

MIMIC User Guide



**12301 Research Blvd.
Building IV, Suite 410
Austin, TX 78759**

U.S. Help Desk Phone: +1-800-546-9646 (or direct +1-512-697-3000), select ext. 3400

U.K. Help Desk Free Phone: 0800 032 6063

Europe Help Desk Phone: +44 20 7190 2947

Help Desk Email: support@lim.com

+1-512-697-3001 (Fax)

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Logical Information Machines, Inc.

120 North LaSalle Street

Suite 2150

Chicago, IL 60602

Phone: +1 (312) 456-3000

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Table of Contents

Chapter 1: Introduction	1
Installation	1
MIMIC Research Capabilities	1
Chapter 2: MIMIC Configuration Window	3
MIMIC Toolbar	4
Worksheet Toolbar	5
The Worksheet	5
Worksheet Shortcuts	6
Copy/Paste Options, Right-Click Menu and Repositioning Rows	6
Synchronization of Columns and Time Units	6
Data Builder	7
Chapter 3: Menu Options	9
File Menu	9
Edit Menu	10
View Menu	10
Options Menu	11
Tools Menu	11
Help Menu	11
Chapter 4: Series Tab – Data Builder	13
Custom Contract/Edit Rollover	14
Setting Custom Contract / Edit Rollover Options	14
Presets	16
Rollover Date	16
Date Offset	16
Expiration	17
Prices	17
Modify Prices	19
Edit Chart Stats	19
Chapter 5: Formula Tab – Data Builder	21
Chapter 6: Curve Tab – Data Builder	23
Chapter 7: Forward Curve Tab – Data Builder	25
Forward Curve Parameters	26
Chapter 8: Date Options and Worksheet Options – Data Builder	29
Seasonal Analysis	29
Seasons Tab	30
Averages Tab	30
Missing Data NaNs	30
Execution Units	32
Axis Config	32
Chapter 9: User Preferences	33

General Tab	34
Table Tab	35
Printing Tab	35
Desktop/Excel Tab	35
Charting Tab	36
Screening Tab	36
Chapter 10: Searching in MIMIC	37
Searching Methods	37
Searching by Symbol	38
Adding Result(s) to the Worksheet	38
Mapping a Result in the Tree View	39
Searching by Description	39
Narrowing a Search	39
Search Options	40
Chapter 11: Charts	41
Chart Options	41
Color Configuration	42
Chapter 12: Tables	43
Table Options in the Worksheet Options Pane	43
Sorting Table Data	44
Table Summary Statistics	45
Chapter 13: Stored Formulas	47
MIM Schema Browser	47
Import Item as Variable	47
Import Item as Formula	47
Symbol Information	48
Formula Specifications	48
Chapter 14: MIMICExcel	51
MIMIC vs. MIMICExcel	52
Toolbars for MIMICExcel	52
MIMICExcel Add-in Toolbar	52
MIMICExcel Toolbar	53
Queries in MIMICExcel	53
Embedding a Query	54
Query Manager	55
Refreshing MIMICExcel Queries	55
Advanced Refresh Options	56
LLC Worksheets	56
Chapter 15: Formula Table	57
Overview	57
Formulas for Built-ins	57
% Move or Move	57
Absolute Value	58
Adjust Contract	58
Average	61
Bollinger High/Bollinger Low	62

Compound_return	62
Construct Date	62
Coregression	63
Coregression_intercept	64
Coregression_slope	64
Correlation	65
Count	66
Covariance	66
Dividend Adjusted Return	66
Ease of Move	67
Exponential Average	67
Extract Day	68
Extract Month	68
Extract Year	68
Greatest Integer	69
Highest	69
If-Then Statement	69
Inverse Log	70
Linear Regression	70
Lowest	71
Macd_osc	71
Macd_signal	72
Median	72
Midpoint or Mid_point	73
Move	73
Natural Log	73
Nearest Integer	74
Negative Value	74
Net Change	74
Net Percent Change	75
On Balance Volume	75
Periods in Range	75
Positive Value	76
Product	76
Range	76
Rel Strength	77
Select Contract	77
Simple_rsi	80
Smallest Integer	80
Standard Deviation	81
Standard Deviation Population	81
Sum	82
True Midpoint	82
True Range	82
Variance	83
Wilders_rsi	83


