compared to the execution period of the SCM/RCM. In extreme cases, several hundred cycles may be needed to save all data of one SCM/RCM. In more common cases where the SCM/RCM period is between 0.5 sec and 2.0 sec, more than one cycle may be needed to save all checkpoint data for the SCM/RCM. The checkpoint data may contain a data set (combination of parameter values) that do not represent a desired data set or do not represent a valid process situation for the SCM/RCM.

Honeywell makes the following recommendations for checkpoint save operations for SCM/RCMs:

- Do not make online modifications of SCM/RCMs while a checkpoint save is in progress or a scheduled checkpoint is expected to be running.
- Avoid saving checkpoints for SCM/RCMs automatically in fast running batch plants. Avoid saving checkpoints for SCM/RCMs while they are in transient STATE (Checking, Running, Interrupting, Holding, Restarting, and Stopping) because it is likely that when the SCM/RCM is restored from this type of checkpoint, it will not match the process conditions.

Regulatory Compliance Warning on Checkpointing SCM/RCM

Checkpointing is provided to reduce mean-time-to-repair for different problem scenarios. Checkpointing is not provided as a regular backup tool for engineering data. Checkpointing should not be used to circumvent versioning of control modules or to avoid change control.

Online changes intended to become permanent must be incorporated into the engineering database. Usage of checkpoints as a permanent repository for engineering data is not recommended by Honeywell and is not considered in conformance with Good Automated Manufacturing Practice (GAMP).

TotalPlant Batch Warning on Checkpointing SCM/RCM

Checkpointing restores data used for communication with TotalPlant Batch (parameters AuxOpt, State, and Modeattr). Because TotalPlant Batch holds only state information about running phases (SCM/RCMs) in many situations, the data restored from checkpoint may not match the information in the TotalPlant Batch Server. The TotalPlant Batch Server may respond with various errors and many or all batches may not be recovered. Recovery of batches may require multiple operator interventions to

SCM/RCMs and batch recipes that should be executed only by persons experienced with the batch configurations.

The following checkpoint scenarios are recommended:

- All SCM/RCMs are restored from checkpoint to IDLE State. MODEATTR = PROGRAM is recommended but not required. A Cold Start is performed for the TotalPlant Server.
- All or some SCM/RCMs are restored from checkpoint and all running batch recipes in TotalPlant Batch which use these SCM/RCMs are to be deleted from the batch list.

Other scenarios may work well but have not been evaluated or analyzed by Honeywell. The resulting behavior depends on many variables defined by specific configuration and runtime environment. It is the responsibility of the user to consider the change of SCM/RCM runtime data after checkpoint restore.

What are Procedural Operations - Interactive Instructions (ProcOps)?

The SCM and RCM views and operator interactive functions that collectively work to improve operator effectiveness are referred to as Procedural Operations – Interactive Instructions or ProcOps. When configured, these functions can deliver automated procedures for startup, shutdown, grade change, etc. in an interactive manner patterned after those previously executed from paper documents.

Views of the SCM/RCM

An SCM/RCM can be viewed in one of two formats: Chart view or Table View.

In Control Builder, the SCM/RCM can be viewed in Chart view or Table View. Chart view is typically used for configuration, testing, and troubleshooting and focuses on the details of sequence execution flow.

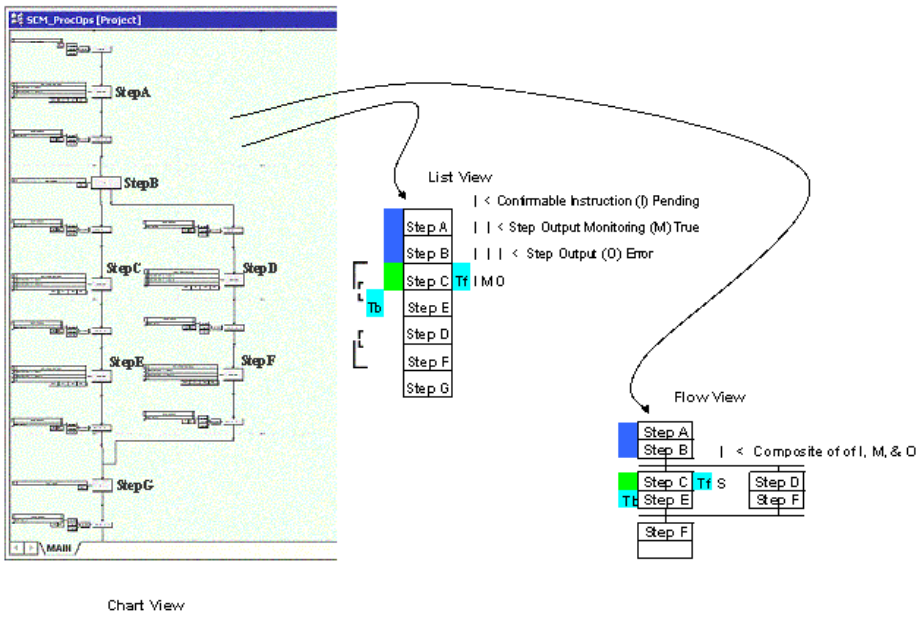


Chart view, Table View Summary List view, Table View Summary Flow view

SCM/RCM Table View features

Table View is designed to facilitate operator interaction with SCMs and RCMs. Some of the features and functions of Table View are the ability to:

- View transition details associated with the step
- View Step associated Instructions when implemented
- Use filters allowing operators to focus on items relating to the steps and outputs currently executing
- Use filters allowing operators to display only executing steps/phases with key trailing transitions
- Enable the operator to 'stand' on a step to view leading and trailing transition details
- Record all operator changes made via the SCM/RCM Table View in the system journal

SCM/RCM Table View structure

In Station, Table View display contains six panes: Summary, Detail, Additional Details, Key Parameters, Minitrend, and Status line. In Control Builder, Table View display contains four panes: Summary, Detail, Additional Details, and Key Parameters,.

The SCM/RCM Summary pane displays SCM/RCM Steps or RCM Phases in List view or Flow view. List view presents the SCM/RCM as a compact linear list of Steps/Phases with basic flow information. Flow view displays the SCM/RCM Summary in a "graphical flow view" of sequence/procedure step/phase execution. Flow view presents data in a form in which the operator can quickly observe key aspects of alternate and parallel path flow.

SCM/RCM Additional Details

SCM/RCM Additional Details pane can include any or all of the following depending on configuration: Warning, Note, Instruction, Comment, and Expression. A Note, Warning, and Instruction can contain up to 9999 characters in raw HTML; visible characters will be less.

Note and Warning support information at the SCM step by providing the operator with specific directives each with an associated level of importance throughout a given step of the process. Note has a lower priority than Warning. During a specific step output, an additional Note can be configured to provide information to the operator for another step output.

Instruction provides the operator with directions at the SCM step output level. An Instruction can be configured to require operator confirmation. When an instruction awaits operator confirmation, the sequence suspends execution. Depending on configuration, Instructions can be confirmed at the Step level or at the individual Step Output level. When the operator confirms at the Step level, Instructions associated with all the Step's Outputs are confirmed. While an Instruction waits for confirmation, it sends an Alert to the operator if alerts are enabled in the SCM/RCM configuration form. Associated with the Instruction is an Alert timeout value. After 'Alert-timeout-value' minutes has passed, an Alarm is issued. Critical instructions should be configured with an Alert timeout value. When the Alert timeout value is set to zero, an Alarm will not occur. Alert timeout value is configured on the SCM Step Main form.

A **Comment** is free format text that is added to the associated SCM Step or RCM Phase when the SCM/RCM is executing and after an SCM Step or RCM Phase has started. The Comment attaches to SCM Step Start or RCM Phase Start event. In order to add a Comment, the configuration option must be selected and a step or phase event must be generated. Comments are added by the operator from Table View by selecting a step or phase, clicking on the event in the Comment tab, and entering text.

SCM/RCM Key Parameters

For the step output, the Key Parameters area can contain the following parameters when configured: target value, current value, entry value. If the target value is configured for change, the operator can adjust the target value – another interaction by the operator.

For the Phase, the Key Parameters area contains Equipment Module Status information. When a Phase is selected in the Summary pane, the tagname of the associated SCM (equipment module) will be shown in this pane along with its State, Execution Status, Mode, and Mode Attribute. The operator can click on the SCM tagname in this pane to quickly invoke the SCM detail display.

SCM/RCM Minitrend

Values can be trended on a Minitrend graph that appears in the lower left pane of the SCM/RCM Table View. In every step and step output, the user can configure the current value shown in the Minitrend. If history collection is configured for the current value and history collection type is specified in step configuration, the Minitrend can retrieve old values. For all other current values, Minitrend starts to collect the values when the Minitrend is opened for a step in the Table View. For an RCM phase, the Minitrend graph can show both the display parameter and the report parameters.

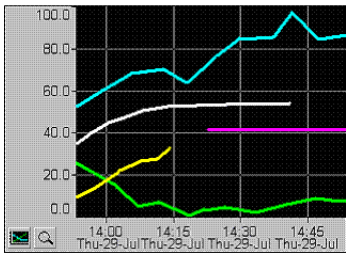


Figure 1 - Minitrend pane

The Minitrend has the following components:

- Trend canvas (black background) to show the graphs
- Value scale to show the value range of trended values (trends share the same value range)
- Time scale to show the time range of the trended values (trends share the same time range)
- Navigation button of a magnifying lens to invoke a standard full size trend that is populated with the same trends as shown in the Minitrend.
- Navigation button of a trend display to invoke a standard trend with a predefined trend set number. Configuration required in the step configuration 'Trend set number'.

The history collection type parameter of a step will be loaded to the controller to allow online changes. If the history type of the collected data is not the same as the defined in the step definition, the cumulative real-time trend is shown instead.

The Minitrend Value scale (y-axis) is shown either as engineering units or percentages. The default is percentages.

The Minitrend time scale (x-axis) indicates both date and time for the grid lines. The start and stop times for the trend are calculated in two different methods: Real-time trend and Frozen trend.

Minitrend real-time trend is used for current values and uses a parameter defined for the step and phase to define the default range for the time scale. The value of this parameter is the estimated duration (EstDuration) of the step/phase execution. The time is in seconds. If no value or the value is zero, the estimated duration time is calculated from the trend update interval of the step. The start and end times are calculated as:

Start time = Current time – EstDuration

End time = Current time

Minitrend Frozen values use two parameters defined for the step to allow visibility for phenomena occurring before the step started and after the step completed. Both times are in seconds with a default of 0. The first one (StartOffset) defines how much history is shown before the step started. The second one (EndOffset) defines how much history is shown after the step completed. The start and end times are calculated as:

Start time = Step start – StartOffset

End time = Step end + EndOffset

When the step is repeated as part of an execution loop in SCM/RCM, the step start time is larger that the recorded step end time when the step is reactivated. In this case, the Minitrend display resumes the real-time method for the current values for the duration of the repeated step execution.

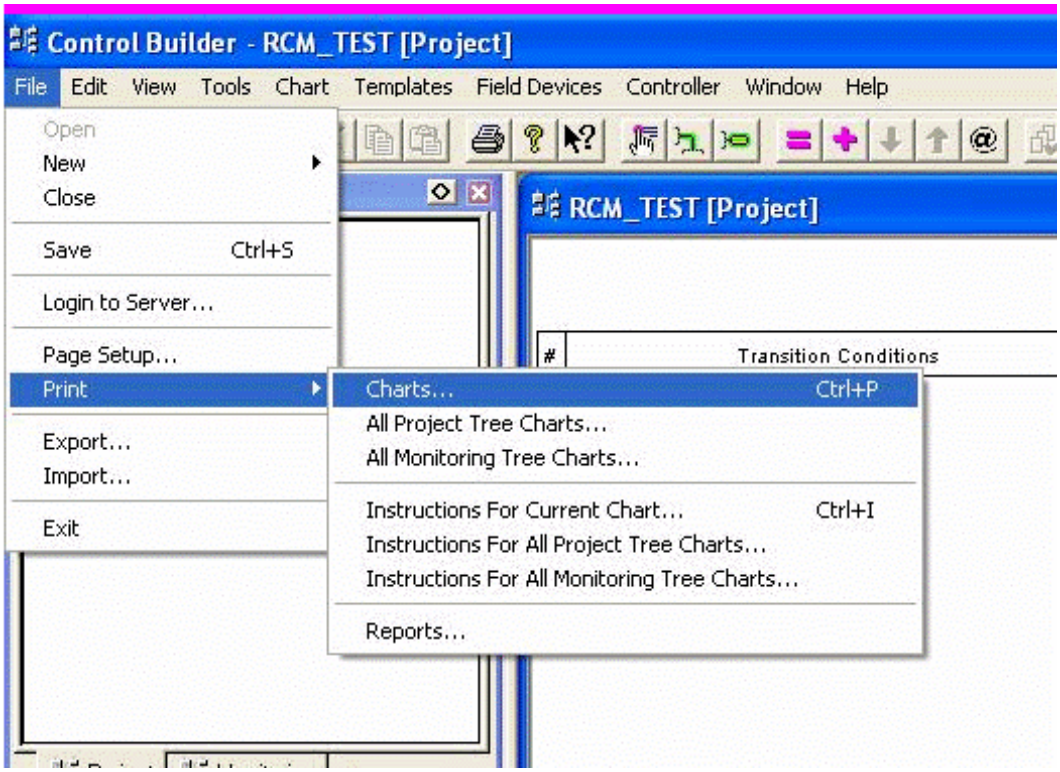
Printing from Table View

The SCM/RCM Table View has a printer icon in the Summary pane. Selecting this icon enables the user to print the SCM. The user can print all SCM/RCM steps or just the steps that have been selected in the print option dialog box. The blocks will be ordered as they are in the Summary list in Table View.

Printing SCM Instructions in Control Builder

In Control Builder, instruction related parameters of an SCM can be printed for the Current Chart, all Project Tree Charts, or all Monitoring Tree Charts. Instruction related parameters include instruction type, instructions, notes and warnings. An instruction identifies its associated Step Output block name, block description, and parameter name in the printout. Instructions, Notes, and Warnings are printed using HTML formatting.

To print SCM Instructions associated with the current chart from Control Builder, select File > Print > Instructions for Current Chart.



Role definition

Role is a text parameter. Because Role definition can be defined at the SCM, Step block, and Step output levels the following role hierarchy is determined:

- Role definition at the SCM level is the default role for all steps in the SCM
- Role definition at the Step block level is the default role for all step outputs. If Role is not defined at this level, the next higher level's value for Role is used.
- Role definition at the Step output level is the actual role. If Role is not defined at this level, the next higher level's value for Role is used.

Why use a Recipe Control Module (RCM)?

The Recipe Control Module is intended for running procedural operations that initiate the execution of one or more SCM in series, parallel, or a combination of both. Although an RCM's handlers can contain steps, transitions, and phases, it is more common for an RCM handler to contain phases with few transitions and steps.

RCM execution

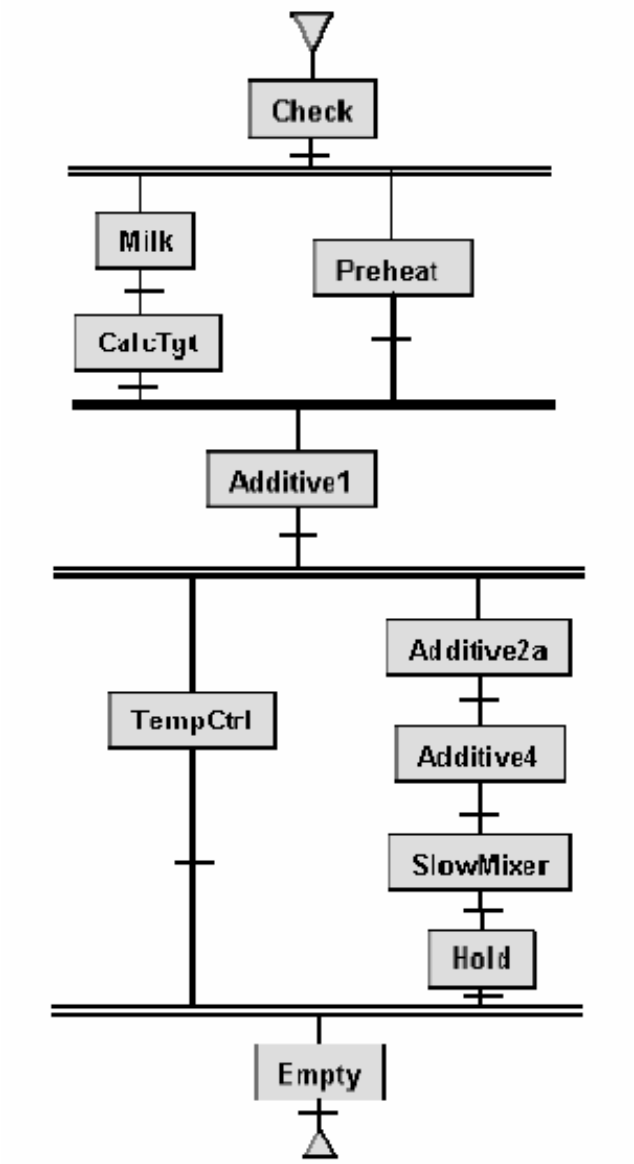
After the RCM is loaded to the CEE and started, the loaded RCM:

- Acquires equipment (associated Unit Control Module) for its procedure execution
- Acquires Equipment Modules when Phase blocks are executed
- Executes Phases, Steps, Transitions, and Synchronization blocks in its procedure.
- Reports its own state
- Reports its own process alarms
- Reports its own events to the event journal for post execution analysis and reporting
- Optionally releases equipment (UCM) and Equipment Modules (SCMs and RCMs) when its execution reaches a terminal state

Typical RCM procedure

The typical RCM procedure uses the following graphical representations:

- Titled blocks represent phases
- 'Ts' between phases represent transition blocks
- Horizontal double lines represent the Synchronization block
- Horizontal single line represents a series of alternative Transitions
- Resource management is embedded in the RCM for UCM
- Resource requests are embedded in the Phase blocks for Equipment Modules
- The triangle standing on its vertex represents the invocation transition
- The triangle standing on its base represents a terminal state of the procedure


Check
Milk
Preheat
CalcTgt
Additive1
Additive2a
TempCtrl
Additive4
SlowMixer
Hold
Empty

RCM and SCM tracking, projection and propagation

State projection and propagation happens between the loaded RCM and the SCMs that the RCM coordinates. The state propagation and projection are done through Phase blocks.

State projection and propagation

State projection is the response of the loaded RCM to the abnormal state of the Phases under its control. The SCM projects its abnormal state up to the loaded RCM.

State propagation is SCM state changes as the result of tracking the failure state of its parent loaded RCM.

The executing RCM supports two parameters, Composite State and State.

- Composite state indicates the composite status of the Phases (SCMs) that are controlled by the RCM. When multiple failures happen on phases that are running in parallel, the Composite state reflects the highest priority abnormal state. The priority from high to low is ABORT, STOP, HOLD.
- Executing RCM state represents the current RCM state. The executing RCM may not always respond to the failure state of its Phase, but this failure state is always reflected by the Composite state of the executing RCM.

The reaction of the executing RCM to the abnormal state of its Phases (SCMs) is configurable. The reaction of the SCM to the abnormal state of its parent RCM is configurable.

SCM State Projection

An SCM abnormal state is always projected to the Composite state of the parent RCM. The executing RCM's state may or may not respond to the abnormal state of the child SCM, depending on the configuration. A set of configurable parameters are used to define if and how the executing RCM reacts to the Phase (SCM) abnormal state. The Phase abnormal states and the choices of the RCM's response for each state are:

Parameter	Description
EQM to State Projection up to Recipe Aborted (EQMTORECMAP[8])	By default, the RCM tracks the most abnormal state of the active SCM in the phases. This option is used when any acquired SCM goes into ABORTED.

Parameter	Description
	Choices are: None (0) – no action Default (1) - (Abort) Hold (6) Stop (7) Abort (8)
EQM to State Projection up to Recipe Stopped (EQMTORECMAP[7])	By default, the RCM tracks the most abnormal state of the active SCM in the phases. This line is used when there is no acquired SCM is ABORTED but at least one stopped acquired SCM. Choices are: None (0) – no action Default (1) –(Stop) Hold (6) Stop (7) Abort (8)
EQM to State Projection up to Recipe Held (EQMTORECMAP[6])	By default, the RCM tracks the most abnormal state of the active SCM in the phases. This line is used when there are no acquired SCM ABORTED or STOPPED but at least one HELD acquired SCM. Choices are: None (0) – no action Default (1) – (Hold) Hold (6) Stop (7) Abort (8)

The executing RCM state change is done through a state command. When a Phase is going to an abnormal state, the executing RCM generates a proper internal command according to the configuration option. This internal command drives the executing RCM to the abnormal state as configured. If the executing RCM is configured not to react to the abnormal state (option = None), there is no internal command to the executing RCM.

Executing RCM State Propagation

The reaction of the SCM state to the executing parent RCM's state change is:

Parameter	Description
Recipe State Propagation down to EQM Aborted (RECTOEQMMAP[8])	By default, the RCM will command all active EQUIPMENT MODULEs (SCMs) to the same state as the RCM. If the RCM state becomes ABORTED, then the Equipment Modules are commanded by value selected here. Choices are: None (0) – no action Default (1) – (Abort) Hold (6) Stop (7) Abort (8)
Recipe State Propagation down to EQM Stopped (RECTOEQMMAP[7])	By default, the RCM will command all active Equipment Modules (SCMs) to the same state as the RCM. If the RCM state becomes STOPPED, then the Equipment Modules are commanded by value selected here. Choices are: None (0) – no action Default (1) – (Stop) Hold (6) Stop (7) Abort (8)
Recipe State Propagation down to EQM Held (RECTOEQMMAP[6])	By default, the RCM will command all active Equipment Modules (SCMs) to the same state as the RCM. If the RCM state becomes HELD, then the Equipment Modules are commanded by value selected here. Choices are: None (0) – no action Default (1) (Hold)

	Hold (6) Stop (7) Abort (8)

What is the Unit Control Module (UCM)?

The licensed Unit Control Module is a container that represents a piece of or logical grouping of physical equipment. AN RCM must acquire a UCM before its procedure can be executed. The Unit Control Module is not part of the standard Experion license and requires an additional license for use.

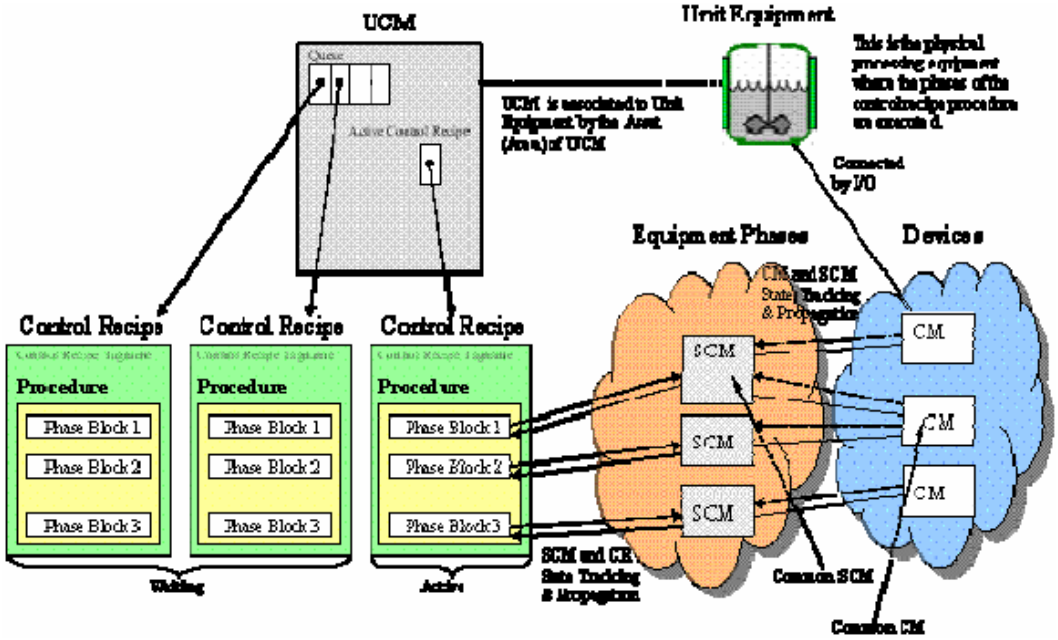
The UCM performs the following tasks:

- Processes arbitration requests
- Identifies the current running RCM
- Optionally projects the state, composite phase state, mode, and mode attribute of the primary active RCM
- Optionally supports parameter Command from which the operator can give commands to the primary active RCM
- Optionally Contains CMs, SCMs, RCMs, other UCMs, CDBs, numeric, numeric array, flag array, and text array blocks as a hierarchical container block and performs parameter projection. The non-executable function blocks CDBs, numeric, numeric array, flag array, and text array bocks perform data store.

Multiple RCMs can be queued to a single UCM, but only one RCM can run against a UCM at a time. UCM does not have a containment relationship with the RCMs that are associated with it.

The UCM maintains an arbitration list that holds the tagnames of all the RCMs that are currently waiting for the UCM for their procedure execution. The RCMs in the arbitration list are the ones that have been started by the operator or a high-level program. When the current RCM is completed, the first one on the list will be started automatically. The start command does not need to be re-issued to the RCM; it only needs to be issued once.

Relationship between UCM, equipment, and RCM



Relationship between UCM, Equipment, and RCM

Comparison of UCM and CM

A Unit Control Module is similar to a Control Module since both are container blocks and both support a hierarchy function.

The UCM and CM differ as follows

- UCM manages resource arbitration. CM does not.
- UCM represents equipment. CM does not.
- UCM can have RCMs associated with it. CM can not.
- CM can contain executable basic function blocks. UCM can not.
- CM can be configured to monitor an SCM's state. UCM can not.

Re-load of UCM and SCM

Re-load of UCM and SCM wipes out their arbitration list.
Inactivate/activate UCM and SCM does not affect the arbitration list.

UCM Execution

Tasks performed by the UCM during execution include:

- Setting Execution State Active
- Processing resource arbitration requests
- Unbinding the RCM
- Providing tagname of the current owner
- Projecting execution information from the current owner
- Commanding RCM
- Updating contained blocks

UCM Execution State set Active

The only valid execution states for the UCM are ACTIVE and INACTIVE.

The user can load and activate in one of two ways which is determined by the selection of the Load and Activate option on the UCM:

- When selected, the UCM is automatically activated when loaded to the controller
- When deselected, the UCM must be manually activated after it is loaded to the controller

UCM execution starts executing as soon as the UCM is set ACTIVE.

Inactivating the UCM and SCM wipes out the arbitration list. Note: After re-activation, of UCM/SCM requesters will immediately re-issue their requests.

The access level of UCM state parameter may be restricted to Engineer or Supervisor level in order to restrict the operator from changing the UCM state.

Processing resource arbitration requests

When the UCM receives an arbitration request from an RCM, it checks the status of the arbitration queue. If the queue is FULL, the UCM returns status = FAIL to the requestor,

otherwise, the UCM will put the tagname of the RCM in its arbitration queue and returns UCM status = OK to the store request.

Arbitration status is set to ACQUIRED or ACQUIRING depending upon the availability of the UCM. The RCM will continue to try again without any user intervention in cases where the original request fails. The following are the possible UCM arbitration status values:

ACQUIRED – the RCM acquired the UCM

ACQUIRING – the UCM is not available but the RCM has been successfully put in the arbitration list

FAIL – the request can not be put in the arbitration list because the queue is full

In the case of a communication failure, the status of the store request of the arbitration is FAIL and the RCM has to reissue the request.

Processing request to release resource

The RCM will always release the UCM when its execution is completed.

When the UCM receives the resource release request, it unbinds the RCM, removes the current owner RCM and returns OK to the release request. The UCM then gives the resource to the RCM that is first in the arbitration queue and binds to the new owner. The UCM then notifies the new owner that it has acquired the resource by setting the arbitration status to ACQUIRED. The UCM moves all the requestors in the arbitration queue up by one step.

Providing the tagname of the current owner

UCM provides the tagname of the current running RCM through parameter Owner ID[1]. When the RCM acquires the UCM, the UCM puts the acquiring RCM's tagname into the ACR parameter. The active RCM's name comes from the parameter OWNERID. The waiting RCM names are stored in parameter QUEUEID.

Projecting execution information from the current owner(s)

The UCM optionally projects the state, composite Phase state, mode, and mode attribute from the primary owner to its parameter State, Composite Phase State, Mode, and Mode Attribute respectively. The projected primary owner's parameters are fetched by the UCM as a structure.

The projection option is configured at RCM configuration time.

Container UCM

The UCM can be used as a container block that hold non executable function blocks, such as CDB blocks, numeric blocks, flag array blocks, numeric array blocks, and text array blocks. The UCM will support data stored to the contained blocks. The UCM will not support executable function blocks like a PID or DevCtl.

Configuration

Configuring Sequential Control Strategy

To create a sequential control strategy, a Sequential Control Module must first be created then Handlers, Transitions, Steps, and/or Synchronization blocks are added to the SCM, configured and connected as required.

The steps to creating a sequential control strategy are:

Step	Action
1	Create SCM instance.
2	Define SCM parameters.
3	Assign SCM to Execution Environment
4	Configure Main Handler
5	Add transition block to SCM. (Invoke transition is part of Main.)
6	Configure transition block
7	Connect transition to previous block if it is not the Invoke transition
8	Add step block to SCM
9	Configure step block
10	Connect step to previous block
11	Add SYNC block to SCM
12	Configure SYNC block
13	Connect SYNC previous block(s)
14	Repeat addition of transition, step, and SYNC blocks as required completing the sequential control strategy.
15	Add additional Handlers as required for abnormal occurrences.

Configuring Procedural Control Strategy

For a procedural control strategy, the Recipe Control Module is created and then the same blocks as in the SCM are added with the addition of a Phase block, then configured and connected.

The five macro steps which must be completed in the correct order are:

1. Create the UCMs to be used by the RCMs.
2. Create the Phase Block Types to be used in the RCMs.
3. Create the complete or skeletal structure (RECIPETARGET and HISTORY definitions) for the SCMs implementing the Equipment Phases.
4. Create the user templates for the phases used in the RCMs based on the Phase Block Types or exisiting user templates for the phases. Define the default values for configuration parameters including the SCM names and UCM names.
5. Create the RCM by adding the standard components from the library (Handlers, Steps, Transitions, and Syncs) and phases based on either phase block types or user templates for phases.

The detailed steps to create a procedural control strategy are:

Step	Action
1	Create RCM instance.
2	Define RCM parameters.
3	Assign RCM to Execution Environment.
4	Configure Main Handler
5	Add transition block to RCM. (Invoke transition is part of Main.)
6	Configure transition block
7	Connect transition to previous block if it is not the Invoke transition
8	Create phase block in Parameter Definition Editor
9	Add phase block to RCM
10	Configure phase block

Step	Action
11	Connect phase to previous block
12	Add step block to RCM
13	Configure step block
14	Connect step to previous block
15	Add SYNC block
16	Configure SYNC block
17	Connect SYNC to previous block(s)
18	Repeat addition of transition, phase, and SYNC blocks as required to complete the sequential control strategy.
19	Add additional Handlers as required for abnormal occurrences.

Creating an SCM instance

Follow the steps in the table below to create a new Sequential Control Module (SCM).

Step	Create SCM Instance - Action
1	Open Control Builder via Configuration Studio/Configure process control strategies
2	Choose File > New > Sequential Control Module. The new SCM • Opens in control chart view • Is assigned a name determined by the system using sequential numbers (SCM_54, SCM_55, ...). The SCM can be renamed later. • Appears under the Root Project Tree under Unassigned. • Is automatically saved.
3	Double-click an empty area of the SCM Control Chart. The Parameters tabs are displayed for SCM configuration.
4	Click on each Parameters tab and fill in the values to define the SCM parameters. During configuration, use the F1 key to access context sensitive Help. Checking the Show Parameter Names box in the lower left of the window will display the system parameter name inplace of the descriptive name for each item.
5	When data entry is complete, click on OK.

Creating an RCM instance

Follow the steps in the table below to create a new Recipe Control Module (RCM).

Step	Create RCM Instance - Action
1	Open Control Builder via Configuration Studio/Configure process control strategies
2	Choose File > New > Recipe Control Module. The new RCM • Opens in control chart view • Is assigned a name determined by the system using sequential numbers (RCM_54, RCM_55, ...). The RCM can be renamed later.

Step	Create RCM Instance - Action
	• Appears under the Root Project Tree under Unassigned. • Is automatically saved.
3	Double-click an empty area of the RCM Control Chart. The Parameters tabs are displayed for RCM configuration.
4	Click on each Parameters tab and fill in the values to define the RCM parameters. During configuration, use the F1 key to access context sensitive Help. Checking the Show Parameter Names box in the lower left of the window will display the system parameter name inplace of the descriptive name for each item.
5	When data entry is complete, click on OK.

Note: The RCM name, description, and asset name are typically entered on the Main tab. Only the UCM name is mandatory on the Recipe Settings tab.

Defining the SCM/RCM Parameters

Because the process of defining SCM and RCM parameters is similar, the tasks are presented jointly with limited exceptions.

Main Tab of SCM/RCM

Main Tab of SCM/RCM contains configuration information for the following parameters:

Main Tab of SCM/RCM	Description
Name (NAME)	The unique SCM/RCM name of up to 16 characters that appears on all related system displays and any generated reports. The name must include at least one alpha character or letter (A-Z), no embedded or leading space, and none of the following: ` ~! @ # $ % ^ & * + - = ( ) { } [ ] | \ \ : ; ' < > , . ? / \ ",. The name automatically assigned to the SCM/RCM by Control Builder is only a reference to ensure name uniqueness and has no other significance.

Main Tab of SCM/RCM	Description
Item Name	Name of the entity that this SCM/RCM will be associated with in the Enterprise Model Builder hierarchy. Can be up to 40 characters and must include at least one alpha character.
Description (DESC)	A text string of up to 132 characters used to describe the SCM/RCM.
Engr Units (EUDESC)	A text string of up to 16 characters used to describe important aspects of the SCM/RCM. Appears in detail and group displays in Station, and on any generated reports.
Keyword (KEYWORD)	A text string of up to 16 characters to be used on detail and group displays in Station and on generated reports. KEYWORD can be used to provide a brief block description on schematic displays where DESC is too long.
Execution: Execution Period (PERIOD)	Choose setting from pull down menu. Period selections are in milliseconds or seconds. Value is dependent on controller base cycle. Refer to the Defining Execution Period section for more information.
Execution: Execution Order in CEE (ORDERINCEE)	Specifies the order of execution of this SCM/RCM within its CEE. Execution order determines which control strategy to execute. The control module with the lowest number will execute first within the CEE. If multiple control modules have the same Order in CEE, the order of execution is based on the order in which the strategies were built. Valid value = 0 to 65535 in multiples of 10 Default value = 10
Execution: Execution Phase (PHASE)	The cycles/phases in which the SCM/RCM executes. Default = -1 (phase assigned automatically) Range = 0 to 39; defines distribution of the block processing among load cycles. Refer to the Defining Execution Phase for more information.
Restart: CEE Restart Option	Saved in checkpoint - Restored from checkpoint

Main Tab of SCM/RCM	Description
(CEESTARTOPT)	SCM/RCM Behavior on CEE Restart FOLLOWCEE (0) follow the restart commanded for CEE (default) – When CEE Cold Restart is selected, the SCM/RCM is set Active and the SCM/RCM Mode is set Manual after activation of the SCM/RCM; other parameters remain unchanged. When CEE Warm Restart is selected, the SCM/RCM is set Active and the SCM/RCM's previous Mode is maintained; other parameters are left unchanged. ALWAYSCOLD (1) executes cold start behavior regardless of CEE Restart command. The SCM/RCM is set Active, SCM/RCM Mode is set Manual, and other parameters are left unchanged. ALWAYSWARM (2) executes warm start behavior regardless of the CEE Restart command. The SCM/RCM is set Active, the previous SCM/RCM mode is maintained, and other parameters are left unchanged. This parameter has no effect on inactive SCM/RCMs. Inactive SCM/RCMs always remain inactive on CEE restart unless specifically activated by a user or user-defined control strategy.
Alarming: Enable Alarming Option (ALMENBSTATE)	Saved in checkpoint - Restored from checkpoint Unchecked (Default) = Off - alarms reports do not propagate out of the CEE, but alarm flags reflect current alarm state Checked = On - alarms detected by component blocks within the SCM/RCM to propagate out of the CEE to alarm displays and journals. When ALMENBSTATE changes from Off to On, all active alarms are regenerated.
Alarming: Journal Only Option: (JOURNALONLY)	Unchecked (Default) = event is logged in Journal Checked = event is logged in the Journal only
Generate Alerts (GENERATEALERTS)	Unchecked (Default) = No Alerts generated Checked = Alerts generated

Main Tab of SCM/RCM	Description
Re-execution - Step Re-execution Policy (REEXECPOLICY)	Provides selection of scheme to be used for the re-execution of Steps. AlwaysReExecute (0) - The Step re-executions will always re-execute all Outputs. One exception case is the return from Handler to a Step in the Main handler scenario when RETAINISTS is On, which will cause confirmable instructions to not be re-executed. Flexible (1) - Enables the use of the configured and one-shot execution options, which allow a Step to be re-exectued or continued. (See parameters REEXECOPT, REEXECOPTOG, REEXECOPTOH, and REEXECOPTOS).
Step Re-execution Policy (REEXECOPT)	Provides a Step Re-execution selection that is applied to all Steps in the SCM/RCM. Individual Steps can deviate from this selection by setting the Step level REEXECOPT parameter as desired. ReExecute (0) - Step is executed *from the top*, all outputs will be executed. Continue (1) - Step is continued *from where it left off*; only incomplete outputs are executed.
Parent Asset (PARENTASSET)	Name of the Enterprise Model Parent that includes the entity associated with this SCM/RCM in the hierarchy. If you are not implementing the Enterprise Model and previously used Areas of control, the name used for the control area will be used as the name for the Parent Asset.
Unit Text (UNITTEXT)	A unique two-character text string to identify the Sequential Control Module's "unit".
Version (VERSION)	Available with QVCS license. Unique 7 character string for SCM/RCM block. You are free to use this in any form applicable to your site.
Dynamic Fetch of Peer Data – Option (PEERALGOPT)	Peer Algorithm Option can only be adjusted when the SCM/RCM is Inactive. This option allocates the necessary amount of memory for the ReadRequst Table (RTable) and determines the maximum

Main Tab of SCM/RCM	Description
	communication load the SCM/RCM can exercise. By adjusting the table option, you can choose between response time and resource usage. None (0) – No RTable; cyclic gets requests of all get connectors of the SCM/RCM will be permanently enabled (default) Auto (1) – The SCM/RCM itself computes the necessary size of the RTable. Max (2) – The RTable is allocated for the total number of steps and transitions across all handlers. 50 Percent – The RTable is allocated for 50% of the value calculated for Max. 33 Percent – The RTable is allocated for 33% of the value calculated for Max. 25 Percent – The RTable is allocated for 25% of the value calculated for Max. 20 Percent – The RTable is allocated for 20% of the value calculated for Max. 10 Percent – The RTable is allocated for 10% of the value calculated for Max.
Dynamic Fetch of Peer Data: Age Time (in seconds) (PEERAGETIME)	Saved in checkpoint - Restored from checkpoint Peer Age Time Range: 0.0075 – 160.0 seconds (Min SCM/RCM Period * 1.5 … Max SCM/RCM Period * 4) Determines how long entries will stay in the RTable. Default = 3.0 sec (provides fast table cleanup as soon as values are not needed anymore) Will have no effect when PEERALGOPT is None.
Bypass Cancel Option (BYPCANCELOPT)	Saved in checkpoint - Restored from checkpoint Chooses SCM/RCM behavior on when to cancel/clear Transition Force Permit/Force requests. Selection applies to all Transitions of all Handlers in the SCM/RCM, but can be changed while the SCM/RCM

Main Tab of SCM/RCM	Description
	is executing. None – Bypassed/forced Transition Conditions are not canceled/cleared OnSCM/RCMReset – Bypassed/forced Transition Conditions are canceled/cleared on SCM/RCM Reset command OnTransEnd – Bypassed/forced Transition Conditions are canceled/cleared when the Transition evaluation finishes (Transition changed from Enabled to Disabled state)
Stopped State Option (STOPSTATEOPT)	Saved in checkpoint - Restored from checkpoint Not Terminal - can return to running state from the Stopped state Terminal - cannot return to running state from the Stopped state; the only command allowed from a Stopped state is Reset
Execution Mode Option (EXCMODEOPT)	None - SCM's mode not changed when there is a change of Handler Auto (default) - SCM's mode is automatically changed to Auto when there is a change of Handler
Role (ROLE)	A specific responsibility in an organization such that tasks/procedures/instructions can be assigned to specific roles in organization, and then indirectly assigned to specific personnel performing that role during that time or shift. A text string of up to 16 characters
Procedural Level (PROCEDURALLEVEL)	Select the desired procedural level. None (0) Phase (1) UnitOP (2) UnitProcedure (3) Procedure (4) Batch (5)

Arbitration Tab of SCM

The Arbitration tab is used for monitoring only. The parameters on this tab of the SCM apply only to the SCM.

Arbitration Tab of SCM	Description
Request Granted Name of the owners	Read only – name(s) of the block(s) granted to use this SCM
Owner Information Max num of current owners (MAXOWNERS)	Read only - Maximum number of granted requestors for this SCM
Owner Information Number of current owners (NUMOWNERS)	Read only - The number of blocks that are granted at the moment to use this SCM
Request Pending Max num of waiting requesters (QUEUESIZE)	Maximum number of waiting requestors for this SCM
Requests Pending Number of waiting requesters (NUMWAITING)	Number of blocks that are waiting at the moment to use this SCM
Name of waiting requesters	Read only – name(s) of block(s) waiting to use this SCM
Availability (Read only)	Is not available (FULLFL) Is in use (USEDFL) Is completely unused (FREEFL)
Conflicts (Read only)	Unmanaged conflicts (CONFLICTFL) Queued requests are waiting (WAITINGFL) No waiting requests (NOWAITINGFL)

Handlers Tab of SCM/RCM

The Handlers tab of SCM/RCM Parameters provides a means of selecting a specific Handler for Main, Checking, Interrupt, Restart, Hold, Stop, and Abort. Choosing the specific Handler on this tab changes the value of the selected handler, SELHANDLER[1..8].

An SCM may contain multiple Main Handlers as well as multiple exception Handlers. Each handler of the SCM consists of Step, Transition, and Synchronization blocks.

Alarm and Event Tab of SCM/RCM

The Alarm and Event tab of SCM/RCM Parameters contains configuration information for the following parameters:

Alarm and Event Tab of SCM/RCM	Description
SCM only Step Duration Timeout Alarm Priority (STEPALM.PR)	Saved in checkpoint - Restored from checkpoint Specifies the alarm priority for the SCM/RCM Step Timeout alarm that occurs when the Active SCM/RCM Step has remained active for longer than the configured maximum step time. Options are: None (0) Journal (1) Low (2) (Default) High (3) Urgent (4) This parameter value applies to all steps in the SCM/RCM but it can be individually overridden by the specific Step's duration timeout alarm priority.
SCM only Step Duration Timeout Alarm Severity (STEPALM.SV)	Saved in checkpoint - Restored from checkpoint Specifies the alarm severity for the SCM/RCM Step Timeout alarm that occurs when the Active SCM/RCM Step has remained active for longer than the configured maximum step time.

