

New Features in ExtendSim 9



New Statistics (DB) Report

Statistics (DB) report contains final values for output parameters. Statistical data from each simulation run is stored in an ExtendSim database, organized by block type so that there is one table per type of block. Blocks included in the report can be all blocks in the model or a user-defined subset of the blocks. Report tables can be exported to external databases or Excel when the simulation is complete.

Of course, ExtendSim's existing text-based reports have been maintained, but the new Statistics (DB) report provides better organization, presentation, and accessibility of model results.

This sample report shows resource usage in a healthcare model.

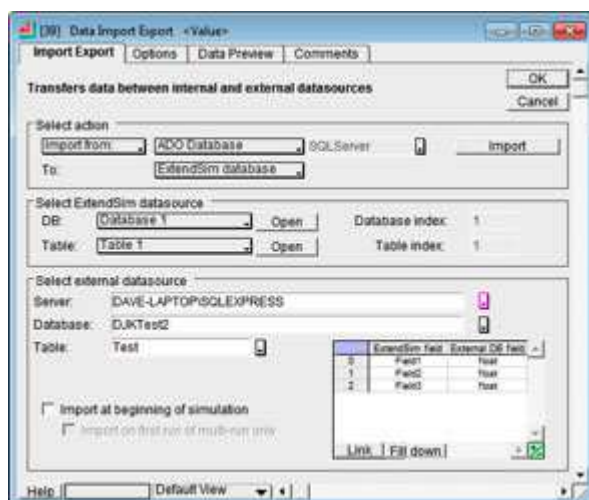
Record #	Block Label	Block Number	Block Name	Total resources	Resources in use	Resources available	Utilization	Name	Waiting
1		112	Resource Pool 2	2	2	0	0.31771855	3	
2		132	Resource Pool 1	1	1	0	0.40426870	0	
3		130	Resource Pool 3	3	3	0	0.64002380	0	
4		170	Resource Pool 1	1	1	0	0.62313704	0	
5		171	Resource Pool	Resource at 1	0	0	0.62051471	0	
6		173	Resource Pool	24	23	1	0.57122792	0	
7	FTBed	112	Resource Pool 2	2	0	0	0.39213150	2	
8	Nurse	132	Resource Pool 2	2	0	0	0.40021207	0	
9	Dr	130	Resource Pool 3	3	0	0	0.65415254	0	
10	FTDr	170	Resource Pool 1	1	0	0	0.62965702	0	
11	FTNurse	171	Resource Pool 0	0	0	0	0.61095856	0	
12	Bed	173	Resource Pool	24	24	0	0.56207943	3	
13	FTBed	112	Resource Pool 0	0	0	0	0.61386637	0	
14	Nurse	132	Resource Pool 1	0	0	1	0.40444429	0	
15	Dr	130	Resource Pool 3	0	0	0	0.64375681	4	
16	FTDr	170	Resource Pool 0	0	0	0	0.62119666	0	
17	FTNurse	171	Resource Pool 0	0	0	0	0.62627128	0	
18	Bed	173	Resource Pool	24	24	0	0.59024120	2	



ADO Database Support (Windows only)

Communicate with the most commonly used external databases. ActiveX Data Objects (ADO) provides built-in import and export support for Microsoft Access, SQL Server, and MySQL. ADO sends an entire table of information at one time, providing high-speed data interchange.

ADO is faster and easier to use than ODBC and it does not require defining a data source name (DSN) before accessing data. It automatically configures the ExtendSim database when importing and the external database when exporting. Plus mirrors fields and records between the source and its destination.