Williamsr	84
Formulas for Server Macros	84
_CoolingDegreeDays	84
_HeatingDegreeDays	85
_OffPeakAverage	86
_OnPeakAverage	86
_2x8Average	87
_2x16Average	88
_5x8Average	89
_5x16Average	89
_7x8Average	90
_7x16Average	91
AccDist	92
Aspect	92
AspectEquatorial	93
AspectHelio	93
AspectPlot	93
PlotAspectX	94
BackContract	95
BlackScholesOptionPrice	95
ChannelIndex	95
ChoppinessIndex	96
DeMarker	96
DeferredContract	96
DirMove	98
DirMoveIdx	99
FarContract	99
FrontContract	100
HistVolLog	101
HistVolPct	102
MoneyFlowIndex	102
NegVolIndex	102
NetHedgers	103
NetHedgersPct	103
NetLargeSpecs	103
NetLargeSpecsPct	104
NetSmallTraders	104
NetSmallTradersPct	104
NormalDist	105
RangeExpIndex	105
RealSum	105
Stochastics	106
Trendline	107
VolPriceTrend	107
Volatility	107
VolatilityIdx	108

WildersADX	108
WildersADXR	108
WildersDIMinus	109
WildersDIPlus	109
WildersDX	109
WildersRSI	110
WilliamsVolAD	110
Index	113

CHAPTER 1

Introduction

This user guide provides an overview of the MIMIC software product, a powerful research tool that incorporates a multitude of market-specific features into a logical, user-friendly platform. The information in this guide introduces the basic functional components of the software interface in an easily-accessible format for users of all skill levels.

MIMIC also features a context-sensitive help system that references the help topics in this guide. To use this system, users can select the  button in the MIMIC toolbar, and then select the appropriate MIMIC component to quickly locate related information.

Installation

For instructions on installing the MIMIC application, see the [“MIMIC Installation and Purchase Options”](#) chapter in the *Client Application Installation Guide*.

MIMIC Research Capabilities

MIMIC is a powerful research tool that incorporates a multitude of market-specific features into a logical, user-friendly platform. Users can easily perform complex market-specific evaluations, and create custom-tailored output using the following MIMIC functionalities:

Functionality	Description
Charts and Tables	MIMIC's advanced charting capabilities create superior charts and tables on the fly. Set trendlines, zoom into specific areas and perform updates with ease. Tables can be exported to Microsoft Excel [®] . The summary statistics at the bottom of the table provide useful information, such as average price for the period, maximum and minimum prices, standard deviation and the last closing price.
Seasonal Analysis	MIMIC allows you to create seasonal analysis studies in which the price history of a commodity can be charted over several years on a single chart.
Forward Curves	Use MIMIC's forward curves functionality to chart today's market estimate of the price of a commodity at various points out into the future. View multiple curves in MIMIC for a particular commodity and see the underlying future series in the same chart.
Units and Currency Conversion	MIMIC allows you to compare different commodities by first establishing a common unit of quotation.

Functionality	Description
Search Functions	The extensive data in the MIM database can be searched using the Search Database button to locate symbol names and descriptions or by drilling down into folders using the Tree View feature.
Formulas	Perform arithmetic computations using the MIM Formula Library that includes technical studies, such as correlation, rsi, macd and moving averages to name a few.
MIMICExcel	Run MIMIC from within Excel (MIMICExcel), providing all the functionality of MIMIC while working in the Excel environment.
7-day & Intraday Data	The MIM database contains 7-day, intraday and tick data values. Event date files are also available.