Alarm and Event Tab of SCM/RCM	Description
	Range is 0 to 15 with 15 as the highest priority. This parameter value applies to all steps in the SCM/RCM but it can be individually overridden by the specific Step's duration timeout alarm severity.
Hold State Alarm Priority (HOLDALM.PR)	Saved in checkpoint - Restored from checkpoint Specifies the alarm priority for the SCM/RCM Hold alarm. Hold alarm occurs when SCM/RCM transitions to Holding or Held. Options are: None (0) Journal (1) Low (2) (Default) High (3) Urgent (4)
Hold State Alarm Severity (HOLDALM.SV)	Saved in checkpoint - Restored from checkpoint Specifies the alarm severity for the SCM/RCM Hold alarm. Hold alarm occurs when SCM/RCM transitions to Holding or Held. Range is 0 to 15 with 15 as the highest priority.
Stop State Alarm Priority (STOPALM.PR)	Saved in checkpoint - Restored from checkpoint Specifies the alarm priority for the SCM/RCM Stop alarm. Stop alarm occurs when SCM/RCM transitions to Stopping or Stopped. Options are: None (0) Journal (1) Low (2) (Default) High (3) Urgent (4)

Alarm and Event Tab of SCM/RCM	Description
Stop State Alarm Severity (STOPALM.SV)	Saved in checkpoint - Restored from checkpoint Specifies the alarm severity for the SCM/RCM Stop alarm. Stop alarm occurs when SCM/RCM transitions to Stopping or Stopped. Range is 0 to 15 with 15 as the highest priority.
Abort State Alarm Priority (ABORTALM.PR)	Saved in checkpoint - Restored from checkpoint Specifies the alarm priority for the SCM/RCM Abort alarm. Abort alarm occurs when SCM/RCM transitions to Aborting or Aborted. Options are: None (0) Journal (1) Low (2) (Default) High (3) Urgent (4)
Abort State Alarm Severity (ABORTALM.SV)	Saved in checkpoint - Restored from checkpoint Specifies the alarm severity for the SCM/RCM Abort alarm. Abort alarm occurs when SCM/RCM transitions to Aborting or Aborted. Range is 0 to 15 with 15 as the highest priority.
Fail State Alarm Priority (FAILALM.PR)	Saved in checkpoint - Restored from checkpoint Specifies the alarm priority for the SCM/RCM Fail State alarm. Fail State alarm occurs when SCM/RCM Execution Status is Fail. Options are: None (0) Journal (1) Low (2) (Default)

Alarm and Event Tab of SCM/RCM	Description
	High (3) Urgent (4)
Fail State Alarm Severity (FAILALM.SV)	Saved in checkpoint - Restored from checkpoint Specifies the alarm severity for the SCM/RCM Fail State alarm. Fail State alarm occurs when SCM/RCM Execution Status is Fail. Range is 0 to 15 with 15 as the highest priority.
Locks: Abort Lock (ABORTLOCK)	Saved in checkpoint - Restored from checkpoint Specify who may issue an Abort command. ENGINEER (Default) OPERATOR OTHERFB (Other Function Block) VIEWONLY
Locks: Control Lock (CONTROLLOCK)	Saved in checkpoint - Restored from checkpoint Specify who may: (1) issue a HOLD command, or (2) change the SCM/RCM mode to SEMIAUTO (Semi-Automatic) or MANUAL - ENGINEER OPERATOR (Default) OTHERFB (Other Function Block) VIEWONLY
Locks: Single Step Lock (SSTEPLOCK)	Saved in checkpoint - Restored from checkpoint Specify who may issue a SingleStep mode command. ENGINEER (Default) OPERATOR OTHERFB (Other Function Block)

Alarm and Event Tab of SCM/RCM	Description
	VIEWONLY
SCM only SCM Overall Event Option (EVTOPT)	Overall SCM event option has highest priority. Checked – the overall SCM/RCM event journal option is enabled. The user can attach Comments to events when enabled. Unchecked – the overall SCM/RCM event journal option is disabled. The user will not be able to attach Comments to events when disabled.
SCM only Event Options: SCM Start Event Option (EVTOPTSCMS)	Checked – the SCM Start event journal option is enabled. The user can attach Comments to the SCM Start event when enabled. Unchecked – the SCM Start event journal option is disabled. The user will not be able to attach Comments to SCM Start event when disabled.
SCM only Event Options: SCM Terminal State Event Option (EVTOPTSCMTS)	Checked – the SCM Terminal State event journal option is enabled. The user can attach Comments to the SCM Terminal State event when enabled. Unchecked – the SCM Terminal State event journal option is disabled. The user will not be able to attach Comments to SCM Terminal State event when disabled.
SCM only Event Options: Recipe Parameter Event Option (EVTOPTRECIPE)	Checked – the SCM Recipe Parameter event journal option is enabled. The user can attach Comments to the SCM Recipe Parameter event when enabled. Unchecked – the SCM Recipe Parameter event journal option is disabled. The user will not be able to attach Comments to SCM Recipe Parameter event when disabled.

Alarm and Event Tab of SCM/RCM	Description
SCM only Event Options: History Parameter Event Option (EVTOPTHIST)	Checked – the SCM History Parameter event journal option is enabled. The user can attach Comments to the SCM History Parameter event when enabled. Unchecked – the SCM History Parameter event journal option is disabled. The user will not be able to attach Comments to SCM History Parameter event when disabled.
RCM only Override CEE Level Event Options (ETTOPTCEE)	Event options are defined at the CEE level. Exceptions to those settings are defined here at the RCM level by selecting the Override CEE Level Event Options flag on the CEE UCF Settings tab. Checked – CEE level events are overridden by the options selected on this tab. Unchecked – CEE level event options supercede any options selected on this tab.
RCM only Enable RCM Event Options (EVTOPT)	Checked – Recipe events are enabled and controlled by the six items in the Event Options group below. The user can attach Comments to events when enabled. Unchecked – all recipe events are disabled. The user will not be able to attach Comments to events when disabled.
RCM only Event Options: Recipe Execution (EVTOPTRCMEXE)	Checked – enables Batch Create, Execution Start, Execution Termination, and State Change events Unchecked – disables Batch Create, Execution Start, Execution Termination, and State Change events

Alarm and Event Tab of SCM/RCM	Description
RCM only Event options: Resource Allocation (EVOPTRESALLOC)	Checked – enables Resource Allocation and Resource Release events for the equipment modules and UCM Unchecked – disables Resource Allocation and Resource Release events for the equipment modules and UCM
RCM only Event options: Execution Details (EVTOPTEXEDTL)	Checked – enables Recipe Command, Active Phase Change, Mode Command, Mode Change, Phase/Step Start, Phase/Step Complete, and Recipe Removal events Unchecked - disables Recipe Command, Active Phase Change, Mode Command, Mode Change, Phase/Step Start, Phase/Step Complete, and Recipe Removal events
RCM only Event options: Formula Parameters (EVTOPTFORMULAPARAM)	Checked – enables Formula Parameter Download and Formula Parameter Download Failure events Unchecked - disables Formula Parameter Download and Formula Parameter Download Failure events
RCM only Event options: Report Parameters (EVTOPTREPORTPARAM)	Checked – enables Report Parameter Upload and Report Parameter Upload Failure events Unchecked – disables Report Parameter Upload and Report Parameter Upload Failure events
RCM only Event options: Recipe Header (EVTOPTRCMINFO)	Checked – enables the Recipe identification information events of Version, Date Modified, and Scale Factor Unchecked - disables the Recipe identification information events of Version, Date Modified, and Scale Factor

Recipe Settings tab of RCM

The Recipe Settings tab is part of RCM parameter configuration only; it does not apply to the SCM. Only Batch ID and Current Batch Size can be modified in the Monitoring Tree.

Recipe Settings Tab of RCM	Description
Unit Control Module (UCMNAME)	Enter associated UCM. Must be defined before RCM can be downloaded to the controller.
Batch ID (BATCHID)	User defined string
Current Batch Size (CURRENTBATCHSIZE)	Default is 100. Can be modified after loaded to the controller.
Default Batch Size (DEFAULTBATCHSIZE)	Default is 100.
Batch Size Engineering Unit (BATCHEUDESC)	Default is %.
EQM Mode Tracking (EQMMODETRACKING)	Defines how the mode attribute of the connected Equipment Module (SCM or RCM) is controlled by the mode changes in the RCM where this phase is enclosed. Options are: None (0)– no tracking ONESHOT (1) – One shot tracking CONTINUOUSReturn (2)– continuous tracking with return SEMI-CONTINUOUS (3)– Semi-continuous tracking CONTINUOUS (4)– continuous tracking
Release resources allocated in Phases In Normal Termination (RLSRESNORM)	By default, the resources acquired by the RCM and its phases are release automatically once the RCM has reached the terminal state. If the same RCM is executed multiple times, then all resources that were not explicitly release by the phases can be left acquired to the RCM by unchecking the release box.

Recipe Settings Tab of RCM	Description
	ON (checked) – default Resources acquired by the RCM and its phases are release automatically once the RCM has reached the terminal state OFF (unchecked) All granted resources that were not explicitly release by the phases are left acquired to the RCM
Release resources allocated in Phases In Abnormal Termination (RLSRESABNORM)	By default, the resources acquired by the RCM and its phases are release automatically once the RCM has reached the terminal state. If the same RCM is executed multiple times, then all resources that were not explicitly release by the phases can be left acquired to the RCM by unchecking the release box. ON (checked) – default Resources acquired by the RCM and its phases are release automatically once the RCM has reached the terminal state OFF (unchecked) All granted resources that were not explicitly release by the phases are left acquired to the RCM
EQM to State Projection up to Recipe Aborted (EQMTORECMAP[8])	By default, the RCM tracks the most abnormal state of the active SCM in the phases. This option is used when any acquired SCM goes into the ABORTED. Indicators are: None (0) – no action Default (1) – do the action implied by the label name (Abort, Stop, Hold) Hold (6) Stop (7) Abort (8)
EQM to State Projection up to Recipe Stopped (EQMTORECMAP[7])	By default, the RCM tracks the most abnormal state of the active SCM in the phases. This line is used when there is no acquired SCM is ABORTED but at least one stopped acquired SCM.

Recipe Settings Tab of RCM	Description
	Indicators are: None (0) – no action Default (1) – do the action implied by the label name (Abort, Stop, Hold) Hold (6) Stop (7) Abort (8)
EQM to State Projection up to Recipe Held (EQMTORECMAP[6])	By default, the RCM tracks the most abnormal state of the active SCM in the phases. This line is used when there are no acquired SCM ABORTED or STOPPED but at least one HELD acquired SCM. Indicators are: None (0) – no action Default (1) – do the action implied by the label name (Abort, Stop, Hold) Hold (6) Stop (7) Abort (8)
Recipe State Propagation down to EQM Aborted (RECTOEQMMAP[8])	By default, the RCM will command all active EQUIPMENT MODULEs (SCMs) to the same state as the RCM. If the RCM state becomes ABORTED, then the Equipment Modules are commanded by value selected here. Indicators are: None (0) – no action Default (1) – do the action implied by the label name (Abort, Stop, Hold) Hold (6) Stop (7) Abort (8)

Recipe Settings Tab of RCM	Description
Recipe State Propagation down to EQM Stopped (RECTOEQMMAP[7])	By default, the RCM will command all active Equipment Modules (SCMs) to the same state as the RCM. If the RCM state becomes STOPPED, then the Equipment Modules are commanded by value selected here. Indicators are: None (0) – no action Default (1) – do the action implied by the label name (Abort, Stop, Hold) Hold (6) Stop (7) Abort (8)
Recipe State Propagation down to EQM Held (RECTOEQMMAP[6])	By default, the RCM will command all active Equipment Modules (SCMs) to the same state as the RCM. If the RCM state becomes HELD, then the Equipment Modules are commanded by value selected here. Indicators are: None (0) – no action Default (1) – do the action implied by the label name (Abort, Stop, Hold) Hold (6) Stop (7) Abort (8)

History Tab of SCM

The History tab of SCM Parameters provides a SCM History Parameters table to enter up to 50 SCM history parameters individually with specified descriptor, type, and value. These are History parameters associated with the SCM only; it does not apply to the RCM.

When entering data in the table, use the tab key to move from one cell to another cell on the table. Right clicking within a cell will provide a menu for choosing Copy, Paste, or Append Row.

Note: If the SCM is used as an Equipment Moduel for an RCM phase, the history array elements should be allocated in the same order as defined in the corresponding Phase Block Type.

History Tab of SCM	Description
Parameter Descriptor (HISTDESC[1…50])	Saved in checkpoint - Restored from checkpoint History parameter textual description of up to 63 character
Parameter Type (HISTTYPE[1…50])	Saved in checkpoint - Restored from checkpoint History type using up to 11 characters. Examples of history types are location, inventory, or actual value.
Parameter Value (HISTVALUE[1...50])	Saved in checkpoint - Restored from checkpoint History parameter value is saved as a real number. Default is NaN.

Recipe Tab of SCM

The Recipe tab of SCM Parameters provides a SCM Recipe Parameters table to enter up to 50 SCM recipe parameters individually with specified descriptor, type, and value. These are Recipe parameters associated with the SCM only; it does not apply to the RCM.

When entering data in the table, use the tab key to move from one cell to another. Right clicking within a cell will provide a menu for choosing Copy, Paste, or Append Row.

Note: If the SCM is used as an Equipment Moduel for an RCM phase, the recipe array elements should be allocated in the same order as defined in the corresponding Phase Block Type.

Recipe Tab of SCM	Description
Parameter Descriptor (RECPDESC[1…50])	Saved in checkpoint - Restored from checkpoint History parameter textual description of up to 63 character
Parameter Type (RECPTYPE[1…50])	Saved in checkpoint - Restored from checkpoint History type using up to 11 characters. Examples of history types are location, inventory, or actual value.
Parameter Value (RECPVALUE[1...50])	Saved in checkpoint - Restored from checkpoint History parameter value is saved as a real number. Default is NaN.

Aliases Tab of SCM

The Aliases tab of SCM provides a means of implementing a Common SCM that can be used to control several equipment units one at a time.

Aliases Tab of SCM	Description
Enable Alias Configuration (ALIASOPT)	Check the Enable Alias Configuration checkbox to enable Alias Table Option configuration and make this a Common SCM/RCM. Default = unchecked or no Alias Table Option.
Number of Aliases (NUMALIASES)	Defines the number of aliases that can be configured in the Alias Table. Aliases are user-defined representations of equipment parameters. Default = 1 Zero (0) is not a valid entry Allowable range = 1 - 500 with a combined maximum of 4,500 instance parameters in the Alias Table. The number of instance parameters is determined by multiplying the Number of Aliases by the Number of Instances. For example, if you configure 500 aliases, you can only configure up to 9 instances. For 100 configured instances, up to 45 aliases can be configured. Memory resources and performance determine the limitation. Once a non-zero number is entered into the edit box, the Alias Table grid with the configured number of rows will be exposed. An alias can be deleted from the Alias Table under Project tab, if there is no connection made to that alias. When an alias is deleted, the whole row will be deleted, and the rows below it will be pushed up. Once a row is deleted, parameter NUMALIASES will be updated to reflect the changes on the number of rows. **An alias cannot be deleted if it is referenced in a connection.** A row can be added to the end of the Alias Table at

Aliases Tab of SCM	Description
	configuration time. When a row is added to the Alias Table, parameter NUMALIASES (number of aliases) will be updated to reflect the change on the number of rows. A row can be deleted or added by changing NUMALIASES. A row can be inserted anywhere in the Alias Table at configuration time. When a row is inserted in the Alias Table, all the rows below it will be pushed down, and parameter NUMALIASES (number of aliases) will be updated to reflect the change on the number of rows.
Number of Instances (NUMINSTANCES)	Defines the number of instances that can be configured in the Alias Table, or the number of instance parameters that can be configured for each alias. Instances are user-selected parameters associated with an alias. Default value = 1 Zero (0) is not a valid entry Allowable range 1 - 100 with a combined maximum of 4,500 instance parameters in the Alias Table. The number of instance parameters is determined by multiplying the Number of Aliases by the Number of Instances. For example, if you configure 500 aliases, you can only configure up to 9 instances. If you configure 100 instances, you can only configure up to 45 aliases. Memory resources and performance determine the limitation. A column can be deleted from the Alias Table at configuration time. When a column is deleted, all the columns behind it will shift to the left. If instance n is deleted, instance n+1 will become instance n, instance n+2 will become n+1, so on and so forth. Parameter NUMINSTANCES (number of instances) will be updated to reflect the change on the number of columns. If the selected instance is deleted, the instance next to it will replace it. The user should receive a warning about the impact of deleting a column. An instance can be added at the right of the Alias Table at configuration time. When an instance is added to the Alias Table, parameter

Aliases Tab of SCM	Description
	NUMINSTANCES (number of instances) will be updated to reflect the change on the number of instances. A column can be deleted or added by changing NUMINSTANCES. A column can be inserted to the Alias Table at configuration time. When a column is inserted, all the columns behind it will shift to the right. Parameter NUMINSTANCES (number of instances) will be updated to reflect the change on the number of columns.
Instance Selection (INSTSELECT)	Saved in checkpoint - Restored from checkpoint Specifies which column of the reference connections the aliases will resolve to at run time. The options for this field are the column numbers of the configured instances. For example, the number 1 represents the Instance 1 column, 2 represents the Instance 2 column, and so on. This parameter is configured using the drop-down list for this field, which provides the valid instance numbers. You may change the instance selection in one of the following ways at run-time. • In Monitoring, call up SCM/RCM Status and change the Instance Selection entry online through the Aliases tab; • In Station, call up SCM/RCM Detail display and change the Instance Selection entry online through the Aliases tab; • Configure a store to the INSTSELECT parameter from an application program; or • Configure a store to the INSTSELECT parameter from a SCM/RCM Step Output.

Alias Table in SCM

The Alias Table associates user-defined alias names with user-selected instance parameters that the aliases are to resolve at run-time. It is the key to the Common SCM functionality and the foundation for the dynamic indirection capability. The Alias Table sits between the client block and the data owner/destination block. A client block can be a Step or Transition block in a Common SCM, and the data owner/destination block can be any function block in a configured CM in the Control Strategy. The Alias Table acts as a switch to connect the client block to different data owner/destination blocks as defined through user selected instance parameters at run-time. This gives the Common SCM the ability to control different equipment each time it runs.

Each row holds all the references for the alias defined in that row, and each column holds one reference for each of the aliases defined in the Alias Table. Each reference is called an instance parameter and each column of references is called an instance.

You must specify a name, Model Block, and Model Parameter for an alias to be defined.

You may not change the Model Block and Model Parameter or delete the alias, if the alias has been referenced in a connection.

The common Windows type edit functions are used to insert, delete, or append rows and columns in the Alias Table. Right-click on the selected row or column then choose the desired action from the pop-up menu.

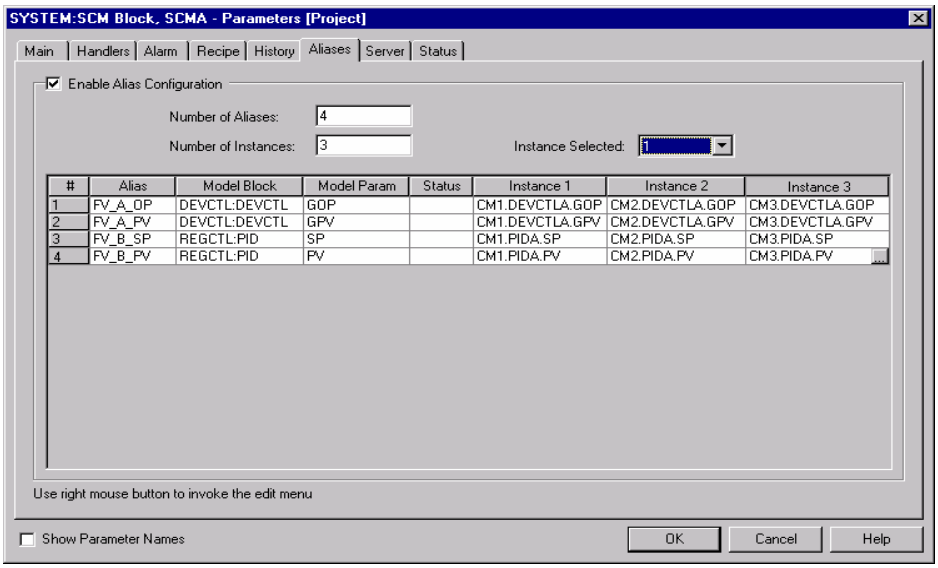
Alias Name, Block Model, and Parameter Model are the Parameters of the Aliases. They define the identification and the data type of the aliases. Alias Name, Block Model, and Parameter Model are arrays, sized by the number of aliases and indexed by the row number of the Alias Table.

SCM Alias Table Parameter	Description
# (numerical index)	Numerical indexing of the Alias rows that correspond with the Number of Aliases specified.
Alias Name	Defines a user name of up to 32 characters that identifies the entry for each row in the Alias Table and allows the user to enter meaningful names to represent the parameters of their process. The name must be unique within the Alias Table and among the parameter names of the container block (CM or SCM) the alias is associated with. It will be referenced as container name.alias name. The Alias Name is configured through an edit box. The valid forms for the Alias Name could be xxxx or

SCM Alias Table Parameter	Description
	xxx.yyy, i.e. My_Alias, StepOutput1.Alias. Alias Name can be changed only at configuration time, under Project tab.
Model Block ALIASBLKTYP[ ]	Defines the block type (ALIASBLKTYP) that may be associated with the alias. A drop-down list for this field includes all the container and component type blocks in the system for convenient selection. This selection drives the Model Parameter selection and together they determine the required data type for the Instance Parameter. This field combined with Model Parameter derives data type of the alias, which is used to validate the data type of the instance parameters of the alias, when the instance parameters are configured, or at run-time when an instance parameter is changed. The options for this field are all system templates. Model Block can be modified only at configuration time, under Project tab. The Model Parameter of the alias can not be configured if the Model Block is not configured, and none of the instance parameters for the alias can be configured if any one of the Model Block and Model Parameter of the alias is not configured.
Model Parameter ALIASPRMTYP[ ]	Defines the parameter model of the alias. A drop-down list for this field includes all the parameters available for the selected Model Block for convenient selection. Any indexed parameters will not include the index. You must select the Model Block before you can select the Model Parameter. This field combined with Model Block derives data type of the alias, which is used to validate the data type of the instance parameters of the alias, when the instance parameters are configured, or at run-time when an instance parameter is changed. The options for this field are all the parameters available for the selected model block, except the aliases. Model Parameter can be modified only at configuration time, under Project tab. None of the instance parameters for the alias can be configured if any one of the Model Block and the Model Parameter

SCM Alias Table Parameter	Description
	of the alias is not configured.
Status (ALIASNAME.STATUS)	Internal read-only parameter representing the binding status of the current selected instance. Status of the binding process for establishing connections between client blocks to aliases to destination blocks in the Monitoring tab only. Null (0) OK (1) Rebind (2)
Instance 1 through x ALIASREF[ ] [ ]	Defines the instance parameter for the corresponding numerical index (1 to 100) for each instance of the alias. The field includes a button to call up the Point Selection dialog box for convenient selection of the desired tag.block.parameter from the configured control strategy. The data type of the instance parameter must be the same as the data type of the alias, which is determined by the Model Block and Model Parameter. But, the instance parameter can be a different block type and parameter. Instance parameters may not specify an alias, but they may specify substitute names. The instance parameters are validated at the configuration time. The alias data type derived from the alias model block and model parameter is used to ensure the consistency between the alias and the instance parameters. The instance parameters do not have to be of identical block type and parameter of their alias. However data type between the instance parameter and the alias should match. Otherwise, the Control Builder will not accept the value. The user is allowed to leave an instance cell blank, in the case that a piece of equipment is not used for a particular instance column. A blank instance cell is called a "null" instance parameter. A store to a null instance parameter may cause the SCM step output failure, therefore causing the SCM EXECSTATE to fail. The user must program around these cases to avoid making connections to null instances.

Example – Alias Table for SCM



Example: SCM Expressions using Alias

To use the instances configured in an SCM's Alias Table, the SCM expression has to reference the aliases as tagname.aliasname. References to aliases defined in another SCM Alias Table are not supported. The following expressions show how an alias is used in an SCM expression.

SCM Expression using Alias	Description
SCMA.FV_A_OP.STATUS = 1 (1=OK)	Used in SCMA's transition condition, this condition waits for the binding status of the alias FV_A_OP to instance 1 (CM1.DEVCTLA.GOP) to equal OK. It is important to check for binding status prior to setting when using Alias Tables.
SCMA.FV_A_OP := 5 (5=State 1 on assignment form)	Used in SCMA's Step expression, this sets CM1.DEVCTLA.GOP to State 1 since the instance selected is 1. Using GOP in the instance eliminates the need to know the text descriptor associated with the device control block's S1 output

SCM Expression using Alias	Description
	state.
SCMA.FV_A_PV = 5 (5=S1)	Used in SCMA's transition condition, this condition waits until the status of CM1.DEVCTLA.GPV =5 (State 1) because the instance selected is 1. Using GPV in the instance eliminates the need to know the text descriptor associated with the device control block's S1 PV state.

Server History Tab of SCM/RCM

The Server History tab of SCM/RCM lets you configure history collection and archive details for the SCM/RCM as well as provides access for creating and editing server scripts. See the Control Builder online help for more information. You can also configure this data through the Station application. For details, see
Server and Client Configuration Guide >
Understanding and Configuring Points >
History Collection and Archiving

Server Displays Tab of SCM/RCM

The Server Displays tab of the SCM/RCM lets you configure server displays for the SCM/RCM. See the Control Builder online help for more information. You can also configure this data through the Station application. For details, see
Server and Client Configuration Guide >
Understanding and Configuring Points >
Configuring Station displays for points

Control Confirmation Tab of SCM/RCM

For this Tab to function, the optional Qualification and Version Control System (QVCS) must be active.

The Control Confirmation tab of SCM/RCM provides a means of specifying electronic signature control confirmation for the SCM/RCM. This feature is part of the optional Qualification and Version Control System (QVCS), a customer defined lifecycle management option that provides capabilities for electronic signature confirmation for points and version management for all tagged objects.

When an operator performs a control action on a point for which control confirmation has been specified, a prompt is displayed to the operator to confirm control. The operator must respond "yes" before the control action is carried out or "no" to abort the command.

If electronic signature has been specified in conjunction with control confirmation, the operator must enter an authorized ID and password before the action is carried out.

Since this is a Server Function, refer to:
Server and Client Configuration Guide >
Configuring Electronic Signatures >
About Electronic Signatures

Control Confirmation SCM/RCM Parameters Tab Parameters	Description
Control Confirmation (CTRLCONFIRM)	Checked = electronic signature feature is ON for the SCM/RCM Unchecked = electronic signature feature is OFF for the SCM/RCM Default = unchecked
Electronic Signature Type (NUMSIGS)	Specify the number of signatures required for control confirmation. None (0) Single (1) Double (2)
Reason Set Number (REASONSET)	Specify the meaning associated with entering the number of signatures. String of 24 characters maximum.
Secondary Signer Security Level (SECSIGSECLVL)	Choose the minimum-security level of the second signature when required. VIEWONLY (0) ACKONLY (1) OPER (2) SUPR (3) ENGR (4) MNGR (5)
Primary Signature Meaning (PRIMARYSIG)	Specify the meaning associated with entering the primary signature. String of 24 characters maximum.
Secondary Signature Meaning (SECONDARYSIG)	Specify the meaning associated with entering the secondary signature. String of 24 character maximum

Status Tab of SCM/RCM

The Status Tab of SCM/RCM is used to operate an SCM/RCM from Control Builder. This tab provides an area to

- Monitor the current operating states of the SCM/RCM,
- Command the SCM/RCM,
- Change Mode, Mode Attribute, Normal Mode, and Normal Mode Attribute.

Status Tab of SCM/RCM	Descriptions
Command (COMMAND)	Last Command sent to the SCM/RCM. To change the state of the SCM/RCM, choose one of the following options from the pull down list: None (0) Inactive (1) Start (2) Reset (3) Interrupt (4) Restart (5) Hold (6) Stop (7) Abort (8) Resume (9) Active (10)
State (STATE)	Saved in checkpoint - Restored from checkpoint Only State Inactive will be restored from checkpoint, otherwise behavior according to CEESTARTOPT and CEETOPSTART. View Only Indicates current state of the SCM/RCM. Possible states are: Loading (0) Loaded (1) Inactive (2) (Default) Validated (3) Running (4) Complete (5) Checking (6) Idle (7) Interrupting (8) Interrupted (9) Restarting (10) Restarted (11)

Status Tab of SCM/RCM	Descriptions
	Holding (12) Held (13) Stopping (14) Stopped (15) Aborting (16) Aborted (17) CommErr (18)
Execution Status (EXECSTS)	View only Execution status of the SCM/RCM and its components. Possible Execution Status are: Ok (0) Bypass (1) Info (2) Warning (3) Fail (4) Error (5) OkPaused (6) BypassPaused (7) InfoPaused (8) WarnPaused (9) FailPaused (10) ErrorPaused (11)
Execution Code (EXECCODE) Execution Code Description (EXECDESC)	View only Execution Code and Descriptors are: **EXECCODE: EXECDESC** None (0):OK ConfigError (1): Configuration Error ExprEvalFail (2): Expression Evaluation Failed StoreFailed (3): Store Failed CommError (4): Communication Error StoreWarning (5): Store Warning InternalErr (6): Internal Error CtrlReqErr (7): Control Request Error DataTypeErr (8): Data Type Error

Status Tab of SCM/RCM	Descriptions
	StorePending (9): Store Pending
Elapsed Time (TIME[1..8])	View only value Range: 0 to 2147483647 TIME[i] contains the number of execution cycles since the TYPE i handler was last invoked or "0" if the TYPE i handler is not currently active. The handler type represented by 0 through 8 are: Null (0) Edit (1) Main (2) Check (3) Interrupt (4) Restart (5) Hold (6) Stop (7) Abort (8)
Mode (MODE)	Saved in checkpoint - Restored from checkpoint Provides a pull down menu for changing the SCM/RCM execution mode. Choices are: None (0) Auto (1) (DEFAULT) SemiAuto (2) SingleStep (3) Manual (4) Normal (5) When Normal (5) is stored to MODE, the SCM/RCM MODE is set to the configured NORMMODE.
Mode Attribute (MODEATTR)	Saved in checkpoint - Restored from checkpoint Provides a pull down menu for changing the SCM/RCM mode attribute. Choices are: None(0) Operator (1) - only an operator can access MODE and COMMAND Program (2) - only programs can store to MODE

Status Tab of SCM/RCM	Descriptions
	and COMMAND Normal (3) – Mode attribute = Normal Mode Attribute
Normal Mode (NORMMODE)	Saved in checkpoint - Restored from checkpoint Provides a pull down menu for changing the normal mode of the SCM/RCM. Valid choices are: None (0) (DEFAULT) Auto (1)
Normal Mode Attribute (NORMMODEATTR)	Saved in checkpoint - Restored from checkpoint Provides a pull down menu for changing the SCM/RCM normal mode attribute. Choices are: None (0) Operator (1) - only an operator can access MODE and COMMAND Program (2) - only programs can store to MODE and COMMAND Normal (3)
Exec Mode Option (EXCMODEOPT)	When EXCMODEOPT is Auto, the SCM/RCMMODE is automatically set to Auto whenever the active handler changes. Choices are: None (0) Auto (1)
Configuration Status (CONFIGSTS)	View only Denotes the configuration status of a configuration error. Choices are: Ok (0) Information (1) Warning (2) SevereWarning (3) Fail (4) Error (5) SevereError (6)
SCM/RCM Configuration Code	View only Denotes a code and description associated with

Status Tab of SCM/RCM	Descriptions
(CONFIGCODE) SCM/RCM Configuration Code Description (CONFIGDESC)	configuration status. Provides a description of the 52 configuration codes. Choices are: **Code - Description** None (0) - OK UnknownError (1) - Unknown error - Call Honeywell. InternalErr (2) - Internal error - Call Honeywell. lLLOwnHandle (3) - Created without valid own handle. lLLHndlrHndl (4) - Handler should belong to itself. Reported by Handler: Internal problem encountered by handler. Reload the SCM/RCM, if the problem continues call Honeywell. NextHNotNull (5) - Next Type = None requires Null Handle. lLLNNextTrns (6) - Number of next transitions out of range. ConnInvObjs (7) - Connected to objects of wrong type. InvNextType (8) - Invalid specified Type of target object. NotImplNxTyp (9) - Sync Objects are not implemented yet. lLLExcConds (10) - Not all exception conditions okay. Reported by Step: Check the parameters CONFIGSTS, CONFIGDESC on the exception conditions of this step for more detailed information. lLLConds (11) - Not all continuation conditions okay. Reported by Transition: Check the parameters CONFIGSTS, CONFIGDESC on the conditions of this transition for more detailed information.

Status Tab of SCM/RCM	Descriptions
	ILLOutputs (12) - Not all outputs okay. Reported by Step: Check the parameters CONFIGSTS, CONFIGDESC on the outputs of this step for more detailed information. IncObjects (13) - Not all contained objects out okay. Reported by handler: One or more objects in this handler encountered an error. It is strongly recommended to review and correct the configuration within this handler. Check the parameters CONFIGSTS, CONFIGDESC on all objects in the handler for more detailed information. The handler may be operational. ILLNOutputs (14) - Number of outputs out of range. ILLNConds (15) - Number of conditions out of range. ILLGateLogic (16) - Invalid Gate Logic configuration. Reported by transition: The gate logic configuration does not allow the transition to function. IncGateLogic (17) - Unused Gates should not be configured. Reported by transition: The transition is operational. The information reported may hint to some configuration issues. NullGateUsed (18) - Gates without inputs are used. Reported by transition: The transition is operational. The information reported may hint to some configuration issues. OvlpGateInps (19) - Gates use overlapping inputs. SkipGateInps (20) - Some gate inputs are skipped. ILLInvkTObj (21) - Could not access invoke Transition. ILLInvkTCnfg (22) - Foreign invoke Transition configured.

Status Tab of SCM/RCM	Descriptions
	ILLHndlrType (23) - Unexpected Handler type. Reported by Handler: Internal problem encountered by handler. Reload the SCM/RCM , if the problem persists call Honeywell. ILLHndlrSel (24) - Wrong Handler selected - Forced Disable. Reported by SCM/RCM: An invalid selection or download occurred. The invalid handler is disabled. The SCM/RCM is operational except for the invalid handler(s). HndlrInstMis (25) - Connected to object of other Handler. Reported by handler. An invalid selection or download occurred. The handler is not operational. Reconfigure and reload the SCM/RCM. ILLExcCProp (26) - Some Exception conditions not set to Edit. IncOpProp (27) - Some outputs not set to Edit. IncCondProp (28) - Some Conditions not set to Edit. IncInvkTProp (29) - Invoke Trans not set to Edit. IncPropagtn (30)- Some objects not set to Edit. LostObjects (31) - Found lost objects. ActIgnored (32) - Activate attempts ignored. EditIgnored (33) - Edit attempt ignored. TooFewCond (34) - More inputs than allocated Conditions. MaxTmLtMinT (35) - Max Time less than Min Time. Reported by step: The step is operational, but the time configuration of the step is very likely not desired NegativeTime (36) - Negative time is not allowed. Reported by step: Correct the times configured. The step is not operational EnbHdUnavail (37) - Enabled Handler became

Status Tab of SCM/RCM	Descriptions
	unavailable. DisHdUnavail (38) - Selected Handler became unavailable. EditNotPermt (39) - Handler cannot be edited right now. IntGateError (40) - Internal Gate Logic Error - Call Honeywell. Reported by transition: The transition is not functioning. UserNullHnd (41) - User defined Null Handler. Reported by SCM/RCM: The SCM/RCM encountered an unsupported configuration. The SCM/RCM may be operational, depending on the status of all handlers. Reload the SCM/RCM. UserEditHnd (42) - User defined Edit Handler. Reported by SCM/RCM: The SCM/RCM encountered an unsupported configuration. The SCM/RCM may be operational, depending on the status of all handlers. Reload the SCM/RCM. ILLObjAsHnd (43) - Invalid object selected as Handler. Reported by SCM/RCM: The SCM/RCM is not operational. An invalid selection or download occurred. NonEditLostO (44) - Found non-editable lost objects. NonOptGatLog (45) - Non-Optimal Gate Logic. Reported by transition: The transition is operational. No action required by the user. Some users may desire to optimize such configurations RefusedConn (46) - Next Object refused connection. ILLMultRef (47) - Same Target specified more than one time. ConfHndErr (48) - Failure in handler(s). Reported by SCM/RCM. One or more selected handlers have an error or fatal error. Check the parameters CONFIGSTS, CONFIGDESC on all

Status Tab of SCM/RCM	Descriptions
	handlers for more detailed information. The SCM/RCM is not operational. A START command shall not be attempted. Reported by handler: One or more objects in the handler encountered a fatal error. Check the parameters CONFIGSTS, CONFIGDESC on all objects in the handler for more detailed information. The handler is not operational. CnfHndSurWrn (49) - One or more Handler(s) with Errors. Reported by SCM/RCM. One or more selected handlers have an error. One or more not selected handlers have a fatal error. Check the parameters CONFIGSTS, CONFIGDESC on all handlers for more detailed information. The SCM/RCM may be operational. The SCM/RCM will fail, if a selected handler with error is executed. Handlers with fatal errors shall not be selected. Reported by handler: One or more objects in the handler encountered an error. Check the parameters CONFIGSTS, CONFIGDESC on all objects in the handler for more detailed information. The handler may be operational. It is strongly recommended to check and correct the configuration within this handler. ConfHndWarn (50) - One or more Handler(s) with Problems. Reported by SCM/RCM. One or more selected handlers have a severe warning. One or more not selected handlers have an error. Check the parameters CONFIGSTS, CONFIGDESC on all handlers for more detailed information. The SCM/RCM is operational. If handlers with severe warnings are executed problems may occur. Handlers with errors shall not be selected. Reported by handler: One or more objects in the handler encountered a severe warning. Check the parameters CONFIGSTS, CONFIGDESC on all objects in the handler for more detailed information. The handler is operational with limitations. It is recommended to check and correct the configuration within this handler.

Status Tab of SCM/RCM	Descriptions
	ConfHndInfo (51) - Not All Handlers Fully Operational. Reported by SCM/RCM. One or more selected handlers have a warning. One or more not selected handlers have a severe warning. Check the parameters CONFIGSTS, CONFIGDESC on all handlers for more detailed information. The SCM/RCM is operational. If handlers with warnings are executed problems may occur. Reported by handler: One or more objects in the handler encountered a warning. Check the parameters CONFIGSTS, CONFIGDESC on all objects in the handler for more detailed information. The handler is operational .It may be advisable to review the configuration within this handler. ConfUnknCnfSt (52)- Unknown Handler Configuration Status. Reported by SCM/RCM or handler: The SCM/RCM encountered an internal problem and was unable to assess the status of all handlers. The SCM/RCM is not functioning. Call Honeywell. Spare53 (53) to Spare61 (61) – Spare
Active Handler (ACTIVELOC.HANDLER)	View only Displays the name (e.g. SCM/RCMName.HandlerName) of the currently active handler. ACTIVELOC.HANDLER is a BlockId parameter and not supported in expressions. Partner Parameter ACTIVELOC.HANDLERN can be used in Transition Condition expressions and Step Output expressions.
For SCM - Active step (ACTIVELOC.STEP[1..10]) **For RCM** – Active phase (ACTIVELOC.PHASE[1..10]	View only ACTIVELOC.STEP[i] contains the currently active step/phase name(s) (e.g. SCMName.StepName. RCMName.PhaseName ACTIVELOC.STEP[1..10] is a BlockId parameter

Status Tab of SCM/RCM	Descriptions
	and not supported in expressions. Partner Parameter ACTIVELOC.STEPN[1..10] can be used in Transition Condition expressions and Step Output expressions.
Active time (ACTIVELOC.TIME[1..10])	View only Range: 0 to 2147483647 The number of execution cycles that the current step/phase has been active. It is reset to "0" when the step/phase is reentered.
Active transition	Read only. Displays the active transition(s) and the following step, phase, and synchronization block(s) of the SCM/RCM.
#, TargetStep[1..10] (TARGETSTEP[1..10] or #, TargetPhase[1..10] TARGETPHASE[1-10]	For use when operating an SCM/RCM in single step mode. Allows the user to choose the next step or phase to be executed by displaying the target steps or phases. TARGETSTEP[i] defines the name (e.g., SCM/RCMName.StepName) of the Step on thread i that will become the active step when a Resume COMMAND is given. It may only be changed while the SCM/RCM's MODE = SingleStep TARGETPHASE[i] defines the name (e.g., RCMName.PhaseName) of the Phase on thread i that will become the active phase when a Resume COMMAND is given. It may only be changed while the RCM's MODE = SingleStep
RCM only Resource Status: UCM Arbitration (ARBITRATIONSTATUS)	Read only
RCM only Resource Status: Composite Arbitration (COMPARBITRATIONSTS)	Read only
RCM only Composite Phase State	Read only

Status Tab of SCM/RCM	Descriptions
(COMPOSITEPHASESTS)	

QVCS Tab of SCM/RCM

The QVCS tab is common to all modules in Control Builder. If you have an active Qualification and Version Control System (QVCS) license, this tab shows current QVCS information. Refer to the online help and the Qualification and Version Control System User's Guide for more information about the data on this tab.

Identification Tab of SCM/RCM

The Identifications tab is common to all modules in Control Builder and only appears when the optional Template license is activated. Refer to online help and Control Building Guide > Appendix C – User Templates > Using the Library Tree > Identification for more information about the data on this tab.

Projected Parameters Tab of SCM/RCM

The Projected Parameters tab is common to all modules in Control Builder. Refer to the online help and Control Building Guide > Appendix B – Hierarchy Building > Parameter Projection Overview and Using the Projected Parameters Tab for more information about the data on this tab.

Block Pins Tab of SCM/RCM

The Block Pins tab is common to all function blocks in Control Builder. For SCM/RCMs, it is applicable to viewing in the Containment View. Lets you choose the available parameters that you want to expose as input/output pins on the function Block in Control Builder. Refer to the online help for more information about the data on this tab.

Configuration Parameters Tab of SCM/RCM

The Configuration Parameters tab is common to all function blocks in Control Builder. For SCM/RCMs, it is applicable to viewing in the Containment View. Lets you choose the available parameters that you want to appear on the face of the function block in the Project tab in Control Builder. Refer to online help for more information about the data on this tab.

Monitoring Parameters Tab of SCM/RCM

The Monitoring Parameters tab is common to all function blocks in Control Builder. For SCM/RCMs, it is applicable to viewing in the Containment View. Lets you choose the available parameters that you want to appear on the face of the function block in the Monitoring tab in Control Builder. Refer to online help for more information about the data on this tab.

Block Preferences Tab of SCM/RCM

The Block Preferences tab is common to all function blocks in Control Builder. Lets you change several block-viewing preferences including the color of the block's faceplate. Refer to online help for more information about the data on this tab.

Assigning SCM/RCM to Execution Environment

Before adding and configuring Steps and Transitions in the SCM or Phases and Transitions in the RCM, assign the SCM/RCM to an Execution Environment. Follow the steps in the table below to assign the SCM/RCM.

Step	Action	Result
1	Close all edit windows.	If all edit windows are not closed, a lock contention results.
2	Choose Edit > Execution Environment Assignment OR Click the ‘Assign’ button on the toolbar.	The Execution Environment Assignment window opens.
3	Click on the appropriate SCM/RCM to be assigned from the list of unassigned Modules - CMs/SCM/RCMs on the left side of the window.	Assignment Information displayed includes CEEs to which you can assign the SCM/RCM, and CMs and SCM/RCMs currently assigned to the selected CEE.
4	If your system has multiple controllers, choose the destination CEE from the ‘Assign to’ area.	The CEE is highlighted in the ‘Assign to’ area.
5	Click the ‘Assign’ button.	After a few seconds, SCM/RCM will appear in the section of the window labeled Assigned Modules.

Step	Action	Result
6	Click Close.	SCM/RCM now appears in the Project tree under and connected to your CEE.

Creating a sequential or procedural control strategy

Step	Action
1	Configuring SCM/RCM Handler
2	Adding Transition to SCM/RCM Main Handler
3	Configuring SCM/RCM Transition Block
4	Adding Step Block to SCM/RCM Handler
5	Configuring SCM/RCM Step Block
6	Creating a Phase Block Type
7	Adding Phase block to RCM Handler
8	Adding SYNC Block to SCM/RCM
9	Configuring SCM/RCM SYNC Block

Configuring SCM/RCM Handler

Step	Create SCM/RCM Instance - Action
1	From the Project tree, double click on the SCM/RCM that will contain the control strategy to be configured. The SCM/RCM chart view opens in Control Builder. By default, the SCM/RCM is made up of a Main Handler containing a default invoke transition.
2	Double click on the word MAIN in the tab area at the bottom of the chart. The Parameters tabs for Main Handler configuration are displayed.
3	Click on the Main and Identification Parameters tab and complete the entries in the parameter fields as required to define the Main Handler. During configuration, use the F1 key to access context sensitive Help. Checking the Show Parameter Names box in the lower left of the window will display the system parameter name inplace of the descriptive name for each item.

Step	Create SCM/RCM Instance - Action
4	When data entry is complete, click on OK. This saves the configuration entries.

The Handler function block has no checkpointable parameters.

Main Tab of SCM/RCM Handler

Main Tab of SCM/RCM Handler	Description
Name (NAME)	Enter a unique block name consisting of up to 16 characters to identify the block in the system. The name must include at least one alpha character or letter (A-Z). The name that is automatically assigned is only a reference created by the Control Library to ensure name uniqueness and has no other significance. This name appears on all related system displays and any generated reports. You can change an assigned name while the component resides in the Project tree and has not been loaded to the Controller. You can not change an assigned name for a component in the Monitoring mode. The name only needs to be unique within the Sequential Control Module that contains it, not system-wide.
Description (DESC)	A text string of up to 132 characters used to describe the SCM/RCM.
Handler Type (TYPE)	Choose from the list of Handler Types to designate the specific handler being built. Choices are: Null (0) Edit (1) Main (2) Check (3) Interrupt (4) Restart (5) Hold (6) Stop (7) Abort (8)
Configuration Status	Refer to Configuration Status on Status Tab of

Main Tab of SCM/RCM Handler	Description
(CONFIGSTS)	SCM/RCM
Configuration Description (CONFIGDESC)	Refer to Configuration Code Description table on Status Tab of SCM/RCM
Execution Status (EXECSTS)	Refer to Execution Status on Status Tab of SCM/RCM
Execution Description (EXECDESC)	Refer to Execution Code Description table on Status Tab of SCM/RCM .