Data Import/Export for ADO Database

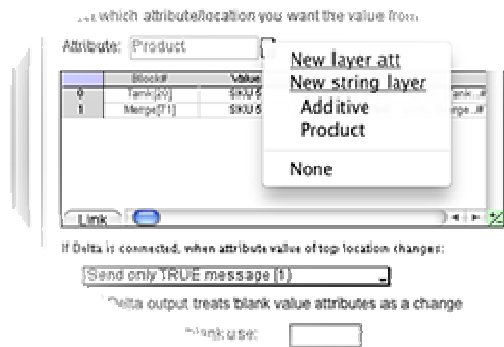


For example, here is the dialog of the Data Import/Export block configured for ADO Import from a SQLServer database into an ExtendSim database. The ADO interface is designed so that the modeler can access an ADO database by adding a Data Import/Export block to the model and selecting the internal and external data sources.



Flow Attributes

Enhancing ExtendSim's unique discrete-rate technology, flow attributes track the properties of the type of product that is modeled as a continuous "flow" in a discrete event environment. Examples of flow include bulk material such as grain or ore, liquids and gases, and product in a high-speed production line. A flow attribute is a quality or characteristic of flow that stays with it as it moves through the model, such as type, product, color, and so forth. Flow attributes provide information about the flow and allow you to organize quantities or volumes of flow into layers. The entire set of attribute values assigned to a particular layer is what distinguishes it from other layers. In other words, all the units of flow in a layer possess the same set of flow attribute values.



Flow attribute usage includes:

- The flow held in a Tank can be organized into individual, distinct layers. This allows you to control where incoming flow is deposited and which type of outgoing flow next exits.
- Flow rates through the Valve block can be calculated based on flow attribute values.
- Flow can be routed through the Merge and Diverge blocks based on flow attribute values.
- Attributes are assigned to the flow by the model builder. They become linked to sections of flow that pass through the blocks, according to settings in the blocks' dialogs.



Excel Add-In

The ExtendSim DB Add-In for Excel works with database text files to transfer data between an ExtendSim database and Microsoft Excel. Excel has become the ubiquitous repository for simulation data and is often used for ad-hoc analysis. However, because of performance and scalability issues, Excel is a less-than-ideal database. To bridge the gap between Excel as a data repository and the ExtendSim database, we created an Excel Add-In that allowed exported ExtendSim database text files to be imported into Excel for editing, then exported back to ExtendSim.

ExtendSim 9 contains an entirely new version of the Add-In that supports most of the construction and editing features available in ExtendSim. This means that you can completely specify a new ExtendSim database in Excel, including parent/child relationships, cell randomization, named distributions, and more. Afterwards, export the database for use in ExtendSim models. In addition, the new Add-In leverages the latest Excel features such as ribbon interface, XML-based file format, and 1 million rows/16,000 columns. Plus, database consistency checking is now faster and has expanded capabilities.



Item Logging

Track items and their states as they move through a simulation. In addition to the existing ExtendSim trace features, the Item Log Manager (ILM) block supports customized data collection and report configuration from within ExtendSim by doing two things:

- During the simulation run, the ILM block directs other blocks in the model to collect data on items as they pass through. These "remote" data collecting blocks include History, Activity, Queue, Queue Equation, and Resource Item. Each of these blocks can be remotely instructed to collect specific item property information for the ILM through its "Data Collection" tab.
- Once the remote blocks have collected the data, the ILM packages it into a report. You can control which types of data are included in the report and the order in which the data appears. This is done on the ILM block's "Configure Log" tab.