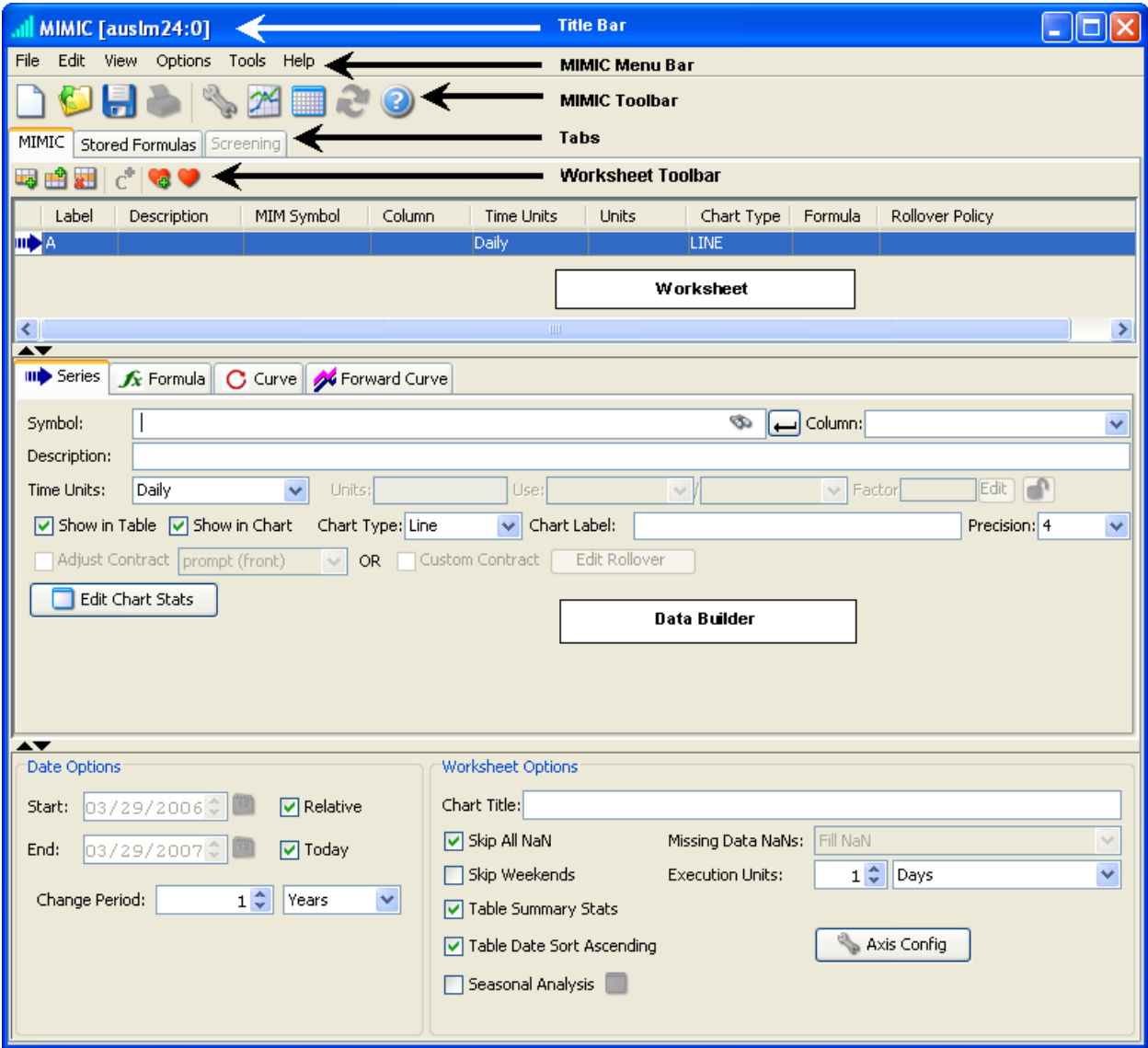


For more information on MIMIC, click the "Documentation" link on the LIM Web site (www.lim.com).


CHAPTER 2

MIMIC Configuration Window

The MIMIC interface, or the MIMIC **Configuration** window, allows users to enter and view query information. It is organized into two distinct areas: the Worksheet (the upper portion of the window) and the Data Builder (the lower portion of the window).












The **Configuration** window includes the following main components:

Component	Function
Title Bar	Displays the software name and server/port number in brackets.
Menu Bar/Toolbar	Provides primary access to MIMIC's functions and commands, such as saving a worksheet, opening a saved worksheet, or printing a table or chart. The menu bar includes menus and menu options and the toolbar includes toolbar buttons.
Tabs	Provides data functionality based on the selected tab: MIMIC, Stored Formulas, or Screening.
 The Stored Formulas and Screening tabs require an additional fee for activation.	
Worksheet Toolbar	Includes buttons with functions specific to the Worksheet.
Worksheet	Includes a record of the data series or formulas that were constructed using the Data Builder.
Data Builder	Allows user to create a detailed query. Includes the following tabs: Series , Formula , Curve and Forward Curve .







