



# Monterey Phoenix

## System and Software Behavior Modeling Language (version 4.0)

# Addendum

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## 1. INTRODUCTION

This addendum accompanies the manual entitled “Monterey Phoenix: System and Software Behavior Modeling Language (version 4.0)” by Mikhail Auguston (dated March 3, 2020) as a supplement to aid in the use of the language and to make notes on the content of the manual. The topics included in this addendum are the following: current implementations of Monterey Phoenix version 4.0, a detailed index of MP Keywords, a detailed index of MP Pre-Defined Attributes, and a detailed index of MP Meta-Symbols.

## 2. CURRENT IMPLEMENTATIONS

MP-Firebird Tool: <https://firebird.nps.edu>

Monterey Phoenix version 4.0 currently has an implementation called the MP-Firebird Tool. This works solely through the web browser over the public internet, so that users do not need to install anything. The operation of MP-Firebird involves the following: a user composes the MP model, then runs it using the tool at the above address. This sends it to the Firebird server at NPS, which is where the MP code gets compiled and the scenarios are generated. As a result, these scenarios are displayed back to the user for inspection and potential re-working.

MP-Gryphon Tool: <https://nps.edu/mp/gryphon>

In addition to the MP-Firebird Tool described above, Monterey Phoenix version 4.0 currently also has another implementation, which is called the MP-Gryphon Tool. This is a stand-alone Python GUI interface that runs the MP trace-generator and displays the graphed results for viewing. Gryphon is installed locally and is currently compatible with several Linux flavors and older Mac systems, and can be accessed on Windows using a Linux emulator. The specific requirement to date is that the trace-generator must be able to build and run 32-bit x86 code.

### 3. INDEX OF MP KEYWORDS

In Version 4.0 of the Monterey Phoenix language, there are 79 keywords to date, all of which are included in Table 1 (below). The MP keywords are already defined within the code, such that each one of them has a specific purpose. Therefore, when integrated into models, none of the MP keywords can be used as root names, event names, or user-defined relation names. Each keyword is found in one or more MP Language Constructs within Chapter 6 of Version 4.0 of the manual, and this information is in Table 1. Additionally, the vast majority of the keywords are demonstrated within one or more numbered examples in Version 4.0 of the manual. For all of these keywords, an example that clearly illustrates a typical use of it in MP was chosen to be included in Table 1. The corresponding page numbers in the manual, as well as the corresponding Preloaded Example File Name, are also in Table 1.

Additional Information: For the 8 keywords that do not currently appear in any examples, dashed lines can be seen in those corresponding columns in Table 1. The keyword 'CONTAINS' does not currently appear in any numbered example, but it is used in a pseudo-code form on Page 146 within Section 7.3 of Version 4.0 of the manual.

In Table 1, there are a few keyword differences that can be seen when compared to the list on Page 147 of Version 4.0 of the manual. These changes are the following: 'AS', 'average', 'earliest', 'latest', and 'WHEN' were removed from Table 1 because they were never implemented as keywords in MP v.4.0; 'TITLE' was added to Table 1 because it is in fact an implemented keyword in MP v.4.0.

In MP-Firebird, the syntax highlighter displays all of the 79 MP keywords in the color purple.

**Table 1: MP Keywords**

MP Keyword	MP Language Construct #'s in Chapter 6	MP Manual Example #	MP Manual Page #	Preloaded Example File Name ( <a href="https://nps.edu/mp/models">https://nps.edu/mp/models</a> )
ACTIVITY	109	51	117	Example20_Activity_Diagram.mp
ADD	34, 104	1	9	Example01_SimpleMessageFlow_EventCoordination.mp
AFTER	22	7	17	Example11_PublishSubscribe_AsynchronousCoordination.mp
ALL	26	3	12	Example02_DataFlow_EventSharing.mp
AND	48, 62, 77, 108	22	41	Example15_BackpackWeight_IntervalAttributes.mp
APPLY	77, 78	21	39	Example14_ShoppingSpree_NumberAttributes.mp
ARROW	63, 104	28	54	Example31_Petri_Net.mp
AT	49	23	43	Work_Productivity.mp
ATTRIBUTES	50	21	39	Example14_ShoppingSpree_NumberAttributes.mp