Runset #	Plane ID	Hours	Block Label	Entry Time	Exit Time
1	747	0.00	Airplane Hanger	0.00	0.00
2	747	0.00	Flight	0.00	9.94
3	747	8.94	Airplane Hanger	8.94	8.94
4	747	8.94	Flight	8.94	19.88
5	747	19.88	Airplane Hanger	19.88	19.88
6	747	19.88	Flight	19.88	24.19
7	747	24.19	Airplane Hanger	24.19	24.19
8	747	24.19	Flight	24.19	29.88
9	747	29.88	Airplane Hanger	29.88	29.88
10	747	29.88	Flight	29.88	35.00
11	747	35.00	Maintenance	35.00	38.00
12	747	0.00	Airplane Hanger	38.00	38.00
13	747	0.00	Flight	38.00	42.00
14	747	6.99	Airplane Hanger	42.00	42.00
15	747	6.99	Flight	42.00	56.07
16	747	20.07	Airplane Hanger	56.07	56.07
17	747	20.07	Flight	56.07	68.07
18	DC-10	0.00	Airplane Hanger	0.00	0.00
19	DC-10	0.00	Flight	0.00	7.39
20	DC-10	7.39	Airplane Hanger	7.39	7.39
21	DC-10	7.39	Flight	7.39	14.71
22	DC-10	14.71	Airplane Hanger	14.71	14.71
23	DC-10	14.71	Flight	14.71	18.81
24	DC-10	18.81	Airplane Hanger	18.81	18.81
25	DC-10	18.81	Flight	18.81	24.06
26	DC-10	24.06	Airplane Hanger	24.06	24.06
27	DC-10	24.06	Flight	24.06	31.31
28	DC-10	31.31	Maintenance	31.31	32.31
29	DC-10	0.00	Airplane Hanger	32.31	32.31
30	DC-10	0.00	Flight	32.31	41.99

Once the run is complete, any number of reports can be generated from the data that has been collected in the remote blocks. These reports can be generated after each run either automatically or manually. Any number of ILM blocks can be used in any one model with each ILM block responsible for generating its own report. The ILM also supports generating reports across multiple runs.

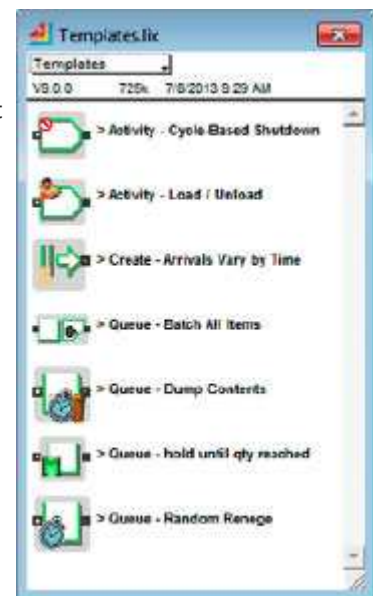
This screenshot is an example log of aircraft operations, showing the individual plane ID's and their corresponding entry and exit times through various points in the model.



9 Templates Library

Speed up model building by using pre-built templates for common modeling situations. These templates are actually submodels within hierarchical blocks - constructs created in ExtendSim by combining just a few blocks together.

ExtendSim's Templates library blocks are similar to standard blocks in that they contain an icon, help, blocks, and animation that can be used directly by the modeler. However, they contain the combined functionality of many blocks. As with any ExtendSim block, simply drag a block from the Templates library into the model and change the parameters to reflect a specific modeling situation.



9 Smart Connections

Intelligent connection line control better automates the modeling process when moving blocks around. Imagine That has developed a series of features collectively called "smart connections" that allow the modeler to quickly and easily modify models by moving blocks into strategic positions.

> Bump Connect

When a block from the Item or Rate library is placed in the model and its input connector is placed on an output connector of the same type, ExtendSim will automatically connect the blocks spaces them evenly, and aligns the connectors.

> Insert Over Connection

Drop a block onto an existing connection line so either the block's input or the output connector is on that connection line. Smart connections will increase the spacing between the existing blocks and insert the new block inline between two existing blocks.

> Connection Routing

If a block is moved, ExtendSim will reroute the connection lines so they will not cross over the icon of the block.



New Menu Commands

Read/Write Index Checking (Database menu)

Gives an error message when a model tries to read or write data using a non-existent or incorrect database address or index. Useful for debugging block code that interfaces with the database.

Smart Connections (Edit menu>Options>Model tab)

If unchecked, turns off the intelligent connection line control discussed in Smart Connections.