MIMIC Toolbar

The buttons in the **MIMIC** toolbar allow users to quickly access a commonly-used MIMIC function. The **MIMIC** toolbar includes the following buttons:


Button	Name	Function
	New	Opens a new worksheet.
	Open	Opens an existing worksheet.
	Save	Saves a worksheet.
	Print	Prints a chart or table.
	Configuration	Returns to the Configuration window from a chart or table.
	Chart	Creates a chart from a worksheet.
	Table	Creates a table from a worksheet.
	Refresh	In a chart or table, select the Refresh button to update the data view.
	Help	Opens the MIMIC content-sensitive help.

Worksheet Toolbar

The buttons in the **Worksheet** toolbar allow users to manage rows within the Worksheet. The **Worksheet** toolbar includes the following buttons:

Button	Name	Function
	Add Row	Adds a new row to the bottom of the Worksheet.
	Insert Row	Inserts a row above the selected row.
	Remove Row	Removes a row from the Worksheet.
	Add Contracts	Adds a new contract. Users can specify a date range (month and year) and the contracts automatically display in the Data Builder. If users check Add Seasonal Contracts , MIMIC adds all the contracts for the entered months/years seasonally in the Data Builder.
	Add to Favorites	Saves commonly-used relation and column names in the Data Builder.
	Favorites	Displays the relation and column names saved in Favorites .




The **Add Contracts**  button is disabled until users add a futures contract to the Data Builder.

The Worksheet

The Worksheet constitutes the top portion of the **Configuration** window, above the Data Builder and below the **Worksheet** toolbar. The Worksheet displays any query information constructed in the Data Builder. MIMIC displays this query information displays in columns in the Worksheet.

The Worksheet contains the following column headings.

Column	Function
Label	Indicates the row as assigned by the system.
Description	Indicates a description of the entered symbol.
MIM Symbol	Indicates the MIM symbol.
Column	Indicates the column.
Time Units	Indicates the time unit.
Units	Indicates the units of measure.
Chart Type	Indicates the chart type. Options include Line , Bar , Baseline , and Invisible .
Formula	Indicates the formula entered under the Formula tab.
Rollover Policy	Indicates the rollover policy that was edited in the Data Builder.

Users can create a new worksheet row by using the **Add Row**  button. Any subsequent query information entered in the Data Builder (symbol name, column, units, etc.) appears in the new row.

Worksheet Shortcuts



MIMIC includes several Worksheet shortcuts. Users can copy and paste rows using keyboard shortcuts, or use the Worksheet right-click menu to copy, paste, insert or delete a row. Users can also reposition rows using keyboard shortcuts, and synchronize the **Column** and **Time Unit** columns.

Copy/Paste Options, Right-Click Menu and Repositioning Rows

MIMIC users can use either the keyboard or the right-click menu to copy and paste a row. Users can also use the right-click menu to insert or delete a row.

- To copy/paste a Worksheet row using keyboard shortcuts, users select a row, and select **Ctrl+C** from the keyboard to copy, and then **Ctrl+V** to paste the row. The row pastes below the selected row.
- To copy/paste a Worksheet row using the right-click menu, users select a row, right-click and select **Copy**, and then right-click again and select **Paste**. The row pastes below the selected row.
- To insert or delete a row using the right-click menu, users select a row, then right-click and select **Insert** or **Delete**. MIMIC inserts a new row above the selected row.



Users can also insert or delete a row by clicking the **Insert Row**  button or the **Remove Row**  button on the **Worksheet** toolbar.

- To reposition or re-order a row, users can select any cell within the row, and then use the Ctrl + the up arrow or the down arrow Up Arrow/Down Arrow to move the row accordingly.

Synchronization of Columns and Time Units

Symbols may contain different **Column** and **Time Units** entries. Users can set or synchronize all rows in a worksheet to have the same **Column** or **Time Units** entries.



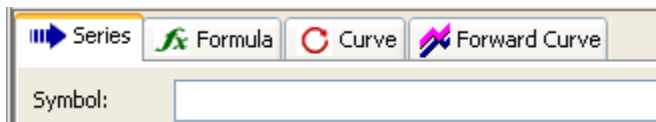
Users can only synchronize the **Column** and **Time Units** entries in MIMIC.

For example, a worksheet contains symbol and information for **HO** (row 'A') and for **NG** (row 'B'). The **Time Units** for **HO** are set to **Daily** and the **Time Units** for **NG** are set to **Weekly**. In this example, users can set or synchronize the **Time Units** entries to **Daily** or **Weekly** for both Worksheet rows.