Identification Tab of SCM/RCM Handler

The Identifications tab is common to all modules in Control Builder and only appears when the optional Template license is activated. Unlike most Identification Parameters tabs, Block Comments are not on the Identification Parameters tab for Handlers. Refer to online help and Control Building Guide > Appendix C – User Templates > Using the Library Tree > Identification for more information about the data on this tab.

Name and Description found on the Identifications Parameters tab of the Handler contain the same values from the Main Parameters tab.

Adding Transition to SCM/RCM Main Handler

Invoke Transition in the SCM/RCM

When an SCM/RCM is initially opened, its Main Handler contains the Invoke Transition by default. The Main Handler's Invoke Transition is named InvokeMain. All SCM/RCMs are required to have one and only one Invoke Transition that is always the first block in the sequential control strategy. The Invoke Transition does not need transition conditions; however, you may add a condition if you want the SCM/RCM automatically invoked under specific conditions. The Invoke Transition of the Main Handler can be used to start the SCM/RCM automatically if the condition expressions and gate logic cause a True result.

The Null Invoke Transition is contained as default at the start of every Handler since all handlers must begin with a transition. The default Null Transition is configured with no gates and no conditions. If you use the default Null Transition as is, an operator must issue a command every time the handler is to be executed.

Other Transitions in the SCM/RCM

The transition block defines a distinct process condition that must be achieved to permit the SCM/RCM to advance to the next STEP block. A transition acts like a simple or compound wait statement depending on the number of conditions in the transition. A maximum of ten conditions is supported per transition block.

Add a Transition block to SCM/RCM

Step	Action
1	Ensure that the SCM/RCM is open. If the SCM/RCM isn't open, double-click the to-be-configured SCM/RCM from the Project Tree to open it. This opens the SCM/RCM in chart view.
2	Open the SCM/RCM branch on the Library Tree.
3	Drag and drop a Transition block into the SCM/RCM control chart. Position the Transition under the preceding Step.
4	Wire the Transition block to the preceding Step block by double clicking on the output pin of the previous Step then clicking on the input pin of the Transition. The blocks are wired. To terminate the wiring function, press the Escape key.
5	Add the required number of conditions by clicking on the ADD button of the transition. Each click on the ADD button will insert a condition into the transition.
6	Open the parameter configuration tab. Right-click the SCM/RCM Transition, choose SCM/RCM Transition Object > Configure Parameters.... OR Double-click on the TRANSITION block. If editing an existing set of expressions, double-click on the desired expression to open the parameter configuration form to the specific tab that contains that expression.
7	Enter values for the configuration parameters on each configuration tab. While in each entry field, press the F1 key to view Help topics for the field.
8	Click on OK before leaving the tab.

Configuring SCM/RCM Transition Block

Main Tab of SCM/RCM Transition

Main Tab of SCM/RCM Transition	Description
Name (NAME)	The transition name of up to 16 characters must be unique within the SCM/RCM block inclusive of all handlers. An assigned name can be changed while the component resides in the Project tree and has not been loaded to the Controller. You cannot change an assigned name for a component in the Monitoring mode. The name automatically assigned to the Transition by Control Builder is only a reference to ensure name uniqueness and has no other significance.
Description (DESC)	A text string of up to 132 characters used to describe the Transition.
Configuration Status	Refer to Configuration Status on Status Tab of SCM/RCM
Configuration Description	Refer to Configuration Code Description table on Status Tab of SCM/RCM
Execution Status	Refer to Execution Status on Status Tab of SCM/RCM
Execution Description	Refer to Execution Code Description table on Status Tab of SCM/RCM .
Force Peer Data Reads to be always active (FORCEREADREQ)	Saved in checkpoint - Restored from checkpoint Forces cyclic get requests for all Transition input connections. OFF (0) – No special handling required (default) ON (1) - All cyclic get requests on the transition have to be enabled permanently This can only be adjusted when the SCM/RCM is Inactive.

Condition Tab of SCM/RCM Transition

Specify details for given input conditions as they are added on the chart. This Tab only appears after you click on the "Add" button below the Transition Conditions box on the chart to add an input condition. The "Up", "Down", and "Del" buttons below the Transition Conditions box only appear as needed based on the number of expressions configured.

All Transitions, except the Invoke Transition require conditions. Conditions are optional for the Invoke Transition.

Condition Tab of SCM/RCM Transition	Description
Description (C[1..10].DESC)	Enter up to 23 characters of descriptor text to describe the condition details for the TRANSITION block. This text appears on detail displays to uniquely describe the TRANSITION block's condition details.
Force Permit (C[1..10].BYPPERM)	Saved in checkpoint - Restored from checkpoint Check this box to enable forcing the condition (to either On or Off) during run time. When Force Permit is ON, the operator with proper access authority or another program to force this condition when selected to ON. Unchecked = Off (0) (Bypass not permitted) DEFAULT Checked = On (1) (Bypass permitted) Assign the Force Permit as a block input to view the Force Permit setting for an input condition on the chart.
Force Request (C[1..10].BYPREQ)	Saved in checkpoint - Restored from checkpoint Force Request specifies the value a condition is to assume when it is forced. Value selections are: ToOff (0) ToOn (1) None (2) DEFAULT Assign C[x].BYPREQ as a block input to view the force request setting for an input condition on the chart. The setting also appears on the far right column of the condition box on the chart as a T, F, or -, respectively.
Condition Expression (C[1..10].EXPR)	Expressions allow for evaluating complex statements using information that is distributed throughout all of the

Condition Tab of SCM/RCM Transition	Description
	Execution Environments. An expression can Evaluate to a Boolean value using a combination of arithmetic and/or logical operators Evaluate to an arithmetic value using arithmetic operators Specify any scalar value (floating point, Boolean, Enumeration, literal string) for comparison in a logical expression. Use the arithmetic and number keys to enter expressions. A graphical keyboard is provided that displays all supported SCM/RCM expression operators and functions. You may choose: – An operator – A function – A number – Specific enumerations – A point name from a dialog box. Number of characters must be <= 255 Number of references must be <= 6 Number of bytes for Pcode <= 200 String, Time, Enumerations and Booleans are supported but values must be entered as integers. For example, CM2.pid1.mode = 2 (where 2 represents Cascade mode) **Expression operators, functions, and strings reference** **Operators: Description** Unary:+ - Binary Arithmetic:+ - * / MOD (x MOD y) ^ (x^y) Logical: AND OR NOT Relational:= <> <= >= < > Conditional: ? : (For example, X ?Y : Z; similar to IF,

Condition Tab of SCM/RCM Transition	Description
	THEN, ELSE) Assignment := Parenthesis: () Array Syntax:[ ] **Unary Functions** ABS: absolute value ATN: arc tangent SIN: sine in radians and **not** degrees COS: cosine in radians and **not** degrees TAN: tangent in radians and **not** degrees LOG: common logarithm LN: natural logarithm MOD: modulo; x MOD y SQR: square of a number SQRT: square root of a number EXP: exponential INT: integer ISFIN: finite ISNAN: not a number RND: round value SGN: sign of a value TIMNUM: time to number NUMTIM: number to time DTIMNUM: Delta time number NUMDTIM: Number delta time

Condition Tab of SCM/RCM Transition	Description
	STRTIM: String time ABSTOD: Absolute time of day TOD: Time of day UTCTOD: current UTC time of day as the Time of Day NOW: current local date and time as absolute time UTCNOW: current UTC date and time of day as absolute time PERIOD: FLOAT64 representing the parent Control Module's period in seconds. LEN: integer length of a string STRNUM: input parameter and converts it to a float64 NUMSTR: input parameter, casts it to a float64 and converts it to a string MID: string, an integer starting position and an integer length. Returns the specified portion of the original string **Multiple Argument Functions** MIN:minimum of n arguments (ignore bad values) MAX:maximum of n arguments (ignore bad values) AVG:average of n arguments MID: middle value of n arguments (average of two middle values for even n) MUL:product of n arguments SUM:sum of n arguments **Case Sensitive Strings for Special Value Constants** NAN:IEEE NaN value +INF:IEEE + Infinity value -INF:IEEE - Infinity value

Condition Tab of SCM/RCM Transition	Description
	PI: π (3.14159. . .) E: e (2.718. . .)
Logic Gate (C[1..10].GATEASGN)	Identifies the gate (P1, P2, or P3) assigned to the condition expression. Assigning a gate means that the calculated condition value will feed into the specified logic gate.
Configuration Status (C[1..10].CONFIGSTS)	View Only – the Condition's configuration status Possible values are: Ok (0) Information (1) Warning (2) SevereWarn (3) Fail (4) Error (5) SevereError (6)
Configuration Description (C[1..10].CONFIGDESC)	View Only – the Condition's configuration description
Execution Status (C[1..10].EXECSTS)	View Only – the Condition's execution status Possible values are: Ok (0) Bypass (1) Info (2) Warning (3) Fail (4) Error (5) OkPaused (6) BypassPaused (7) InfoPaused (8) WarnPaused (9) FailPaused (10) ErrorPaused (11)
Execution Description (C[1..10].EXECDESC)	View Only – the Condition's execution description
Connection Status (C[1..10].INCONNSTS1 to 6	View only – the input connection status (0 or 1) of each of the six possible inputs to the ten condition statements in a transition.

Gates Tab of SCM/RCM Transition

Lets you specify the logic gate types for each of the three primary gates and the secondary gate. The three primary gates are inputs to the single secondary gate.

Gates Tab of SCM/RCM Transition	Description
Primary Gate (P1) Type (G[2].ALGID)	Choices from pull down menu are: None (0) (has zero inputs) On (1) (has zero inputs) Off (2) (has zero inputs) Connect (3) (has only one input) Not (4) (has only one input) Or (5) Nor (6) And (7) Nand (8) XOR (9) (must have two inputs) XOR = Off when an even number of inputs are ON XOR = On when an odd number of inputs are ON
Primary Gate (P2) Type (G[3].ALGID)	Choices from pull down menu are: None (0) (has zero inputs) On (1) (has zero inputs) Off (2) (has zero inputs) Connect (3) (has only one input) Not (4) (has only one input) Or (5) Nor (6) And (7) Nand (8) XOR (9) (must have two inputs) XOR = Off when an even number of inputs are ON XOR = On when an odd number of inputs are ON
Primary Gate (P3) Type (G[4].ALGID)	Choices from pull down menu are: None (0) (has zero inputs) On (1) (has zero inputs) Off (2) (has zero inputs) Connect (3) (has only one input) Not (4) (has only one input) Or (5) Nor (6) And (7) Nand (8)

Gates Tab of SCM/RCM Transition	Description
	XOR (9) (must have two inputs) XOR = Off when an even number of inputs are ON XOR = On when an odd number of inputs are ON
Secondary Gate (S) Type (G[1].ALGID)	The secondary logic gate Choices from pull down menu are: None (0) (has zero inputs) On (1) (has zero inputs) Off (2) (has zero inputs) Connect (3) (has only one input) Not (4) (has only one input) Or (5) Nor (6) And (7) Nand (8) Xor (9) (must have two inputs) XOR = Off when an even number of inputs are ON XOR = On when an odd number of inputs are ON

Identification Tab of SCM/RCM Transition

The Identifications tab is common to all modules in Control Builder and only appears when the optional Template license is activated. Refer to online help and Control Building Guide > Appendix C – User Templates > Using the Library Tree > Identification for more information about the data on this tab.

Block Pins Tab of SCM/RCM Transition

The Block Pins tab is common to all function blocks in Control Builder. Lets you choose the available parameters that you want to expose as input/output pins on the function block in Control Builder. Refer to online help for more information about the data on this tab.

Configuration Parameters Tab of SCM/RCM Transition

The Configuration Parameters tab is common to all function blocks in Control Builder. Lets you choose the available parameters that you want to appear on the face of the function block in the Project tab in Control Builder. Refer to online help for more information about the data on this tab.

Monitoring Parameters Tab of SCM/RCM Transition

The Monitoring Parameters tab is common to all function blocks in Control Builder. Lets you choose the available parameters that you want to appear on the face of the function block in the Monitoring tab in Control Builder. Refer to online help for more information about the data on this tab.

Block Preferences Tab of SCM/RCM Transition

The Block Preferences tab is common to all function blocks in Control Builder. Lets you change several block-viewing preferences including the color of the block's faceplate. Refer to online help for more information about the data on this tab.

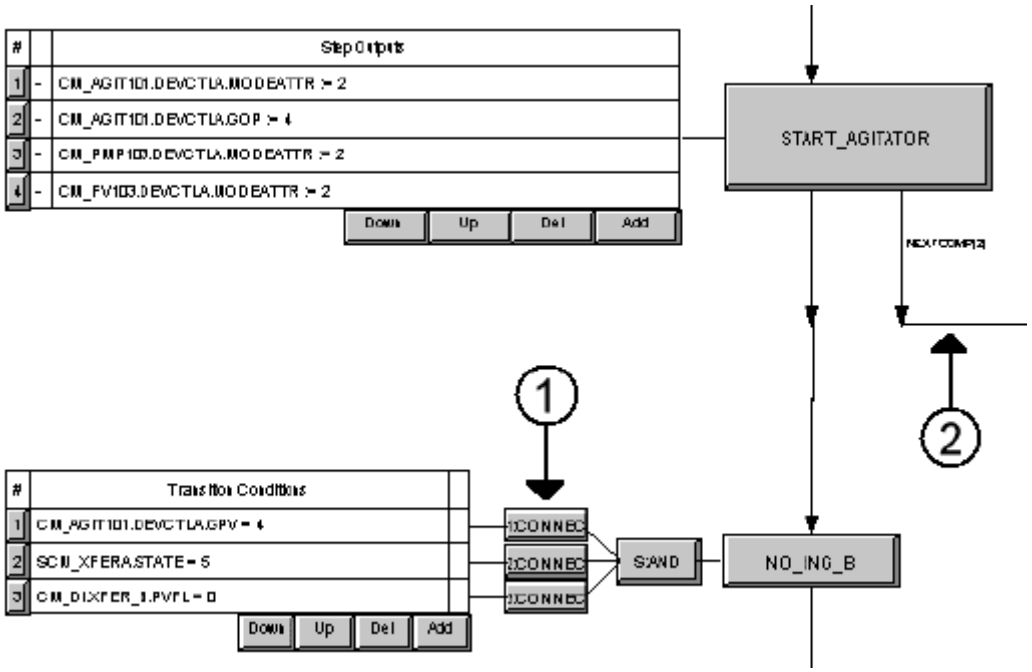
Example – SCM/RCM Transition Condition Expressions

Condition Expression	Meaning
CM101.EXECSTATE = 1	CM101 execution state is Active.
SCM/RCM301.STATE = 7	SCM/RCM301 state is Idle
CM301.PIDA.MODE = 1	PIDA block in CM301 is in Manual Mode.
CM301.PIDA.MODEATTR = 2	PIDA block in CM301 has a Mode Attribute of Program.
CM201.DI04.PVFL	DI04 block in CM201 is ON
CM401.PIDA.PV <= 20	PIDA block in CM401 has a PV value of less than or equal to 20.
CM401.PIDA.PV >20.0 AND CM401.PIDA.PV < 70.0	PIDA block in CM401 has a PV value between 20.0 and 70.0.
CM501.PIDA.PV<= CM501.PIDA.SP + 5	PIDA block in CM501 has a PV value that is less than or equal to the value of its SP value plus 5.
CM201.DI02.PVFL AND CM201.DI03.PVFL	The PV flags for blocks DI02 and DI03 in CM201 are TRUE.
NOT(CM201.DI02.PVFL AND CM201.DI03.PVFL)	The negative of the PV flags for blocks DI02 and DI03 in CM201 is FALSE.
(CPMFB.HOUR = 8) AND (CPMFB.MINUTE = 0)	Checks for 8:00 a.m. every day.
MyCM.block.elapsedtime > 5 MINS	Waits for function block’s elapsed time to be greater than 5 minutes

Condition Expression	Meaning
CEE01.CURRTIME + 2 DAYS	CEE01's current time plus 2 days
CEE01.CURRTIME > 10/30/2002	Wait for CEE01's current time to be greater that 10/30/2002
CEE01.CURRTIME + CM.TIMER.SP secs	CEE01's current time plus CM.TIMER.SP seconds
(CEE01.CURRTIME – 1/01/2002 10:15:01) * 2.	(CEE01's current time minus 1/01/2002 10:15:01) times two
STRTIM("12/01/2002") > CEE01.CURRTIME	Checks string time 12/01/2002 is greater than CEE01 current time
TIMNUM(CEE01.CURRTIME)	Absolute time of CEE01 current time
NUMTIM(1000.0)	Converts 1000.0 to delta Time data type
NOW – MyCM.myblock.todparam	Now time minus CM.FB's time of day parameter
ABSTOD(CEE01.CURRTIME)	Absolute time of day of CEE01's current time
CM.block.mystringparam + CM.desc	Mystring parameter plus CM description
CM.block.mystringparam = CM.desc	Wait for mystringparameter to be equal to CM description
CM.block.mystringparam <> "This is a string"	Wait for mystringparam to not equal "this is a string"
LEN("This is a string")	Returns integer length of the string
STRNUM("123")	Converts string input to a float64
NUMSTR(CM.block.pv)	Casts input to a float64 then converts it to a string
MID("This is a test", 5, 4)	Returns specified portion of the string where 5 is the start position and 4 is the integer length

Example: SCM/RCM configuration using dual Transitions

The following figure and its companion callout description table show a portion of an SCM/RCM configuration using a dual transition flow for quick reference. Configuration of the SCM/RCM in this way causes two possible paths of control strategy execution. Transitions are evaluated from left to right. The transition that becomes TRUE first will determine the path the strategy will followed while the other path is ignored. This differs from a SYNC block configuration because the SYNC block creates a scenario in which all the paths after the SYNC block are executed in parallel. The view in the following figure depicts a configuration in Project tab.



The following table includes descriptions of the callouts in the previous figure.

Callout	Description
1	Verify the gate configuration for the number of conditions attached. In this example, the CONNECT gate type is used in the primary gates with one condition for each gate. The secondary gate is an AND gate for the three primary gate inputs. An alternative structure for this could have been to feed the three conditions into one AND algorithm in a primary gate and

Callout	Description
	place a CONNECT algorithm in the secondary gate.
2	The STEP block must be configured with an additional component connection. Configure the STEP block to add another NEXTCOMP[X] as an output pin to permit an additional connection the output of the STEP block. By default, the NEXTCOMP[1] pin is always exposed but not labeled for connection to one TRANSITION block.

Example: SCM/RCM Transition waits for a specified Time

To create a transition designed to wait until a time specified by an operator or supervisor:

Step	Action
1	Setup Custom Data Block (CDB) located within a Control Module. Name the Custom Data Block CDB2.
2	Locate CDB2 in a control module called CM2. The SCM/RCM will use CDB2 within CM2 as a data repository.
3	CM2.CDB2 has a parameter called STARTTIME of type TIME. The operator will specify STARTTIME.
4	The SCM/RCM's transition waits until the specified time before advancing. The transition condition expression reads: UTCNOW = CM2.CDB2.STARTTIME UTCNOW is the valid time parameter to use in this instance. UTC (Universal Coordinated Time) is stored raw time with no time zone and no daylight savings time adjustments. UTC is converted to local time when shown to the user and then includes time zone and daylight savings time adjustments. (The transition condition expression NOW = CM2.CDB2.STARTTIME would **not** work even though the operator enters values for STARTTIME according to the local time zone.)

Implicit Transitions

Implicit transitions can be used anywhere except:

1. When there are multiple transitions after a setp or phase
2. Simultaneously before and after a SYNC block

In these exception cases, an explicit dummy transition with second gate type defined as ON (always ON transition) has to be used.

SCM/RCM Transition Failure Handling

The following table summarizes possible failure handling for TRANSITION conditions.

If…	Then
An error occurs during the evaluation of a TRANSITION Input Condition.	The condition's C.EXECSTS changes to Fail, which in turn changes the SCM/RCM EXECSTS to Fail. The condition's C.EXECCODE specifies the actual error. The SCM/RCM is already waiting for the TRANSITION to become satisfied so it can make the next STEP active.
The evaluation of the Failed TRANSITION input condition continues.	Failure recovery may occur in one of the following ways. • The problem is fixed and the failed input condition can now be successfully evaluated. • The condition status flag (C.FL) is recomputed. • The condition's C.EXECSTS changes to OK and the SCM/RCM EXECSTS to OK. • The operator forces the input condition, which causes the following. – The condition's C.EXECSTS changes to Bypass, which may in turn change the SCM/RCM EXECSTS to Bypass. – The condition status flag (C.FL) is set to On or Off. – Bypasses the evaluation of the input condition to allow the TRANSITION to become true , so the next STEP can become active. – The condition's C.EXECSTS changes to OK, which in turn changes the SCM/RCM EXECSTS to OK, depending on the successful evaluation of the TRANSITION following the activated STEP.

Adding Step Block to SCM/RCM Handler

Step blocks are commonly found in SCMs. Occasionally Steps are used in RCMs, but this is not the norm.

To add a Step block:

Step	Action
1	Ensure that the SCM/RCM chart is open. Double-click the to-be-configured SCM/RCM in the Project Tree to open the SCM/RCM chart in the drawing area.
2	Open the SCM/RCM branch on the Library Tree.
3	Drag and drop a STEP onto the SCM/RCM control drawing. Position the STEP under the preceding Transition so that its input pin does not touch the output pin on the previous Transition. Connections between the pins are not made unless they are explicitly wired together. If the pins touch, they look connected, even though they have not been wired. Please be aware of these configuration rules when building your SCM. (See rules 1 through 5 in Sync block configuration.)
4	Wire the Step block to the preceding Transition by double clicking on the output pin of the previous Transition then clicking once on the input pin of the Step. An alternate method to activate the Wiring function is to choose Chart>Insert>Wire then click on the appropriate connections. Verify that the blocks are wired. For more information on wiring, see Connecting Blocks with Insert Wire in the *Control Building Guide*.
5	Add the required number of output expressions by clicking on the ADD button of the Step. Each click on the ADD button inserts a single output expression.
6	Open the parameter configuration form by Right-clicking the SCM/RCM Step, then choose SCM/RCM Step Object > Configure Parameters.... OR Double-clicking on the STEP block. If editing an existing set of expressions, double-click on the desired expression to open the parameter configuration form to the specific tab that contains that expression.
7	Enter the desired configuration parameters on each tab of the configuration form. While in each entry field, press the F1 key to view Help topics for the

Step	Action
	field.
8	Click OK after entering the data on each tab.

Configuring SCM/RCM Step Block

Main Tab of SCM/RCM Step

Main Tab of SCM/RCM Step	Description
Name (NAME)	The unique step name of up to 16 characters. Must be unique within the SCM block inclusive of all handlers. An assigned name can be changed while the component resides in the Project tree and has not been loaded to the Controller. You can not change an assigned name for a component in the Monitoring mode. The name automatically assigned to the Step by Control Builder is only a reference to ensure name uniqueness and has no other significance.
Description (DESC)	STEP descriptor of up to 132 characters long.
Min Wait Time (MINTIME)	Saved in checkpoint - Restored from checkpoint Step minimum wait time in execution cycles - the minimum number of execution cycles that the step is active. Specifies how long to delay evaluation of succeeding TRANSITION block after STEP outputs are stored. Calculate the delay time by multiplying the Execution Period by the Min Wait Time setting. For example, If the Execution Period is 50 milliseconds and the Min Wait Time is 100, the start of the succeeding TRANSITION evaluation will be delayed by 5000 ms (5 seconds), which equals 50 ms times 100. Range: 0 to (2^31)-1 You can assign the parameter MINTIME as a block input to view the Min Wait Time setting on the chart. When Step TIME is less-than-or-equal to MINTIME it prevents the transition(s) out of the step from being evaluated.

Main Tab of SCM/RCM Step	Description
Max Active Time (MAXTIME)	Saved in checkpoint - Restored from checkpoint The maximum number of execution cycles that the step can be active before an SCM Step Alarm (STEPALM) is generated. Setting MAXTIME = 0 disables STEPALM. Calculate the STEP time-out alarm trip point time by multiplying the Execution Period by the Max Active Time setting. For example, if the Execution Period is 100 milliseconds and the Max Active Time is 200, the time-out alarm will be tripped when the STEP remains active for more than 20,000 ms (20 seconds), which equals 100 ms times 200. Range: 0 or greater-than MINTIME You can assign the parameter MAXTIME as a block input to view the Max Active Time setting on the chart.
Update Restart Address (UPDRESOPT)	Saved in checkpoint - Restored from checkpoint Update Restart address Option Off (0) On (1) When the Update Restart address is selected (ON) for a STEP in a Main or Interrupt Handler, SCM execution will resume at the beginning of this STEP upon its return from a preemption caused by an Exception Handler. Always set the Update Restart address to ON (1) for the first STEP in a Main Handler. This ensures that the SCM always has somewhere to return to from Exception Handlers. You can assign the parameter UPDRESOPT as a block input to view the state of this option (On/Off) on the chart. For more information on the Restart address, read Example – Restart address and Restart address Configuration Considerations.
Configuration Status (CONFIGSTS)	Refer to Configuration Status on Status Tab of SCM/RCM

Main Tab of SCM/RCM Step	Description
Configuration Description (CONFIGDESC)	Refer to Configuration Code Description table on Status Tab of SCM/RCM
Execution Status (EXECSTS)	Refer to Execution Status on Status Tab of SCM/RCM
Execution Description (EXECDESC)	Refer to Execution Code Description table on Status Tab of SCM/RCM .
Peer Data Reads Always Enabled (FORCEREADREQ)	Saved in checkpoint - Restored from checkpoint Force cyclic requests for all Step input connections. OFF (0) – No special handling required ON (1) – All cyclic get requests of the Step are enable permanently
Step Loop Counter (LOOPCOUNT)	Read only – Step loop counter provides the current run count of the step. Possible values: 0 - Step has not been executed yet. 1 – Step is already started or completed. x>1 - Step is involved in a looping structure and it has been executed ‘x’ times in the current looping structure.
Step Start Time (STARTTIME)	Read only – time Step starts
Step Complete Time (ENDTIME)	Read only - time Step completes
Edit Warning (WARNING)	Click on this button to open the HTML editor window, then configure the Warning. Enter the text Warning for this Step. This parameter contains raw HTML for configured Step Warning with a maximum length of 9999 characters. The Warning is shown on the SCM Table View when the Step is selected. The Warning can be used to present critical information to the Operator throughout the execution of the Step. User does not have to be aware of or do anything with this parameter.
Edit Note (NOTE)	Click on this button to open the HTML editor window, then configure the Note. Enter the text Note for this

Main Tab of SCM/RCM Step	Description
	Step. This parameter contains raw HTML for configured Step Note with a maximum length of 9999 characters. The Note is shown on the SCM Table View when the Step is selected. The Note, which is lower priority compared to the Warning, can be used to present important information to the Operator throughout the execution of the Step. User does not have to be aware of or do anything with this parameter.
Current Parameter (CURRVALREF)	Specifies the parameter (AnyTag.[Block].Parameter) identified as Current Value
Trend (CURRVALTREND)	Specifies whether the parameter identified by CURRVALREF is added to Trend. Unchecked – CURRVALREF not added to Trend Checked – CURRVALREF is added to Trend
Monitor Task Parameter (MONTASKREF)	Identifies a parameter (Any Tag.[Block].Parameter) as the Monitoring Task result associated with the Step. The identified parameter is interpreted as a Boolean value (0 is Off; non-0 is On) even if the parameter data type is not Boolean. The parameter is monitored and an indication shown on the SCM Table View associated with the Step. A “Monitoring Task” is a control strategy that evaluates a process condition for which the result is normally True/On or False/Off.
Enforce Order Option (ENFORCESEQ)	Saved in checkpoint - Restored from checkpoint Chooses whether the Step’s confirmable instructions or all Outputs of the Step must be confirmed and executed in order from Output #1, #2, … up to Output #N. Step level confirmation is not supported when ENFORCESEQ is equal to AllOutputs. None – Sequential order is enforced CnfnInstrs – Sequential order is enforced for confirmable instructions of Step AllOutputs – Sequential order is enforced for all Outputs of Step
Role (ROLE)	A specific responsibility in an organization such that tasks/procedures/instructions can be assigned to specific roles in organization, and then indirectly

Main Tab of SCM/RCM Step	Description
	assigned to specific personnel performing that role during that time or shift. A text string of up to 16 characters
Alert Time Out (ALERTTIMEOUT)	Range: 0.0 - 1092.25 minutes Default: 1 minute If an Instruction has not been confirmed and ALERTTIMEOUT minutes have passed, an ALARM is generated. To never generate an Alarm, set ALERTTIMEOUT = 0.0
Allow Step-level Confirmation of all Confirmable Instructions (STEPICNFMENB)	Saved in checkpoint - Restored from checkpoint Specifies whether Step level confirmation will be supported by this Step. Unchecked – Step-level Confirmation not allowed Checked – Step-level Confirmation is allowed Step-level confirmation is possible when STEPICNFMENB is On and ENFORCESEQ is not AllOutputs.
One or more Step Outputs Need Attention (INSTRUCTPEND)	Read only Unchecked – Instruction(s) are not pending (Default) Checked – Instruction(s) are pending Provides a summary indication of whether the Step currently has an Instruction pending that requires operator interaction.
Step Output Instructions are Complete (INSTRUCTCOMP)	Read only Unchecked – Instruction(s) are not complete (Default) Checked – Instruction(s) are complete Provides a summary indication of whether the Step Instruction(s) have been completed.

Step Settings tab of SCM/RCM Step

Current and Monitor task parameters and Trend parameters are configured on the Step block's Step Settings tab.

Step Settings Tab of SCM/RCM Step	Description
Current and Monitor: Current Parameter (CURRVALREF)	Step Current Value Reference Any Tag.[Block].Parameter reference Identifies a parameter as the Current Value for the Step. The identified parameter is monitored and shown on the SCM/RCM Table View associated with the Step. Example values are CMName.Pid.PV and SCM/RCMName.INALM.
Current and Monitor: Trend Current Parameter (CURRVALTREND)	Output Current Value add to Trend Unchecked –CURRVALREF not added to Trend Checked –CURRVALREF is added to Trend Specifies whether the parameter identified by CURRVALREF is added to the built-in Trend display that is part of the SCM/RCM Table View.
Current and Monitor: Current Description (CURRDESCREF)	Current value parameter's description Any Tag.[Block].Parameter reference Identifies the description of the current value parameter being displayed in Table View.
Current and Monitor: Current EU Description (CURREUDESCREF)	Current value parameter's engineering unit description Any Tag.[Block].Parameter reference Identifies the engineering unit description of the current value parameter being displayed in Table View.
Current and Monitor: Monitor Task Parameter (MONTASKREF)	Step Monitoring Task Reference Any Tag.[Block].Parameter reference Identifies a parameter as the Monitoring Task result associated with the Step. The identified parameter is interpreted as a Boolean value (0 is Off; non-0 is On)

Step Settings Tab of SCM/RCM Step	Description
	even if the parameter data type is not Boolean. The parameter is monitored and an indication shown on the SCM/RCM Table View associated with the Step Output. A “Monitoring Task” is a control strategy that evaluates a process condition for which the result is normally True/On or False/Off.
Trend: Trend Set Number (TRENDSETNUMB)	Defines which trend set is displayed in the trend display when the standard trend button is clicked. Default = 1 The range depends on the maximum trend sets configured in the system.
Trend: Trend Update Interval (TRENDINTRVAL)	Specifies the Trend Update Interval. Range is: (0) 1Min (1) 6MinAvg (2) 1HourAvg (3) 8HourAvg (4) 24HourAvg (5) 5Sec (Default) (6) 1Hour (7) 8Hour (8) 24Hour If the interval does not match the collection type defined for the trend variables, the real-time data is shown in place of the historical data.
Trend: Estimated Phase Duration (ESTDURATION)	Defines the time scale (in seconds) for the trend until the phase is completed. If there is no duration time entered, the time scale is calculated based on the selected trend history collection type. The trending start and stop times are defined as: Start time = phase start – start offset End time = current time Once the phase has been completed, the trend is frozen for the time duration as:

Step Settings Tab of SCM/RCM Step	Description
	Start time = phase start – start offset End time = phase end + end offset
Trend: Start Offset (STARTOFFSET)	In seconds (default = 0 sec)
Trend: End Offset (ENDOFFSET)	In seconds (default = 0 sec)

Output Tab of SCM/RCM Step

Up to 16 outputs can be configured for each Step Block. This tab only appears after clicking the 'Add' button below the step outputs box on the Step Block. The 'Up', 'Down', and 'Delete' buttons below the Step Output box only appear as needed based on the number of expressions configured.

The Step's Output configuration is modified to include the following parameters.

Output Tab of SCM/RCM Step	Description
Description (OP[1..16].DESC)	Output descriptor of up to 23 characters long
Configuration Status (OP[1..16].CONFIGSTS)	Output Configuration Status – Possible values are: Ok (0) (Default) Information (1) Warning (2) SevereWarn (3) Fail (4) Error (5) SevereError (6) Step output configuration status parameters OP[1..16].CONFIGSTS, OP[1..16].CONFIGCODE, OP[1..16].CONFIGDESC are set on SCM/RCM STATE transition from Inactive to Validated.
Conf Description (OP[1..16].CONFIGDESC)	Output Configuration Description – maximum of 39 characters

Output Tab of SCM/RCM Step	Description
Execution Status (OP[1..16].EXECSTS)	Possible values are: Ok (0) Bypass (1) Info (2) Warning (3) Fail (4) Error (5) OkPaused (6) BypassPaused (7) InfoPaused (8) WarnPaused (9) FailPaused (10) ErrorPaused (11) Step output execution status parameters OP[1..16].EXECSTS, OP[1..16].EXECCODE, and OP[1..16].EXECDESC are updated when the step is in the SCM/RCM's current scope of execution. On a Reset command to the SCM/RCM, the Output Execution Status (OP.EXECSTS) and the Output Execution Code (OP.EXECCODE) are initialized to Ok.
Execution Description (OP[1..16].EXECDESC)	Output Execution Code Description - Maximum of 39 characters
Instruction Complete (OP[1…16].INSTRUCTCOMP)	Provides an indication of whether the Step Output Instruction has been completed. View only. Off (unchecked) – Instruction is not complete On (checked) – Instruction is complete
Delay Remaining (seconds) (OP[1…16].DELAYTIMREM)	Step Output Delay Time Remaining (in seconds) - Provides the number of seconds remaining for the current Output delay/pause in progress. Range: 0 to 25000000 Value will be 0 unless the Output delay/pause is in progress.
Filter (OP[1..16].FILTERABLE	Checked (default) = user can filter a specific Step output in the Step Detail Table View display

Output Tab of SCM/RCM Step	Description
	Unchecked = user can **not** filter a specific Step output in the Step Detail Table View display The 'INFO Filter' button in the Table View's Step Detail pane only applies when this parameter is checked.
Connection Status Input # 1 through 6 (OP[1…16].INCONNSTS1…6	Six inputs are permitted per expression. These inputs display the current value (1 or 0) of each of the six possible inputs to the ouput's expression.
Connection Status Output Store (OP[1…16].STORESTS)	Status of the Output (1 or 0) that is stored.
Expression Tab - Type (OP[1..16].TYPE) **SCM only** **disable for RCM**	Output Type defines how the destination device in a Device Level 1 control scheme handles the SCM/RCM request. The following Output Types are supported and selectable from the pull down menu: NotStored (2) Set (1) Null (0) (Default) **Not-Stored (N)** A "control request" is posted to the destination FB and it remains active only as long as the current STEP remains active. This is the safest form of output since the device itself resets the control request from the SCM/RCM whenever: A new (other than the one that issued the request) STEP becomes active, or SCM/RCM transitions into or out of an abnormal state, or Communication between the SCM/RCM and the device is interrupted. Output destination point must be a DEVCTL (Device Control) function block configured for SCM/RCM-Option of other than None. The destination variable must be Generic Output (GOPREQ) for a DEVCTL block.

Output Tab of SCM/RCM Step	Description
	Set (S) A "control request" is posted to the destination FB and it remains active until explicitly overwritten. Normal operational situations such as operator intervention, Interlocks etc. do not overwrite the posted control request. Output destination point must be a DEVCTL (Device Control) function block or a Regulatory Control type (AUTOMAN, PID, etc.) function block configured for SCM/RCM-Option of other than None. The destination variable must be one of the following depending on the given function block: Output (OP) Generic Output (GOPREQ) (DEVCTL block only) Set-Point (SPREQ) SP-Target-Value (SPTVREQ) Mode (MODEREQ) **Null (-)** All variables other than the ones identified above fall into this category. The value is stored (subject to all the normal store restrictions applicable) and it remains there until overwritten. It can be easily overwritten during normal operational situations. If the destination FB Variable is a control request (XXREQ) one that supports Set (Stored) or Not-Stored output type then Null is not allowed. However, an SCM/RCM can store a Null type output to the SP of a PID FB in a CM with an SCM/RCMOPT of None. Although, this configuration does not make use of any of the Level 1 device driver functions. The parameter OP.TYPE can be assigned as a block input to view the Output Type setting on the chart. The Output Type setting is also

Output Tab of SCM/RCM Step	Description
	displayed in the second column on the left side of the condition output box as N (Not Stored), S (Set), or - (Null). Null output type is valid only if ControlModule.SCM/RCMOPT = None. If ControlModule.SCM/RCMOPT = Fixed, then Control Requests (CONTROLREQ) to the RegCtl function block must use a set output type, output requests to the DevCtl function block, and use a set of NotStored output type
Expression Tab - Delay (seconds) (OP[1…16].DELAYTIME)	Saved in checkpoint - Restored from checkpoint Step Output Delay time in seconds Range: 0 to 25000000 seconds Specifies the number of seconds that an Output will delay/pause before its expression execution. Value stored is “rounded up” to the next multiple of the SCM/RCM PERIOD. For example, with an SCM/RCM PERIOD of 10secs, a value of 15 stored to OP[i].DELAYTIME will be rounded up to 20. Only applicable to “automatic” Outputs that have expressions configured. A non-zero Step Output Delay Time for an Output with only an Instruction configured will have no effect.
Expression Tab - Output Expression (OP[1..16].SRCEXPR)	The processing of outputs includes: • Storing the source value to the destination (for all outputs). • Collecting store status response for each output. • Providing separate Output Execution Status (OP.EXECSTS) for each of the 16 outputs. These possible status's are supported: – Ok => output was stored successfully. – Warning => output was stored but may be with some constraint.

Output Tab of SCM/RCM Step	Description
	– Fail => output store failed for a reason such as invalid mode or state, or configuration mismatch. The Output Execution Code (OP.EXECCODE) defines the exact cause of this failure. Output Expressions allow for complex statements using information that is distributed throughout all of the Execution Environments. An output expression can Evaluate to a Boolean value using a combination of arithmetic and/or logical operators Evaluate to an arithmetic value using arithmetic operators Specify any scalar value (floating point, Boolean, Enumeration, literal string). Use the arithmetic and number keys to enter expressions. Number of characters must be <= 255 Number of references must be <= 6 Number of bytes for Pcode <= 200 String data type is not supported. Enumerations and Booleans are supported but values must be entered as integers. For example, CM2.pid1.mode = 2 (where 2 represents Cascade mode) **Expression operators, functions, and strings reference** **Operators:Description** Unary:+ - Binary Arithmetic:+ - * / MOD (x MOD y) ^ (x^y) Logical:AND OR NOT Relational:= <> <= >= < > Conditional:? : (For example, X ?Y : Z; similar to IF, THEN, ELSE)

Output Tab of SCM/RCM Step	Description
	Assignment ::= Parenthesis: () Array Syntax:[ ] **Unary Functions** ABS: absolute value ATN: arc tangent SIN: sine in radians and **not** degrees COS: cosine in radians and **not** degrees TAN: tangent in radians and **not** degrees LOG: common logarithm LN: natural logarithm MOD: modulo; x MOD y SQR: square of a number SQRT: square root of a number EXP: exponential INT: integer ISFIN: finite ISNAN: not a number RND: round value SGN: sign of a value TIMNUM: time to number NUMTIM: number to time DTIMNUM: Delta time number NUMDTIM: Number delta time STRTIM: String time

Output Tab of SCM/RCM Step	Description
	ABSTOD: Absolute time of day TOD: Time of day UTCTOD: current UTC time of day as the Time of Day NOW: current local date and time as absolute time UTCNOW: current UTC date and time of day as absolute time PERIOD: FLOAT64 representing the parent Control Module's period in seconds. LEN: integer length of a string STRNUM: input parameter and converts it to a float64 NUMSTR: input parameter, casts it to a float64 and converts it to a string MID: string, an integer starting position and an integer length. Returns the specified portion of the original string **Multiple Argument Functions** MIN:minimum of n arguments (ignore bad values) MAX:maximum of n arguments (ignore bad values) AVG:average of n arguments MID: middle value of n arguments (average of two middle values for even n) MUL:product of n arguments SUM:sum of n arguments **Case Sensitive Strings for Special Value Constants** NAN:IEEE NaN value

Output Tab of SCM/RCM Step	Description
	+INF:IEEE + Infinity value -INF:IEEE - Infinity value PI: π (3.14159. . .) E:e (2.718. . .)
Instruction Tab - Edit Instruction (OP[1..16].INSTRUCTION)	Step Output Instruction button opens the HTML editor. Allows entry of an output instruction with a maximum length of 9999 characters. Contains raw HTML for configured Step Output Instruction. User does not have to be aware of or do anything with this parameter.
Instruction Tab - Edit Note (OP[1..16].NOTE)	Step Output Note button opens HTML editor. Allows entry of an output instruction with a maximum length of 9999 characters. Contains raw HTML for configured Step Output Note. User does not have to be aware of or do anything with this parameter.
Instruction Tab - Instruction Type (OP[1..16].INSTRUCTTYPE)	Chooses the Instruction Type for the Step Output: None (0) – no Instruction is configured Info (1) – an Informational Instruction is configured that does not require operator confirmation Confirm (2) – a Confirmable Instruction is configured that does require operator confirmation
Instruction Tab - Target Parameter (OP[1..16].TARGETVALREF)	Step Output Target Value Reference Any Tag.[Block].Parameter reference Identifies a parameter as the Target Value associated with the Step Output. The identified parameter is shown on the SCM/RCM Table View associated with the Step Output. The Target Value can be used to show the operator the intended result for the Output's Instruction.

Output Tab of SCM/RCM Step	Description
Instruction Tab - Allow Change (OP[1..16].TARGETCHANGE)	Step Output Target Value Change Allowed Unchecked – Operator cannot change displayed Target Value Checked – Operator can change displayed Target Value Specifies whether the Operator will be able to change the Target Value associated with the Step Output shown on the SCM/RCM Table View.
Instruction Tab - Current Parameter (OP[1..16].CURRVALREF)	Step Output Current Value Reference Any Tag.[Block].Parameter reference Identifies a parameter as the Current Value for the Step Output. The identified parameter is monitored and shown on the SCM/RCM Table View associated with the Step Output. Example values are CMName.Pid.PV and SCM/RCMName.INALM.
Instruction Tab - Trend (OP[1..16].CURRVALTREND)	Step Output Current Value add to Trend Unchecked – OP[1..16].CURRVALREF not added to Trend Checked – OP[1..16].CURRVALREF is added to Trend Specifies whether the parameter identified by OP[1..16].CURRVALREF is added to the built-in Trend display that is part of the SCM/RCM Table View. Note that the built-in Trend display is not supported in the pilot release.
Instruction Tab - Entry Parameter (OP[1..16].ENTRYVALREF)	Step Output Entry Value Reference Any Tag.[Block].Parameter reference Identifies a parameter as the Entry Value for the Step Output. The identified parameter is shown on the SCM/RCM Table View associated with the Step Output, and the Operator can store a value to this parameter as the result of the Step Output's Instruction. Example values are CMName.Pid.PV and SCM/RCMName.INALM.