MP Keyword	MP Language Construct #'s in Chapter 6	MP Manual Example #	MP Manual Page #	Preloaded Example File Name ( <a href="https://nps.edu/mp/models">https://nps.edu/mp/models</a> )
BAR	93	48	111	Example27_Table_and_Bar_Chart.mp
BEFORE	22	5	14	Example04_StackBehavior_EnsureCondition.mp
BUILD	54	5	14	Example04_StackBehavior_EnsureCondition.mp
CHAIN	29	-	-	-
CHART	93	48	111	Example27_Table_and_Bar_Chart.mp
CHECK	46	10	21	Example06_UnreliableChannel_AssertionChecking.mp
CLEAR	110	39	94	Example21_DataFlow_LocalReport.mp
CONTAINS	22	Section 7.3	146	-
COORDINATE	27, 28	1	9	Example01_SimpleMessageFlow_EventCoordination.mp
CUT_END	33	45	106	Example32_ATMWithdrawal_StatechartView.mp
CUT_FRONT	33	45	106	Example32_ATMWithdrawal_StatechartView.mp
DIAGRAM	109	51	117	Example20_Activity_Diagram.mp
DISJ	65	6	15	Example05_CarRace_NestedComposition.mp
DO	27, 28, 39, 105	1	9	Example01_SimpleMessageFlow_EventCoordination.mp
ELSE	42, 81	24	45	Railroad_Crossing_Safety.mp
ENCLOSING	22	-	-	-
ENSURE	45	5	14	Example04_StackBehavior_EnsureCondition.mp
EXISTS	65	25	47	Dining_Philosophers.mp
FI	42, 81	7	18	Example11_PublishSubscribe_AsynchronousCoordination.mp
FIRST	33	-	-	-
FOLLOWS	22	7	18	Example11_PublishSubscribe_AsynchronousCoordination.mp
FOR	39, 105	43	102	Example25_Graph_as_Data_Structure.mp
FOREACH	65	5	14	Example04_StackBehavior_EnsureCondition.mp
FROM	22, 24, 64, 93	1	9	Example01_SimpleMessageFlow_EventCoordination.mp
GLOBAL	48, 70, 79	40	95	Example22_UnreliableMessageFlow_GlobalReport.mp
GRAPH	88	43	101	Example25_Graph_as_Data_Structure.mp
HAS	63	-	-	-
IF	42, 81	7	18	Example11_PublishSubscribe_AsynchronousCoordination.mp
IN	22, 34	42	100	Example24a_Compiler_ComponentDiagram.mp

MP Keyword	MP Language Construct #'s in Chapter 6	MP Manual Example #	MP Manual Page #	Preloaded Example File Name ( <a href="https://nps.edu/mp/models">https://nps.edu/mp/models</a> )
IS	63	33	64	Example19_StackBehavior_BayesianProbabilityCalculationsType2.mp
LAST	33, 102, 104	42	100	Example24a_Compiler_ComponentDiagram.mp
LEAST	49	23	43	Work_Productivity.mp
LINE	63, 104	42	100	Example24a_Compiler_ComponentDiagram.mp
MAP	37	36	71	Example35_Authentication_SystemReuse.mp
MARK	43, 80	7	18	Example11_PublishSubscribe_AsynchronousCoordination.mp
MAX	78	-	-	-
MAY_OVERLAP	63	25	47	Dining_Philosophers.mp
MIN	78	-	-	-
NEW	103, 104	41	97	Example23_CarRace_LocalGraph.mp
NOT	63	18	33	Example04b_QueueBehavior_UserDefinedRelations.mp
OD	27, 28, 39, 105	1	9	Example01_SimpleMessageFlow_EventCoordination.mp
ON	37	36	71	Example35_Authentication_SystemReuse.mp
ONFAIL	46	10	21	Example06_UnreliableChannel_AssertionChecking.mp
OR	48, 61, 77, 108	17	32	Example04a_StackBehavior_UserDefinedRelations.mp
PRECEDES	22, 34	1	9	Example01_SimpleMessageFlow_EventCoordination.mp
REJECT	43	47	109	Knapsack_Weight_Limit.mp
REPORT	84	39	94	Example21_DataFlow_LocalReport.mp
REVERSE	33	17	32	Example04a_StackBehavior_UserDefinedRelations.mp
ROOT	3	1	9	Example01_SimpleMessageFlow_EventCoordination.mp
ROTATE	93	50	114	Example29_Gantt_Chart.mp
SAY	47, 107	6	16	Example05_CarRace_NestedComposition.mp
SCHEMA	1	1	9	Example01_SimpleMessageFlow_EventCoordination.mp
SET	49	23	43	Work_Productivity.mp
SHARE	26, 44	3	12	Example02_DataFlow_EventSharing.mp
SHIFT_LEFT	33	16	31	Example12_RingTopology_UserDefinedRelations.mp
SHIFT_RIGHT	33	-	-	-
SHOW	109, 111	40	95	Example22_UnreliableMessageFlow_GlobalReport.mp
SORT	33, 111	26	49	Example33_FiniteStateDiagram_PathAnnotation.mp