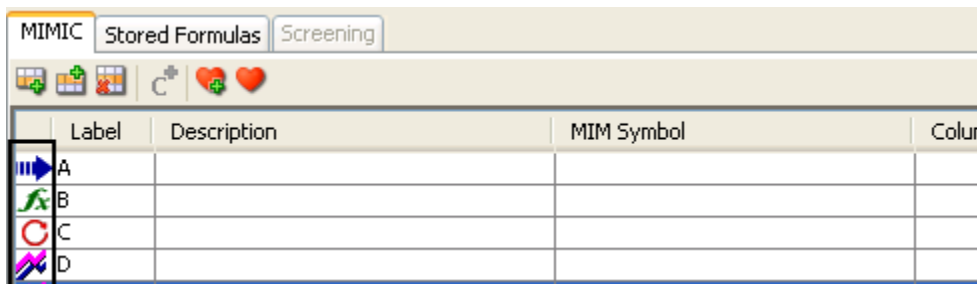
- To synchronize the **Column** entry, in a Worksheet row, users select the **Column** entry, right-click and then select **Set all Columns to X**, where **X** represents the setting, such as **Close** or **Bar**.
- To synchronize the **Time Units** entry, in a Worksheet row, users select the **Time Units** entry, then right-click and select **Set all Time Units to X**, where **X** represents the setting, such as **Daily** or **Weekly**.

Data Builder

The Data Builder constitutes the lower portion of the **Configuration** window, below the Worksheet. The Data Builder allows users to search for MIM symbols, set date and worksheet options, create custom formulas, and load curve and forward curve data. The **Series**, **Formula**, **Curve** and **Forward Curve** tabs, as shown below, control the different MIMIC query functionalities:



The Data Builder's Search Database functionality allows users to perform detailed database searches for specific symbols (for more information, see [Chapter 10, "Searching in MIMIC"](#)). When a symbol is selected, its descriptive information, such as MIM symbol name, column and unit type displays by row in the Worksheet. The icons at the left side of the Worksheet indicate the type of query used for each symbol, either a series, formula, curve or forward curve:



CHAPTER 3

Menu Options

The **Configuration** window includes the following menu options: **File**, **Edit**, **View**, **Options**, **Tools** and **Help**.

File Menu

The **File** menu includes the following options:

Option	Function
New (Alt+N)	Opens a new worksheet.
Load (Alt+L)	Opens an existing worksheet.
Save (Alt+S)	Saves a worksheet.
Save As	Saves an existing worksheet with a new name.
Import Symbols	Imports symbols from the following type files: .llc, .csv or .txt. Files of type .csv and .txt must be in the format: SYMBOL,[COLUMN] where COLUMN is optional. If the column is omitted, then the default column for the symbol is used.
Export Symbols	Exports all symbols and columns contained within a worksheet to a file with the format SYMBOL,COLUMN. The file may be saved as a .txt or .csv file.
XML Converter	Use Save Current Worksheet as XML to save current MIMIC worksheets in XML format (.xml). Users can also convert existing MIMIC worksheets (.llc files) to XML using the Convert Existing Sheets option.
Print Chart	Prints a chart.
Print Table	Prints a table.
Save Chart As	Saves an existing chart with a new name.
Save Table As	Saves an existing table with a new name.
Exit	Exits the MIMIC application.

Edit Menu

The **Edit** menu includes the following options:

Option	Function
Cut/Copy/Paste	Use the Copy command to copy charts and table data into other applications.
Add Row (Alt+A)	Adds a new row to the bottom of the Worksheet.
Insert Row (Alt+I)	Adds a new row above the selected row.
Remove Row (Alt+R)	Removes a row from the Worksheet.

View Menu

The **View** menu includes the following options:

Option	Function
Chart Options	<p>Grid - Displays gridlines on a chart.</p> <ul style="list-style-type: none"> ● Symbols - Displays the symbol. This helps when printing charts in black and white, so users can distinguish between symbols. ● Controls - Displays the chart controls at the bottom of the Chart window. Controls include Trendlines, Mouse Pick, and Zoom. ● Legend - Displays the legend. ● Legend Anchor - Enables the legend anchor. Options include North, East, South and West. ● Legend Orientation - Enables the legend orientation. Options include Vertical and Horizontal.
Configuration	Returns users to the Configuration window.
Chart	Displays the Worksheet data in a chart.
Table	Displays the Worksheet data in a table format.
Query	Displays the XMIM query language.