Output Tab of SCM/RCM Step	Description
Instruction Tab - Monitor Task Parameter (OP[1..16].MONTASKREF)	Step Output Monitoring Task Reference Any Tag.[Block].Parameter reference Identifies a parameter as the Monitoring Task result associated with the Step Output. The identified parameter is interpreted as a Boolean value (0 is Off; non-0 is On) even if the parameter data type is not Boolean. The parameter is monitored and an indication shown on the SCM/RCM Table View associated with the Step Output. A “Monitoring Task” is a control strategy that evaluates a process condition for which the result is normally True/On or False/Off.
Instruction Tab - Role (OP[1..16].ROLE)	Role specifically associated with the Step Output A specific responsibility in an organization such that tasks/procedures/instructions can be assigned to specific roles in organization, and then indirectly assigned to specific personnel performing that role during that time or shift. A text string of up to 16 characters
Advanced Tab - Conf Associated Parameters (OP[1..16].CONFIGASSOCPARAM)	Advanced tab contains parameters associated with Key Parameters on the Instruction tab. Checked = key parameters are enabled for entering associated parameters Unchecked = key parameters are disabled, associated parameters are not available for entry.
Advanced Tab - Target Descriptor (OP[1..16]TARGETDESCREF)	Reference for target value Description Select from list of existing parameters. Of type <Param> – This entry does not contain text value but refers to another parameter which contains text value.
Advanced Tab - Target Value Maximum (OP[1..16]TARGETMAXREF)	Reference for maximum value of target Select from list of existing parameters. Of type <Param> – This entry does not contain numeric value but refers to another parameter

Output Tab of SCM/RCM Step	Description
	which contains numeric value.
Advanced Tab - Target value Minimum (OP[1..16]TARGETMINREF)	Reference for minimum value of target Select from list of existing parameters. Of type <Param> – This entry does not contain numeric value but refers to another parameter which contains numeric value.
Advanced Tab - Target Engineering Units (OP[1..16]TARGETEUDESCREF)	Reference for engineering units descriptor for target Select from list of existing parameters. Of type <Param> – This entry does not contain text value but refers to another parameter which contains text value.
Advanced Tab - Current Value Descriptor (OP[1..16]CURRDESCREF)	Reference for description of current value Select from list of existing parameters. Of type <Param> – This entry does not contain text value but refers to another parameter which contains text value.
Advanced Tab - Current Value Engineering Units (OP[1..16]CURREUDESCREF)	Reference for engineering units descriptor for current value Select from list of existing parameters. Of type <Param> – This entry does not contain text value but refers to another parameter which contains text value.
Advanced Tab - Entry Value Descriptor (OP[1..16]ENTRYDESCREF)	Reference for description for entry value Select from list of existing parameters. Of type <Param> – This entry does not contain text value but refers to another parameter which contains text value.
Advanced Tab - Entry Value Maximum (OP[1..16]ENTRYMAXREF)	Reference for maximum value of entry value Select from list of existing parameters. Of type <Param> – This entry does not contain numeric value but refers to another parameter which contains numeric value.
Advanced Tab - Entry Value Minimum	Reference for Minimum value of entry value

Output Tab of SCM/RCM Step	Description
(OP[1..16]ENTRYMINREF)	Select from list of existing parameters. Of type <Param> – This entry does not contain numeric value but refers to another parameter which contains numeric value.
Advanced Tab - Entry Value Engineering Units (OP[1..16]ENTRYEUDESCREF)	Reference for Engineering units descriptor for entry value Select from list of existing parameters. Of type <Param> – This entry does not contain text value but refers to another parameter which contains text value.

Alarm and Event Tab of SCM/RCM Step

The parameters on this tab cover the options relating to alarms and events at the Step level.

Alarm and Event Tab of SCM/RCM Step	Description
Override SCM/RCM Step Timeout Alarm Config (OVRSCM/RCMTMPRSR)	Checked – For this specific Step, overrides the SCM/RCM's Step Duration Timeout Alarm's priority and severity configuration. When checked, Step Duration Timeout Priority and Severity are revealed for configuration. Unchecked – Step Duration Timeout configuration reverts to the SCM/RCM's Step Duration Timeout Alarm's priority and severity configuration.
Step Duration Timeout Priority (TIMEOUTALM.PR)	Saved in checkpoint - Restored from checkpoint This setting can be overridden by the individual step configuration for Step Duration Timeout priority. Is configurable only when the Override SCM/RCM Step Timeout Alarm Configuration (OVRSCM/RCMTMPRSR) option is checked. Specifies the SCM/RCM Step Timeout alarm's priority. The priority applies only when this SCM/RCM Step has remained active for longer than the configured maximum step time. Options are: None (0) Journal (1) Low (2) High (3) (Default) Urgent (4)
Step Duration Timeout Severity (TIMEOUTALM.SV)	Saved in checkpoint - Restored from checkpoint Is configurable only when the Override SCM/RCM Step Timeout Alarm Configuration (OVRSCM/RCMTMPRSR) option is checked. This setting can be overridden by the individual step configuration for Step Duration Timeout severity.

Alarm and Event Tab of SCM/RCM Step	Description
	Specifies the SCM/RCM Step Timeout alarm's severity. The severity applies only when this SCM/RCM Step has remained active for longer than the configured maximum step time. Range is 0 to 15 with 15 as the highest priority. Default is 4.
Event Options – Step Start Event Option (EVTOPTSTEPS)	Checked – the Step's Start event journal option is enabled. The user can attach Comments to the Step's Start event when enabled. Unchecked – the Step's Start event journal option is disabled. The user will not be able to attach Comments to Step's Start event when disabled.
Event Options – Step Complete Event Option (EVTOPTSTEPC)	Checked – the Step's Complete event journal option is enabled. Unchecked – the Step's Complete event journal option is disabled.

Stop Condition Tab of SCM/RCM Step

Specify an optional Stop Condition for the Step when activated. When active, you can configure Condition Details that include a Condition Expression, Force Permit and Force Request selection, which are very similar to the details configured for a Transition input condition. You can assign the parameter SC.OPT as a block input to view the state of this option (On/Off) on the chart.

Stop Condition Tab of SCM/RCM Step	Description
Condition Option (SC.OPT)	Unchecked (0) (Default) - disables the Step's Stop Condition capability Checked (1) - enables the Step's Stop Condition capability
Description (SC.DESC)	Step Stop Condition Description String Length: 23 characters
Force Permit	Saved in checkpoint - Restored from checkpoint

Stop Condition Tab of SCM/RCM Step	Description
(SC.BYPPERM)	Step Stop Force Permit – allows the user to force the state of the condition Unchecked (0) (Default) – Stop Condition flag (SC.FL) is set condition expression's value Checked (1) – Stop Condition flag (SC.FL) is set according to SC.BYPREQ
Force Request (SC.BYPREQ)	Saved in checkpoint - Restored from checkpoint Step Stop Force Request can be set to: ToOff (0) – Stop Condition flag forced Off ToOn (1) – Stop Condition flag forced On None (2) (Default) – Stop Condition flag determined by expression's value
Configuration Status (SC.CONFIGSTS)	Step Stop Condition Configuration Status Ok (0) (Default) Information (1) Warning (2) SevereWarn (3) Error (4) SevereError (5) Stop input condition configuration status parameters SC.CONFIGSTS, SC.CONFIGCODE, and SC.CONFIGDESC are set on SCM/RCM STATE transition from Inactive to Validated
Configuration Description (SC.CONFIGDESC)	Step Stop Condition Configuration Description - View Only Maximum of 39 characters
Execution Status (SC.EXECSTS)	Step Stop Condition Execution Status (View Only) Ok (0) (Default) Bypass (1) Info (2) Warning (3) Fail (4) Error (5) OkPaused (6) BypassPaused (7)

Stop Condition Tab of SCM/RCM Step	Description
	InfoPaused (8) WarnPaused (9) FailPaused (10) ErrorPaused (11) Step Stop Condition execution status parameters SC.EXECSTS, SC.EXECCODE, and SC.EXECDESC are updated when the step is in the Sequential Control Module's (SCM/RCM) current scope of execution.
Execution Description (SC.EXECDESC)	Step Stop Condition Execution Code Description – View only Maximum of 39 characters.
Connection Status Input # 1 through 6 (SC.INCONNSTS1…6)	Six inputs are permitted per expression. These inputs represent the current value of each of the six possible inputs to the stop condition's expression.
Condition Expression (SC.EXPR)	Step Stop Condition Expression String Length: 255 characters Follow all rules associated with a Transition condition expression. When the condition becomes true during this step, the Abnormal Stop Handler will execute.

Interrupt Condition Tab of SCM/RCM Step

Specify an optional Interrupt Condition for the Step when activated. When active, you can configure Condition Details that include a Condition Expression, Force Permit and Force Request selection, which are very similar to the details configured for a Transition input condition. You can assign the parameter IC.OPT as a block input to view the state of this option (On/Off) on the chart.

Interrupt Condition Tab of SCM/RCM Step	Description
Condition Option (IC.OPT)	Step Interrupt Condition Option Unchecked(0) (Default) – disables the Step Interrupt condition capability Checked(1) – enable the Step Interrupt

Interrupt Condition Tab of SCM/RCM Step	Description
	condition capability
Description (IC.DESC)	Interrupt Condition Description String Length: 64 characters
Force Permit (IC.BYPPERM)	Saved in checkpoint - Restored from checkpoint Step Interrupt Force Permit Unchecked (0) (Default) – the Interrupt condition flag is equal to the value of the Interrupt condition's expression. Checked (1) – the Interrupt condition flag is set equal to the Force Request value
Force Request (IC.BYPREQ)	Saved in checkpoint - Restored from checkpoint Step Interrupt Force Request can be set to: ToOff (0) – the Interrupt condition flag is forces OFF ToOn (1) – the Interrupt condition flag is forced ON None (2) (Default) – the Interrupt condition flag is set to the value of the interrupt condition expression
Configuration Status (IC.CONFIGSTS)	Step Interrupt Condition Configuration Status Ok (0) (Default) Information (1) Warning (2) SevereWarn (3) Error (4) SevereError (5) Interrupt input condition configuration status parameters IC.CONFIGSTS, IC.CONFIGCODE, and IC.CONFIGDESC are set on ICM STATE

Interrupt Condition Tab of SCM/RCM Step	Description
	transition from Inactive to Validated
Configuration Description (IC.CONFIGDESC)	Step Interrupt Condition Configuration Description - View Only Maximum of 39 characters
Execution Status (IC.EXECSTS)	Step Interrupt Condition Execution Status (View Only) Ok (0) (Default) Bypass (1) Info (2) Warning (3) Fail (4) Error (5) OkPaused (6) BypassPaused (7) InfoPaused (8) WarnPaused (9) FailPaused (10) ErrorPaused (11) Step Interrupt Condition execution status parameters IC.EXECSTS, IC.EXECCODE, and IC.EXECDESC are updated when the step is in the Sequential Control Module's (ICM) current ICope of execution.
Execution Description (IC.EXECDESC)	Step Interrupt Condition Execution Code Description – View only Maximum of 39 characters
Connection Status Input # 1 through 6 (IC.INCONNSTS1…6)	Six inputs are permitted per expression. These inputs represent the current value of each of the six possible inputs to the interrupt condition’s expression.
Condition Expression (IC.EXPR)	Step Interrupt Condition Expression String Length: 255 characters Follow all rules associated with a Transition condition expression. When the condition becomes true during this

Interrupt Condition Tab of SCM/RCM Step	Description
	step, the Abnormal Interrupt Handler will execute.

Identification Tab of SCM/RCM Step

The Identifications tab is common to all modules in Control Builder and only appears when the optional Template license is activated. Refer to online help and Control Building Guide > Appendix C – User Templates > Using the Library Tree > Identification for more information about the data on this tab.

Block Pins Tab of SCM/RCM Step

The Block Pins tab is common to all function blocks in Control Builder. Lets you choose the available parameters that you want to expose as input/output pins on the function block in Control Builder. Refer to online help for more information about the data on this tab.

Configuration Parameters Tab of SCM/RCM Step

The Configuration Parameters tab is common to all function blocks in Control Builder. Lets you choose the available parameters that you want to appear on the face of the function block in the Project tab in Control Builder. Refer to online help for more information about the data on this tab.

Monitoring Parameters Tab of SCM/RCM Step

The Monitoring Parameters tab is common to all function blocks in Control Builder. Lets you choose the available parameters that you want to appear on the face of the function block in the Monitoring tab in Control Builder. Refer to online help for more information about the data on this tab.

Block Preferences Tab of SCM/RCM Step

The Block Preferences tab is common to all function blocks in Control Builder. Lets you change several block-viewing preferences including the color of the block's faceplate. Refer to online help for more information about the data on this tab.

Example – SCM/RCM Step Output Expressions

The following table lists some example output expressions along with their meaning for reference.

Output Expression	Meaning
CM151.PIDA.OPX := 35.0, OR CM151.PIDA.OPX := 35.	Sets the output of the PIDA block in CM151 to 35 percent.
CM590.EXECSTATE := 1	Sets CM590 to Active state.
SCM/RCM301.COMMAND := 3	Commands SCM/RCM301 to Reset.
CM152.PIDA.MODE := 1	Sets the PIDA block in CM152 to MANual Mode.
CM152.PIDA.MODEATTR := 2	Sets the Mode Attribute of the PIDA block in CM152 to Program.
ClM191.DEVCTL.GOP := 5	Sets the output of the DEVCTLA block in CM191 to State 1 (ON).
SCM/RCM235.HISTVALUE[1] := (CM151.PIDA.PV + CM251.PIDA.PV)2	Stores the average of the PV values for CM151 and CM251 as first historical value.
ENBHANDLER[1] := 2	Enables the Main Handler that is second in the list of configured Main Handlers.
CM456.PID.SP := (CM456.SPREC1FLAG.PVFL) ? SCM/RCM457.RECTARGET[1] : SCM/RCM457.RECTARGET[2]	If the PV flag for the FLAG block in CM456 is ON, then set the SP for the PID block in CM456 equal to the number 1 recipe target value in SCM/RCM457. If the PV flag for the FLAG block in CM456 is OFF, then set the SP for the PID block in CM456 equal to the number 2 recipe target value in SCM/RCM457.
CM.block.mystringparam := “This is a string constant”	Sets my string parameter equal to This is a string constant
CM.block.mystringparam := CM.desc	Sets my string parameter equal to CM description

Example – SCM/RCM records Time of process command

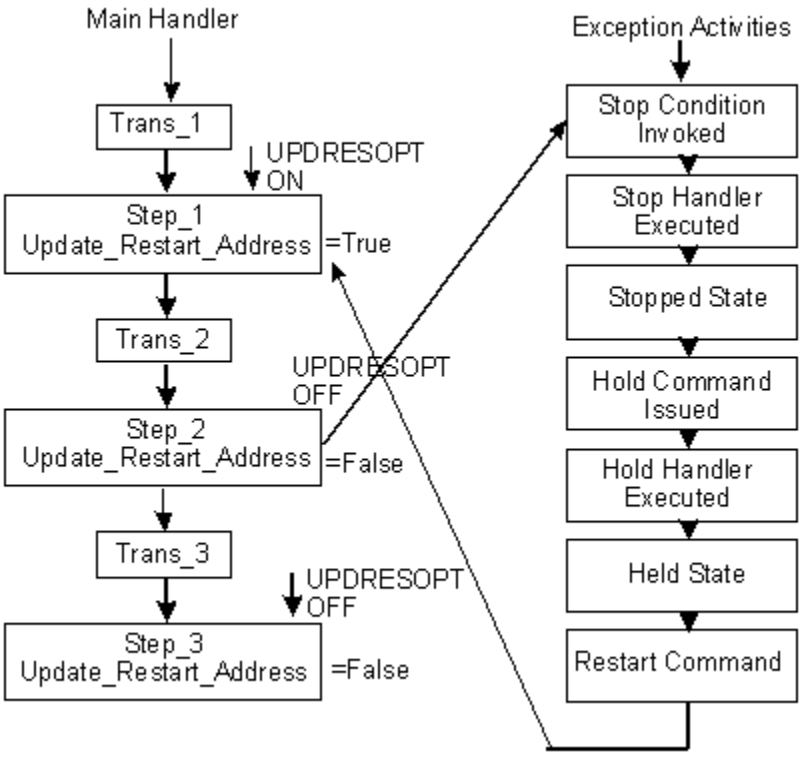
To record the time at which an important process command was issued:

Step	Action
1	Create a Custom Data Block (CDB) called CDB1 in a Control Module called CM1.
2	Create a parameter of type TIME in CM1.CDB1 called CMDISSUETIME.
3	To capture the time the command was issued and save it in a proper format, SCM/RCM1.STEP1 uses the output expression: CM1.CDB1.CMDISSUETIME := UTCNOW UTCNOW is the valid time parameter to use in this instance. UTC (Universal Coordinated Time) is stored raw time with no time zone and no daylight savings time adjustments. UTC is converted to local time when shown to the user and then includes time zone and daylight savings time adjustments. (The output expression CM1.CDB1.CMDISSUETIME := NOW is incorrect because the display would **not** use the value of CMDISSUETIME according to the local time zone.)

Example – SCM/RCM Restart Address

The following figure shows how the Update Restart Address is used to restart SCM/RCM Main Handler execution at STEP1 after preemption due to a Stop invoke condition during STEP2. In this case, the SCM/RCM executes the Stop Handler, transitions to stopping , then Stopped state, issues Hold command, executes Hold handler, transitions to holding, then Held state, issues Restart command and returns to STEP1 since its Update Restart Address flag is set to True and there is no Restart Handler.

The update restart option is configured on the Main tab of the Step and the Main tab of the Phase.



SCM/RCM Restart Address configuration considerations

The SCM/RCM parameter Restart Address (RESADDR[1..10]) and Restart Address Future (RESADDRFUTUR[1..10]) are updated by the Restart Option Address to tell the SCM/RCM which step in the Main or Interrupt Handler it is to return to upon completion of an Interrupt or Hold Handler. You can also use the partner integer parameters Restart Address (RESADDRN[1..10]) and Restart Address Future (RESADDRFUTRN[1..10]) to specify the return step through an output expression.

You can use the SCM/RCM Component Number (NUM) parameter to modify RESADDRN[X] and RESADDRFUTRN[X] parameters in expressions using only statements referring directly or indirectly to the Step, such as STEP_X.NUM.

Do not use absolute number constants in the expressions, since the NUM parameter could change after new downloads.

You can use the RESADDRN[1..10] to set the Restart Address to the next return level as follows.

An Interrupt Handler includes an expression to set the RESADDRN[1] parameter to a specified Step in the Main Handler. After the SCM/RCM transitions from Running to Interrupting, the Interrupt Handler updates the Restart Address to the specified Step to be executed in the Main Handler upon completion of the Interrupt Handler.

A Hold Handler includes an expression to set the RESADDRN[1] parameter to a specified Step in the Main Handler. After the SCM/RCM transitions from Running to Holding, the Hold Handler updates the Restart Address to the specified Step to be executed in the Main Handler when the Restart command is issued upon completion of the Hold Handler.

A Hold Handler includes an expression to set the RESADDRN[1] parameter to a specified Step in the Interrupt Handler. After the SCM/RCM transitions from Running to Interrupting to Holding, the Hold Handler updates the Restart Address to the specified Step to be executed in the Interrupt Handler when the Restart command is issued upon completion of the Hold Handler. In this case, the Hold Handler can only update the Restart Address in the Interrupt Handler, since it represents the next level up from the Hold Handler.
Note that you could use Flag and Numeric blocks in a CM to coordinate Restart Address functions between the Hold and Interrupt Handlers. Include expressions in the Hold Handler to set the Flag block to let the Interrupt Handler know that it must update the Restart Address and specify the Step in the Main Handler in the Numeric block to update the Restart Address in the Interrupt Handler. Include a condition in the Interrupt Handler that checks the status of the Flag block to determine if it needs to update the Restart Address to the Numeric block value or not.

Use the RESADDRFUTRN[1] parameter to specify the Restart Address to be used for the current level in the future. For example, you want the Main Handler to restart at a Step based on process conditions instead of returning to the last Step that was executed per the normal Restart Address function. Include an expression in the Main Handler to set the RESADDRFUTRN[1] parameter to a specified Step in the Main Handler, so the Restart Address is set equal to the Restart Future Address after an SCM/RCM transition from Running to either Interrupting or Holding occurs.

HTML Editing in SCM/RCM

An HTML Editor is used to configure the Instructions, Warnings, and Notes of the Step, Step Outputs, Phase, and Phase Outputs. The three tabs of the HTML Editor are used as follows.

Tab	Description
Edit	Text can be entered and formatted as desired
HTML	The raw HTML can be edited directly if desired.
View	Provides a preview of what the current configuration will look like in a view only display similar to the text presented to the operator in the SCM/RCM Table View.

A few tips on HTML editing are provided.

Tip	Description
1	Use Single-spaced vs. Double-spaced text
2	An <Enter> key creates a new paragraph resulting in a blank line before the new paragraph. Depress the <Shift> key while striking the <Enter> key to continue text on the next line without creating a new paragraph.
3	Hyperlinks to documents on an accessible server, an Intranet site, an Internet site, etc. are supported in the HTML. The HTML can be created to support two different behaviors when an operator clicks on the hyperlink: (Default) Content at destination of hyperlink is displayed in the Instruction/Warning/Note cell, overwriting what was previously displayed in the cell. This default behavior happens when entering the hyperlink directly in the Edit tab of the HTML Editor. The raw HTML will appear as "<A href=\"http://www.honeywell.com\"><p>www.honeywell.com</A>" Content at destination of hyperlink is displayed in a new window, leaving the Instruction/Warning/Note cell unchanged however the new window will cover up a portion of the Table View. To obtain this behavior the raw HTML is edited from the HTML tab of the HTML Editor to insert a TARGET field as shown below ("new1" will be the name of the new window that appears). "<A href=\"**Error! Hyperlink reference not valid.**" TARGET=\"new1\"><p>www.honeywell.com</A> "

HTML Editor Toolbar Buttons

Icon	Tool Tip	Description
	Cut	Copy selected text to clipboard and delete from screen.
	Copy	Copy selected text to clipboard.
	Paste	Paste last item placed into clipboard at current cursor position.
	Delete	Delete selected text from screen.
	Bold selected text	Bold the selected text. If selected text is bolded, un-bold it. If selected text is mixed, bold entire selection
	Italicize selected text	Italicize the selected text. If selected text is italicized, un-italicize it. If selected text is mixed, italicize entire selection
	Underline selected text	Underline the selected text. If selected text is underlined, un-underline it. If selected text is mixed, underline entire selection
	Left Justify selected (or current) paragraph	Left justifies the section of text at current cursor position.
	Center Justify selected (or current) paragraph	Center justifies the section of text at current cursor position.
	Right Justify selected (or current) paragraph	Right justifies the section of text at current cursor position.
	Make Ordered List from selected (or current) paragraph	Make Ordered List of items of text at current cursor position. If current position is already an Ordered List, return the text to regular.
	Make Unordered (or Bullet)	Make Unordered List of items of text at current cursor position. If current position is already an Unordered List,

Icon	Tool Tip	Description
	List from selected (or current) paragraph	return the text to regular.
	Unindent selected (or current) paragraph	Unindent text at current cursor position.
	Indent selected (or current) paragraph	Indent text at current cursor position.
	Highlight selected text	Set the selected text to have the current highlight color.
	Change highlight color	Bring up the standard Color Selection dialog (without any setting for Custom Colors) to set the highlight color. Current color selected is displayed in the Icon.
	Change font for selected text	Bring up the standard Font Selection dialog to set the selected text's Font, Size, and Color on "OK" button.

Adding SYNC Block to SCM/RCM

To add a Sync block:

Step	Action
1	Ensure that the SCM/RCM is open. Double-click the to-be-configured SCM/RCM from the Project Tree to open it. This opens the SCM/RCM in the drawing area.
2	Open the SCM/RCM branch on the Library Tree.
3	Drag and drop SYNC onto the SCM/RCM control drawing. Position the SYNC under the preceding Step or Transition so that its input pin does not touch the output pin on the previous Step. Connections between the pins are not made unless they are explicitly wired together. If the pins touch, they look connected, even though they have not been wired.

Step	Action
4	Connect the pins. Double click on the output pin of the previous block then click on the input pin of the Sync. The blocks are wired. Alternate methods of activating the wiring tool are: Click on the Wire icon in the toolbar the click on the output pin followed by the input pin. For more information on wiring, see Connecting Blocks with Insert Wire in the *Control Building Guide*.
5	Right-click the Sync block, then click SCM/RCM Sync Object > Configure Parameters...DDCF block**.** Alternate Method: Double-click on the SYNC block to open the parameter configuration form.
6	Enter the desired configuration parameters on each tab. While in each entry field, press the F1 key to view Help topics for the field.
7	Click OK after entering the data on each tab.

Configuring SCM/RCM SYNC Block

The SYNC Function Block has no checkpointable parameters.

There must be an explicit transition either before of after the SYNC block.

These rules must be followed for SYNC block implementation:

1	The SYNC block is transparent to the basic rule that Steps and Transitions must alternate.
2	Inputs to SYNC block have to be either all Steps or all Transitions.
3	Outputs from SYNC block have to be either all Steps or all Transitions.
4	Two SYNC blocks cannot be connected together.
5	The outputs of two separate Step blocks cannot be connected to the same Transition block if its output is connected to a SYNC block.

The connection rules are:

1	Multiple wires can be connected to the input pin (up to ten).
2	Each output pin can only be connected to one output wire.
3	To add more outputs (up to ten), use the Block Pins parameter configuration tab of the Sync block.

Main Tab of SCM/RCM SYNC

Main Tab of SCM/RCM SYNC block	Description
Tag Name (NAME)	The unique transition name of up to 16 characters. Must be unique within the SCM/RCM block inclusive of all handlers. An assigned name can be changed while the component resides in the Project tree and has not been loaded to the Controller. You can not change an assigned name for a component in the Monitoring mode. The name automatically assigned to the Transition by Control Builder is only a reference to ensure name uniqueness and has no other significance.
Description (DESC)	Block descriptor of up to 132 characters long.
Configuration Status (CONFIGSTS)	Configuration Status – Possible values are: Ok (0) (Default) Information (1) Warning (2) SevereWarn (3) Fail (4) Error (5) SevereError (6)
Conf Description (CONFIGDESC)	Configuration Description – maximum of 39 characters
Execution Status (EXECSTS)	Possible values are: Ok (0) Bypass (1) Info (2) Warning (3) Fail (4) Error (5) OkPaused (6)

Main Tab of SCM/RCM SYNC block	Description
	BypassPaused (7) InfoPaused (8) WarnPaused (9) FailPaused (10) ErrorPaused (11)
Execution Description (EXECDESC)	Execution Description - Maximum of 39 characters

Identification Tab of SCM/RCM SYNC block

The Identifications tab is common to all modules in Control Builder and only appears when the optional Template license is activated. Refer to online help and Control Building Guide > Appendix C – User Templates > Using the Library Tree > Identification for more information about the data on this tab.

Block Pins Tab of SCM/RCM SYNC block

Defining the number of connections for the SYNC Block's joining (input) and forking (ouput) paths are made on the Block Pins tab. Typically the inputs to the SYNC Block are joined on the top of the block while the outputs of the SYNC block are forked from the bottom of the block. From the list of parameters, choose DESC for the input connections and NEXTCOMP[x] for the output connections.

Refer to online help for more information about the data on this tab.

Configuration Parameters Tab of SCM/RCM SYNC block

The Configuration Parameters tab is common to all function blocks in Control Builder. Lets you choose the available parameters that you want to appear on the face of the function block in the Project tab in Control Builder. Refer to online help for more information about the data on this tab.

Monitoring Parameters Tab of SCM/RCM SYNC block

The Monitoring Parameters tab is common to all function blocks in Control Builder. Lets you choose the available parameters that you want to appear on the face of the function block in the Monitoring tab in Control Builder. Refer to online help for more information about the data on this tab.

Block Preferences Tab of SCM/RCM SYNC block

The Block Preferences tab is common to all function blocks in Control Builder. Lets you change several block-viewing preferences including the color of the block's faceplate. Refer to online help for more information about the data on this tab.

Creating a Phase Block Type

To create a PHASE block type, choose **File > New > Type > Phase Block** in Control Builder. A dialog box appears in which you specify the Custom Library Name, either by entering the name of a new custom library item, or by selecting an existing library name from a drop-down list. Enter the name of the new block (PHASE) type.

Rules for library names are:

- Maximum character count for library name is 50, minimum 1.
- All characters except * | \ : < > ? / " and tab are legal.

Rules for block type names are:

- Maximum character count for block name is 50, minimum 1.
- Name must include an underscore or an alpha character.
- All characters except * | \ : < > ? / " and tab are legal.

After specifying the Custom Library Name and the Block Type Name, you click **OK**. The data entered is checked to ensure that only valid characters were entered and that the maximum character count was not exceeded. If the data is valid, the IDE opens with the Parameter Definition Editor window

Defining Phase in Parameter Definition Editor

Refer to the Parameter Definition Editor Guide Reviewing Container Types in PDE->Phase Block for detailed information on defining the Phase: Formula parameters and Report parameters.

Adding Phase block to RCM Handler

To add a Phase block:

Step	Action
1	Ensure that the RCM chart is open. Double-click the to-be-configured RCM in the Project Tree to open the RCM chart in the drawing area.
2	Open the Phase Block Type library or user template library branch on the Library Tree.
3	Drag and drop a Phase Block Type onto the RCM control drawing. Position the PHASE under the preceding block so that its input pin does not touch the output pin on the previous block. Connections between the pins are not made unless they are explicitly wired together. If the pins touch, they look connected, even though they have not been wired.
4	Wire the Phase block to the preceding block by double clicking on the output pin of the previous block then clicking once on the input pin of the Phase. An alternate method to activate the Wiring function is to choose Chart>Insert>Wire then click on the appropriate connections. Verify that the blocks are wired. For more information on wiring, see Connecting Blocks with Insert Wire in the *Control Building Guide*.
6	Open the parameter configuration form by Right-clicking the RCM Phase, then choose RCM Phase Object > Configure Parameters.... OR Double-clicking on the Phase block.
7	Enter the desired configuration parameters on each tab of the configuration form. While in each entry field, press the F1 key to view Help topics for the field.
8	Click OK after entering the data on each tab. The Phase name is created based on the name of the Phase Block Type or the User template. The phase name can be modified but not cleared and must be unique within the RCM. On the Phase Settings tab, either enter the Equipment Module name or clear all four checkboxes in Resource Management and Execution group.

Configuring RCM Phase block

The tabs of the RCM's Phase block that specify parameters directly related to the RCM's phase function are:

- Phase Settings to identify the SCM used as the Equipment Module resource
- Formula Parameters to identify the parameter values loaded to the controller at the start of the phase
- Report Parameters to identify the parameter values retrieved from the controller during or at the end of the phase

Main Tab of RCM Phase

Define the parameters of the Phase on the Main tab.

Main Tab of RCM Phase	Description
Name (NAME)	The unique phase name of up to 16 characters. Must be unique within the SCM/RCM block inclusive of all handlers. An assigned name can be changed while the component resides in the Project tree and has not been loaded to the Controller. You can not change an assigned name for a component in the Monitoring mode. The name automatically assigned to the Phase by Control Builder is only a reference to ensure name uniqueness and has no other significance.
Description (DESC)	PHASE descriptor of up to 40 characters long. Can be used to define a localized name for the phase to be shown in the RCM detail display
Block Type ID (BLOCKTYPEID)	This is a system value. No entry required.
Update Restart Address (UPDRESOPT)	This parameter is restricted and only allowed for Null phases. Saved in checkpoint - Restored from checkpoint Update Restart address Option Unchecked = Off (0)

Main Tab of RCM Phase	Description
	Checked = On (1) When the Update Restart address is checked (ON) for a PHASE in a Main or Interrupt Handler, RCM execution will resume at the beginning of this PHASE upon its return from a preemption caused by an Exception Handler. Always set the Update Restart address to ON (1) for the first PHASE in a Main Handler. This ensures that the RCM always has somewhere to return to from Exception Handlers. You can assign the parameter UPDRESOPT as a block input to view the state of this option (On/Off) on the chart. For more information on the Restart address, read Example – Restart address and Restart address Configuration Considerations.
Configuration Status (CONFIGSTS)	Refer to Configuration Status on Status Tab of SCM/RCM
Configuration Description (CONFIGDESC)	Refer to Configuration Code Description table on Status Tab of SCM/RCM
Exec Status (EXECSTS)	Refer to Execution Status on Status Tab of SCM/RCM
Execution Description (EXECDESC)	Refer to Execution Code Description table on Status Tab of SCM/RCM .
Peer Data Reads Always Enabled (FORCEREADREQ)	Saved in checkpoint - Restored from checkpoint Force cyclic requests for all Phase input connections. Unchecked = OFF (0) – No special handling required Checked = ON (1) – All cyclic get requests of the Phase are enable permanently
Phase Loop Counter (LOOPCOUNT)	Read only – Phase loop counter provides the current run count of the phase. Possible values: 0 - Phase has not been executed yet. 1 – Phase is already started or completed. x>1 - Phase is involved in a looping structure and it has been executed ‘x’ times in the current looping structure.

Main Tab of RCM Phase	Description
Phase Start Time (STARTTIME)	Read only – time Phase started This value is cleared when the RCM executes the Reset command.
Phase Completion Time (ENDTIME)	Read only - time Phase completed This value is cleared when the RCM executes the Reset command.
Phase Block State Edit Lock (EDITLOCK)	A read-only value
Phase Block State CDB Software Version (CDBSOFTVER)	A read-only value

Phase Settings Tab of RCM Phase

Define the parameters of the Phase on the Phase Settings tab.

Phase Setting Tab of RCM Phase	Description
Resource Management and Execution: Equipment Name (EQUIPNAME)	Enter the tagname of the SCM that is used at runtime as the resource. While this field does **not** automatically restrict entries to valid SCM names only, a SCM name is the **only** valid entry for this field in R300.1 Experion systems. No Entry - the block is used as Null Phase to hold formula and report parameters. When Phase is used as Null Phase, clear the four check boxes in Resource Management and Execution Group.
Resource Management and Execution: Acquire Equipment before Execution (ACQUIREOPT)	Checked = ON (default) - Phase block will acquire the resource defined in the equipment module Unchecked = OFF - Phase block will not acquire the resource defined in the equipment module When a Phase block is used only for resource arbitration, it acquires the SCM before another Phase block. In this case, Phase block execution should be OFF.

Phase Setting Tab of RCM Phase	Description
Resource Management and Execution: Execute on the Equipment (EXECUTEOPT)	Checked = ON (default) - the Equipment Name indicates an SCM to be controlled by the phase. Unchecked = OFF - no equipment name identified
Resource Management and Execution: Wait for Terminal State (TERMSTATEOPT)	Checked = ON (default) –the control should not move immediately to the following phase or step even when the conditions in the following transitions are true. Unchecked = OFF – control moves immediately to the following phase/step when the one of the following transitions becomes true.
Resource Management and Execution: Release Equipment after Execution (RELEASEOPT)	Checked = ON (default) – the resource defined in the equipment is automatically released after the phase is completed. Unchecked = OFF – the resource defined in the equipment module will stay granted to the RCM after the phase is completed
Equipment Module Status: State (EQUIPSTATE)	Shows the State of the SCM identified in the Equipment Module name. If no Equipment Module name is identified, the value is blank.
Equipment Module Status: Mode (EQUIPMODE)	Shows the Mode of the SCM identified in the Equipment Module name. If no Equipment Module name is identified, the value is blank.
Equipment Module Status: Mode Attribute (EQUIPMODEATTR)	Shows the Mode Attribute of the SCM identified in the Equipment Module name. If no Equipment Module name is identified, the value is blank.
Equipment Module Status: Execution Status (EQUIPEXECSTS)	Shows the Execution Status of the SCM identified in the Equipment Module name. If no Equipment Module name is identified, the value is blank.
EQM State Projection Up to Recipe: Override Recipe Level Configuration (EQMTORECENB)	Checked = ON – Abnormal states set below will override the RCM configuration Unchecked = OFF (default) – RCM configuration will prevail. The RCM tracks the most abnormal state of the active RCMs

Phase Setting Tab of RCM Phase	Description
EQM State Projection Up to Recipe: EQM State Held (EQMENUMNAME and EQMTORECMAP)	Used when the active SCM is held. The projected Recipe State options are: None Default (Hold) Abort Stop
EQM State Projection Up to Recipe: EQM State Stopped (EQMENUMNAME and EQMTORECMAP)	Used when the active SCM is stopped. The projected Recipe State options are: None Default (Stop) Abort Hold
EQM State Projection Up to Recipe: EQM State Aborted (EQMENUMNAME and EQMTORECMAP)	Used when the active SCM is aborted. The projected Recipe State options are: None Default (Abort) Stop Hold
Recipe State Propagation Down to EQM: Override Recipe Level Configuration (RECENUMNAME and RECTOEQMMAP)	Checked = ON – Abnormal states set below will override the RCM configuration Unchecked = OFF (default) – RCM configuration will prevail. The active RCM will command all active SCMs to the same state as the RCM.
Recipe State Propagation Down to EQM: Recipe State Held (RECENUMNAME and RECTOEQMMAP)	Used when the RCM becomes held. The Equipment Module Command options are: None Default (Hold) Abort Stop
Recipe State Propagation Down to EQM: Recipe State Stopped (RECENUMNAME and	Used when the RCM becomes stopped. The Equipment Module Command options are:

Phase Setting Tab of RCM Phase	Description
RECTOEQMMAP)	None Default (Stop) Abort Hold
Recipe State Propagation Down to EQM: Recipe State Aborted (RECENUMNAME and RECTOEQMMAP)	Used when the RCM becomes aborted. The Equipment Module Command options are: None Default (Abort) Stop Hold
Current & Monitor Task Parameters: Current Parameter (CURRVALREF)	Select the tag.parameter to be used as the current parameter
Current & Monitor Task Parameters: Trend Current Parameter (CURRVALTREND)	Checked – current parameter will be trended Unchecked – current parameter will not be trended The trend is shown in the Table View mini-trend pane.
Current & Monitor Task Parameters: Current description (CURRDESCREF)	Reference for current parameter description Select from list of existing parameters. Of type<Param> - this entry does not contain text value but refers to another parameter which contains text value. Use this entry to define or override the default selection done when the current parameter was defined.
Current & Monitor Task Parameters: Current EU description (CURREUDESCREF)	Reference for current Engineering Units description Select from list of existing parameters. Of type<Param> - this entry does not contain text value but refers to another parameter which contains text value.
Current & Monitor Task Parameters: Monitor Task Parameter (MONTASKREF)	Select the tag.parameter to be used as the monitor task parameter
Trend: Trend Update Interval	Specifies the Trend Update Interval.

Phase Setting Tab of RCM Phase	Description
(TRENDINTRVAL)	Range is: (0) 1Min (1) 6MinAvg (2) 1HourAvg (3) 8HourAvg (4) 24HourAvg (5) 5Sec (Default) (6) 1Hour (7) 8Hour (8) 24Hour If the interval does not match the collection type defined for the trend variables, the real-time data is shown in place of the historical data.
Trend: Trend Set Number (TRENDSETNUMBER)	Defines what is displayed in the trend display when the standard trend button is clicked. Default = 1 The range depends on the maximum trend sets configured in the system.
Trend: Estimated Phase Duration [Sec] (ESTDURATION)	Defines the time scale (in seconds) for the trend until the phase is completed.
Trend: Start Offset [secs] (STARTOFFSET)	In seconds (default = 0 sec)
Trend: End Offset [secs] (ENDOFFSET)	In seconds (default = 0 sec)

Formula Parameters Tab of RCM Phase

This tab contains all the user defined formula parameters for the Phase block. Each Formula Parameter has one or more attribute/field and an associated default value that have been defined earlier in the configuration process using the Parameter Definition Editor (PDE) or modified in the user template.

Although the parameter attributes cannot be modified in this tab, the values contained within those fields can be modified:

Formula Parameters Tab of RCM Phase (pertains to each parameter)	**Description**
Parameter Description	Description is included in the parameter downloading event Use the Show Parameter Name checkbox to toggle between the description and name
Enable	Checked – parameter is used in the phase block instance Unchecked – parameter is not used in the phase block instance and not shown in the RCM detail display
Use Ref Value	Checked – value is retrieved from the specified source. Unchecked – value is a constant
Value	Value of the formula parameter; can be a simple value or a reference to another point parameter A simple value can be overwritten by an authorized user during runtime. A bad referenced value can be overwritten by an authorized user during runtime.
Eng Unit	Engineering Unit of the value - a string
Min Value	Minimum value - Low limit of value that is permissible for the numeric formula parameter
Max Value	Maximum value - High limit of value that is permissible for the numeric formula parameter

Formula Parameters Tab of RCM Phase (pertains to each parameter)	Description
Scale	Checked – the value is scaled with the ratio between current batch size and the default batch size when the value is downloaded into the target parameter Unchecked – no scaling is done in the value download operation
Access Lock	Access level for making changes
Parameter reference	User defined parameter name Defines the destination of the formula parameter. This can be any parameter in the same Server. Note: A default connection can be defined in a user template for a phase block. If it is not a template defining parameter, it can be modified here.

Report Parameters Tab of RCM Phase

This tab contains all the user defined report parameters for the Phase block. The Parameter Definition Editor is used to define the parameters.

Each of the formula parameters has the following fields

Report Parameters Tab of RCM Phase (pertains to each parameter)	Description
Parameter Description	Description is included in the parameter downloading event Use the Show Parameter Name checkbox to toggle between the description and name
Enable	Checked – parameter is used in the phase block instance Unchecked – parameter is not used in the phase block instance and not shown in the RCM detail display

Report Parameters Tab of RCM Phase (pertains to each parameter)	Description
Value	Default value for the report parameter Any user can overwrite a bad value received through the parameter reference.
Eng Unit	Engineering Unit of the value - a string
Min Value	Minimum value - Low limit of value that is permissible for the numeric formula parameter
Max Value	Maximum value - High limit of value that is permissible for the numeric formula parameter
Trend	Trend flag Checked – the value will be trended, shown in the Minitrend, parameter name and value shown in the Tableview. Unchecked – the value will not be trended
Parameter reference	User defined parameter name Defines the destination of the report parameter. This can be any source parameter in the same Server. Note: A default connection can be defined in a user template for a phase block. If it is not a template defining parameter, it can be modified here.

Identification Tab of RCM Phase

The Identifications tab is common to all modules in Control Builder and only appears when the optional Template license is activated. Refer to online help and Control Building Guide > Appendix C – User Templates > Using the Library Tree > Identification for more information about the data on this tab.

Block Pins Tab of RCM Phase

The Block Pins tab is common to all function blocks in Control Builder. Lets you choose the available parameters that you want to expose as input/output pins on the function block in Control Builder. Refer to online help for more information about the data on this tab.

Configuration Parameters Tab of RCM Phase

The Configuration Parameters tab is common to all function blocks in Control Builder. Lets you choose the available parameters that you want to appear on the face of the function block in the Project tab in Control Builder. Refer to online help for more information about the data on this tab.

Monitoring Parameters Tab of RCM Phase

The Monitoring Parameters tab is common to all function blocks in Control Builder. Lets you choose the available parameters that you want to appear on the face of the function block in the Monitoring tab in Control Builder. Refer to online help for more information about the data on this tab.

Block Preferences Tab of RCM Phase

The Block Preferences tab is common to all function blocks in Control Builder. Lets you change several block-viewing preferences including the color of the block's faceplate. Refer to online help for more information about the data on this tab.

Dependencies tab of RCM Phase

The Dependencies tab is common to some function blocks in Control Builder. Refer to online help for more information about the data on this tab.

Template Defining Tab of RCM Phase

The Template Defining tab is common to all function blocks in Control Builder. Lets you define the block as a template block.

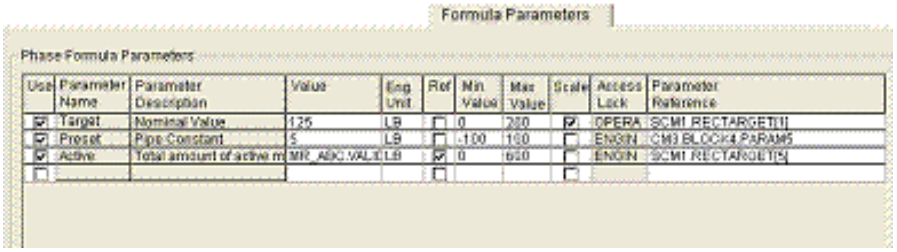
Use this tab to prevent value changes in the phase instances. For example, the management of the value range (Min Value and Max Value) can be enforced in the user templates, when the changes are disabled in the instances by adding them in the template defining tab.

Refer to online help for more information about the data on this tab.

Example – Phase Formula Parameters

Each formula parameter can have many attributes displayed on the Formula Parameters tab. Although the parameter names for the parameter formula fields were defined in the PDE and cannot be modified in this tab, the values contained within those fields can be modified:

The following example uses the defaults found in the PDE



In this example 1st and 3rd parameter are linked to SCM Recipe parameters RECTARGET[1] and RECTARGET[5]. The second parameter is connected to a point parameter in a control module (CM3.BLOCK4.PARAM5).

The target values for the first two parameters are constants (125 and 5). The third target value is retrieved from a point parameter (MR_ABC.VALIDATE.ACTUAL). The selection between constant and reference is done through the Value Reference nested parameter. By checking Value Reference, the text entry in Value is replaced with a pulldown menu that allows the selection of the value reference. This works in the same way as the Parameter Reference.

In this example, the third parameter (Active) refers to a Loaded RCM parameters (phase = VALIDATE, parameter = ACTUAL). The reference was done using the RCM name (MR_ABC). When an RCM is loaded to the controller, then all RCM references are automatically replaced with the loaded RCM references.

A parameter reference is typically linked to an SCM Recipe parameter, but it can be linked to any point in CEE or ACE. The phase formula parameter fields are very similar with the SCM recipe parameter fields. The Material Code field is not directly supported in phase formula parameters, but it can be added as a user defined parameter.

Adding Information into SCM/RCM Charts

Information can be added to the white space of an SCM/RCM by the use of Object linking and embedding (OLE). The user can transfer and share information between a third-party Windows-based application and the SCM/RCM chart. Information can be added to the SCM/RCM chart by inserting a Microsoft Word (or Wordpad/Notepad/Clipart) file to an SCM/RCM chart.

For more information on this feature, see Inserting OLE Objects into Charts in the *Control Building Guide*.

Inserting text descriptions into an SCM/RCM chart

Perform the following steps to embed text descriptions into an SCM/RCM chart.