Statistics (DB) Report (Run menu>Report Type>Statistics DB)

Automatically stores and organizes statistical data from each simulation run in an ExtendSim database as discussed in Statistics (DB) Report.



Other New Blocks

Get(R) and Set(R)



Both the Get(R) and Set(R) blocks support the Rate library's new flow attributes feature.

The Set(R) block is for setting value or string flow attributes.



The Get(R) block displays either multiple flow attributes from one location or one flow attribute from multiple locations.



Meter block



Provides more flexibility and features than the Meter control (Model>Controls>Meter). For example, the color and pattern of the indicator change when the current value has reached specified high and low values. Use the Meter block as a progress bar or to animate a hierarchical block.



Other New Features Added in ExtendSim 9

Equation-based blocks :

- ▶ New input and output variables in equation-based blocks.
- ▶ Options added in equation-based blocks that provide more control as to when the equation executes.

Data import: New options for importing a named range of data from Excel.

Interval statistics: Record the mean, variance, confidence interval, and standard deviation at specific intervals during the simulation using interval statistics.

Quantile statistics: Can now be calculated within ExtendSim.



Multi-component failure modeling

New options are available for multi-component failure modeling



User Interface and Block Enhancements

String Attributes

- If a change is made to the value of a string attribute, all the blocks that were referencing the old attribute value will now reference the new value.
- If the index for the value of a string attribute changes (the order of the values for the string attribute change), all the blocks that were referencing that value will be alerted to the change in location.
- Changes to string attribute values defined in the database are now error checked at the beginning of the run. This provides more freedom to manipulate databases without having to worry about losing critical pieces of information.
- A new string attribute interface in the Executive block allows modelers to make global changes to string values that are referenced in other blocks in the model.



Speed Improvements

- Models with blocks that don't have Simulate messages now execute faster.
- Linked list optimization speeds up the performance of Item library queues and the blocks in the Rate library.



Other Application Enhancements

ExtendSim Database

Automatically resizes itself based on the number of rows in the imported data.

Variable names

The upper limit of the variable name length for static and local variables has been increased from 63 to 127 characters.

Data tables

Double-clicking the upper left cell of a data table linked to a database goes directly to the database view of that table.

Block Profile

Reports results even if the simulation ends prematurely.



Shift capabilities

ExtendSim's shift capabilities are enhanced and interfaced with additional blocks.



E3D

Mount nodes on custom 3D objects have been increased from 8 to 20.



Enhancements to Equation-Based Blocks

- Additional input and output variables in most blocks.
- New checkboxes in the Options tab control the execution of the equation.
- Equation blocks now support static variables that have been declared in include files.
- Query Equation (AT and Suite only) has new input variables.

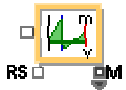


Value Library Enhancements



Data Import Export

- ▶ Incorporates the new ADO capability.
- ▶ New option to import named range from Excel spreadsheet.
- ▶ Database field names can be exported to Excel.
- ▶ When importing from Excel, the number of rows in the database automatically adjust.



Mean & Variance

- ▶ Collects interval statistics for a specified time period. At the end of the period it reports the calculated statistics, clears the statistics, and begins a new reporting period.
- ▶ Has quantiles so you can see what proportion of the observations fell within an interval.

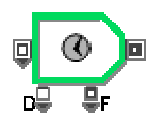


Item Library Enhancements

Residence blocks

(Activity, Queue, Queue Equation, and Workstation)

Added variable item input connectors to each block to allow the merging of multiple item streams. This functionality works the same as the Select Item In block's Merge option.



Activity

- ▶ Two new value inputs:
 - ▶ PC (Processing Cost) allows users to target different processing costs on different items.
 - ▶ CPI (Cost Per Item) attaches a unique CPI to each item.
- ▶ One new value output: TE (Total Items Exited)
- ▶ If preempting with items, attributes on the preempting item can be transferred to the preempted item.