Options Menu

The **Options** menu includes the following options:

Option	Function
Color Print	When checked, uses the colors defined in the Color Configuration option (Options>Color Configuration).
Mixed Case Symbols	Allows the user to type in lowercase and have the letters appear uppercase in the Symbol field. This is convenient when entering symbols into the MIM Symbol field as symbols must be entered in uppercase.
Server Config	Defines the server, port number and server type. You must restart the application for the changes to take affect.
User Preferences	For a detailed description of the different User Preferences options, see Chapter 9, "User Preferences" .
Color Configuration	Change the color options for charts for printing and on-line viewing.
Axis Font	Change the font type for the chart axis display.

Tools Menu

The **Tools** menu includes the following options:

Option	Function
Curve Matrix	When a futures symbol is entered into a worksheet, the Curve Matrix menu option becomes accessible. Use this feature to create a .csv file (opens in Excel) showing the futures contracts by value or contract name for a specified date range.
Validate Formulas	Validates formulas created under the Stored Formulas tab, and notifies users if a formula becomes broken.


Help Menu

The **Help** menu includes the following options:

Option	Function
About	Displays MIMIC release and copyright information.
Java Console	Displays communication between MIMIC and the MIM server in a Java console window. Used for troubleshooting purposes.
MIMIC Help	Opens the MIMIC Help.

CHAPTER 4

Series Tab – Data Builder

The **Series** tab is the first tab in the Data Builder. MIMIC represents a series in the Worksheet with the **Series**  icon.

The **Series** tab in the Data Builder includes the following options:

Option	Function/Description
Symbol	Displays the symbol name. User can enter the symbol name (or use the Search Database  button), and then press or select Enter to populate the symbol information in the Worksheet.
Column	Indicates the data series that relates to the symbol. Every symbol name has a list of associated columns and a default column. Users can select the pull-down for different Column options
Description	For a series or curve, displays the description of the symbol. The description name for a series is in the format: exchange: symbol description (units): session. For a formula, users can enter a description.
Time Units	Indicates the unit of measurement that the series is quoted in.
Units	Indicates the default units of quotation associated with a symbol.
Use	Indicates a pull-down option that allows users to select different units of quotation for a symbol.
Factor	Overrides the units of measure conversion factor.
Edit	Allows users to change the conversion factor number.
Lock	Allows users to lock the unit of measure for a symbol to the same unit of measure as a previously entered symbol when conversion factors are available.
Show in Table/Show in Chart	Displays the results for the selected row in a table or chart. These options are selected by default. If not selected, the row in question will not be included if users selected the Table  button or the Chart  button from the toolbar.
Chart Type	Sets a chart type for the results. Options include Bar , Chart , Line , or Invisible . The Invisible setting does not chart the selected row.
Chart Label	Indicates a title or label for the a chart.
Precision	Indicates the number of decimal places that the series will be quoted in. Users can select the pull-down for a value between zero and eight.
Adjust Contract	Allows users to override default settings for contract rollover policies when using futures-type data. This setting also allows users to instantly determine which “relative” contract of a futures contract to display or analyze. The default is “prompt (front),” meaning the nearest contract to expire at any point in time. Use the associated pull-down list to select the number of contracts out. Note: The Adjust Contract option only allows users to select which relative option is displayed. If you want to specify the rollover policy and expiration date policy for futures, users can select the Custom Contract option.
Custom Contract/Edit Rollover	Allows users to determine the futures contract used for creating a custom continuation futures series.

Option	Function/Description
Edit Chart Stats	Allows users to display the maximum, minimum, average, last or standard deviation in a chart. By checking the Apply to All Items box, users can keep the selections for any future items that are added.

Custom Contract/Edit Rollover

The **Custom Contract/Edit Rollover** options allow users to determine the futures contract used for creating a custom continuation futures series. The default selection for futures in MIMIC is usually the parent contract (e.g. “CL” NYMEX Light, Sweet Crude Oil) which always returns the CL contract closest to expiration, changing or rolling over to the next contract on the day the closest contract expires.

The **Adjust Contract** option allows users to change from the contract closest to expiration to one relatively further out. For example, “prompt + 1” looks at the contract one further away from expiration than the prompt. The **Custom Contract** option allows users to make complex adjustments to the handling of the change-over between contracts, usually with the intention of smoothing over any price differences between the old and new contracts. With the rollover date functionality, users can also adjust the date on which the rollovers between contracts occur.