Step	Action
1	With the SCM/RCM open on the screen, Click Chart> Insert > OLE Object. An Insert Object dialog box appears on the screen,
2	Choose Create New to create a new file and then choose the desired third party application type file you want to create. In the case of adding text descriptions to an SCM/RCM, choose Object Type WordPad or Word Document. OR Choose Create from File to use an existing file and specify the proper pathname in the File entry field. If necessary, click on the Browse button to help locate the desired file. All applications on your computer that support object linking and embedding are listed.
3	If you want to display the text as an icon, check the 'Display as Icon' box. Choosing this option displays the entry as an icon instead of as the object itself. The user needs to double click on the icon to view its contents.
4	A text box opens in the SCM/RCM. Enter text. When complete, click outside the text box.
5	Move the text box or icon to the desired location on the SCM/RCM chart.
6	If the text was selected and not the icon and the text appears difficult to view, right click on the text box and choose Reset Size.

Add another Handler to an SCM/RCM

Follow the steps in the table below to add a new Handler to an SCM/RCM. All Handler Types are added in the same way.

Step	Action
1	Ensure that the SCM/RCM to which the new Handler will be added is open.
2	From the Library tree, drag and drop a Handler from the SCM/RCM group to the Control Drawing.
3	The Parameters Configuration form for the Handler block appears.
4	Enter a Name for the Handler.
5	Enter a Description for the Handler
6	Enter a Handler Type from the drop-down list box.
7	Click OK. The new Handler name appears on the tab at the bottom of the SCM/RCM.
8	Add Step and Transition blocks to the new Handler you just created per your strategy requirements and wire the blocks together.

Validating SCM/RCM done by Edit Handler

When you are configuring an SCM/RCM, the following checks are done:

- expression syntax
- database syntax

The Edit Handler validates the SCM/RCM and identifies configuration errors in all SCM/RCM Steps and Transitions. This validation occurs on transition from Inactive to Validated.

The Monitor Tree shows the configuration status that results from validation. The SCM/RCM can be expanded in the Monitor Tree to display the Handlers and the Handler can be expanded to display the Steps and Transitions. A red X on the Handler, Step, or Transition that has the error indicates configuration errors in the Monitor tree view of the SCM/RCM. These configuration errors are reported using the SCM/RCM, Handler, Step, and Transition parameters: CONFIGSTS, CONFIGCODE, and CONFIGDESC.

Loading SCM/RCM to controller

Follow the steps in the table below to load your SCM/RCM. The SCM/RCM must be assigned to a CEE and all edit windows (such as SCM/RCM charts) must be closed before attempting to load

Step	Action	Result
1	Open the Project Tree in Control Builder.	
2	Click on the SCM/RCM.	The SCM/RCM backlights.
3	Right click on the SCM/RCM and choose Load … or Click the 'Load' button on the toolbar.	A Load Dialog box appears displaying the list of modules to be loaded, its Current state, the State to Load, and the Post Load State.
4	Click the OK button.	In a few moments the load completes. If there are any errors, a dialog box appears with details of the problem(s).

Creating a UCM

Follow the steps in the table below to create a new UCM.

Step	Create UCM Instance - Action
1	Open Control Builder via Configuration Studio/Configure process control strategies
2	Choose File > New > Unit Control Module. The new UCM • Opens in control chart view • Is assigned a name determined by the system using sequential numbers (UCM_54, UCM_55...). The UCM can be renamed later. • Appears under the Root Project Tree under Unassigned. • Is automatically saved.
3	Double-click an empty area of the UCM Control Chart. The Parameters tabs are displayed for UCM configuration.
4	Click on each Parameters tab and fill in the values to define the UCM parameters. During configuration, use the F1 key to access context sensitive Help. Checking the Show Parameter Names box in the lower left of the window will display the system parameter name in place of the descriptive name for each item.
5	When data entry is complete, click on OK.

Defining UCM Parameters

Main Tab of UCM

Main Tab of UCM contains configuration information for the following parameters:

Main Tab of UCM	Description
Tag Name (NAME)	The unique UCM name of up to 16 characters that appears on all related system displays and any generated reports. The name must include at least one alpha character or letter (A-Z), no embedded or leading space, and none of the following: ` ~! @ # $ % ^ & * + - = ( ) { } [ ] | \ : ; ' < > , . ? / \ ",. The name automatically assigned to the UCM by Control Builder is only a reference to ensure name uniqueness and has no other significance.
Item Name	Name of the entity that this UCM will be associated with in the Enterprise Model Builder hierarchy. Can be up to 40 characters and must include at least one alpha character.
Description (DESC)	A text string of up to 132 characters used to describe the UCM.
Engr Units (EUDESC)	A text string of up to 16 characters used to describe important aspects of the UCM. Appears in detail and group displays in Station, and on any generated reports.
Keyword (KEYWORD)	A text string of up to 16 characters to be used on detail and group displays in Station and on generated reports. KEYWORD can be used to provide a brief block description on schematic displays where DESC is too long.
Execution: Execution State (EXECSTATE)	Displays the current state of the UCM and provides a location for the operator to change the UCM state. Choices are: ACTIVE INACTIVE

Main Tab of UCM	Description
Execution: Execution Period (PERIOD)	Choose setting from pull down menu. Period selections are in milliseconds or seconds. Value is dependent on controller base cycle. Refer to the Defining Execution Period section for more information.
Execution: Execution Order in CEE (ORDERINCEE)	Specifies the order of execution of this UCM within its CEE. Execution order determines which control strategy to execute. The control module with the lowest number will execute first within the CEE. If multiple control modules have the same Order in CEE, the order of execution is based on the order in which the strategies were built. Valid value = 0 to 65535 in multiples of 10 Default value = 10
Execution: Execution Phase (PHASE)	The cycles/phases in which the UCM executes. Default = -1 (phase assigned automatically) Range = 0 to 39; defines distribution of the block processing among load cycles. Refer to the Defining Execution Phase for more information.
Execution: Execution Phase Minute: (PHASEMIN)	Time that the phase has been executing (minutes). PHASEMIN in connection with PHASEHOUR displays the entire time that the phase has been executing.
Execution: Execution Phase Hour: (PHASEHOUR)	Time that the phase has been executing (hours). PHASEHOUR in connection with PHASEMIN displays the entire time that the phase has been executing.
Restart: CEE Restart Option (CEESTARTOPT)	Saved in checkpoint - Restored from checkpoint UCM Behavior on CEE Restart FOLLOWCEE (0) follow the restart commanded for CEE (default) – When CEE Cold Restart is selected, the UCM is set Active and the UCM Mode is set Manual after activation of the UCM; other parameters remain unchanged. When CEE Warm Restart is selected, the UCM is set Active and the UCM's previous Mode is maintained; other parameters are

Main Tab of UCM	Description
	left unchanged. ALWAYSCOLD (1) executes cold start behavior regardless of CEE Restart command. The UCM is set Active, UCM Mode is set Manual, and other parameters are left unchanged. ALWAYSWARM (2) executes warm start behavior regardless of the CEE Restart command. The UCM is set Active, the previous UCM mode is maintained, and other parameters are left unchanged. This parameter has no effect on inactive UCMs. Inactive UCMs always remain inactive on CEE restart unless specifically activated by a user or user-defined control strategy.
Parent Asset (PARENTASSET)	Name of the Enterprise Model Parent that includes the entity associated with this UCM in the hierarchy. The equipment that the UCM represents. If you are not implementing the Enterprise Model and previously used Areas of control, the name used for the control area will be used as the name for the Parent Asset.
Unit Text (UNITTEXT)	A unique two-character text string to identify the Sequential Control Module's "unit".
Owner Information: Project Owner Status and Command Parameters (PROJOWNRPARAMOPT)	Checked – owner RCM's status and command parameters are projected to this UCM Unchecked - owner RCM's status and command parameters are not projected to this UCM
Owner Information: Command (COMMAND)	Read-only Command sent to the RCM that owns this UCM
Owner Information: State (STATE)	Read-only State of the RCM that owns this UCM
Owner Information: Composite Phase State (COMPOSITEPHASESTS)	Read-only The most serious state of the active phases and steps

Main Tab of UCM	Description
Owner Information: Mode (MODE)	Read-only Mode of the RCM that owns this UCM
Owner Information: Mode Attribute (MODEATTR)	Read-only Mode attribute of the RCM that owns this UCM

Arbitration Tab of UCM

The Arbitration tab is used for monitoring only. The UCM's Arbitration tab parameters apply only to the UCM. The Arbitration tab contains the current owner of the UCM (active RCM) and the list of RCMs that are waiting for the UCM.

The Requests Granted list of loaded RCMs associated with the UCM includes the RCMs that are in the INACTIVE state, IDLE state, COMPLETE state, ABORTED state, and terminal STOPPED state.

Arbitration Tab of UCM	Description
Request Granted Name of the owners	Read only – name(s) of the block(s) granted to use this UCM
Requests Granted Command	Read only – command associated with the owner
Requests Granted State	Read only – state of the owner
Requests Granted Composite Phase State	Read only – composite phase state of the owner
Requests Granted Mode	Read only – mode of the owner
Requests Granted Mode Attribute	Read only – mode attribute of the owner

QVCS Tab of UCM

The QVCS tab is common to all modules in Control Builder. If you have an active Qualification and Version Control System (QVCS) license, this tab shows current QVCS information. Refer to the online help and the Qualification and Version Control System User Guide for more information about the data on this tab.

Server History Tab of UCM

Assets are configured from Server History tab. Asset is the equipment that the UCM represents.

The Server History tab of UCM lets you configure history collection and archive details for the UCM as well as provides access for creating and editing server scripts. See the Control Builder online help for more information. You can also configure this data through the Station application. For details, see
Server and Client Configuration Guide >
Understanding and Configuring Points >
History Collection and Archiving

Server Displays Tab of UCM

The Server Displays tab of the UCM lets you configure server displays for the UCM. See the Control Builder online help for more information. You can also configure this data through the Station application. For details, see
Server and Client Configuration Guide >
Understanding and Configuring Points >
Configuring Station displays for points

Control Confirmation Tab of UCM

For this Tab to function, the optional Qualification and Version Control System (QVCS) must be active.

The Control Confirmation tab of UCM provides a means of specifying electronic signature control confirmation for the UCM. This feature is part of the optional Qualification and Version Control System (QVCS), a customer defined lifecycle management option that provides capabilities for electronic signature confirmation for points and version management for all tagged objects.

When an operator performs a control action on a point for which control confirmation has been specified, a prompt is displayed to the operator to confirm control. The operator must respond "yes" before the control action is carried out or "no" to abort the command. If electronic signature has been specified in conjunction with control confirmation, the operator must enter an authorized ID and password before the action is carried out.

Since this is a Server Function, refer to
Server and Client Configuration Guide >
Configuring Electronic Signatures >
About Electronic Signatures

Control Confirmation Tab	Description
Control Confirmation (CTRLCONFIRM)	Checked = electronic signature feature is ON for the UCM Unchecked = electronic signature feature is OFF for the UCM Default = unchecked
Electronic Signature Type (NUMSIGS)	Specify the number of signatures required for control confirmation. None (0) Single (1) Double (2)
Reason Set Number (REASONSET)	Specify the meaning associated with entering the number of signatures. String of 24 characters maximum.
Secondary Signer Security Level (SECSIGSECLVL)	Choose the minimum-security level of the second signature when required. VIEWONLY (0) ACKONLY (1) OPER (2) SUPR (3) ENGR (4) MNGR (5)
Primary Signature Meaning (PRIMARYSIG)	Specify the meaning associated with entering the primary signature. String of 24 characters maximum.
Secondary Signature Meaning (SECONDARYSIG)	Specify the meaning associated with entering the secondary signature. String of 24 character maximum

Identification Tab of UCM

The Identifications tab is common to all modules in Control Builder and only appears when the optional Template license is activated. Refer to online help and Control Building Guide > Appendix C – User Templates > Using the Library Tree > Identification for more information about the data on this tab.

Dependencies tab of RCM Phase

The Dependencies tab is common to some function blocks in Control Builder. Refer to online help for more information about the data on this tab.

Projected Parameters Tab of UCM

The Projected Parameters tab is common to all modules in Control Builder. Refer to the online help and Control Building Guide > Appendix B – Hierarchy Building > Parameter Projection Overview and Using the Projected Parameters Tab for more information about the data on this tab.

Block Pins Tab of UCM

The Block Pins tab is common to all function blocks in Control Builder. For UCMs, it is applicable to viewing in the Containment View. Lets you choose the available parameters that you want to expose as input/output pins on the function Block in Control Builder. Refer to the online help for more information about the data on this tab.

Configuration Parameters Tab of UCM

The Configuration Parameters tab is common to all function blocks in Control Builder. For UCMs, it is applicable to viewing in the Containment View. Lets you choose the available parameters that you want to appear on the face of the function block in the Project tab in Control Builder. Refer to online help for more information about the data on this tab.

Monitoring Parameters Tab of UCM

The Monitoring Parameters tab is common to all function blocks in Control Builder. For UCMs, it is applicable to viewing in the Containment View. Lets you choose the available parameters that you want to appear on the face of the function block in the Monitoring tab in Control Builder. Refer to online help for more information about the data on this tab.

Block Preferences Tab of UCM

The Block Preferences tab is common to all function blocks in Control Builder. Lets you change several block-viewing preferences including the color of the block's faceplate. Refer to online help for more information about the data on this tab.

Template Defining Tab of RCM Phase

The Template Defining tab is common to all function blocks in Control Builder. Lets you define the block as a template block. Refer to online help for more information about the data on this tab.

Assigning UCM to Execution Environment

The UCM must be assigned to a CEE before it can be loaded to the controller. The UCM block resides in the ERDB, the controller database, and the server database after it is loaded to the controller and the server. Follow the steps in the table below to assign the UCM.

Step	Action	Result
1	Close all edit windows.	If all edit windows are not closed, a lock contention results.
2	Choose Edit > Execution Environment Assignment OR Click the 'Assign' button on the toolbar.	The Execution Environment Assignment window opens.
3	Click on the appropriate UCM to be assigned from the list of unassigned Modules - CMs/UCMs on the left side of the window.	Assignment Information displayed includes CEEs to which you can assign the UCM, and CMs and UCMs currently assigned to the selected CEE.
4	If your system has multiple controllers, choose the destination CEE from the 'Assign to' area.	The CEE is highlighted in the 'Assign to' area.
5	Click the 'Assign' button.	After a few seconds, UCM will appear in the section of the window labeled Assigned Modules.
6	Click Close.	UCM now appears in the Project tree under and connected to your CEE.

Configuring the UCM

Drag data blocks and other control modules into the UCM as required.

Data blocks that can be dragged into the UCM chart are:

- Custom Data Block (CDB)
- Numeric
- Numeric Array
- Flag Array
- Text Array

Other module types that can be dragged into the UCM chart are:

- Control Module (CM)
- Sequential Control Module (SCM)
- Recipe Control Module (RCM)
- Unit Control Module (UCM)

Loading UCM to the controller

Follow the steps in the table below to load your UCM. The UCM must be assigned to a CEE and all edit windows (such as UCM charts) must be closed before attempting to load.

Step	Action	Result
1	Open the Project Tree in Control Builder.	
2	Click on the UCM.	The UCM backlights.
3	Right click on the UCM and choose Load … or Click the 'Load' button on the toolbar.	A Load Dialog box appears displaying the list of modules to be loaded, its Current state, the State to Load, and the Post Load State.
4	Click the OK button.	In a few moments the load completes. If

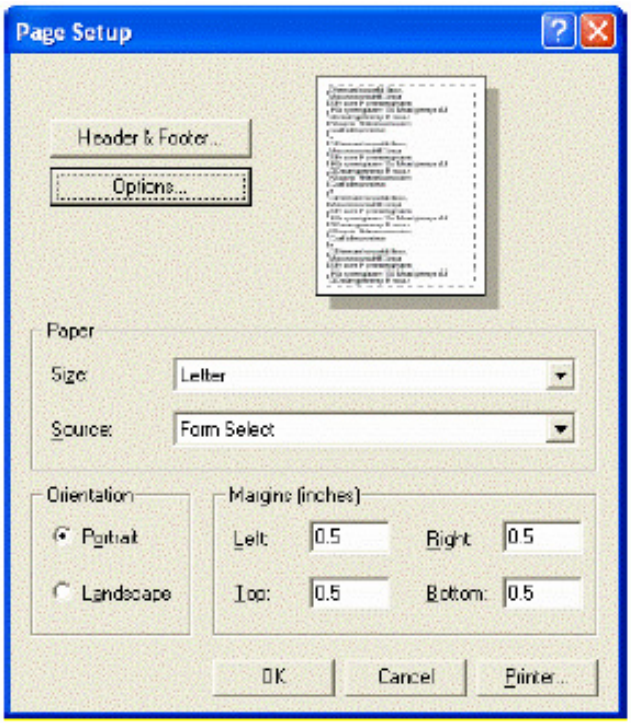
Step	Action	Result
		there are any errors, a dialog box appears with details of the problem(s).

Printing SCM/RCM charts in Control Builder

To customize the format of the SCM/RCM printout, define the Page Setup.

Printing Page Setup

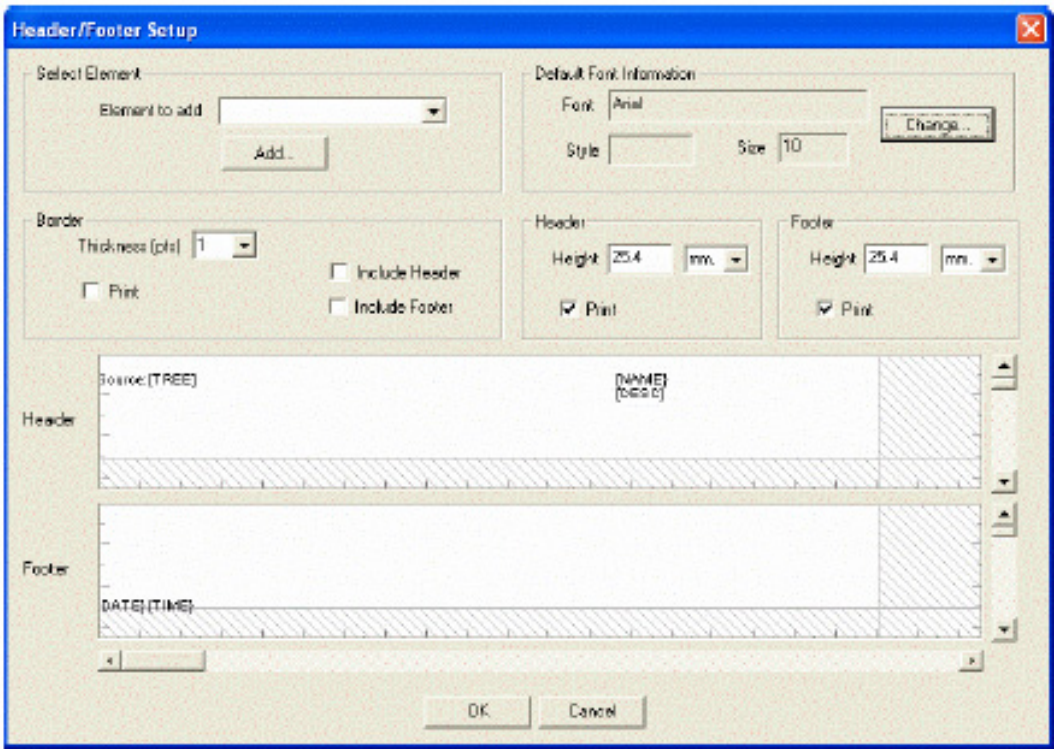
Printouts of a SCM/RCM chart can be customized with Headers, Footers, and specific requirements. These requirements are specified in the Page Setup dialogue box. To initiate the print page setup, select File > Page Setup to invoke the following window.



From this window, setup: Paper Size, Paper Source, Orientation (Portrait or Landscape), and the Margin settings for the printout.

Header & Footer Setup

To customize the Header and Footer contents, select the Header & Footer button.



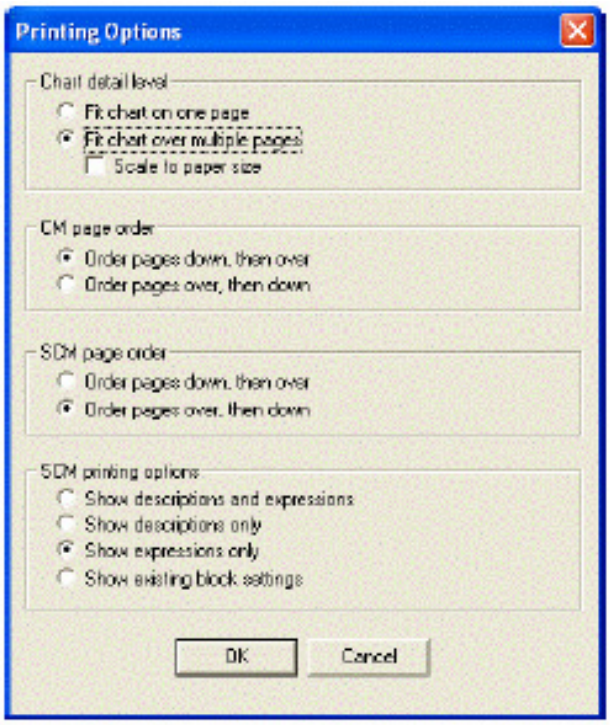
From this window, specify the following items:

Item	Description
Select Element	The Element to add pull down menu lists: Automatic text User text Line Rectangle Bitmap User text provides a way to add specific customer/project information to the header or footer. Bitmap provides a way to add a company logo to the

Item	Description
	header or footer.
Border	Thickness in points Option to print border – when checked, a border surrounds the printed chart Option to include header – when checked, the header is printed inside the border Option to include footer – when checked, the footer is printed inside the border
Default Font Information	Click the change button to modify the default font, style, and size of the text used in the header/footer.
Header height	In millimeters or inches – sets the length of the page reserved for the header Option to print – when checked, the header is printed
Footer height	In millimeters or inches – sets the length of the page reserved for the footer Option to print – when checked, the footer is printed
Header content	The header content is displayed. You can move the contents by grabbing it and moving to the desired location in the header.
Footer content	The footer content is displayed. You can move the contents by grabbing it and moving to the desired location in the header. Note: Date and Time are date and time the SCM/RCM is printed.

Printing Options

Clicking on the Options button invokes



Choose the Printing Options as required for your project.

Printing

In Control Builder, the SCM/RCM chart print options are as follows:

To print …	Action
Chart currently open in CB	Ctrl+P
Project tree chart(s)	Highlight chart(s) to be printed, choose 1. File>Print>Charts from the menu or 2. Ctrl+P
Monitor tree chart(s)	Highlight chart(s) to be printed, choose 1. File>Print>Charts from the menu or 2. Ctrl+P
All Project tree charts	File > Print > All Project Tree Charts
All Monitoring tree charts	File > Print > All Monitoring Tree Charts
Instructions for Chart currently open in CB	1. File>Print>Instructions for Current Chart or 2. Ctrl+I
Instructions for All Project tree charts	File>Print>Instructions for All Project Tree Charts
Instructions for All Monitoring tree charts	File>Print>Instructions for all Monitoring Tree Charts

A chart prints at the same size scale specified for its display as selected by the drop down scale factor on the Control Builder tool bar. The chart print scale size does not change the scale of the header or footer or any information in the header and footer.

If the All Project Tree Charts or All Monitoring Tree Charts print option is selected, all of the charts are printed at 100%. The choices for scale are 500%, 300%, 200%, 150%, 120%, 100%, 80%, 50%, and 20%.

Delete an SCM/RCM

The loaded SCM/RCM exists in two databases, the controller database and the engineering database. The Monitoring Tree Window of Control Builder represents the controller database. The Project View of Control Builder represents the engineering database.

To delete an SCM/RCM, the delete action must take place both from the Monitoring View and from the Project View. If the SCM/RCM is just deleted from the Monitoring View, it will not be deleted from the engineering database.

Delete an SCM/RCM is a three step process.

Step	Action
1	Set SCM/RCM to Inactive.
2	Delete SCM/RCM from controller database.
3	Delete SCM/RCM from Engineering database.

Set SCM/RCM to Inactive

To transition an SCM/RCM from its Running state to its Inactive state, several steps are required:

Step	Action
1	In the Monitoring Tree, right click on the SCM/RCM to be made Inactive, choose Inactivate>Selected Item. Or Select the SCM/RCM in the Monitoring Tree then choose the Inactivate/Activatate icon from the tool bar. A dialog box displays module to be set Inactive. Click on OK to make the SCM/RCM inactive.
2	If the SCM/RCM does not go to the Inactive state and the SCM/RCM's Invoke Transition is not blank, the SCM/RCM Invoke Transition must be forced off. With the SCM/RCM chart open, ensure all conditions in the Invoke Transition are forced off when the Invoke Transition is an OR block. Abort and reset the SCM/RCM to force it into Idle. Then set the SCM/RCM to Inactive by the method described in Step 1.

Delete SCM/RCM from the controller database

Follow the steps in the table below to inactivate an SCM/RCM and then delete the SCM/RCM from the controller.

Step	Action
1	Set up Control Builder with the Monitoring Tree Window visible.
2	Double-click the SCM/RCM (you wish to delete) to open the SCM/RCM.
3	If the Invoke transition is blank, skip steps 4-8. Otherwise, the initial transition of the SCM/RCM must be forced off.
4	Double-click the Invoke (initial) transition to display the Parameters Configuration form.
5	From the Cond#1 Tab of the Parameters Configuration form: Click Force Permit. When asked, "Change Online Value?" click YES. Set Force Request equal to TOOFF.
6	Click OK.
7	For each condition of the Invoke Transition, repeat steps 4-6.
8	To abort the SCM/RCM, open the Status Tab and choose Abort from the Command list.
9	To set the SCM/RCM to idle, open the Status Tab and choose Reset from the Command list.
10	To set the SCM/RCM inactive, click on the Active/Inactive.
11	Close the SCM/RCM.
12	Choose the SCM/RCM you wish to delete.
13	From the Edit Menu, click Delete. Alternate method: Press the <Delete> key.
14	Click Delete Selected Objects to delete the SCM/RCM. The deleted SCM/RCM will no longer appear in the Monitoring Tree Window.

Delete SCM/RCM from the Engineering database

Follow the steps in the table below to delete a SCM/RCM from the "engineering database" or the Project Tree Window.

Step	Action
1	Set up the Control Builder with the Project Tree Window visible and click the SCM/RCM you wish to delete. The SCM/RCM must be closed first before deleting.
2	Click Edit > Delete. Alternate method: Press the <Delete> key.
3	Click Delete Selected Objects to delete the SCM/RCM.

Configure Control Module as Level 1 device

To enable a relationship between an SCM and a CM that is more than monitoring CM parameters in the conditions of a Transition block or changing the value of a CM parameter in the output of a Step block, complete the following:

Step	Action
1	Bind the CM to the SCM
2	Configure the RegCtl and/or DevCtl Function Block’s SCM Parameters tab.
3	Configure SCM Step Output to change DevCtl during time that Step is Active.

Bind CM to SCM

To bind a CM to an SCM, set the SCM option on the CM's Main Parameters tab to FIXED and enter the name of the SCM being bound to the CM into the SCM Name parameter.

When this connection is made between the CM and the SCM, the CM fetches the SCM state, active step, and mode every scan.

CM Parameter (Main Parameters Tab)	Description
SCM Option (SCMOPT)	Specifies the relationship of the Control Module and its contained devices SCMs. None (0) (Default) Fixed (1) Dynamic (2) (Dynamic is reserved for future development)
SCM Name (SCMNAME)	The block designated by SCMNAME is the SCM associated with the CM. SCM Name is configurable on CM's Main Parameters tab. It identifies the related SCM and it cannot be changed on-line. This entry is not required if SCMOPT selection is None.

Configuring Regulatory Control / Device Control SCM Parameters Tab

RegCtl/DevCtl function blocks have an SCM Parameters tab that contains the parameters related to this functionality.

Parameter (SCM Parameters Tab)	Description
RegCtl/DevCtl Mode Tracking (MODETRACK)	Specifies when the operator can take over control of the device from the SCM. Mode Tracking is used to determine the state of RegCtl/DevCtl's Mode Attribute based upon the Mode and state transitions of the monitored SCM. **Options**: **NONE**: No Tracking If SCM Mode changes from Man to Auto, Semi, or SStep, CM's Mode Attribute is not changed. If SCM Mode changes back to Man, No action is taken

Parameter (SCM Parameters Tab)	Description
	ONESHOT: One Shot Tracking (Default) If SCM Mode changes from Man to Auto, Semi, or SStep, OR SCMState changes from Idle to Running, then CM's Mode Attribute is set to Program and can be changed by the operator. If SCM Mode changes back to Man, Mode Attribute is returned to Operator. **SEMICONT**: Semi-Continuous Tracking If SCM Mode changes from Man to Auto, Semi, or SStep, OR SCMState changes from Idle to Running, OR SCM Active Step changes while SCMMode=Auto, then CM's Mode Attribute is set to Program and can be changed by the operator. If SCM Mode changes back to Man, Mode Attribute is returned to Operator. **CONTRTN**: Continuous Tracking with Return If SCM Mode changes from Man to Auto, Semi, or SStep, OR SCMState changes from Idle to Running, then Mode Attribute is set to Program and **cannot** be changed by the operator. If SCM Mode changes back to Man, Mode Attribute is returned to Operator. **CONT**: Continuous Tracking If SCM Mode changes from Man to Auto, Semi, or SStep, then the Mode Attribute is set to Program and **cannot** be changed by the operator as long as the SCMMode=Auto. If SCM Mode changes back to Man, Mode Attribute is not changed, but the operator can overwrite it.
RegCtl Start State Option (STARTOPT)	Specifies the action a RegCtl block executes when the SCM state is Checking, Idle, or Complete. **Options**: **NONE**: No action is taken (Default) **MAN**: Manual Control (MODEREQ = MANUAL) **AUTO**: Automatic Control (MODEREQ = AUTO) **CAS**: Cascade Control (MODEREQ = CASCADE) **FIXEDOP**: Fixed Output (OPREQ = STARTVAL) **HOLDPV**: Hold the Process Variable (SPREQ = PV)

Parameter (SCM Parameters Tab)	Description
	FIXEDSP: Fixed Set Point (SPREQ = STARTVAL and SPRATEREQ = NaN) **RAMPEDSP**: Ramped Set Point (SPTVREQ = STARTVAL and SPRATEREQ = STARTRATE) Notes: HOLDPV, FIXEDSP, and RAMPEDSP selections do not apply for OVRDSEL blocks. FIXEDOP selection does not apply for the POSPROP block.
RegCtl Stop State Option (STOPOPT)	Stop/Abort State Option specifies the resulting action when the SCM state is Stopping/Aborting or Stopped/Aborted. **Options**: **NONE**: No action is taken (Default) **MAN**: Manual Control (MODEREQ = MANUAL) **AUTO**: Automatic Control (MODEREQ = AUTO) **CAS**: Cascade Control (MODEREQ = CASCADE) **FIXEDOP**: Fixed Output (OPREQ = STOPVAL) **HOLDPV**: Hold the Process Variable (SPREQ = PV) **FIXEDSP**: Fixed Set Point (SPREQ = STOPVAL and SPRATEREQ = NaN) **RAMPEDSP**: Ramped Set Point (SPTVREQ = STOPVAL and SPRATEREQ = STOPRATE) Notes: Stop/Abort State Option should be disabled when sequencing actions are required as part of the SCM. In this case, the Stop and Abort Handler should be executed as part of the SCM. The Stop State Option may be disabled by the SCM. HOLDPV, FIXEDSP, and RAMPEDSP selections do not apply for OVRDSEL blocks.

Parameter (SCM Parameters Tab)	Description
	FIXEDOP selection does not apply for the POSPROP block.
RegCtl Hold State Option (HOLDOPT)	Specifies the resulting action when the SCM is Holding/Held. **Options**: **NONE**: No action is taken (Default) **MAN**: Manual Control (MODEREQ = MANUAL) **AUTO**: Automatic Control (MODEREQ = AUTOMATIC) **CAS**: Cascade Control (MODEREQ = CASCADE) **FIXEDOP**: Fixed Output (OPREQ = HOLDVAL) **HOLDPV**: Hold the Process Variable (SPREQ = PV) **FIXEDSP**: Fixed Set Point (SPREQ = HOLDVAL and SPRATEREQ = NaN) **RAMPEDSP**: Ramped Set Point (SPTVREQ = HOLDVAL and SPRATEREQ = HOLDRATE) Note: The Hold State Option should be disabled when sequencing actions are required as part of Hold handling. In this case, the Hold Handler should be executed as a part of the SCM. The Hold State Option may be disabled by the SCM. Hold PV, Fixed SP, and Ramped SP selections do not apply for OVRDSEL blocks. Fixed Op selection does not apply for the POSPROP block.
RegCtl Restart State Option (RESTARTOPT)	Specifies the resulting action when the SCM state is either Restart or Running. **Options**: **NONE**: No action is taken. If state changes were desired, a separate RESTART Handler would use SCM Step Outputs to command the block. **LASTREQ**: Running in the last requested mode. Depends on value of LASTOPTYPE as follows:

Parameter (SCM Parameters Tab)	Description
	If LASTOPTYPE = Type Set, the values of LASTOPREQ and LASTOPTYPE are used to set OPREQ and OPTYPE. If LASTOPTYPE is Default, the DEVCTL block sets OPREQ to SAFEOP and OPTYPE is set to Default. Note: The values of LASTOPREQ and LASTOPTYPE are displayed whenever SCMSTATE is in an abnormal state and the Restart State Option is LASTREQ.
DevCtl Start State Option (STARTOPT)	Specifies the resulting action when the SCM state is Checking, Idle, or Complete. **Options** **NONE**: No action is taken with the following exception: If the Requested Output Option (OPTYPE) is Not Stored, then the Requested Output State (OPREQ) is set to the configured Safe Output State (SAFEOP) and OPTYPE is set to the default value NONE. **SAFEOP**: Requested Output State (OPREQ) is automatically set to the configured Safe Output State (SAFEOP) and the Requested Output Option (OPTYPE) is set to the default value NONE.
DevCtl Stop/Abort State Option (STOPOPT)	Specifies the resulting action when the SCM state is Stopping, Stopped, Abort, or Aborting. **Options**: **NONE**: No action is taken (with the following exception): If the Requested Output Option (OPTYPE) is Not Stored, then the Requested Output State (OPREQ) is set to the configured Safe Output State (SAFEOP) and OPTYPE is set to the default value (that is, NONE). **SAFEOP**: Requested Output State (OPREQ) is automatically set to the configured Safe Output State (SAFEOP) and the Requested Output Option (OPTYPE) is set to the default value (that is, NONE). Notes: The Stop/Abort State Option should be disabled when

Parameter (SCM Parameters Tab)	Description
	sequencing actions are required as part of Stopping or Aborting. In this case, a Stop or Abort handler should be executed as part of the SCM. The SCM can also disable the Stop/Abort State Option.
DevCtl Hold State Option (HOLDOPT)	Specifies the resulting action when the SCM status is Holding or Held. **Options**: **NONE**: No action is taken with the following exception: If the Requested Output Option (OPTYPE) is Not Stored, then the Requested Output State (OPREQ) is set to the configured Safe Output State (SAFEOP) and OPTYPE is set to the default value (that is, NONE). **SAFEOP**: Requested Output State (OPREQ) is automatically set to the configured Safe Output State (SAFEOP) and the Requested Output Option (OPTYPE) is set to the default value (that is, NONE). Notes: The Hold State Option should be disabled when sequencing actions are required as part of Hold Handling. In this case, a Hold handler should be executed as part of the SCM. The SCM can also disable the Hold State Option.
DevCtl Restart State Option (RESTARTOPT)	Specifies the resulting action when the SCM status returns to Restart or Running. **Options:** **NONE**: No action is taken by the DEVCTL block -- in this case, if state changes are desired, a separate RESTART Handler sequence would use SCM Step Outputs to command the DEVCTL block **LASTREQ**: Depends on value of LASTOPTYPE as follows: LASTOPTYPE = Set (1), then OPREQ = LASTOPREQ and OPTYPE = LASTOPTYPE (Set). LASTOPTYPE = Not Stored (2) AND LASTSTEP = ASTEPID, then OPREQ = LASTOPREQ and OPTYPE =

Parameter (SCM Parameters Tab)	Description
	LASTOPTYPE (Not Stored). LASTOPTYPE = Not Stored (2) AND LASTSTEP ≠ ASTEPID, then OPREQ = SAFEOP and OPTYPE = Default. If LASTOPTYPE = Default (3), OPREQ = SAFEOP and OPTYPE = Default. The values of LASTOPREQ and LASTOPTYPE are displayed whenever SCMSTATE is in an abnormal state and the Restart State Option is LASTREQ.

Configuring SCM Step Output Type to change DevCtl

When configuring a Step Output, there is an option of output TYPE that can be set to NULL, SET, or NOTSTORED.

When the Step's Output is changing the state of the DevCtl Block and the output TYPE is NOTSTORED, the output state of the DevCTL block changes and then returns to its safe state upon completion of the Step.

Example: Configuring a Level 1 Device

This specific example is for DevCtl, but the general principle applies to both RegCtl and DevCtl.

Configure the CM

To make CM123 a Level 1 Device:

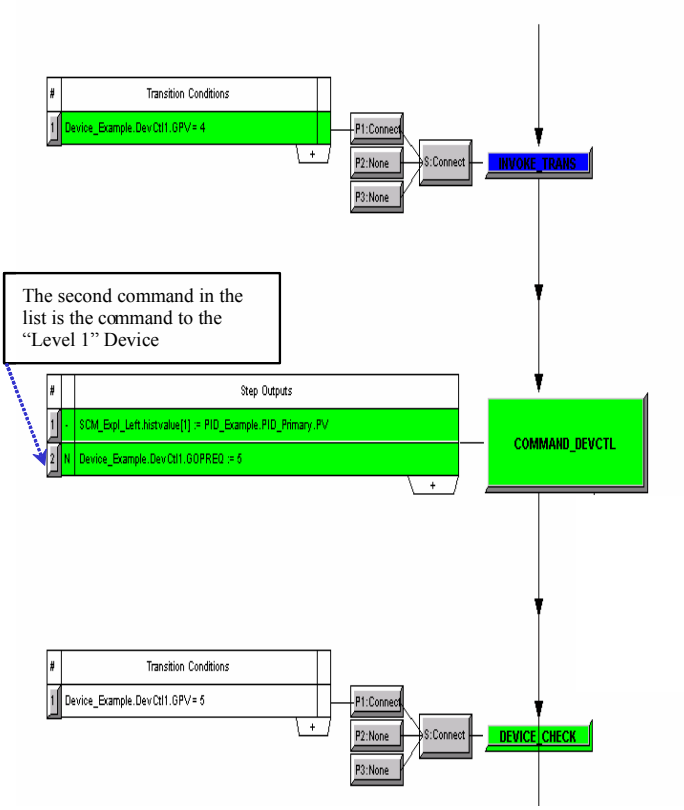
Step	Action
1	Set CM123.SCMOPT = Fixed.
2	Identify the SCM that will drive CM123's function blocks.
3	For a RegCtl function block in CM123, configure the SCM tab as previously described.
4	For a DevCtl function block in CM123, configure the SCM tab as previously described.

Configure the SCM Step Output

To use a Level 1 Device in the Step Output of a SCM:

Step	Action
1	Set the Output Type to SET or NotStored (When NotStored is selected for a DevCtl, the request is asserted only while the SCM Step is Active. The device returns to SAFEOP when the SCM Step changes.)
2	In the expression, use xxREQ parameter instead of xx (e.g. SPREQ, OPREQ, GOPREQ, etc.) After the proper expression is entered, the Step Output will be configured automatically as multiple and OP[i].DSTNCTRLREQ connection to device CONTROLREQ will occur.

Note: Only one Control Request per device per Step is supported.



Level 1 Device Control Sample

Operating SCM/RCM

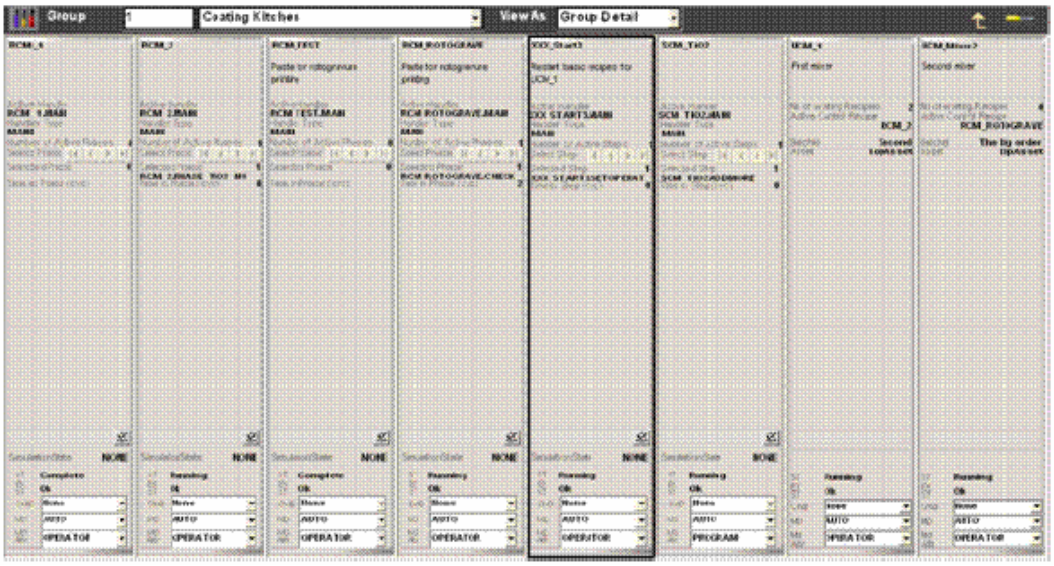
An SCM/RCM that has been configured and loaded to the controller can be monitored and operated from Station and from Control Builder.

Station is the primary operator tool used to monitor SCM/RCM execution and interact with the SCM/RCM as required. To monitor and operate the running SCM/RCM in Station, invoke the point detail display of the SCM/RCM then select the Chart or Table View tab for SCM or the Active Recipe tab in UCM default display. Table View has two formats for displaying the running SCM/RCM Summary: List or Flow.

Control Builder is primarily an engineering tool used during SCM/RCM configuration and startup. Control Builder has two tabs that contain a list of SCMs/RCMs: Project and Monitoring. Project tab contains all the SCMs/RCMs that have been configured for your system. Opening an SCM/RCM from the Project tab, displays the SCM/RCM configuration. Opening an SCM/RCM from the Monitoring tab, invokes the SCM/RCM that is loaded to and running in the CEE or ACE. The running SCM/RCM is viewable in Control Builder as Chart view or Table view. Chart view is a dynamic graphical representation of the SCM/RCM's transition, step, and phase blocks with colors indicating execution activity. Table View is a dynamic representation that shows the SCM/RCM's transitions, steps, and phases in either a list format or a flow format with colors indicating execution activity.

SCM/RCM Group Display in Station

A group display can be used to monitor the recipe execution in multiple units that are represented by the UCMs, which are showing the information for the RCM that is using the unit at that moment. The group display can be used to show selected RCMs and SCMs.

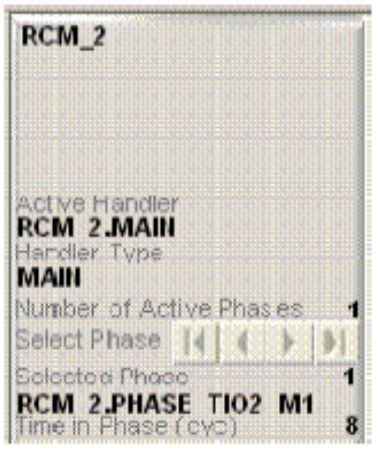


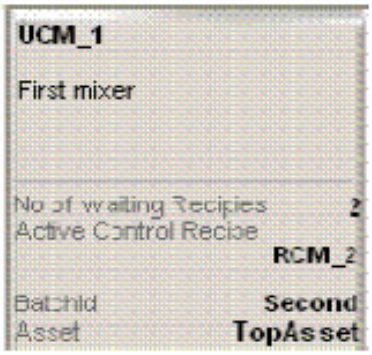
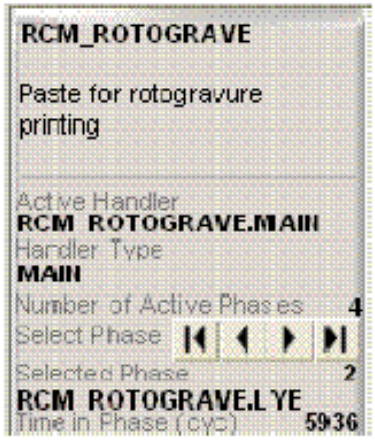
Display Navigation

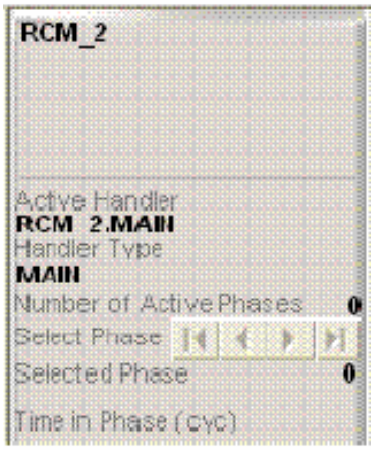
Double clicking on the faceplate opens the detailed display for the selected tag with the exception of the UCM faceplate, which is representing both itself and the RCM that has acquired the UCM at the moment. If you double click on line “Number of Waiting Recipes” or any line above it, the UCM detail display is opened. All lines below that line are parameters that the UCM reflects from the RCM. If you double click on any of those lines, the RCM detail display is opened.