Executive

Added variable connectors for events.



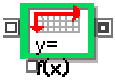
Gate

Now allows the Shift block to control its behavior.



History

- ▶ Provides more control over data collection in ExtendSim 9, plus has new options for handling data storage in multi-run scenarios.
- ▶ A checkbox on the Options tab causes data to be stored in a database table at the end of each run.



Query Equation (I) *(AT and Suite only)*

Added targeted querying and two new input variables.



Queue Equation

Gained new input and output variables.



Queue Matching

New "recipe" building and batching capabilities added.



Read (I) and Write (I)

These blocks have new options for querying where to read and write data.



Scenario Manager

(AT and Suite only)

Supports the optimal design of experiments (DOE) method for Minitab 16, a statistical software product from Minitab Inc.



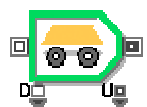
Shift

Allows modelers to display a symbol on block icons if a specific Shift block is used.



Shutdown

- ▶ Separate and independent polices can be specified for both Shift and connector-based scheduled shutdowns.
- ▶ Off-shift downs (OFD) connector reports the number of shutdowns due to off shifting.
- ▶ Accumulated off-shift downtime (OST) connector reports the amount of time the block has been down due to off shifting.
- ▶ The "multiple components" option has new capabilities:
 - ▶ The matching feature allows one master failure table to represent multiple failure points in a model.
 - ▶ Summary failure data for each component.
 - ▶ Component state and dependency/independency options.
 - ▶ Block state versus component state reports.



Transport

Now has an option to prevent items from passing each other when traveling through the block.



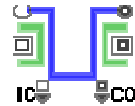
Rate Library Enhancements

Flow attributes

- ▶ Characteristics of the flow such as type, product, color, and so forth can be associated with each specified volume of flow.
- ▶ Two types of flow attributes are supported: layer and string layer.

Contents tab

Each Rate block that holds/provides flow has a Contents tab showing the attribute values of its flow by volume.



Interchange

Now includes a matrix for converting item attributes into flow attributes and vice versa.



Tank

Provides multiple options for defining how the incoming and outgoing flow should be layered.



New Functions, Message Handlers, and Global Variables

In addition to the functions listed below, include files are useful when creating custom blocks. To see a block's include file, open the block's structure. Then give the menu command Develop>Open Include Files.


New Modl Functions

- blockRect
- clearUndo
- DBAddressGetAllIndexes
- DBDatabaseOpenViewerToTab
- DBDatabaseTabChangeName
- DBDatabaseTabDelete
- DBDataGetCurrentSeed
- DBDataSetCurrentSeed
- DBFieldExists
- DBRecordExists
- dialogRefresh
- EquationCompileSetStaticArray
- fileChoose
- INetFileImportText
- INetOpenURL
- lastSetDialogVariableString
- whoInvoked

 WinSetForegroundWindow




New Message Handlers and Global Variables

 ModifyRunParameter

 BlockReceive5-9

 SysGlobal20-29

 SysGlobalInt30-59




ADO (ActiveX Data Object) Functions

These functions are used to communicate between ExtendSim and external databases. They are not part of the ExtendSim application but instead are located in the "ADO_DBFunctions v9.h" include file.

 ADO_Setup

 ADO_Close

 ADO_OpenConnection


 ADO_GetNumTables

 ADO_GetTables

 ADO_GetTableColumns

 ADO_SetTableColumns

 ADO_AddRecords


 ADO_SQLServerGetServers

 ADO_SQLServerGetDatabases

 ADO_CreateTable

 ADO_GetFields

 ADO_GetNumRows

 ADO_GetNumFields

 ADO_ExecuteNonQuery

 ADO_ExecuteQuery

 ConvertADODataType

 ConvertExtendSimDataType

 DB_FieldGetTypeString

 ADO_CheckCompatibleFieldType