<b>MP Keyword</b>	<b>MP Language Construct #'s in Chapter 6</b>	<b>MP Manual Example #</b>	<b>MP Manual Page #</b>	<b>Preloaded Example File Name (<a href="https://nps.edu/mp/models">https://nps.edu/mp/models</a>)</b>
STEP	40	49	113	Example28_Histogram.mp
SUCH	24	11	22	Example07_UnconstrainedStack_TraceAnnotation.mp
SUM	78	21	39	Example14_ShoppingSpree_NumberAttributes.mp
TABLE	90	48	111	Example27_Table_and_Bar_Chart.mp
TABS	92, 93	48	111	Example27_Table_and_Bar_Chart.mp
THAT	24	11	22	Example07_UnconstrainedStack_TraceAnnotation.mp
THEN	42, 81	7	18	Example11_PublishSubscribe_AsynchronousCoordination.mp
THIS	72	19	34	Web_Browser_Formal_Security.mp
TIMES	78	-	-	-
TITLE	86	48	111	Example27_Table_and_Bar_Chart.mp
WITHIN	98	28	54	Example31_Petri_Net.mp
X_AXIS	93	49	113	Example28_Histogram.mp

## 4. INDEX OF MP PRE-DEFINED ATTRIBUTES

Aside from the keywords detailed in Table 1, there are also 10 separate pre-defined attributes in MP v.4.0. These are already defined within the code, such that each one of them has a specific purpose. Pre-defined attributes can be integrated into models in various ways, such as setting event timing intervals (by using 'start', 'end', and 'duration'), or yielding a unique number of trace instance under derivation (using 'trace\_id'). Information regarding MP Language Construct numbers, MP Manual Example numbers, Page numbers, and Preloaded Example File Names for each pre-defined attribute are all included in Table 2.

Additional Information: For the 3 pre-defined attributes that do not currently appear in any examples, dashed lines can be seen in those corresponding columns in Table 2.

In MP-Firebird, the syntax highlighter displays the MP pre-defined attributes in the color blue, except for the `##$TP()` function. In this case, it is the color gray due to the double dollar sign (`##`).

**Table 2: MP Pre-Defined Attributes**

MP Pre-Defined Attribute	MP Language Construct #'s in Chapter 6	MP Manual Example #	MP Manual Page #	Preloaded Example File Name ( <a href="https://nps.edu/mp/models">https://nps.edu/mp/models</a> )
duration	49	23	43	Work_Productivity.mp
end	49	24	45	Railroad_Crossing_Safety.mp
largest	69	50	114	Example29_Gantt_Chart.mp
len	69	-	-	-
max	48, 69, 108	-	-	-
min	48, 69, 108	-	-	-
smallest	69	50	114	Example29_Gantt_Chart.mp
start	49	24	45	Railroad_Crossing_Safety.mp
trace_id	53	21	39	Example14_ShoppingSpree_NumberAttributes.mp
##\$TP(trace_id)	82	46	108	Example26_UnreliableMessageFlow_GlobalQuery.mp



## 5. INDEX OF MP META-SYMBOLS

Aside from the keywords detailed in Table 1 and the pre-defined attributes detailed in Table 2, there are also 6 separate meta-symbols in MP v.4.0. These are already defined within the code, such that each one of them has a specific purpose. The MP meta-symbols '\$\$EVENT', '\$\$ROOT', '\$\$COMPOSITE', and '\$\$ATOM' can be used to provide the following, respectively: the total number of events within another event E, the number of root events only, the number of composite events only, and the number of atomic events only. The meta-symbol '\$\$TRACE' can be used to provide the number of valid event traces derived for the current scope. The meta-symbol '\$\$scope' can be used in models to provide the number of the current scope, which is desirable in many different instances. Information regarding MP Language Construct numbers, MP Manual Example numbers, Page numbers, and Preloaded Example File Names for each meta-symbol are included in Table 3.

Additional Information: The meta-symbol '\$\$ATOM' does not currently appear in any examples in the manual, but it can be found in one of the preloaded examples, as indicated in Table 3 below.

In MP-Firebird, the syntax highlighter displays the MP meta-symbols in the color gray, due to the presence of the double dollar sign (\$\$).

**Table 3: MP Meta-Symbols**

MP Meta-Symbol	MP Language Construct #'s in Chapter 6	MP Manual Example #	MP Manual Page #	Preloaded Example File Name ( <a href="https://nps.edu/mp/models">https://nps.edu/mp/models</a> )
\$\$TRACE	82	40	95	Example22_UnreliableMessageFlow_GlobalReport.mp
\$\$EVENT	36	23	44	Work_Productivity.mp
\$\$ROOT	36, 63	19	35	Web_Browser_Formal_Security.mp
\$\$COMPOSITE	36, 63	28	54	Example31_Petri_Net.mp
\$\$ATOM	36, 63	-	-	Baseball_At_Bat.mp
\$\$scope	15	7	16	Example11_PublishSubscribe_AsynchronousCoordination.mp