Summary Information

From this group display you can observe the following

Display portion	Description
	RCM_2 is executing phase TiO2_M1 in Main handler to dose titan oxide into mixer 1. The execution has been going on for 8 cycles. With 500 ms execution rate this represents 4 seconds.
	SCM_TiO2 is used to implement the phase logic for phase TiO2_M1. It has just started to execute the step AddMore.
	RCM_2 has acquired the UCM_1 as long as the recipe is active in the Mixer 1. There are two other RCMs that are waiting to use Mixer 1, once RCM_2 has

Display portion	Description
	released UCM_1.
	RCM_Rotograve has been 5936 cycles (2968 seconds, around 50 minutes) in phase Lye, which is second of 4 parallel phases. By clicking on the First, Previous, Next, and Last buttons, you can identify the names of the other parallel phase names and the time how long they have been active.
	Once RCM_2 is complete, there are no active phases in the recipe.

Display portion	Description
	
	Once there are no RCM requiring the UCM_1, the BatchID and Asset Name fields will be empty.

Monitoring SCM/RCM in Table View

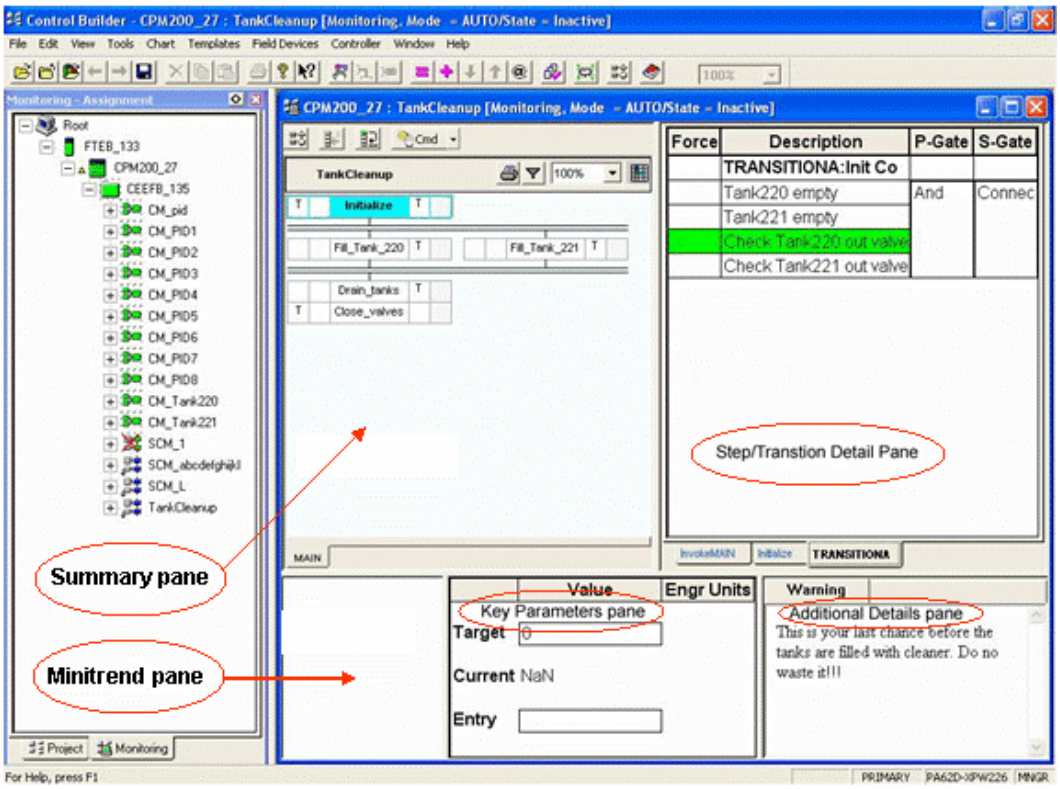
Table View is the primary display for monitoring and operating an SCM/RCM. Table View is available in Station and Control Builder.

SCM/RCM Table View panes

SCM/RCM Table View display consists of five panes:

- SCM/RCM **Summary pane** displaying SCM/RCM in List or Flow format
- SCM/RCM **Details pane** displaying step outputs, phase formula and report parameters, or transition conditions associated with the item selected in the Summary pane
- **Additional Details pane** displaying Notes, Instructions, Warnings, Comments, and/or Expression associated with item selected in Details pane
- **Key Parameters pane** displaying Target value, Current value, Entry value of item selected in Details pane
- **Minitrend pane** displaying trended values associated with item selected in Summary pane

All operator changes made using the SCM/RCM Table View are recorded in the Operator Change journal.



SCM Table View

SCM/RCM Table View Summary Pane

The Summary pane is located in the upper left portion of the Table View display. It can contain the SCM/RCM in two forms: List or Flow.

SCM/RCM Toolbars

The Summary pane toolbar contains the following buttons:

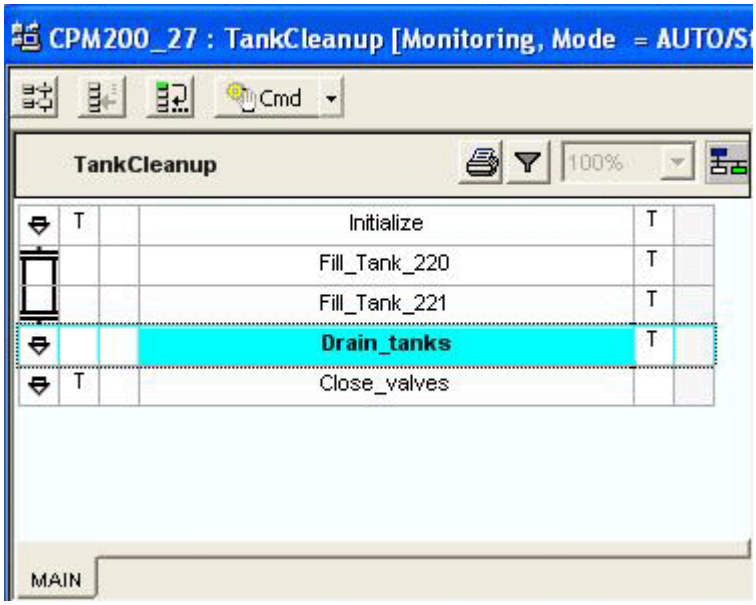
Button	Function
 in Control Builder toolbar only	In Control Builder,  navigates the display to Chart view; hitting F8 returns the display back to Table View. When an SCM/RCM is initially opened, it opens in Chart view. To change to Table View, select the identical icon located in the toolbar at the top of Control Builder. Right clicking on an SCM/RCM will directly open the selected module in Table View.
 and 	Enables/Disables Automatic Tracking and selection of the active Step Unlit button – Tracking = Off Lit button – Tracking = On Clicking on the button toggles between the two states
	Used in the GoTo Step action. When this is selected, a warning appears to let the user know that the SCM/RCM will be placed in to SingleStep mode before the GoTo dialog box appears. Enables jumping from the current active step/phase to a new active step/phase. The number of active paths cannot be expanded with the GoTo Step command. If fewer target blocks are required than those in the current blocks, some of the target blocks can be left empty. GoTo allows you to reach an illegal situation that can cause an error in the SCM/RCM. The user must have Engineer/Manager level access to execute a GoTo command. For additional details on using the GoTo button, read the section ‘Starting Execution of a different SCM step’.
 Cmd	Used to Command the SCM/RCM (Start, Hold, Abort, etc.) These are the same commands that are available in the faceplate.

SCM/RCM Table View colors

The step box colors apply to both Table View – List and Table View – Flow.

Table View When the Step box's color is	The step …
Outlined in Cyan	Is currently selected
Green highlighted	Is currently the active Step
Blue	Finished execution and moved to the next Step
Teal	Finished execution but not yet moved to the next Step (Waiting for trailing Transition conditions to be true.)
Magenta	Some outputs were not completed when the Step was left.

SCM/RCM Table View – List in Summary pane



SCM Summary in List view

The summary pane of the SCM/RCM Table View - List provides the following information and buttons.

Table View Summary in List view	Description
Tabs at bottom of Summary pane	Each tab is associated with a Handler of the SCM/RCM. Clicking on the tab will bring that Handler to the forefront of the display.
Row 1 –SCM/RCM Name	SCM/RCM Name Appears in Bold 
Row 1 - 	Alarm icon appears next to Name when the SCM/RCM is in alarm
Row 1 - 	Print the selected portion of the Summary Pane and the SCM/RCM. Invokes the following print options window. Select one or more steps to be printed. Check appropriate print options. 

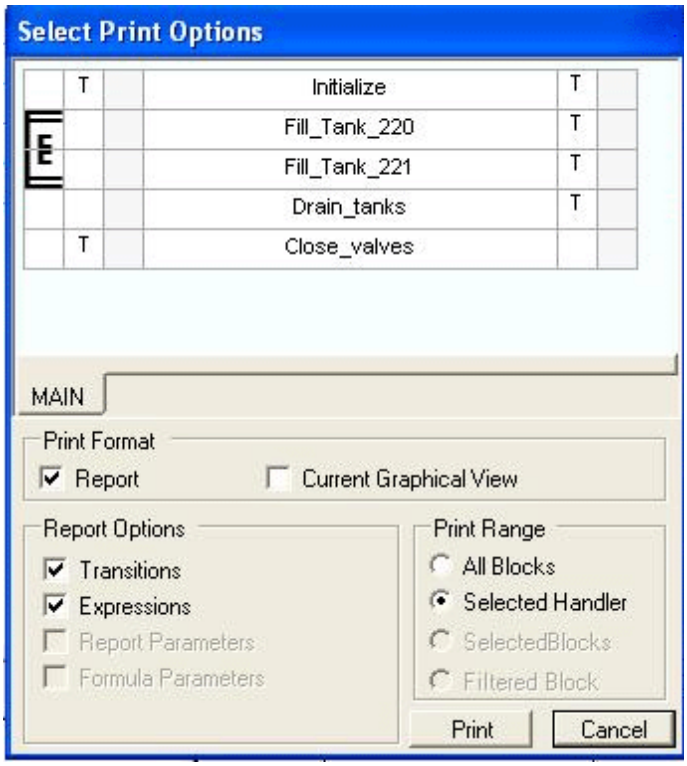
Table View Summary in List view	Description
	
Row 1 - 	Invokes the following Filter window to reduce the number of items shown in the Summary Pane and control how the details are shown.  Allows the user the ability to select the items to be viewed in the Summary pane.

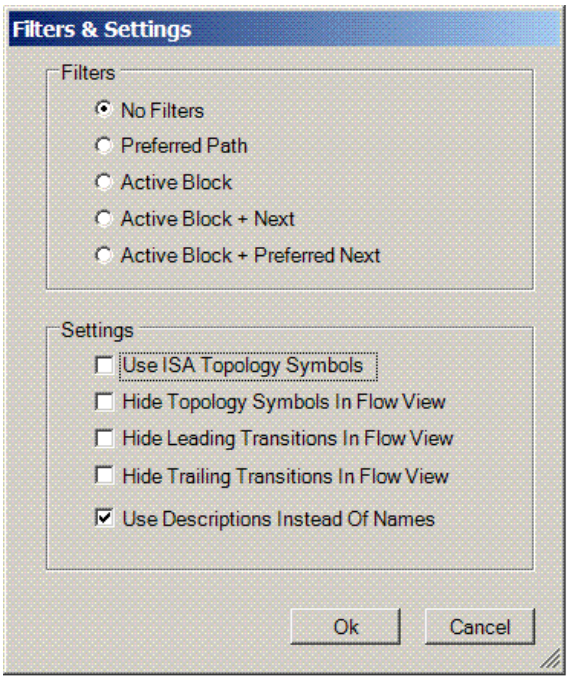
Table View Summary in List view	Description
	
Row 1 - 	Toggle between Flow View and List View presentation in the Summary Pane. This icon appears only when the Summary pane is in List view. Selecting this icon, changes the Table View Summary to Flow 
Rows 2 through N Column 1 – Topology Symbol	This column is populated with either ISA or Honeywell topology symbols.

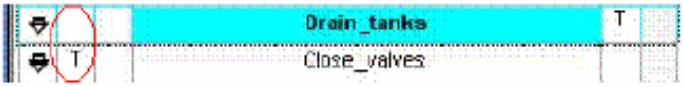
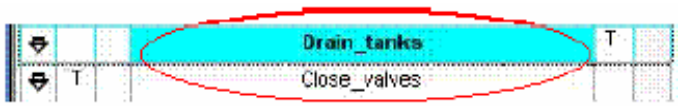
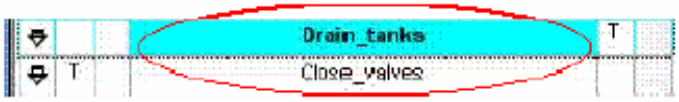
Table View Summary in List view	Description
	 When the 'Use ISA Topology Symbols' is selected, ISA Topology symbols are displayed. These topology symbols indicate the boundaries between serial steps in parallel paths. If an SCM/RCM has branch outs or sync blocks then topology symbols appear to the left of the step name. When the 'Use ISA Topology Symbols' is **not** selected, the Honeywell topology symbols are displayed. Refer to the Topology Symbol Set Enumeration Table for an explanation of the symbols.
Rows 2 through N Column 2 - Leading Transition	When a transition leads the Step, a 'T' appears in column 2.  Status of the Transition is indicated by color of the box: White – Transition is not yet active or complete Light green – at least one of the transitions is evaluated Red – an error exists in one of the transitions
Rows 2 through N Column 3 - Step Execution status	Execution status is indicated by the color that appears in this block.  White – step/phase is not yet started Green – step/phase is executing Teal – step/phase complete, waiting for trailing transition Dark blue – step/phase has been executed Yellow – step/phase execution has started and warning exists Red – step/phase execution has started and error exists

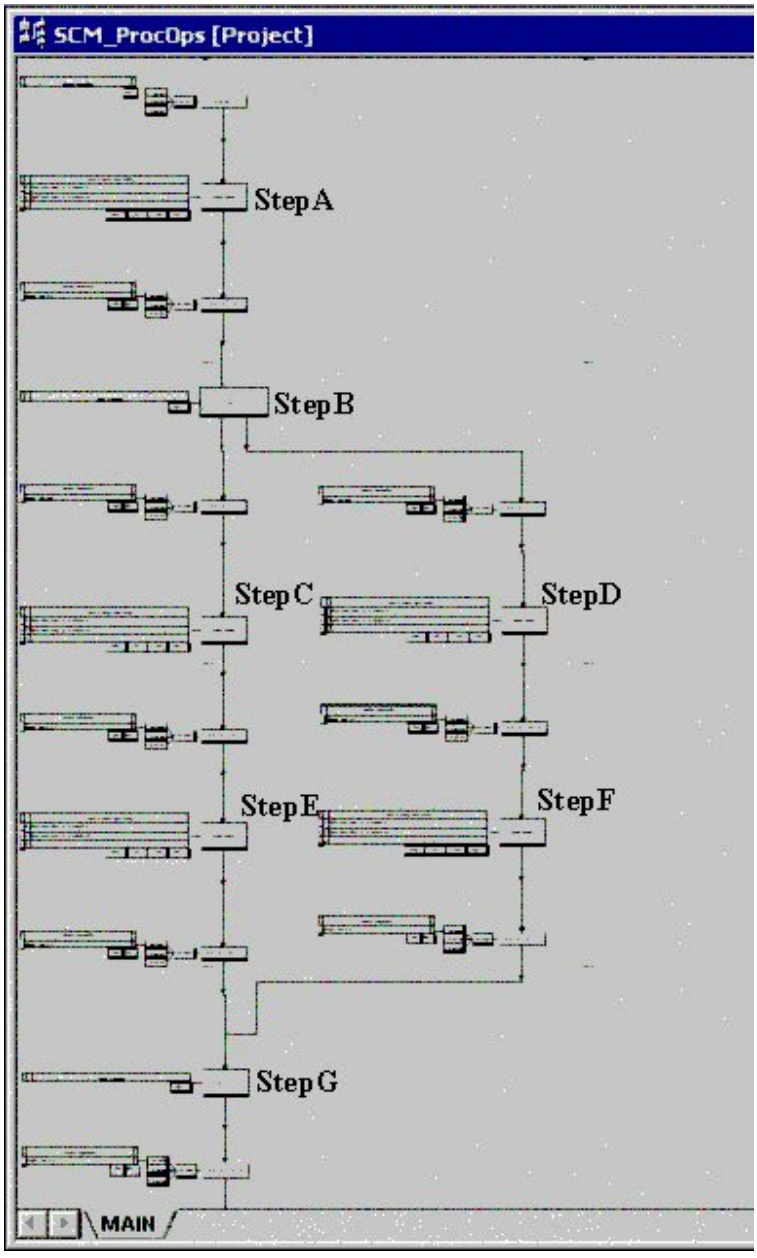
Table View Summary in List view	Description
Rows 2 through N Column 4- Step Name	The order of Steps in the list is determined by the configured SCM/RCM and cannot be modified during operation. 
Rows 2 through N Column 5 - Trailing Transition	When a transition trails the Step, a 'T' appears in column 5.  Status of the Transition is indicated by color of the box: White – Transition is not yet active or complete Light green – at least one of the transitions is evaluated Red – an error exists in one of the transitions
Rows 2 through N Column 6 - Step indicator	 No active error or message - Blank Executing step has an output error or failure -  Step has begun execution and has a pending confirmable instruction - 

SCM/RCM Table View – List Step order

Steps in Table View – List are in order of most likely execution, based on the assumption that the left-most path at branching points is the most common path. Steps for all possible paths are shown, though only one path is selected when the SCM/RCM executes.

The SCM/RCM chart view shows a Sequence Function Chart view representation of an SCM/RCM configuration that consists of seven Steps: StepA, StepB, StepC, StepD, StepE, StepF, and StepG. The two Transitions after StepB make a choice between one of two paths. For this example SCM/RCM, the SCM/RCM Table View Summary – List view will show the Steps in the following order.

StepA
StepB
StepC
StepE
StepD
StepF
StepG



Step Order in List view

SCM/RCM Table View – Flow in Summary pane

The Summary pane in Flow view provides a graphical representation of all steps, phases, SYNC blocks, and paths of the SCM/RCM.

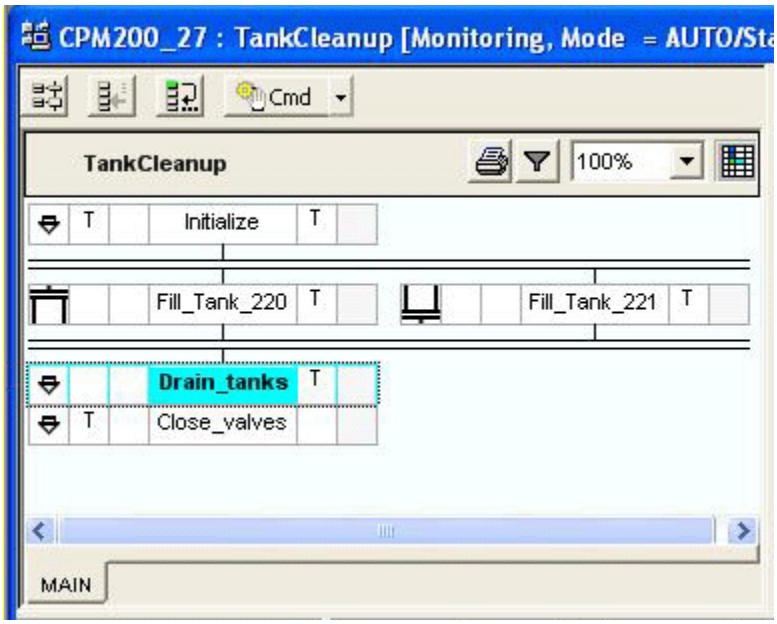


Table View Summary in Flow view

The summary pane of the SCM/RCM Table View - Flow provides the following information and buttons.

Table View Summary - Flow view	Description
Tabs at bottom of summary pane	Each tab is associated with a Handler of the SCM/RCM. Clicking on the tab will bring that Handler to the forefront of the display.
Row 1 –SCM/RCM Name	SCM/RCM Name Appears in Bold
Row 1 - 🔔	Alarm icon appears next to Name when the SCM/RCM is in alarm

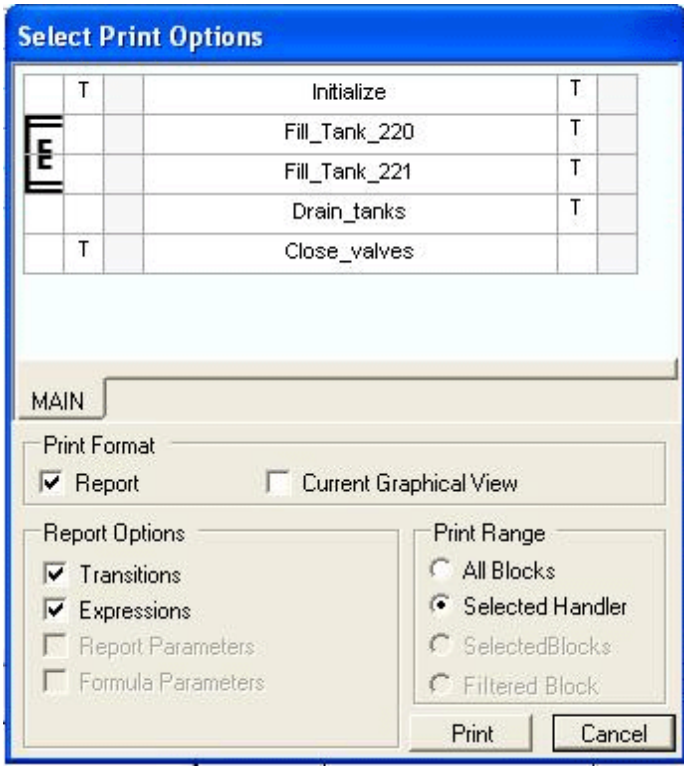
Table View Summary - Flow view	Description
Row 1 - 	Invokes the following print options window. Select one or more steps to be printed. Check appropriate print options. 
Row 1 - 	Invokes the following Filter window. Allows the user the ability to select the items to be viewed in the Table View.

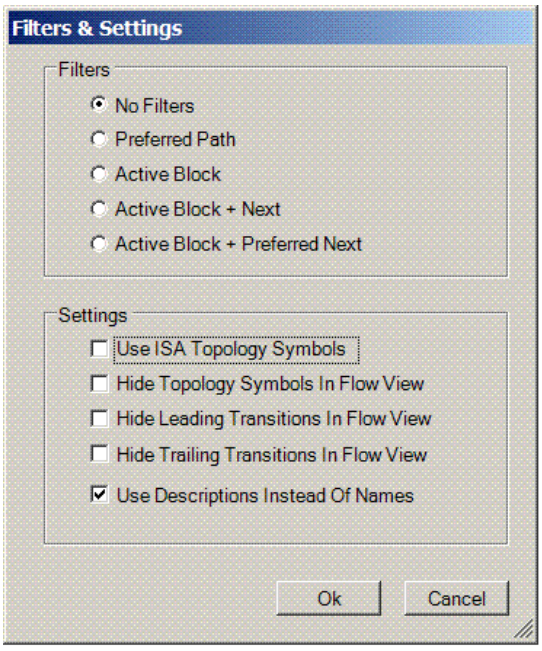
Table View Summary - Flow view	Description
	
	Zoom selects the desired percentage for viewing. Default is 100%. This is useful in instances where there is a very long SCM/RCM. An SCM/RCM displayed at 50% view could provide the operator with a glimpse of the entire sequence with indications and color changes associated with its execution.
	Appears only when the Summary pane is in Table View – Flow. Selecting this icon, changes the Summary pane to Table View - List.
Flow of Steps/Phase arrangement	The SCM/RCM is displayed in a view that provides a representation of parallel paths and synchronization blocks. Table View – Flow provides a clear view of the paths of the SCM/RCM. Each step has six columns providing information for that step.

Table View Summary - Flow view	Description
Column 1 of Step/Phase – Topology Symbol	Column 1 is fully populated when the filter for 'Hide Topology Symbols in Flow View' is deselected in the filter option. When the filter is not selected, simple topologies are displayed. The topology symbols indicate the boundaries between serial steps in parallel paths. If an SCM/RCM has branch outs or sync blocks then topology symbols appear to the left of the step name. Refer to the Topology Symbol Set Enumeration Table for an explanation of the symbols.
Column 2 of Step/Phase – Leading Transition	Column 2 is populated when the filter option 'Hide leading transitions in Flow view' is deselected. When option is deselected and a transition precedes the Step, a 'T' appears in column 2. Status of the Transition is indicated by color of the box: White – Transition is not yet active or complete Light green – at least one of the transitions is evaluated Red – an error exists in one of the transitions
Column 3 of Step/Phase – Status	Execution status of the Step/Phase is indicated by the color that appears in this block. White – step/phase is not yet started Green – step/phase is executing Teal – step/phase complete, waiting for trailing transition Dark blue – step/phase has been executed Yellow – step/phase execution has started and warning exists Red – step/phase execution has started and error exists
Column 4 of Step/Phase – Name	The name of the Step/Phase is listed in this column.
Column 5 of Step/Phase – Trailing Transition	Column 5 is populated when the filter option 'Hide trailing transitions in Flow view' is deselected. When option is deselected and a transition trails the Step, a 'T' appears in column 5. Status of the Transition is indicated by color of the box: White – Transition is not yet active or complete Light green – at least one of the transitions is evaluated Red – an error exists in one of the transitions

Table View Summary - Flow view	Description
Column 6 of Step/Phase - Indicator	No active error or message - Blank Executing step has an output error or failure -  Step has begun execution and has a pending confirmable instruction - 

SCM/RCM Table View - Topology Symbols

A topology symbol associated with each Step of the SCM/RCM can be analyzed in a way where the steps are identified as a

- Start
- End
- Sequence
- Conditional
- Parallel path

The symbol either describes a step outside of a section or it contains two parts. The first part indicates the branching and the second part indicates the sequencing.

Topology Symbol Set Enumeration

Table View ISA Symbols	Table View Honeywell Symbol	Description
	Blank	Basic sequence outside of the sections
		Beginning of a parallel sequence on left
		Beginning of a parallel sequence on left when inside a nested structure

Table View ISA Symbols	Table View Honeywell Symbol	Description
		Beginning of a single action parallel sequence on left
		Beginning of a single action parallel sequence on left when inside a nested structure
		Beginning of a sequence in a middle path
		Continue a sequence
		End of a sequence in a middle path
		Single action sequence in a middle path
		End of a single action parallel sequence on right when inside a nested structure
		End of a single action parallel sequence on right
		End of a parallel sequence on right when inside a nested structure
		End of a parallel sequence on right
		Beginning of an alternative sequence on left

Table View ISA Symbols	Table View Honeywell Symbol	Description
		Beginning of an alternative sequence on left when inside a nested structure
		Beginning of an alternative single action parallel sequence on left
		Beginning of an alternative single action alternative sequence on left when inside a nested structure
		End of an alternative single action alternative sequence on right when inside a nested structure
		End of an alternative single action alternative sequence on right
		End of an alternative sequence on right when inside a nested structure
		End of an alternative sequence on right

SCM Table View Detail pane

The Detail pane contains detailed information from the Step that is selected in the Summary pane. For a selected Step, the Detail pane displays the Step Outputs.

Table View Detail pane with Step selected

The Step displayed in the Detail pane is determined by the step selected in the Summary pane. In the example below, the step Initialize is displayed in the Detail pane because it is selected in the Summary pane.

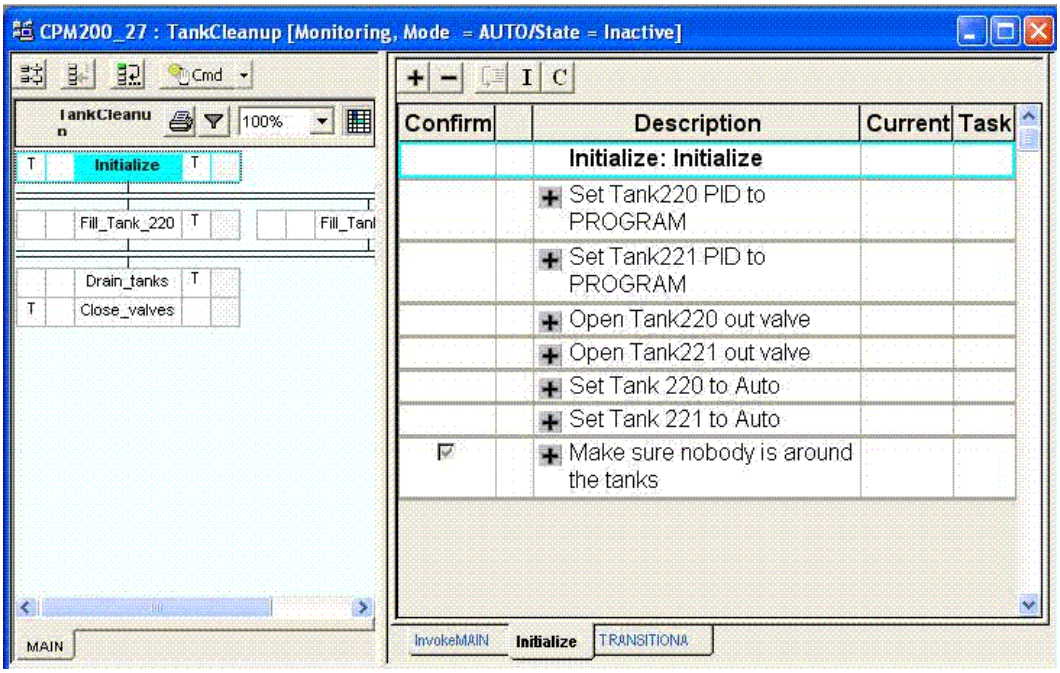


Table View Detail pane

When a Step is selected in the Summary pane (indicated by a cyan outlined box), the Detail pane provides the following buttons and Step output details.

Detail pane – Step	Description
Tabs at the bottom of the Detail pane	Tabs are associated with the leading transition, the step, and the trailing transition where applicable. The selected tab determines the information brought to the front of the Detail pane.
Row 1 –  button	Clicking on this button will expand all Outputs that contain  to show critical information below the Output line.
Row 1 -  button	Clicking on the  button at the top of the Detail pane will collapse all Outputs that contain a  to hide critical information from below the Output line.

Detail pane – Step	Description
Row 1 -  button	Bypasses Outputs by opening a dialogue box and completing the subsequent confirmation dialog
Row 1 –  button	INFO Filter Selecting the 'INFO Filter' button will hide all step outputs that have no Instruction or Confirmation associated with them. When not selected, all step outputs are displayed. In Control Builder, this button is available in both Project and Monitoring.
Row 1 –  button	Completed Filter Selecting the 'Completed Filter' button will hide all step outputs that have been completed/evaluated by the controller. When not selected, all step outputs are displayed. In Control Builder, this button is available in Monitoring only.
Row 2 – column headers	Predefined column headers are: Confirm, (Status), Description, Current, and Task
Row 3 – step name: step description	Step name and step description appear in bold
Rows 4 through N column 1 – Confirm checkbox 	A checkbox appears in this column when the step output is configured with confirmation required. If there is no checkbox, there is no confirmable Instruction in the Step Output. Clicking on the **Step's** confirm checkbox provides a 1-click operation that causes all individual Stepout confirmable Instructions of the Step to be confirmed.
Rows 4 through N column 2 – Step output Status	Status of the step output is indicated by the color of this block. Step output indicators are shown in priority order. A higher priority indicator will suppress the lower ones. See the Step Output Status indication table.
Rows 4 through N column 3 – Output description	The description of the output. The expression for the output appears in the additional details pane when

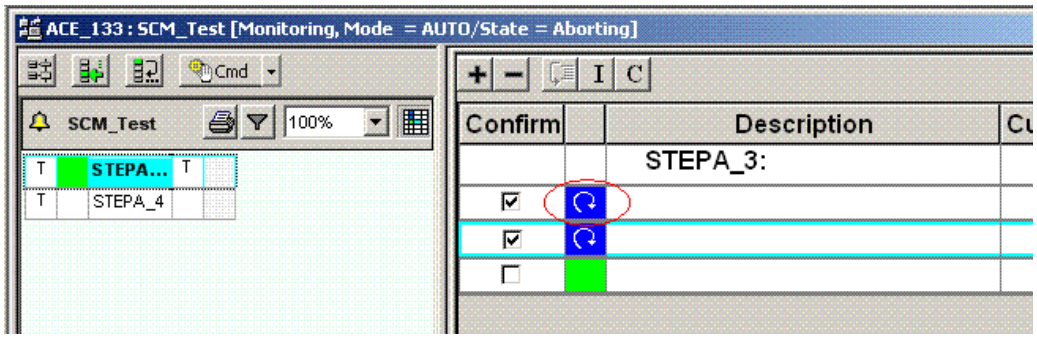
Detail pane – Step	Description
	the step output is selected.
Rows 4 through N column 3 - 	When a Step's Output has an instruction or role associated with it, the '+' icon is displayed on the Output line. Selecting the icon will expand the area below the output to display the Step output's associated role and/or instruction information.
Rows 4 through N column 3 - 	Clicking on the  will collapse the Output detail area.
Rows 4 through N column 4 – Current	When the step output is configured with a parameter in the Current parameter, the value of that parameter appears in this column. Displays live, monitored value of configured Current parameter for Step/Step Output. When the block that supplies the Current parameter supports EUDESC parameter, the engineering units are displayed.
Rows 4 through N column 5 – Task	When the step output is configured with a parameter in the Monitor task parameter, the value of that parameter appears in this column. Displays status of associated Monitoring Task identified for Step/Step Output.  appears when Monitoring task result is On. Clicking on the icon will navigate to the associated display of the tag providing the Monitoring Task result.

Step Output Status indication in Table View

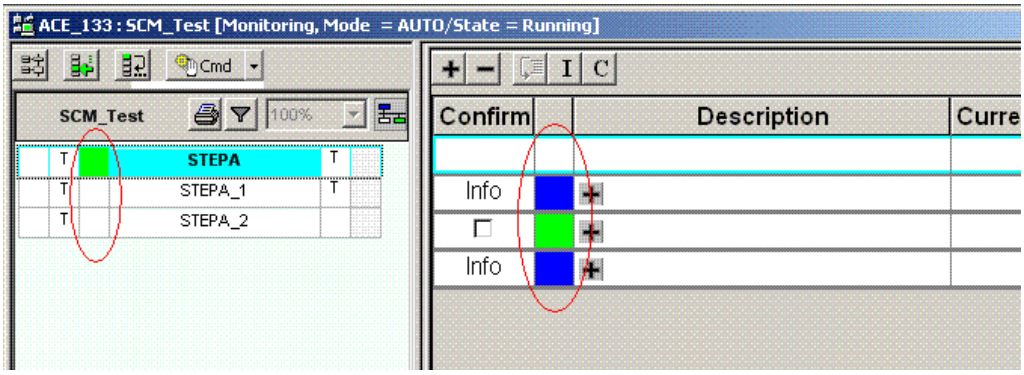
Status of the step output is indicated by the color of this block. Step output indicators are shown in priority order. A higher priority indicator will suppress the lower ones. Indicator conditions from highest to lowest priority with symbol and color are:

Step Output Status Colors and Symbols

Color	Symbol	Description
Red	None	Execution Status of Step Output is completed and FAILED
Yellow	None	Execution Status of Step Output is completed with WARNING
Green	None	Status of the Step Output is executing or delayed
Blue	None	Status of the Step Output is complete. If an expression output was completed, its color is shown Blue; and if not completed, its color remains White. If a confirmable instruction was confirmed, its color is also Blue with a disabled checkbox with a check mark; and if not confirmed, it is shown without a color with a disabled checkbox without a check mark.
Arrow symbol		Step output Bypass flag = ON. Step output will not be executed.



Step Output Bypass in Detail pane



Step Output Status in Detail pane

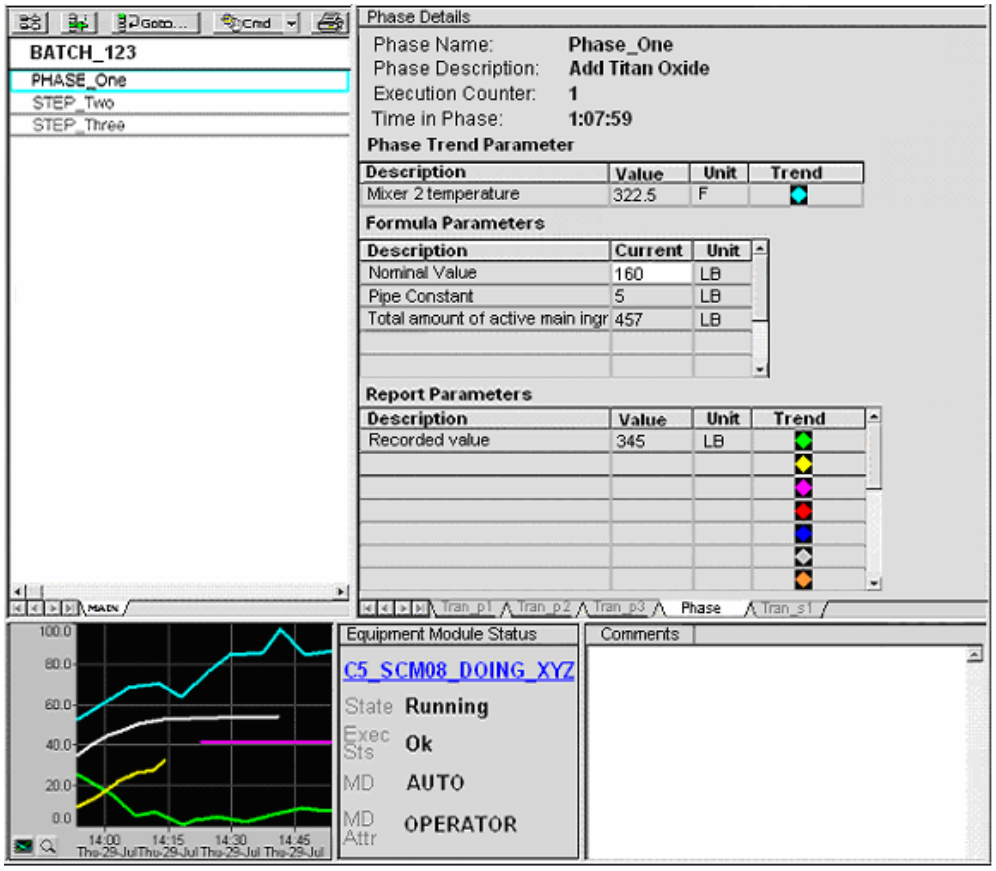
Table View Detail pane with Phase

When an RCM's Phase is selected in the Summary pane, Phase Details are presented in the Detail pane. Phase detail information includes:

- Phase name
- Phase description
- Execution counter
- Time in Phase (how long the phase has been running)
- Phase trend parameter(s) description, value, engineering unit, and trend color (if trended)
- Formula parameter(s) description, current value, and engineering unit
- Report parameter(s) description, current value, engineering unit, and trend color (if trended)

The trend color denotes the color of the trended parameter in the Minitrend pane.

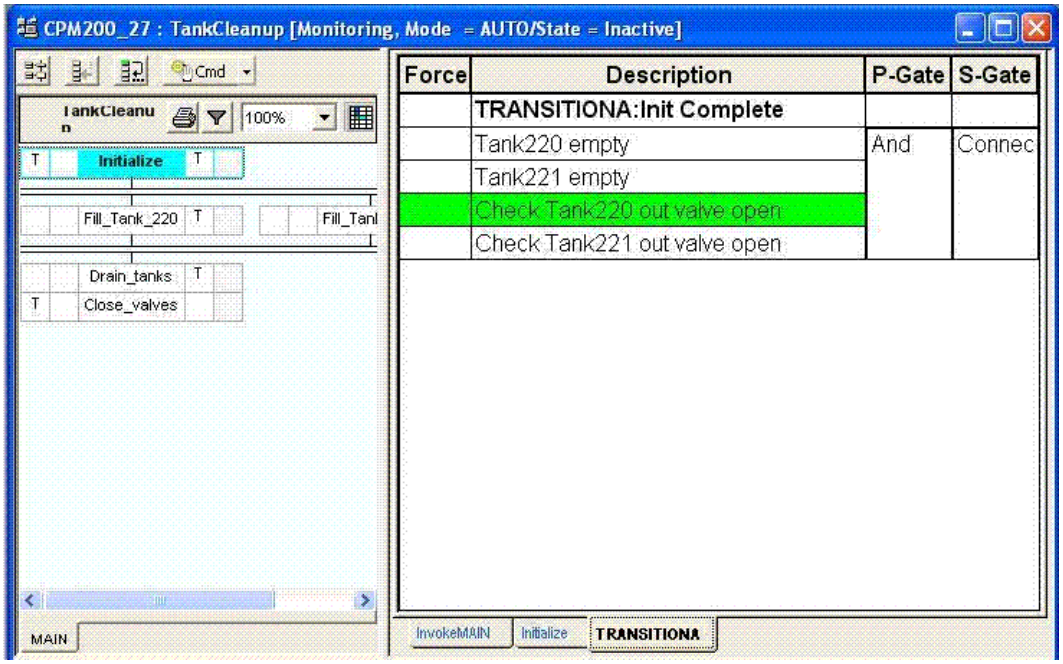
For the RCM, the Equipment Module Status pane replaces the Key Parameters pane.



Phase in Table View

Table View Detail pane with Transition

The Transition displayed in the Detail pane is determined by two factors: the selected Step from the Summary pane and the selected tab at the bottom of the Detail pane. In the example, TransitionA is displayed in the Detail pane because Step Initialize is selected in the Summary pane and the TransitionA tab is selected at the bottom of the Detail pane.



Transition in Detail pane

The Detail pane of the SCM/RCM Table View provides the following information for the Transition selected in the Detail pane.

Detail pane - Transition	Description
Row 1 – Column Headers	Predefined column headers are: Force, Description, P-Gate, and S-Gate
Row 2 – Transition Name: Description	Transition name and description appear in the Description column. Other columns have no entries.
Row 3 through N – Force (column 1)	When the Force Permit option of the transition is enabled, a combo box is displayed. The three options in the combo box are used for forcing the value of the condition to one of the following values: None, ToOn, ToOff. By selecting one of these options, the operator forces

Detail pane - Transition	Description
	the state of the transition to a specific state. When the Force Permit option of the transition is not enabled, the column is blank. When an SCM/RCM is invoked from the Project tree, the column is blank.
Row 3 through N – Description	Transition name: Transition description
Row 3 through N – P-Gate	The Primary Gate's logical operator is displayed. Not every row has a gate since, input conditions that feed the gate are grouped with a single operator. Logical operators are: NONE, ON, OFF, CONNECT, NOT, OR, NOR, AND, NAND, XOR
Row 3 through N – S-Gate	The Secondary Gate's logical operator is displayed. Not every row has a gate since, input conditions that feed the gate are grouped with a single operator. Logical operators are: NONE, ON, OFF, CONNECT, NOT, OR, NOR, AND, NAND, XOR

SCM/RCM Table View Additional Details pane

The Additional Details area of the SCM Table View provides details for the Step Output or Transition Condition that is selected in the Details window. A tab appears in this area only when configured. Tabs that can be displayed in their prioritized order from highest (1) to lowest (5) are:

Priority	Tab heading	Description
1	Warning	When a Warning exists on a Step Output, the Warning will be shown as the first priority regardless of whether the Step or Step Output is selected in the Details window.
2	Note	When a Note exists on a Step Output and the Output is selected in the Details pane, the Note tab will appear in the Additional Details pane. Selection of another Step Output in the Detail pane will cause the Additional Details window to revert to the higher prioritized Step Warning.
3	Instruction	When an instruction exists on a step output and the output is selected in the Details pane, the Instruction tab will be shown.
4	Expression	Step output expression.
5	Comment	Available only in Station. Used by the operator for entering comments during procedure execution. When a comment is entered, it is entered into the event journal along with other SCM/RCM execution events.

Table View Additional Details pane with Warning

The example Step has an associated Warning which has highest priority for display in the Additional Details pane. A Warning is configured for a specific Step, not a Step Output. The Warning is displayed in the Additional Details pane as shown.

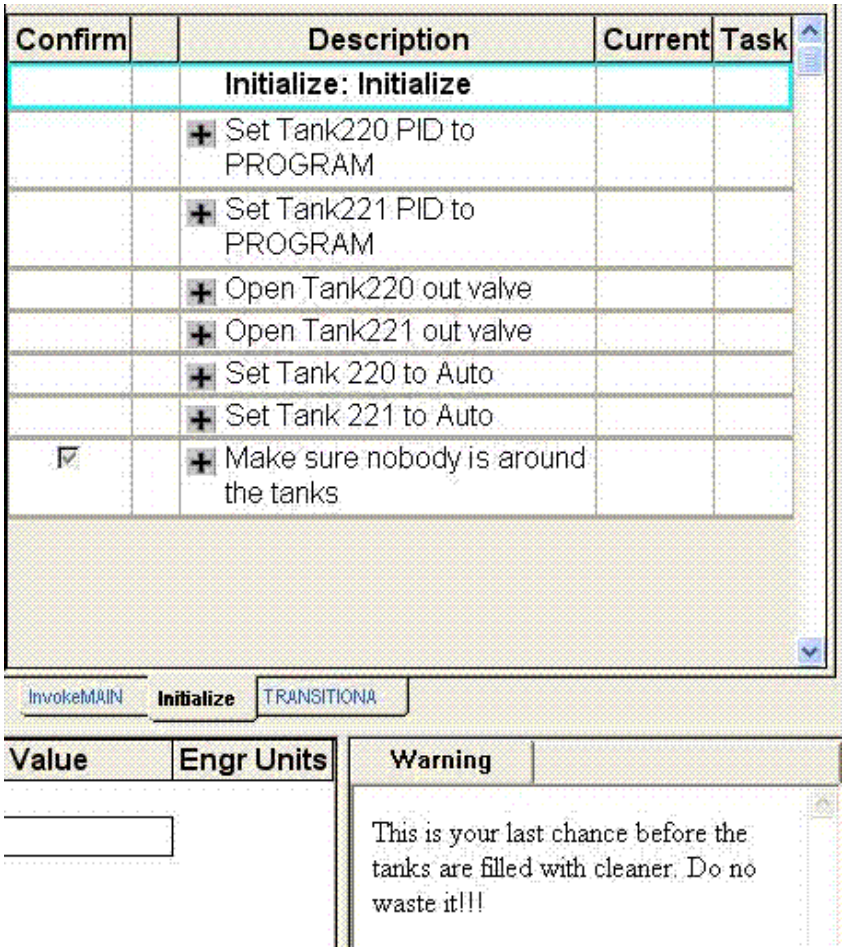


Table View Additional Details pane, Warning

Table View Additional Details pane with Note and Instruction

This example shows both a Note and an Instruction.

When the '+' icon is selected and the Step Output is configured with an Instruction, the Step Output expands to reveal the instruction beneath the Step description. The Step Output Instruction can also be viewed on the Instruction tab in the Additional Details pane. Typically an instruction is part of a step output when confirmation of the step output is required. Note the Confirmation check box on the Step Output "Confirm tanks are fully drained".

The example shown has a note configured for the Step Output; therefore, the Step Output's Note appears in the Additional Details pane.

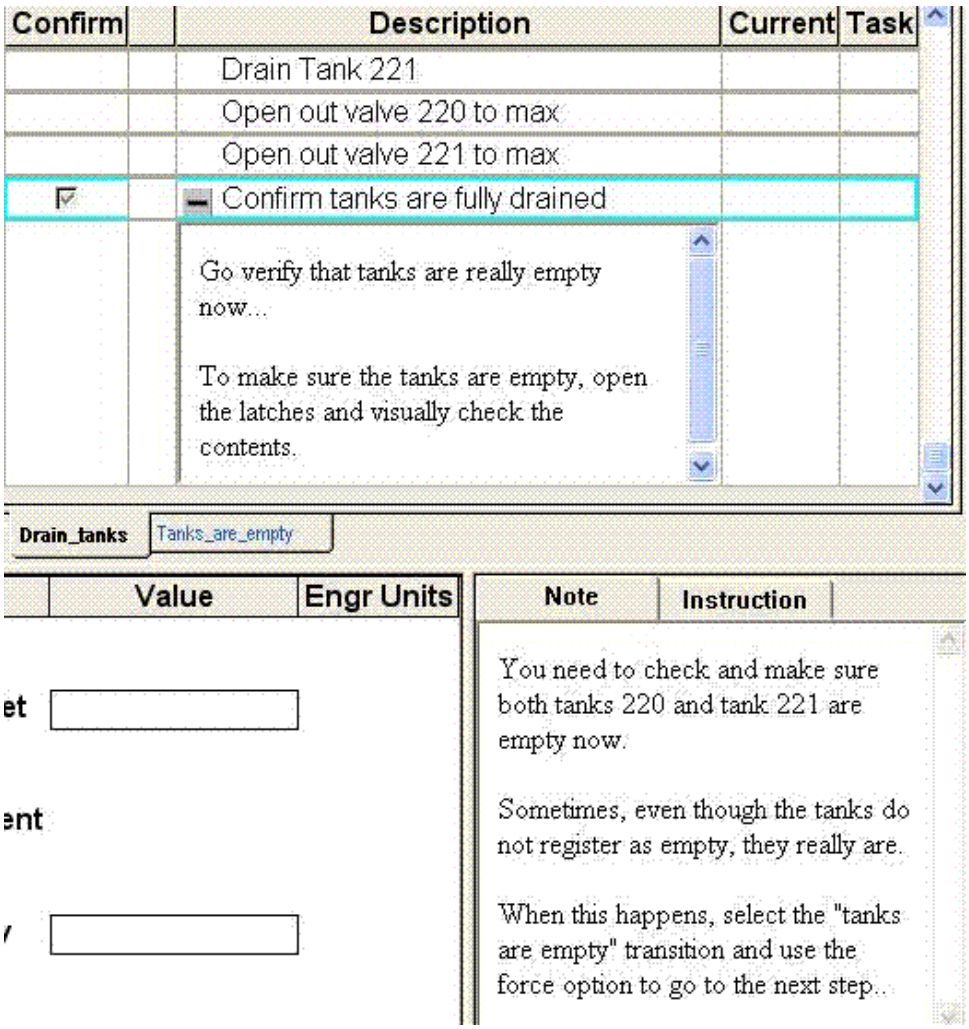


Table View Expanded Step Output, Additional Details Note

Table View Additional Details pane with Expression

When a Step output has an expression, the expression is displayed in the Additional Details pane when the Step output is selected in the Details pane.

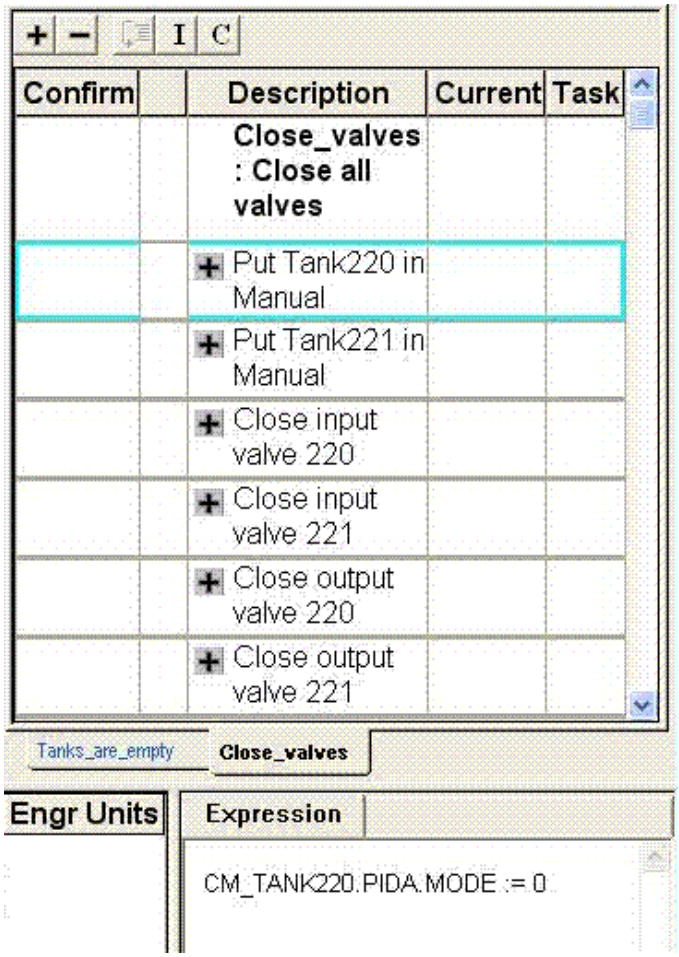


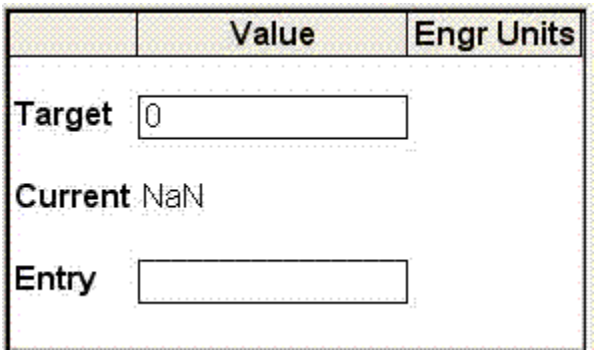
Table View Additional Details, Expression

SCM Table View Key Parameters pane

The Key Parameters area of the Table is primarily used to display the Target value and Entry values and for operator interaction where the operator can enter an Entry value.

The Key Parameters area of the SCM Table View provides the following features:

- When a Step is selected in the Summary pane and nothing is selected in the Detail pane, a Current Parameter will be shown if the Current Parameter reference is configured.
- When a Step Output is selected in the Detail pane, the Target, Current, and Entry Parameters will be shown if the associated Parameter references are configured. (See example below.)



SCM Table View Key Parameters pane

When the Target or Entry field is needed for data entry, the allowed data range is shown in the Table View status line and the previous data value is shown in the message zone.

RCM Equipment Module Status pane in Table View

For the RCM, the area that was the Key Parameters area of the Table is replaced with Equipment Module Status information.

When a Phase is selected in the Summary pane, the tagname of the associated SCM (Equipment Module) will be shown along with its State, Execution Status, Mode, and Mode Attribute. The operator can click on the SCM tagname to invoke the Point Detail display of the SCM.



RCM Table View Equipment Module Status pane

SCM/RCM Table View Minitrend pane

Up to eight values can be trended on a Minitrend graph that appears in the lower left pane of the SCM/RCM Table View. If history collection is configured for the current value and history collection type is specified in step configuration, the Minitrend can retrieve old values. For all other current values, Minitrend starts to collect the values when the Minitrend is opened for a step in Table View.

The Minitrend has the following components:

Component	Description
Value scale	Along the Y-axis, the value scale is displayed to show the range of trended values. All trends share the same value scale.
Time scale	Along the X-axis, the time range of the trended values is displayed. All trends share the same time range.
 - Trend button	Trend button invokes a standard trend with a predefined trend set number. Configuration in the step of 'Trend set number' is required for this to execute.
 - Magnifying lens	Lens button invokes a standard full size trend that is populated with the same trends as shown in the Minitrend

To allow online changes, the history collection type parameter of a step must be loaded to the controller. If the history type of the collected data is not the same as that defined in the step definition, the cumulative real-time trend is shown instead.

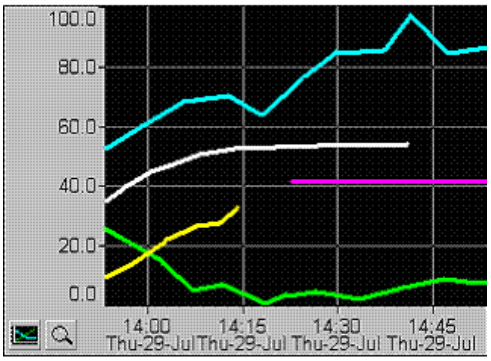


Table View Minitrend pane

Monitoring SCM/RCM in Control Builder

The SCM/RCM appears as an icon in Project tree and Monitoring tree of Control Builder. To view the details of a running SCM/RCM, double click on the SCM/RCM in the Monitoring tree. The SCM/RCM opens in Chart view by default. To switch to Table View, click on the  button in the toolbar.

SCM/RCM icons in Control Builder

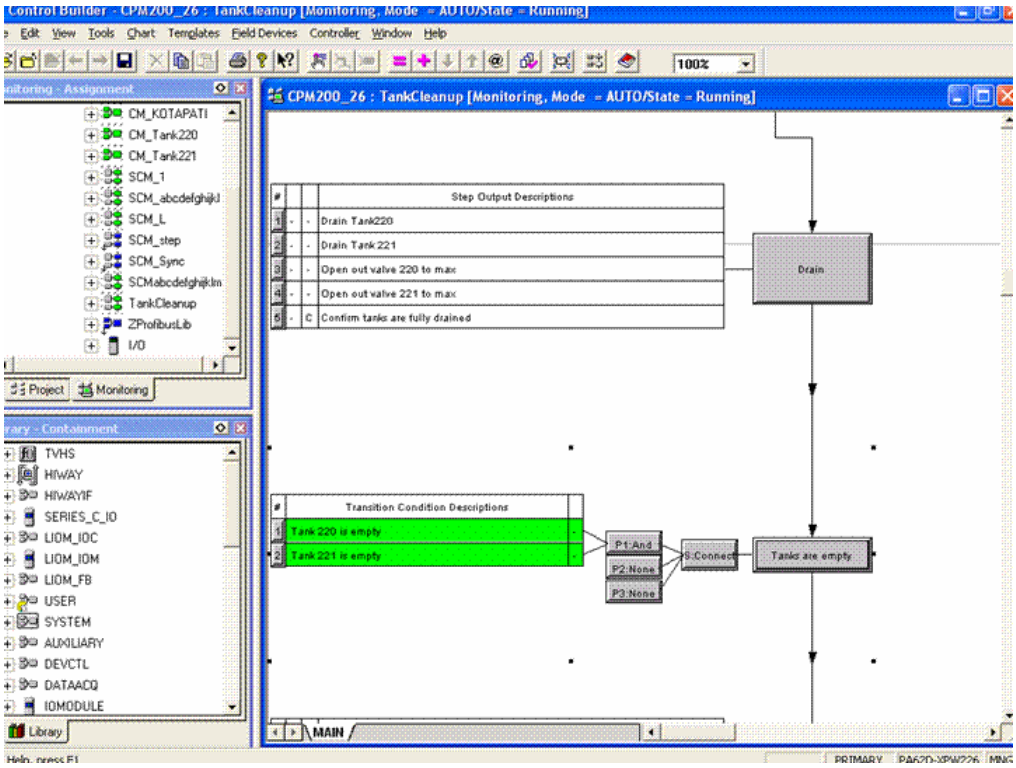
The status of the SCM/RCM is represented by an icon in the Monitoring tree which precedes the SCM/RCM name in the list. The icons represent the SCM/RCM status as follows:

SCM icons in Monitoring tree

SCM/RCM Icon	Meaning
	SCM/RCM Loaded, not monitoring
	SCM/RCM Communication Failure
	SCM/RCM Inactive
	SCM/RCM Active
	SCM/RCM Not used
	SCM/RCM Configuration Error

SCM/RCM Chart View in Control Builder

The following example shows a chart for the SCM named ‘TankCleanup’. TankCleanup is a single path sequence. Notice that TankCleanup appears in the Monitoring tab with a green sequence symbol preceding it because the sequence is Active and running without errors.



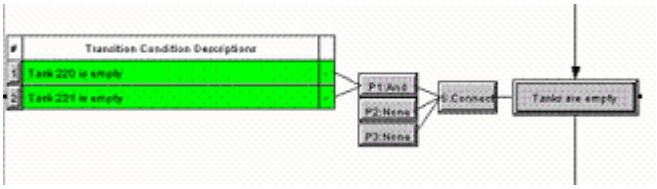
SCM Chart view

SCM/RCM Description/Expression Toggle in Chart View

In chart view, the text within each Step or Transition can toggle between Description and Expression. To toggle between description and expression, click in the heading area of the step or transition.

SCM/RCM Transition in Chart view

The Transition is represented in Chart view in four segments. From left to right, the segments are: transition condition(s), primary gates, secondary gate, and transition block.



Transition Condition in Chart view

Transition conditions are represented in a table format as:

Column	Contents
1	Number of the transition condition (maximum 10)
2	Either the transition condition's description or the transition condition's expression (This can be toggled by clicking on the header of the table.)
3	Determined by the state of the Force Request flag. Force request flag not defined (none) – '-' appears Force request flag set ON – '1' appears Force request flag set OFF – '0" appears Force request flag not set – 'blank'

As an SCM/RCM executes, the background color of the transition condition will change as follows.

Color	State	Transition condition parameter
Green	ON	C[1…10] = ON
Background color (as configured)	OFF	C[1…10] = OFF
Red	Fail or Error	C[1…10].EXECSTS=Fail
Yellow	Warning	C[1…10].EXECSTS=Warning

Primary gates in Chart view

The three primary gates P1, P2, and P3 are displayed for all transitions. The logic operator that has been configured for each gate is shown within that gate. Conditions that are inputs to the gate are represented as inputs with a connecting line from the condition to the gate. There is no color associated with the gate.

Secondary gate in Chart view

There is only one Secondary gate in a transition. The configured logic operator of the secondary gate is shown within the gate. All primary gates feed the secondary. There is no color associated with the gate.

Transition Block in Chart view

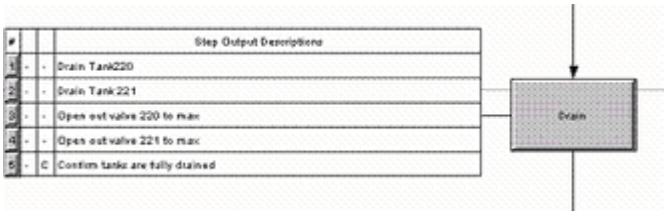
The fourth segment of the transition represents the entire Transition block.

As an SCM/RCM runs, the colors of a transition block will change as follows.

Color	State	Transition block parameter
Gray	To be executed	State = Disabled & Processed = OFF
Green	In execution	State = Enabled
Blue	Execution complete	State = Disabled & Processed = ON

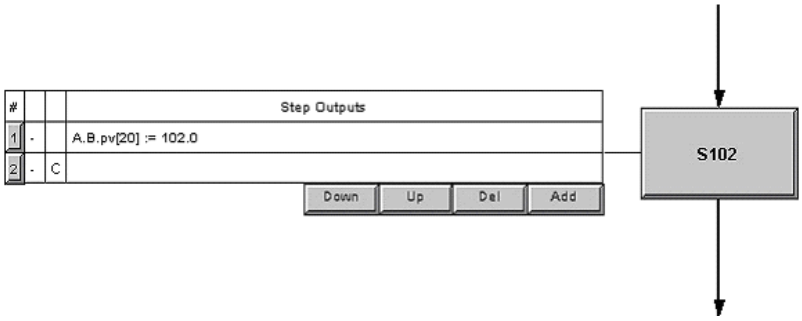
SCM/RCM Step Block in Chart view

The Step is represented in Chart view in two segments: Step outputs and Step block.



Step Outputs in Chart view

Step outputs are represented in a table format as:

Column	Contents
1	Number of the step output
2	The expression type OP.TYPE which can be NULL represented by a '–' (dash) SET represented by an 'S' NOTSTORED represented by an 'N'
3	Instruction Indication is displayed as: Blank - Null instruction; no operator action required 'I' - Informational instruction; no operator action required 'C' - Confirmable instruction; operator must confirm instruction before SCM/RCM will continue execution 
4	Either the step output's description or the step output's expression (This can be toggled by clicking on the header of the table.) A step output can be configured without an expression when the step output is used for an instruction, note, warning, etc. The example above shows a Step output with a confirmable instruction and no expression.

As an SCM/RCM executes, the colors of a step output will change as follows. The SCM/RCM will continue to try to complete any step outputs that are red.

Color	State	Step Output Parameter
Red	Fail or Error - cannot be completed	OP[1…16].EXECSTS = Fail or Error
Yellow	Warning	OP[1…16].EXECSTS = Warning
Green	OK	OP[1…16].EXECSTS = OK and OP[1…16].STATE = In Execution

Step Block in chart view

The second segment of the step represents the entire Step block.

As an SCM/RCM runs, the colors of a step block will change as follows.

Color	State	Step Block Parameter
Gray	To be executed	State = Inactive and Processed = Off
Green	In execution Currently being completed	State = Active or ProcOutputs or ProcMessages or ProcMinWait
Blue	Execution complete	Processed = On

SCM/RCM Chart Automatic Tracking

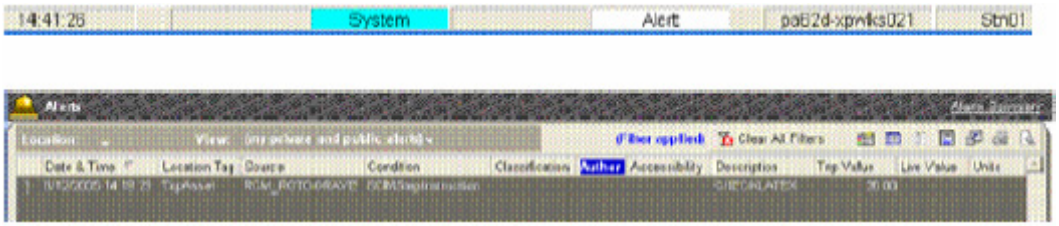
Chart Automatic Tracking causes the SCM/RCM chart to scroll as it executes displaying the active Step in the Module Window. The display size of the SCM/RCM can change automatically when this feature is on.

Chart Automatic Tracking is adjusted by clicking on the Auto Track button or by choosing the Operate pull down menu then Cancel Chart Automatic Tracking or Resume Chart Automatic Tracking

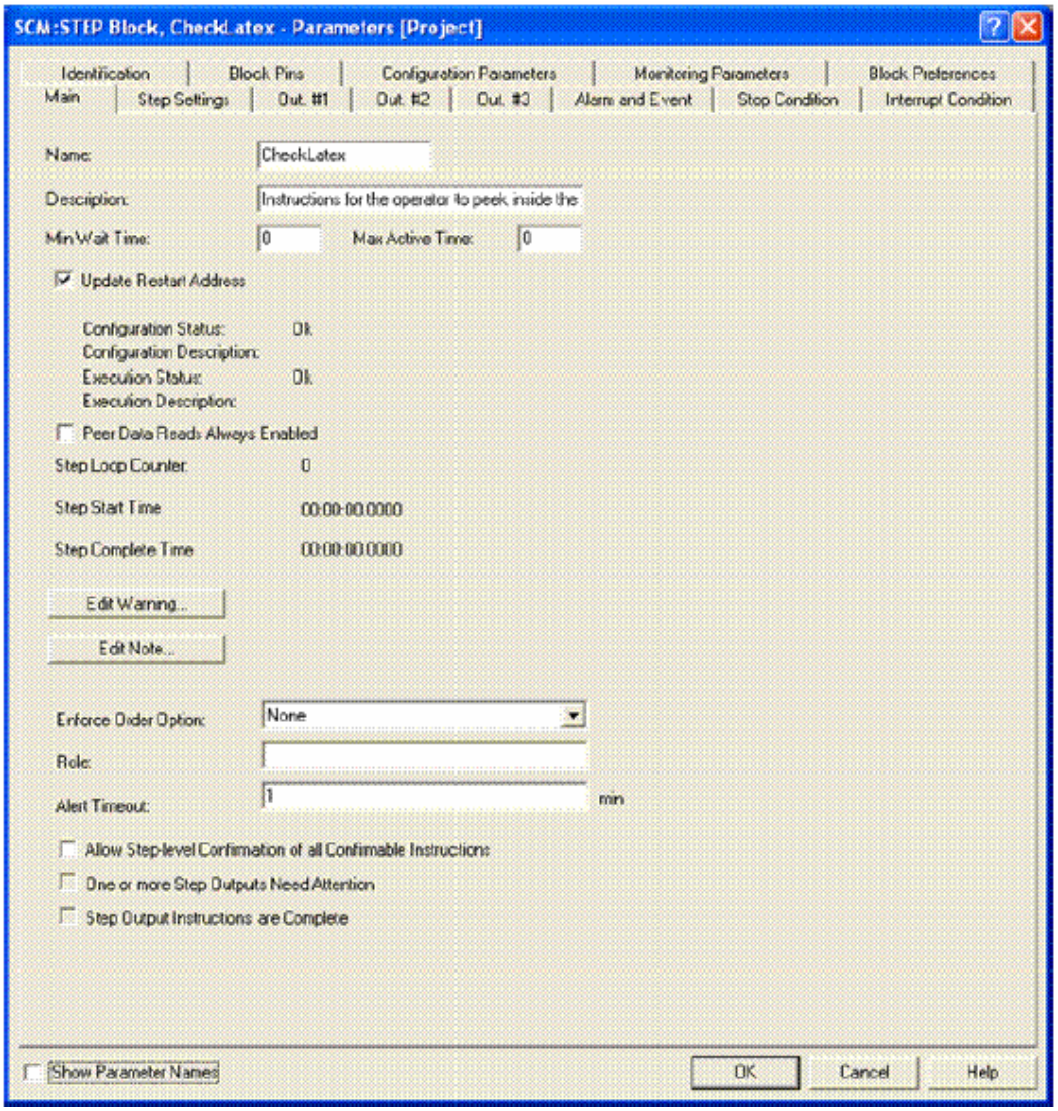
The default for Chart Automatic Tracking is ON. When an SCM/RCM is continually cycling through its entire program on a fast execution cycle, having Chart Automatic Tracking ON will be ineffective because the display will not stop on any specific Step long enough to provide information to the user.

Alert Processing

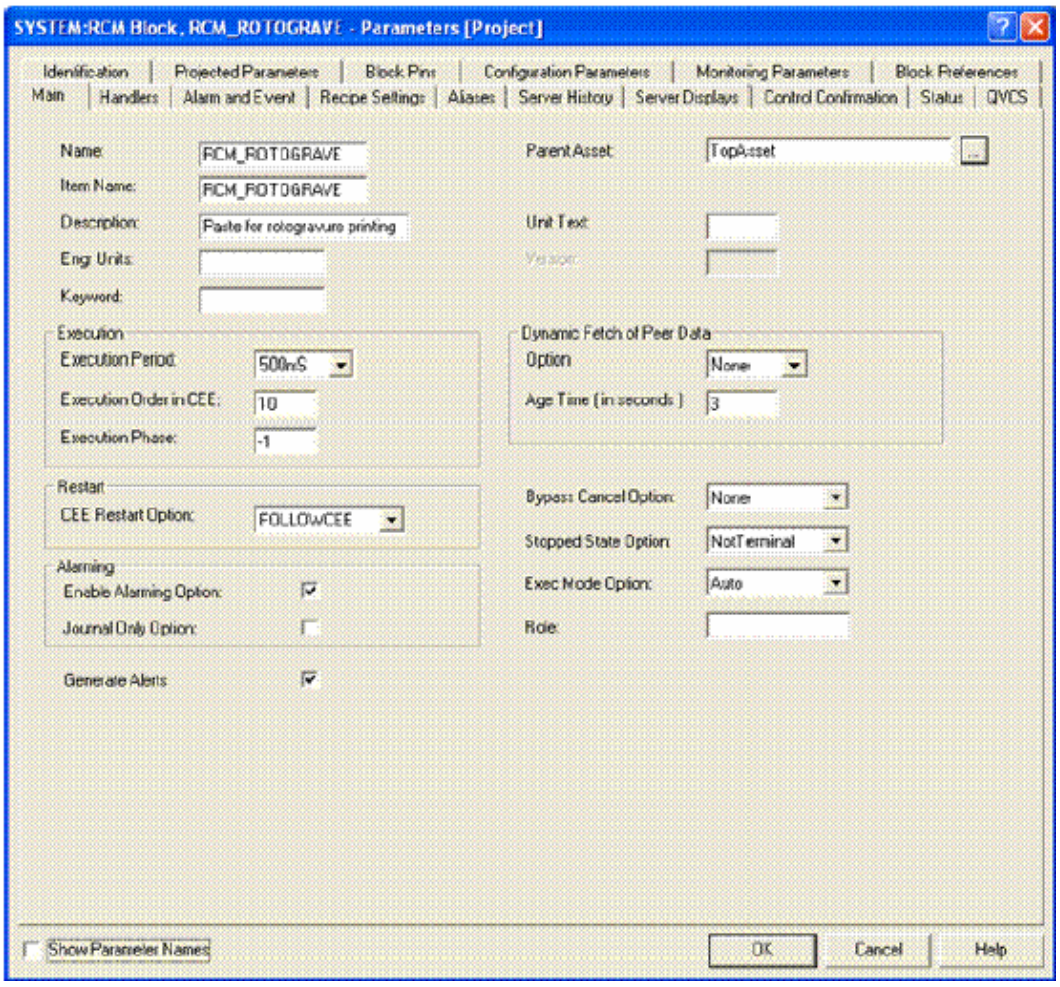
If user doesn't check the confirmable instruction during the alert timeout, an alert will be generated and indicted in the station status zone and alert display.



The alert timeout is defined in the step Main Tab.


SCM:STEP Block, CheckLatex - Parameters [Project]
Identification
Block Pins
Configuration Parameters
Monitoring Parameters
Block Preferences
Main
Step Settings
Out. #1
Out. #2
Out. #3
Alarm and Event
Stop Condition
Interrupt Condition
Name:
CheckLatex
Description:
Instructions for the operator to peek inside the
Min Wait Time:
0
Max Active Time:
0
Update Restart Address
Configuration Status:
Ok
Configuration Description:
Execution Status:
Ok
Execution Description:
Peer Data Reads Always Enabled
Step Loop Counter:
0
Step Start Time
00:00:00.0000
Step Complete Time
00:00:00.0000
Edit Warning...
Edit Note...
Enforce Order Option:
None
Role:
Alert Timeout:
1
min
Allow Step-level Confirmation of all Confirmable Instructions
One or more Step Outputs Need Attention
Step Output Instructions are Complete
Show Parameter Names
OK
Cancel
Help

The alerts are enabled in the RCM main tab by checking the flag “Generate Alerts”.



Operating SCM/RCM via Control Builder

Activating/Deactivating the SCM/RCM in Control Builder

To activate/deactivate the SCM/RCM:

Step	Action
1	Click on the SCM/RCM in the Monitoring tree.
2	Click on the Activate/Inactivate button  in the tool bar. When the SCM/RCM is Active, clicking on this button will make it Inactive. When the SCM/RCM is Inactive, clicking on this button will make it Active.

Operating SCM/RCM via Parameters Status Tab in Control Builder

For information only, the Status tab displays:

- Current SCM/RCM State (SCM/RCMSTATE)
- Current SCM/RCM Execution Status (EXECSTS)
- The name of the Active Step
- The name of the Active Transition
- The time spent in the currently active Step

Operating changes to an SCM/RCM are done via the Status tab of the SCM/RCM. SCM/RCM parameters that can be manipulated on the Status tab are: Command, Mode, Mode Attribute, Normal Mode, Normal Mode Attribute, and the Target Step that is used only when operating in Single Step Mode.

Step	Action
1	Open the SCM/RCM Block Parameters by – Double clicking in a blank area of the open SCM/RCM chart, or – Selecting the SCM/RCM in the Monitor Tree, then Tools > Configure Module Parameters
2	Choose the Status Tab
3	To Command the SCM/RCM state, choose the desired Command from the pull down menu. Choices are:

Step	Action
	None (0) (default) Inactive (1) Start (2) Reset (3) Interrupt (4) Restart (5) Hold (6) Stop (7) Abort (8) Resume (9) Active (10)
4	To change the SCM/RCM Mode, choose the desired Mode from the pull down menu. Choices are: None (0) Auto (1) (default) SemiAuto (2) SnglStep (3) Manual (4) Normal (5)
5	To change the SCM/RCM Mode Attribute, choose the desired SCM/RCM Mode Attribute from the pull down menu. Choices are: Operator (1) – Operator controls the SCM/RCM (default) Program (2) – Another SCM/RCM / program controls the SCM/RCM Normal (3) – Mode attribute is set to the Normal Mode Attribute
6	To change the SCM/RCM Normal Mode, choose the desired SCM/RCM Normal Mode from the pull down menu. Choices are: None (0) (default) Auto (1) SemiAuto (2) SingleStep (3) Manual (4) Normal (5)
7	To change the SCM/RCM Normal Mode Attribute, choose the desired SCM/RCM Normal Mode Attribute from the pull down menu. Choices are: None (0) (default) Oper (1) Program (2)

Operating an SCM/RCM in Single Step Mode

When initially testing an SCM/RCM, it is convenient to operate the SCM/RCM one step at a time. This can be done using Single Step Mode.

Step	Action
1	Set SCM/RCM Mode to Single Step.
2	From the Status tab, select the target step(s) that you want executed next from the TargetStep[1..10] list. The target step(s) can be one that is forward in the program or one that causes the program to go back and re-execute a step. Multiple steps can be selected provided they are within a parallel section of the SCM/RCM.
3	A dialog box appears asking 'Change Online Value?' Click on the YES box.
4	Pull down the Command list and choose RESUME. The Target Step will execute. The SCM/RCM will continue to execute until reaching the next step then the Execution Status = OkPaused.
5	To continue execution of the next step, enter the new Single Step Target then click on the Resume command again. If you choose Start and the mode is in Single Step, only one step will execute.

Starting the Execution of a different SCM/RCM Step

An easy to use and quick way to start the execution of a different Step

Step	Action
1	Choose the Step to be executed next in SCM/RCM Summary window of Table View. When the Step is selected, tracking is automatically turned off preventing the newly selected Step from changing unexpectedly. Tracking will not be turned on again automatically. The behavior of a Step selection causing tracking to be automatically turned off occurs on all Step selections in the SCM/RCM Summary window. This behavior is not specific to the GoTo Step scenario, because at this point the Goto Step button has not been clicked.
2	Click on the 'GoTo' button to initiate the execution of the selected Step.
3	A dialog box is shown so that the operator has to confirm the intended operation. An option will be provided on the confirmation dialog for whether to stay in SingleStep MODE or return to the previous MODE before this action was

Step	Action
	initiated.
4	Confirming the requested action. The following will occur without any further interaction with the operator. SCM/RCM MODE is changed to SingleStep SCM/RCM TARGETSTEP is changed to the selected Step SCM/RCM COMMAND of Resume is provided to initiate execution of the new Step Optionally, return SCM/RCM Mode to its previous MODE (normally this will be Auto) Note that the above stores to MODE, TARGETSTEP, and COMMAND done by the Goto Step dialog are subject to restrictions based on the current SCM/RCM MODEATTR and SSTEPLOCK values. The access level that is used by the Goto Step dialog is derived from the user account that is logged in to the machine. MODEATTR and SSTEPLOCK are used as follows. MODEATTR (possible values of Operator or Program) is checked on stores to MODE and COMMAND SSTEPLOCK (possible values of Operator, Engineer, or ViewOnly) is checked on stores to MODE (of SingleStep value) and TARGETSTEP

SCM/RCM Step Output Bypass in Table View

A Step Output can be bypassed when the following conditions are true:

- The Step owning the output is Active
- The Output is not completed yet

Bypassing an Output will set BYPREQ parameter of the Step Output to SKIP and subsequently mark the Output as completed (blue). Setting the BYPREQ parameter will be logged in the Event Log of the Experion Server. Besides this there will be no further indication that an Output was bypassed.

To bypass a step output:

Step	Action
1	Select the Output in the Details area.
2	Click the ‘Bypass’ button
3	A confirmation dialog appears showing the Step Output Description to be bypassed.

Operating SCM via Station

Execution of Interactive SCM

An operator starts and executes an interactive SCM procedure.

Assumptions:

- SCM to be executed is already loaded
- Transitions only check that the previous Step is complete.
- On Table View display call up, automatic tracking defaults to On

Step	Action
1	Call up the SCM's Table View in Station.
2	Using the Command button, issue a Start command to the SCM. In Table View, the first Step of the Main handler is automatically selected in the Summary area and the Details area displays the first Step's Outputs.
3	Outputs of the Step are expanded one by one to see the Instruction. After completing each action, the operator confirms each Instruction by clicking the checkbox to the left of the output.
4	After the last Output is completed, the Summary advances the selection to the next Step and the Step Output descriptors for the next Step are shown in the Details area of the display. The Step Outputs are shown collapsed and can be expanded as desired. If a Warning exists for the next Step, it will be shown in the Additional Detail area of the Table.
5	On completion of the last Step, the SCM changes state from Running to Complete.
6	Using the Command button, the operator issues a Reset command to the SCM to prepare the SCM for another execution

Entering an SCM Comment

With reporting of SCM events configured, an operator adds comments to particular steps in an SCM as it executes. The comment will be attached to the selected event.

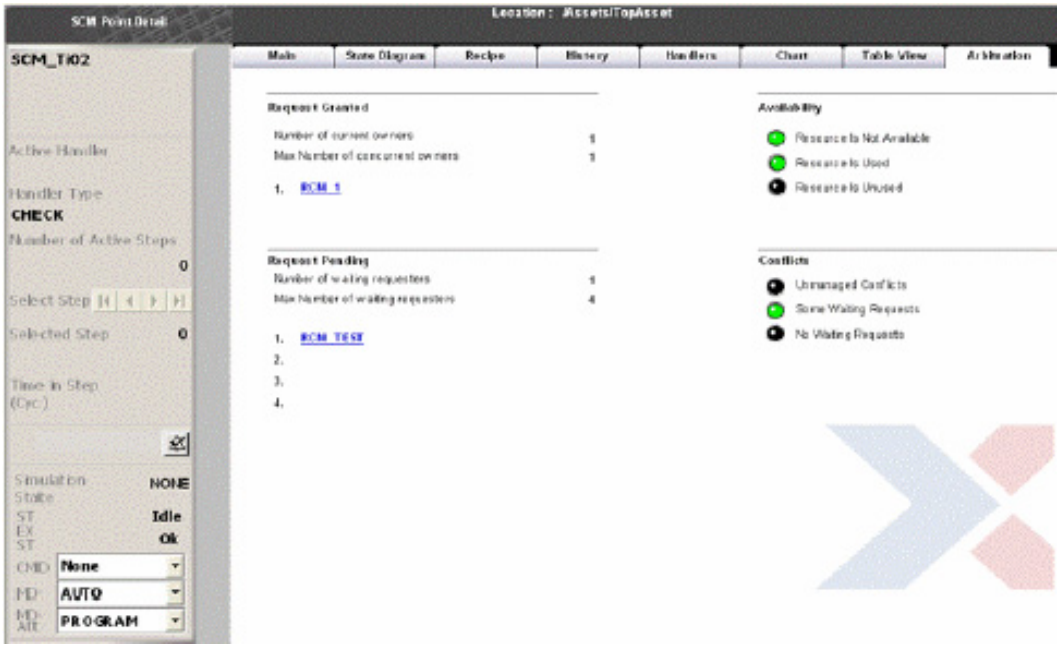
Step	Action
1	Open the SCM detail display Table View.
2	Click on the SCM Step to which you want to add a comment. Steps are located in the Summary pane of the SCM's Table View.
3	Find the SCM Step Output in the pre-filtered mini event list in the bottom right corner window.
4	Add a comment or update the previous comment that appears. Press the Save button.

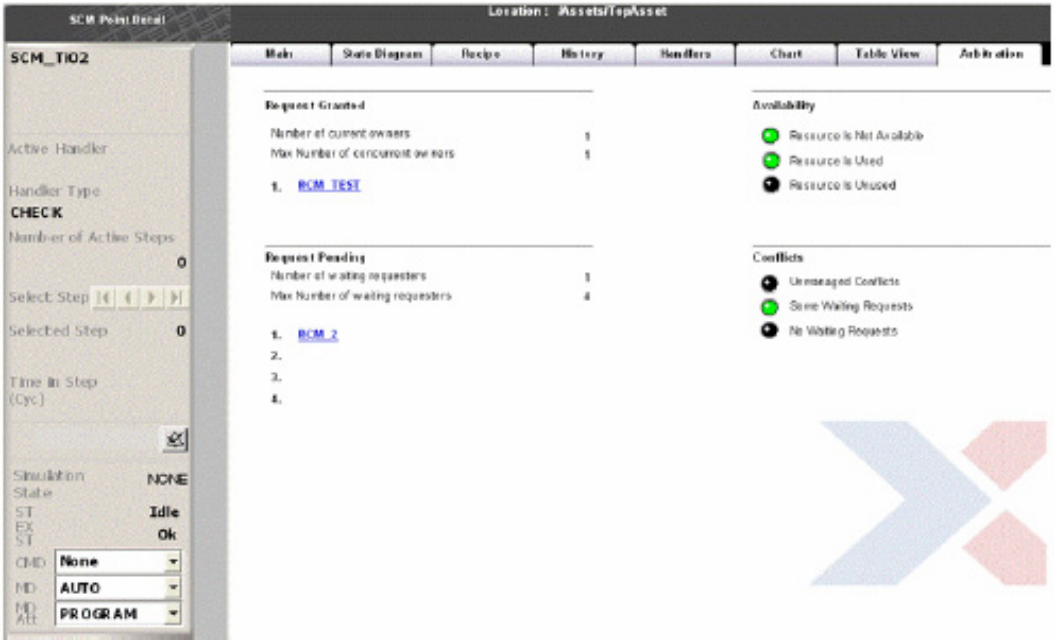
SCM Detail Display in Station

In Station, the SCM detail display has eight tabs:

- Main – displays the current status of the SCM
- State Diagram – displays standard State Diagram for an SCM
- Recipe – displays the configured Recipe parameters for the SCM
- History – displays the configured History parameters for the SCM
- Handlers – displays the Handlers of the SCM
- Chart – displays the Chart View of the SCM
- Table View – displays the Table View of the SCM
- Arbitration

SCM Arbitration tab in Station



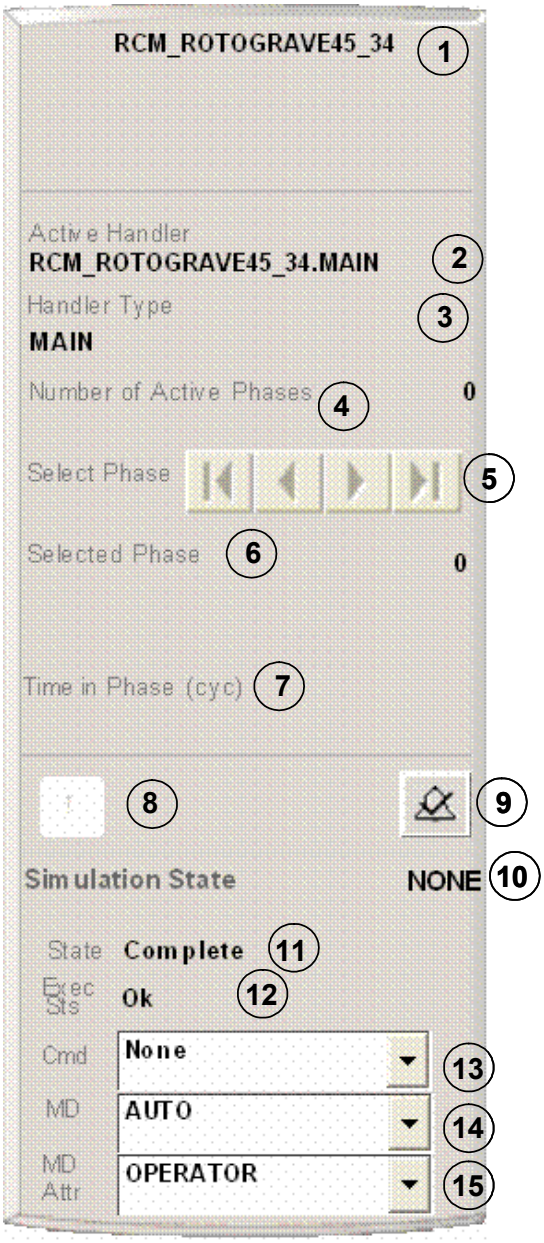

SCM Point Detail
Location : /Assets/TopAsset
SCM_TIO2
Main
State Diagram
Recipe
History
Handlers
Chart
Table View
Arbitration
Active Handler
Handler Type
CHECK
Number of Active Steps
0
Select Step
Selected Step
0
Time in Step (Cyc)
Simulation State
NONE
ST
Idle
EX ST
Ok
CMD
None
MD
AUTO
MD Att
PROGRAM
Request Granted
Number of current owners
1
Max Number of concurrent owners
1
1. RCM_TEST
Request Pending
Number of waiting requesters
1
Max Number of waiting requesters
4
1. RCM_2
2.
3.
4.
Availability
Resource is Not Available
Resource is Used
Resource is Unused
Conflicts
Unmanaged Conflicts
Some Waiting Requests
No Waiting Requests

Operating RCM via Station

RCM Faceplate

The RCM's faceplate can be viewed in a Station Group Display, a custom display, and as part of the RCM point detail display. Operators use the RCM point faceplate to

- Change the RCM Mode attribute
- Change the RCM Mode
- Changes RCM Command
- Single step through an RCM
- Acknowledge RCM alarms


RCM_ROTOGRAVE45_34
1
Active Handler
RCM_ROTOGRAVE45_34.MAIN
2
Handler Type
3
MAIN
Number of Active Phases
4
0
Select Phase
5
Selected Phase
6
0
Time in Phase (cyc)
7
8
9
Simulation State
NONE
10
State
Complete
11
Exec Sts
Ok
12
Cmd
None
13
MD
AUTO
14
MD Attr
OPERATOR
15

Callout	Descripton
1	RCM Name (read only)
	RCM Descriptor (read only) appears below the RCM name when configured.
2	Active Handler of the RCM (read only)
3	Handler Type (read only)
4	Number of Active Phases defines how many execution threads are active in the RCM (read only)
5	Select Phase buttons Click on the button on far left to set the selected Phase to 1. Click on button second from left to decrease selected Phase index by 1. Click on third button in row to increase selected Phase index by 1. Click on last button in the row to set selected step index to same as number of active steps. If the number of active steps is less than two or the selected step index is not less than the number of active steps, the last two buttons are disabled.
6	Selected Phase index and name. If the number of active phases is less than one, this field is cleared. (read only)
7	The time spent in the Phase in cycles. (read only)
8	RCM Fail Alarm is On when RCM Execution Status is failed. (read only) FAILALM.FL
9	Acknowledge Alarm Button. Click this button to acknowledge an active alarm on this RCM.
10	Simulation state
11	RCM State (read only)
12	RCM Execution Status (read only)
13	RCM Command last issued with pull down menu for issuing a new command to the RCM.
14	RCM Mode with pull down menu for changing the mode.
15	RCM Mode Attribute with pull down menu for changing mode attribute.

Active Phases Tab in RCM Detail Display

The value of the Current Parameter defined in the Phase Settings or Step Settings is shown in the column Trend Value. This can be used to monitor the progress of the actions done in the phases or steps. If a step or phase is in a loop in the RCM main handler, the execution count indicates how many times the loop has been executed. The loop count is cleared after reset command and the loop initialization logic can be implemented in the check handler.

In RCM_Test the first parallel section has two phases in parallel.



In the following parallel section, there are two active steps (dummy and check latex) and two active phases (lye and TiO2). In this case the trend values (current parameters) are indicating the flow rate of these two ingredients.

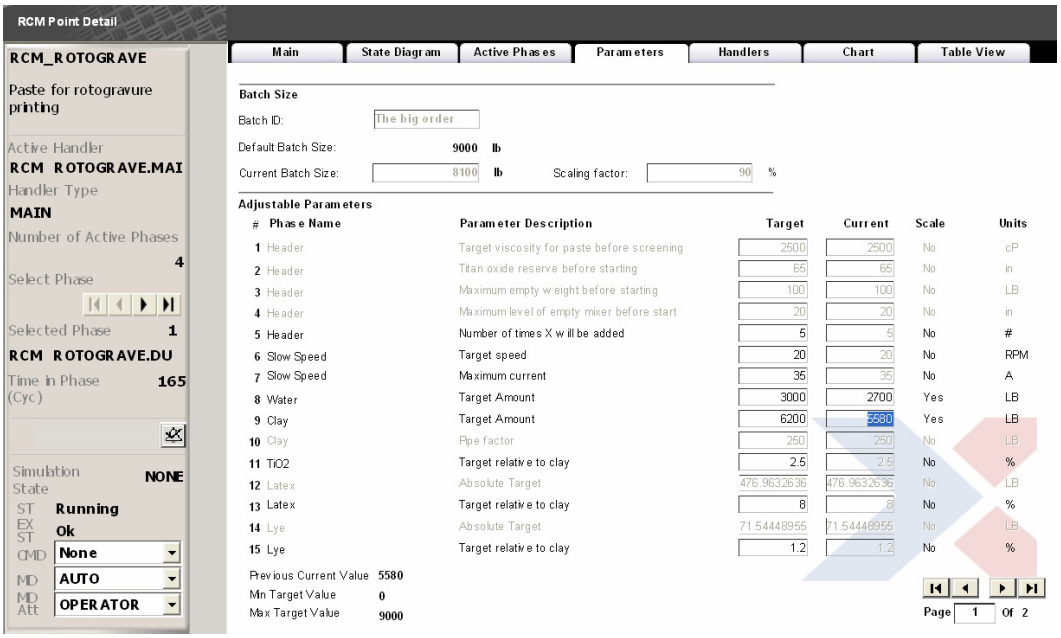


Once the user has confirmed the user instruction in the check latex step, the latex phase is started. Its flow rate (6.67), indicates that it is active. The two other flow rates for lye and TiO2 are zero indicating that those phases are done.

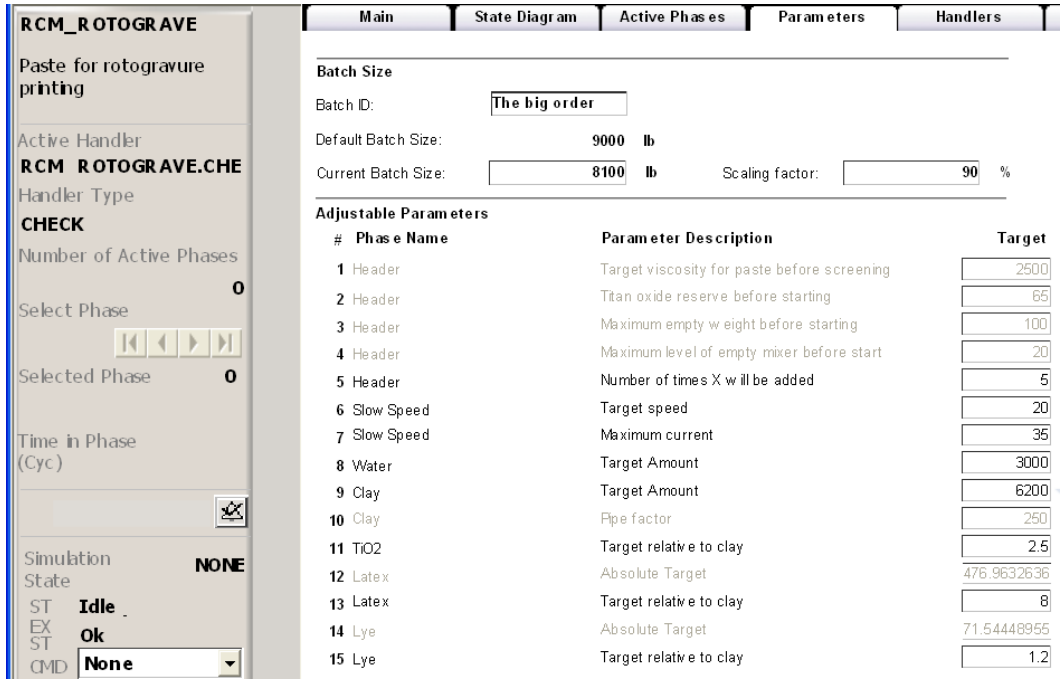


Parameters Tab in RCM Detail Display

The following screenshot shows that there are 2 pages of parameters that the current user can modify. Once the recipe is started and not yet reset, the user cannot change the batch ID or the batch size. In the display below, Current Batch Size is grayed out and cannot be changed because the RCM State = Running.



After reset and after initial loading, the RCM STATE = IDLE and allows the editing of batch ID and batch size. The batch size can be modified either in the engineering units or in percentage. The default batch size can be modified only with Control Builder. In the screen capture below, you are able to change the Current Batch Size and related parameters because the RCM STATE = IDLE.



If a parameter is scalable, it can be modified either in the target column (connect to the nested parameter VALUE) or in the current column (connected to nested parameter CV, current value). The change in batch size is immediately reflected in the current value. A parameter change is active until it is changed again or the RCM is reloaded. In the screen capture below, the Scaling Factor is 90%; therefore, the current value is 90% of the target value.

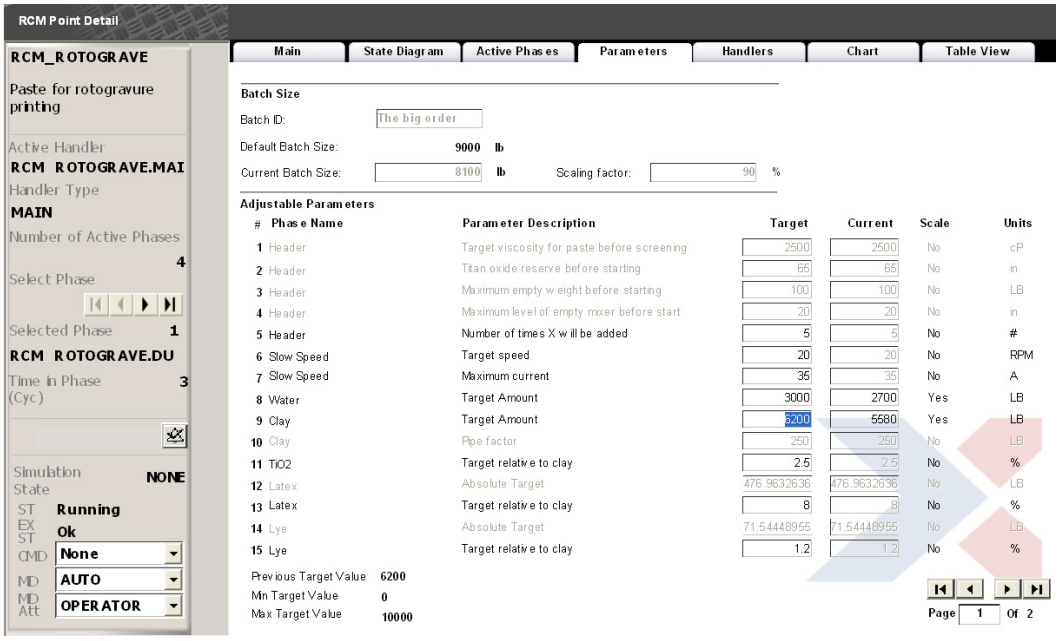
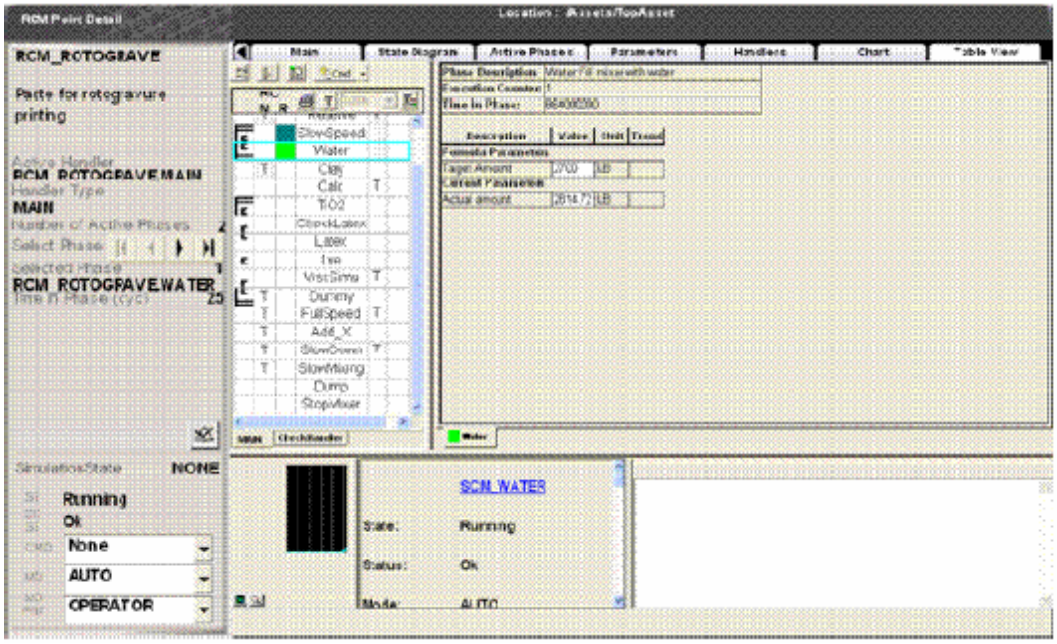
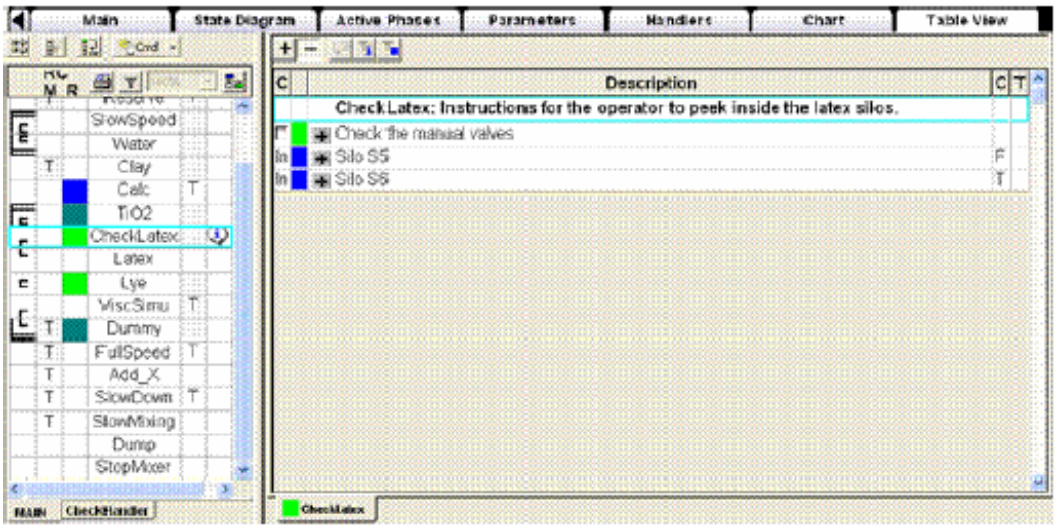


Table View Tab in RCM Detail Display

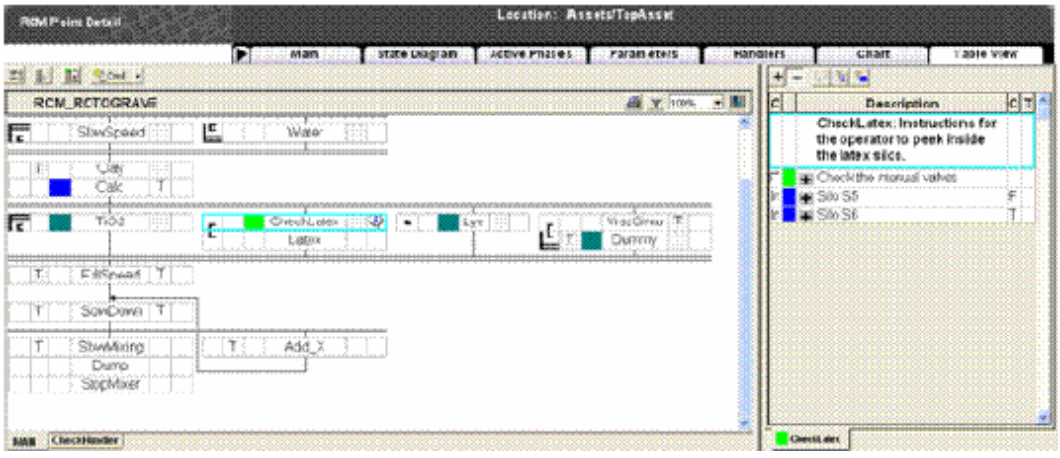
In the example below, water phase was selected in RCM_Rotograve List View.



In the example below, check latex step was selected showing a pending request for operator to check the latex silos before proceeding. The current parameters in step outputs are used to indicate the current status of the manual valves in the silos S5 and S6.



If the user wants to see larger portion of the flow view, the faceplate can be hidden (click the small triangle pointing left) and that are is then available for Table View. Click the small triangle pointing to right to unhide the faceplate.



Execution of Interactive RCM

An operator starts and executes an interactive RCM procedure.

Assumptions:

- RCM to be executed is already loaded
- Transitions only check that the previous Phase is complete.
- On Table View display call up, automatic tracking defaults to On

Step	Action
1	Call up the RCM's Table View in Station.
2	Using the Command button, issue a Start command to the RCM. In Table View, the first Phase of the Main handler is automatically selected in the Summary area and the Details area displays Formula and Report parameters for the Phase.
3	After the last Phase is completed, the Summary advances the selection to the next Phase.
4	On completion of the last Phase, the RCM changes state from Running to Complete.
6	Using the Command button, the operator issues a Reset command to the RCM to prepare the RCM for another execution

Operating UCM via Station

UCM faceplate

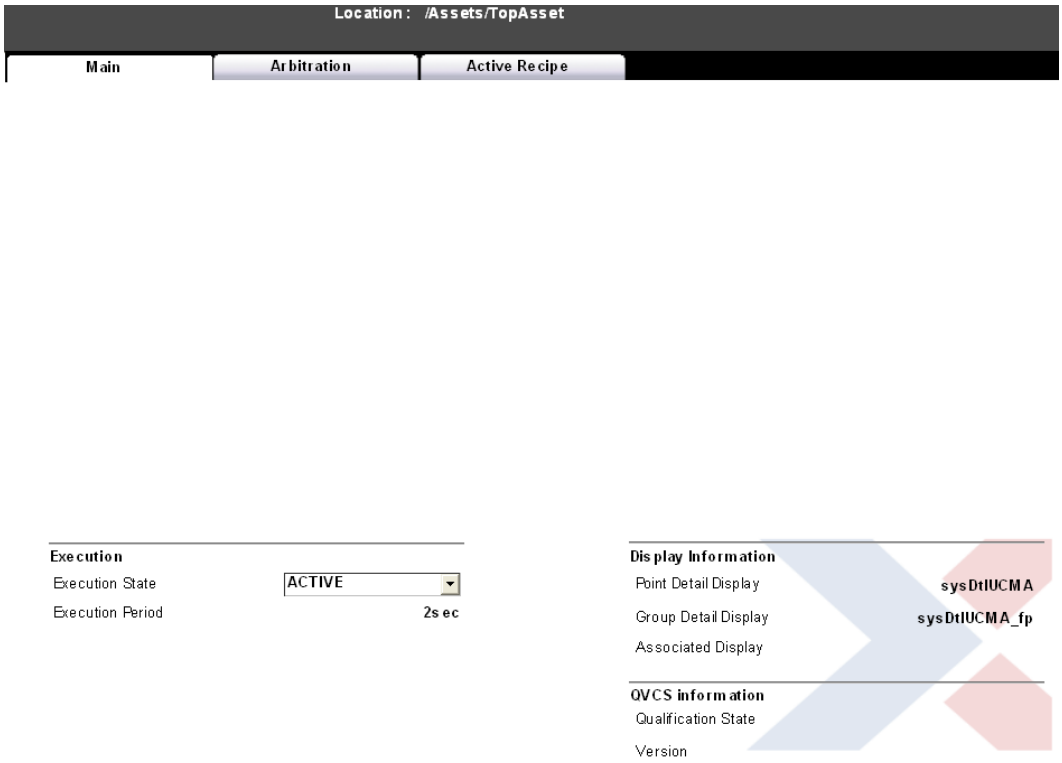
The UCM faceplate shows the number of waiting RCMs and the Active RCM's details. Information contained within this tab is projected from the active RCM to the UCM. If there is no active RCM, the fields will be blank.


UCM_Mixer2
1
Second mixer
2
No of waiting Recipies
3
0
Active Control Recipe
4
RCM_ROTOGRAVE
BatchId
5
The big order
Asset
6
TopAsset
ST
Running
7
EX ST
Ok
8
Cmd
None
9
MD
AUTO
10
MD Attr
OPERATOR
11

Callout	Descripton
1	UCM Name (read only)
2	UCM Descriptor (read only) appears below the UCM name when configured.
3	Number of RCMs waiting in the UCM arbitration queue (read only)
4	Name of the RCM that is actively using the UCM, Active Control Recipe (read only)
5	BatchID defined in the ACR (read only)
6	Name of the asset in the ACR, inherited from the UCM (read only)
7	State of the ACR (read only)
8	Execution status of the ACR (read only)
9	Command of the ACR, use the standard options in the pull down menu
10	Mode of the ACR, use the standard options in the pull down menu
11	Mode attribute of the ACR, use the standard options in the pull down menu

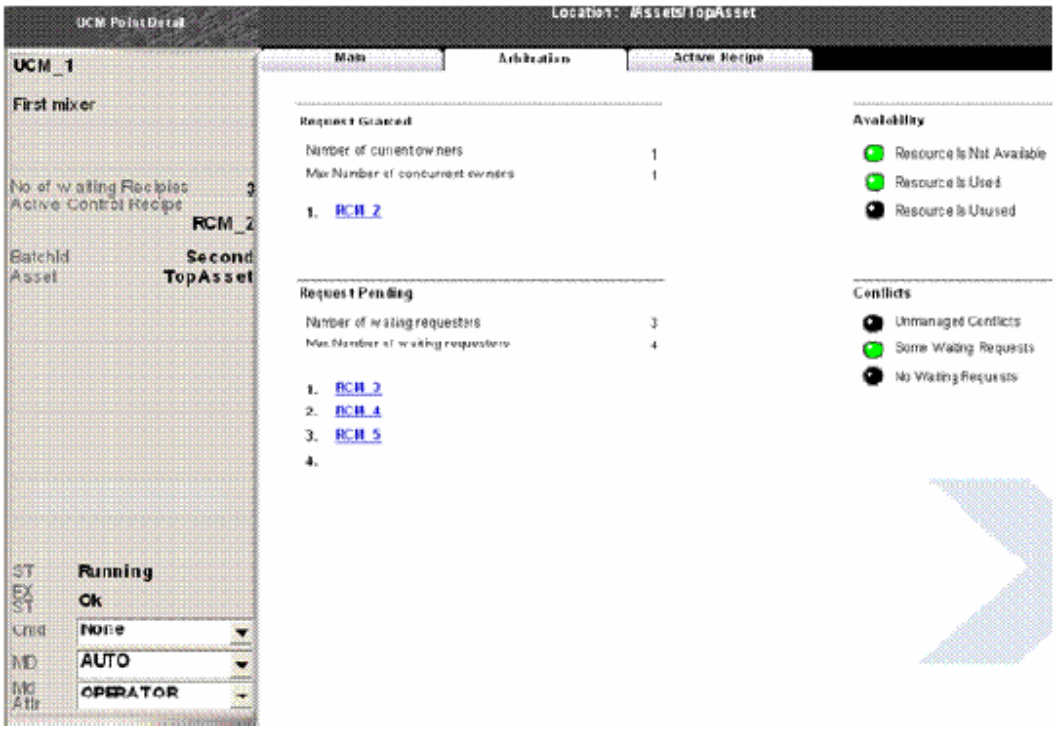
Note: Double click on items 1-3 will navigate to the detail display of the UCM. Double click on the items 4-11 will navigate to the detail display of the RCM that is actively using the UCM.

Main tab of UCM Point Detail

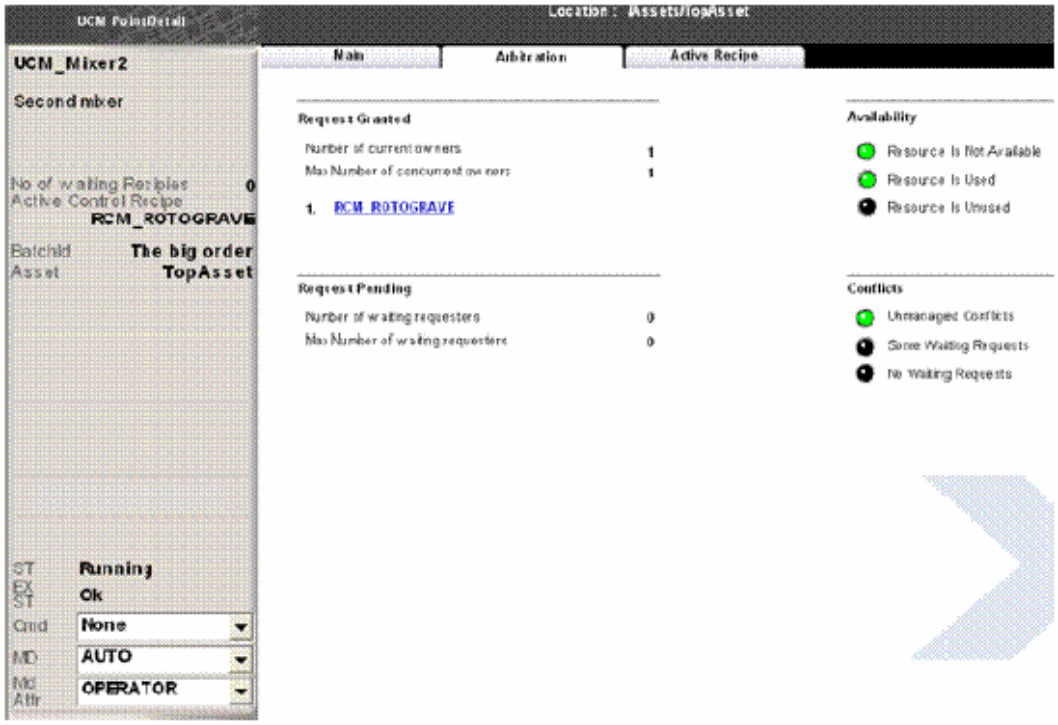


Arbitration in UCM Detail Display

In UCM_1, there were 4 slots defined for the waiting RCMs. In the example below three of those slots are used.

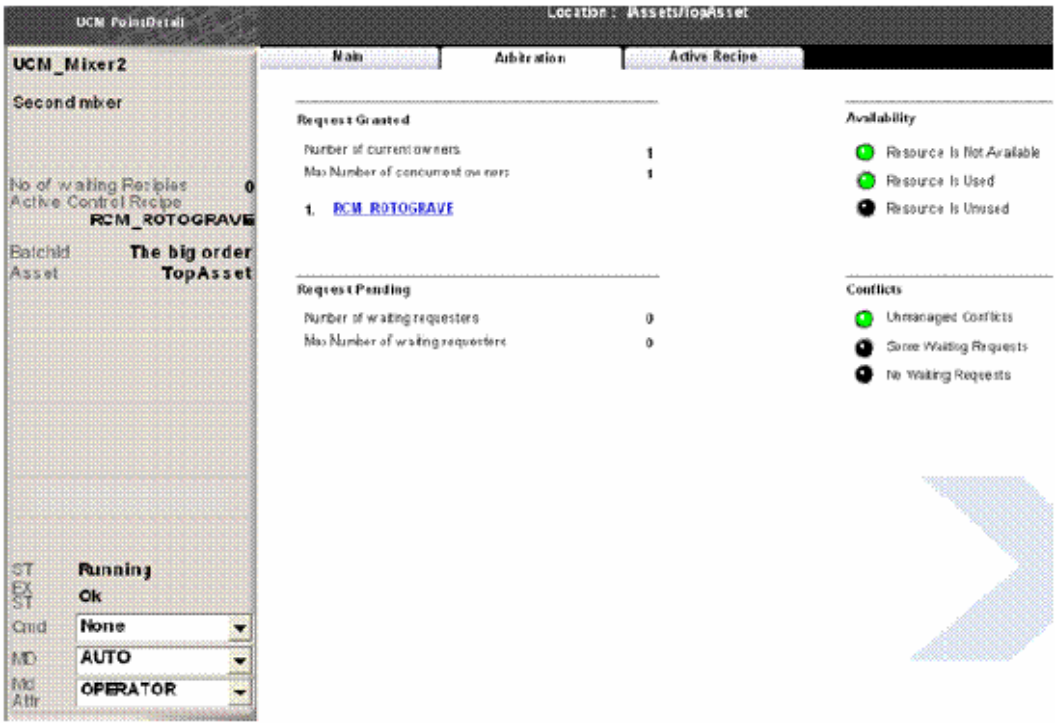


In UCM_Mixer2, there were no slots defined for the waiting RCMs. For that reason when the RCM_Rotograve is using the UCM and RCM_Test is trying to acquire it, there is an unmanaged conflict. The system logic in RCM_Test repeats the request until the UCM is granted. Not the "Unmanaged Conflicts" flag in the picture below.



Active Recipe in UCM Display

This tab indicates that RCM_Rotograve is running in UCM_Mixer2 in Auto mode and that operator can change the mode. There are 4 active phases in the RCM. Their composite status (Inactive) indicates that the recipe is not doing any active processing, but waiting a confirmation for a user instruction in step CheckLatex.



The fields in this tab are similar to the fields shown in the RCM faceplate. The following fields have special features:

Command – allows the user to select a command to be sent to the RCM

Composite failure state – shows the potential failures in the RCM and its phases

Active phase – shows the name of the last activated step or phase

SCM/RCM Troubleshooting

Chart visualization function not working

Chart visualization function not working	
When the SCM/RCM chart is viewed, it does not represent a running SCM/RCM.	
Diagnostic check:	
Cause:	Engineering Tools and Server/Client software components are not installed
Solution:	Both Engineering Tools and Server/Client software components must be installed on the computer.

Unable to reload the SCM/RCM

Unable to reload the SCM/RCM	
SCM/RCM must be in the Inactive State to load.	
Diagnostic check:	You are unable to reload an SCM/RCM.
Cause:	SCM/RCM is not in the Inactive state.
Solution:	Change the SCM/RCM state to inactive by: 1. Open SCM/RCM in Control Builder. 2. Open the Configuration Parameters by double clicking in an open area of the SCM/RCM or right clicking on the SCM/RCM in the Project Tree and selecting Configure Parameters. 3. Choose the Status tab. 4. Change the Mode Attribute to Operator if necessary. 5. From the Command pull down list, choose Inactive.

Unable to Change SCM/RCM State to Idle

Unable to change SCM/RCM state to Idle.	
Need to edit SCM/RCM but can't get the SCM/RCM into IDLE	
Diagnostic check:	You want to edit the SCM/RCM in Control Builder Project and then reload the modified program but you can't get the SCM/RCM in the Monitor tab into the IDLE state. You know that the SCM/RCM must be in the INACTIVE state before reload is permitted and to get to INACTIVE, the SCM/RCM must be in IDLE.
Cause:	The Invoke Transition Condition is always ON.
Solution:	To force the Invoke Transition Condition to OFF: 1. Set the condition's Force Permit On by checking the Force Permit box. 2. Set the Force Request to TOOFF. 3. Command the SCM/RCM to RESET. The SCM/RCM goes to IDLE. 4. Command the SCM/RCM to INACTIVE. 5. Don't forget to return the Force Permit to Off after the SCM/RCM is reloaded.

SCM/RCM State goes from Start to Complete without Executing

SCM/RCM state goes from Start to Complete without executing	
Start SCM/RCM and it immediately goes to Complete	
Diagnostic check:	You start an SCM/RCM and it goes to the complete state without executing any transitions or steps.
Cause 1:	Invoke transition is not set ON in the initial transaction.
Solution 1:	Check the expression(s) in the Invoke transition condition. If the expressions are written correctly and the reason for the conditions not being met is known, then force the not true condition to the On state. To force the Invoke Transition Condition to ON: 1. Set the condition's Force Permit On by checking the Force Permit box. 2. Set the Force Request to TOON. 3. Don't forget to return the Force Permit to Off.
Cause 2:	Handler tab is not assigned in Handler Tab of SCM/RCM configuration.
Solution 2:	Assign the Handler to the SCM/RCM. 1. Open the SCM/RCM configuration by double clicking in blank area of an open SCM/RCM chart or right click on the SCM/RCM in the Monitor tree and selecting Configure Module Parameters. 2. Choose the Handlers tab. 3. Assign the Handler to the SCM/RCM by pulling down the associated handler type list and selecting the specific handler that needs assigning.
Cause 3:	Transitions and Steps are not wired correctly.
Solution 3:	Open the SCM/RCM from the Monitoring tree and reexamine the wiring. Verify that all Transitions and Steps are wired correctly.

SCM/RCM Not Responding to INACTIVE or START Commands

SCM/RCM not responding to Inactive or Start Command	
The SCM/RCM does not respond to an operator command of INACTIVE or START.	
Diagnostic check:	The SCM/RCM is configured with a Check Handler and a Main Handler. The Check Handler contains only one Invoke Transition condition that is always True. Once the SCM/RCM is activated, SCM/RCM State = Idle; however, the Invoke Transition of the Main Handler has a state of Disabled (not being evaluate, not green).
Cause:	The CHECK handler is re-invoked every cycle, because its transition is true. Re-invokation of a CHECK handler in state IDLE is an intended feature, allowing re-arbitration of devices multiple times if the CHECK handler is used for arbitration of devices and other preparations before execution of the MAIN sequence. The explanation can be confirmed by setting SCM/RCM.RstProcessed = TRUE while watching the CHECK handler in Control Builder. Occasionally the color of the CHECK invoke transition will change back to gray and then to blue again, sometimes blue will stay on (depends of timing of communication and how fast the SCM/RCM is executing).
Solution:	Choose the invoke transition of the CHECK Handler and bypass one or more conditions to make the transition false. To avoid this situation in the future refine the CHECK invoke transition, so that it is not permanently true. If re-invokation from IDLE is not desired at all, include a condition SCM/RCM.STATE <> IDLE in the invoke transition. Another solution with a slightly different behavior is achieved, if a condition SCM/RCM.COMMAND = NONE is included. This will render the START condition ineffectual, but the commands INACTIVE and START will be honored by the SCM/RCM.

SCM/RCM MAIN Handler DISABLED - SCM/RCM not responding to Commands

SCM/RCM Main Handler disabled and SCM/RCM not responding to Inactive or Start Command	
Diagnostic check:	When the SCM/RCM is activated, it appears in STATE = IDLE. However the Invoke Transition of the MAIN Handler has a state of DISABLED (not being evaluated, not green) and SCM/RCM does not respond to INACTIVE or START commands. The Check Handler contains only one invoke transition and this transition is configured in a way that it is always true or the fetched external variables make it true all the time.
Cause:	The CHECK handler is reinvoked every cycle, because its transition is true. Reinvokation of a CHECK handler in state IDLE is an intended feature, allowing re-arbitration of devices multiple times if the CHECK handler is used for arbitration of devices and other preparations before execution of the MAIN sequence. The explanation can be confirmed by setting SCM/RCM.RstProcessed = TRUE while watching the CHECK handler in Control Builder. Occasionally the color of the CHECK invoke transition will change back to gray and then to blue again, sometimes blue will stay on depending of timing of communication and how fast the SCM/RCM is executing.
Solution:	Choose the invoke transition of the CHECK Handler and bypass one or more conditions to make the transition false. To avoid this situation in the future refine the CHECK invoke transition, so that it is not permanently true. If reinvokation from IDLE is not desired at all, include a condition SCM/RCM.STATE <> IDLE in the invoke transition. Another solution with a slightly different behavior is achieved, if a condition SCM/RCM.COMMAND = NONE is included. This will render the START condition ineffectual, but the commands INACTIVE and START will be honored by the SCM/RCM.

Transition Condition Stalls SCM/RCM Execution

Transition condition stalls SCM/RCM execution	
A transition condition remains false and execution of the SCM/RCM is stalled.	
Diagnostic check:	Check for the cause of the condition failure: controller failure, transmitter failure, etc.
Cause:	The field transmitter has failed and you are waiting for a new transmitter to be installed.
Solution:	You know that the process will run fine without the signal from the transmitter because you are receiving another transmitter signal from the same vessel. How can you move the SCM/RCM over this transition condition until the transmitter is repaired or replaced? To Bypass the transition condition: 1. Using Control Builder, double click on the transition condition to open the condition's configuration window. 2. Click on the condition's Force Permit to place a check in the box. This sets the Force Permit ON. The Condition Force Permit access lock is engineer. 3. Pull down the Force Request menu and choose TOON. This forces the condition to always True. The Force Request access lock is operator. 4. Don't forget to return the Force Permit to OFF after the failure has been corrected. If operators frequently enact this scenario, then the Force Permit should be set to ON at configuration time permitting the operator to bypass the condition as needed.

SCM/RCM Transition is always False

SCM/RCM transition is always False	
Diagnostic check:	At runtime the Transition is always false and can not be cleared.
Cause:	One of the Transitions has no conditions defined and all gates are configured with NONE. This is a valid default configuration but there is no bypass/force feature on a Transition level.
Solution:	If the Handler is not the ABORT Handler, an ABORT command should resolve the problem. If the Handler is the ABORT Handler, 1. Change SCM/RCM.MODE to SingleStep. 2. Set SCM/RCM.TARGETSTEP[1] to a Step ID after the failed transition. 3. Set SCM/RCM.Command = RESUME 4. Change MODE back to AUTO

SCM/RCM Transition Condition Always False and Never Cleared

SCM/RCM transition condition always False and never cleared	
One of the transitions has no conditions defined and all gates are configured with NONE.	
Diagnostic check:	One of the Transitions has no conditions defined and all gates are configured with NONE. This is a valid default configuration. However, at runtime the Transition will always be false and can never be cleared.
Cause:	There is no bypass/force feature on a Transition level.
Solution:	If the Handler is not the ABORT Handler, an ABORT command should resolve the problem. In any case, the resolution recommended in SCM/RCM.ABORT.ConfigSts=SEVEREWARN will work. In difference to that example, there is no configuration error or warning.

SCM/RCM Step Output Fails

SCM/RCM Step Output fails	
A Step Output failure occurs causing an SCM/RCM Failure.	
Diagnostic check:	The SCM/RCM failure occurs because one Output of a Step does not successfully complete execution. This failure is reported in the Output Execution Status. The SCM/RCM will remain on this Step until the Step Output is completed.
Cause:	Controller failure; communication failure; function block failure.
Solution:	The SCM/RCM will continue to execute the output expression each cycle. If you know the reason for the failure and correct it, the output will execute on the next cycle and the alarm will clear. If you cannot correct the failure and are certain that it is alright to continue execution of the SCM/RCM, then use SingleStep Mode with GoTo to advance the SCM/RCM to its next Step bypassing the failed output. Available with R210 or later: you may use BYPREQ=SKIP to

	just skip the offending output.

SCM/RCM Output to CM not executing

SCM/RCM output to CM not executing	
The SCM/RCM Output fails because it is unable to change parameter in a CM while operator is able to make the same change manually.	
Diagnostic check:	An output command to a RegCtl function block that sets the setpoint to 50.0 but the RegCtl block's setpoint is not changed as expected. Check everything to ensure that the CM was configured correctly. Test that you can change the setpoint manually when the CM is in Auto mode.
Cause:	The CM's RegCtl function block must have a Mode Attribute of Program; otherwise, commands from the SCM/RCM to change parameters are ignored.
Solution:	Change the mode attribute to Program. (CMname.FBname.MODEATTR=2) When the mode attribute is in Program, the operator is unable to change parameters on the CM. For the operator to change CM parameters, the Mode Attribute must be Operator.

SCM/RCM Output to SCM/RCM not executing

SCM/RCM output to SCM/RCM not executing	
The SCM/RCM Output fails because it is unable to change parameter in an SCM/RCM while operator is able to make the same change manually.	
Diagnostic check:	An output command to an SCM/RCM sets the command to RESET but the SCM/RCM does not change as expected. Check everything to ensure that the SCM/RCM was configured correctly. Test that you can change the SCM/RCM Command manually.
Cause:	The SCM/RCM's must have a Mode Attribute of Program; otherwise, commands from another SCM/RCM to change parameters are ignored.
Solution:	Change the mode attribute to Program. (SCM/RCMname.MODEATTR=2) When the mode attribute is in Program, the operator is unable to change parameters on an SCM/RCM. For the operator to change SCM/RCM parameters, the Mode Attribute must be Operator.

Red X on SCM/RCM in Control Builder Monitor Tree

Red X on SCM/RCM in Control Builder Monitor tree	
A red X is displayed next to the SCM/RCM in Control Builder Monitor Tree.	
Diagnostic check:	The red X indicates a configuration problem.
Cause:	Configuration errors in SCM/RCM have occurred. The red X on the Handler, Step, or Transition indicates the location of the configuration error.
Solution:	The SCM/RCM, each Transition and each Output have configuration errors that are reported in their respective parameters: CONFIGSTS, CONFIGCODE, and CONFIGDESC. Examine these parameters for further detail regarding the configuration error.

SCM/RCM Step Output Timeout Alarm

SCM/RCM Step output timeout alarm	
A Step Output Timeout Alarm occurs causing an SCM/RCM Failure.	
Diagnostic check:	The SCM/RCM failure occurs because one Output of a Step does not successfully complete execution in the time allotted for that Output's Maximum Active Time. This failure is reported in the Output Execution Status. The SCM/RCM will remain on this Step until the Step Output is completed or operator action occurs to bypass the Step.
Cause:	Controller failure; communication failure; function block failure for a time that exceeds the configured Maximum Wait Time.
Solution:	If you know the reason for the failure and correct it, the output will execute on the next cycle and the alarm will clear. If you cannot correct the failure and are certain that it is alright to continue execution of the SCM/RCM, then use SingleStep Mode with GoTo to advance the SCM/RCM to its next Step bypassing the failed output. Available with R210 or later: you may use BYPREQ=SKIP to just skip the offending output.

Maximum Time Alarm on in Multiple SCM/RCM Outputs

Maximum time alarm on in multiple SCM/RCM outputs	
The Alarm Summary Display reports Step Timeout Alarm on multiple step outputs in multiple SCM/RCMs even though the outputs were executed as expected.	
Diagnostic check:	Check the step output expressions to verify that the expressions were executed as expected even though the maximum time alarms are on.
Cause:	Maximum active time is set incorrectly.
Solution:	The Maximum active time is set in cycles. A Maximum Active Time of 5 will allow 5 times the cycle time before the Output Timeout Alarm parameter is set On. If your base cycle time is 10 msec and your Maximum Active Time is 5, then the alarm will be set On after 50 msec.

SCM/RCM Cycle Overruns

SCM/RCM cycle overruns	
Cycle overruns occur when the scheduled processing for a cycle does not finish by the start of the next cycle. Potential causes for overruns include the following. • Unbalanced loading across the execution cycle. • Loaded configuration is too large. • Combination of block and communication processing is too large for a particular cycle. The CEE responds to cycle overruns as follows. • Completes execution of all blocks on the current cycle. • Delays execution of the waiting cycle until the start of the next 50-msec time interval. • Allows communications and housekeeping operations within the controller to catch up while execution of the waiting cycle is being delayed.	
Diagnostic check:	CEE issues a diagnostic alarm for cycle overruns that occur on a regular basis.
Cause (if controller is CPM with 50 ms Base Period):	Two consecutive intervals of 2000 milliseconds have at least one cycle overrun. Alarm is cleared when four consecutive intervals of 2000 milliseconds have no cycle overruns.
Cause (if controller is ACE with 500 ms Base Period):	Two consecutive intervals of 20 seconds have at least one cycle overrun. Alarm is cleared when four consecutive intervals of 20 seconds have no cycle overruns.
Solution:	After becoming aware of an overrun condition and viewing the overrun statistics, determine the cycle or cycles with overruns. At this point, do a checkpoint save followed by refresh monitor from checkpoint in order to save the current phase and period for all SCM/RCMs executing in the controller. A database query tool can be run against the monitor side of the database to determine which SCM/RCMs execute in the cycle with the overrun. Enter the following information into the Cycle Overrun Tool: • Controller node number

	• Base-cycle of controller • Cycle with overruns The query then produces a list of all the CMs and SCM/RCMs for the requested controller that run in the specific cycle with the overrun. This is determined based on the various combinations of Phase and Period that result in a CM or SCM/RCM executing in that cycle. The database query is run on the monitor version of the database to preserve the user's original configuration for Period and Phase (especially if the execution balancing was requested using -1 value for Phase). Once the CMs and SCM/RCMs that execute in the cycles with overruns are identified, redistribute their execution. If the execution balancing option was not used initially, it is recommended that all CMs and SCM/RCMs without order dependency be loaded using the execution balancing option Phase = -1. If execution balancing is not desired, then redistribute the CMs and SCM/RCMs by phasing them. Change Phase parameter to achieve a more balanced execution.

SCM/RCM STATUS = Binding

SCM/RCM status = Binding	
Diagnostic check:	Data owner/reference destination block of an alias can not be located
Cause:	Failure to bind is caused by any of the following situations: • The data owner/reference destination block is not loaded • The data owner/reference destination block is deleted
Solution:	Load and/or create then load the data owner / reference destination block.

SCM/RCM.ABORT.ConfigSts=SEVEREWARN

SCM/RCM.Abort.ConfigSts=SEVEREWARN	
After an ABORT was given, the SCM/RCM entered the ABORT Handler and stuck in front of the transition having the configuration error. Situation indicated by STATE = Disabled and color = gray.	
Diagnostic check:	ABORT Handler was defined with multiple Transitions and Steps, and one of the transitions in the ABORT handler had a configuration error. (indicated by .ConfigSts). As a consequence, SCM/RCM.ABORT.ConfigSts = SEVEREWARN. After an ABORT was given, the SCM/RCM entered the ABORT handler and stuck in front of the transition having the configuration error. This situation is indicated by its STATE being DISABLED and its gray color.
Cause:	The SCM/RCM can potentially be a very large and complex set of objects; therefore hierarchical principles of error propagation and the principle of graceful degradation are used. The SCM/RCM allows execution, even if the entire configuration is not completely valid.
Solution:	1. Change SCM/RCM.MODE to SingleStep. 2. Set SCM/RCM.TARGETSTEP[1] to a Step ID after the failed transition. 3. Set SCM/RCM.Command = RESUME. 4. Change MODE back to AUTO. Before starting a SCM/RCM, verify the ConfigSts of all Handlers. Disable Handlers in WARNING or SEVEREWARN. Handlers in ERROR are automatically disabled by the SCM/RCM. If you have multiple handlers of the same type, choose one with a good configuration.

Honeywell

Honeywell International
Process Solutions
2500 West Union Hills
Phoenix, AZ 85027