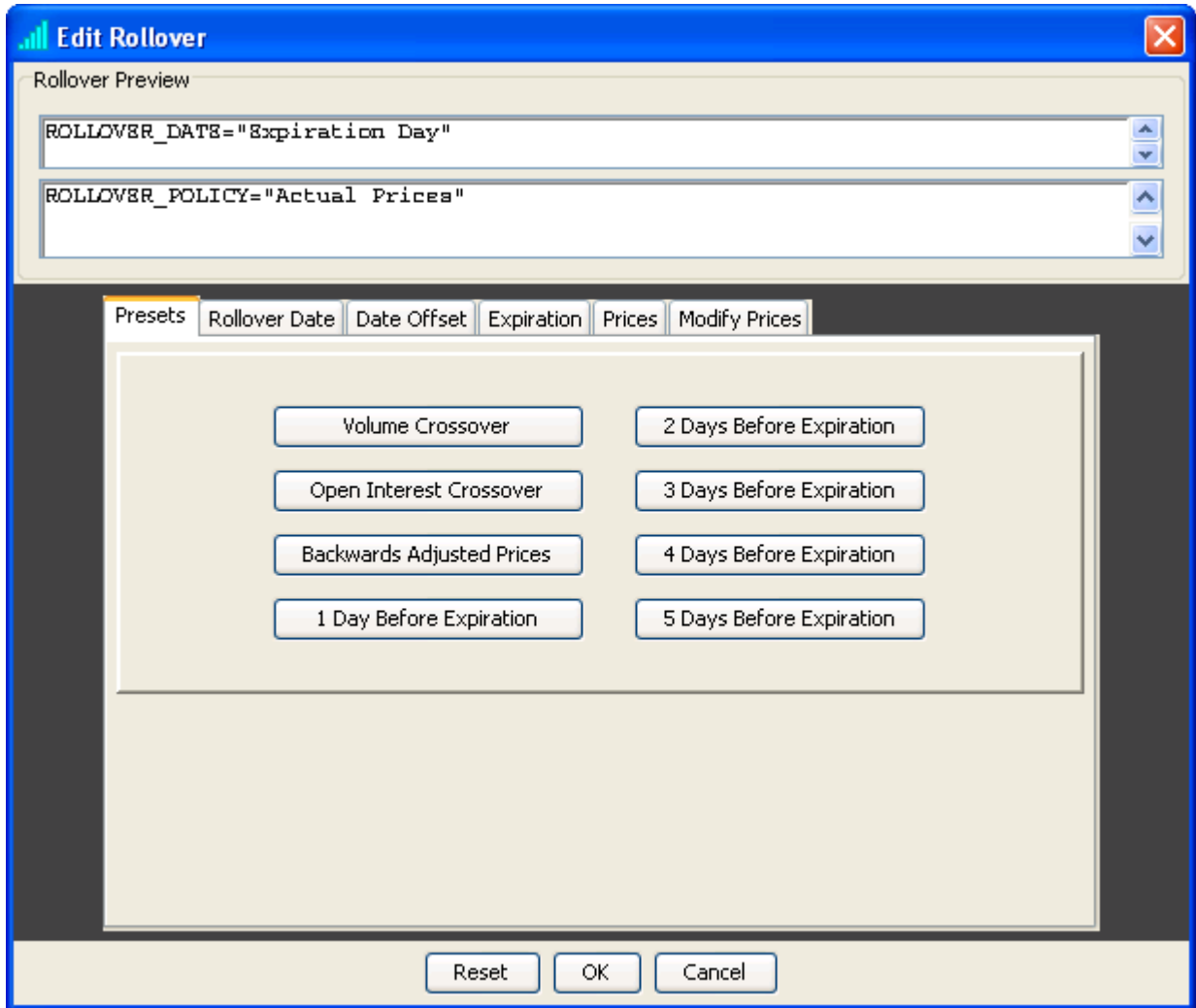
MIMIC offers a number of presets and custom selections under the **Custom Contract/Edit Rollover** option. Expert users may prefer to use the query statements under the **Rollover Preview** section of the **Edit Rollover** window. For more information on rollovers, see the [Rollovers](#) guide in the "Documentation" section of the LIM Web site (www.lim.com).

Setting Custom Contract / Edit Rollover Options

Users can open the **Edit Rollover** window to set custom contracts and edit rollover options.

To open the **Edit Rollover** window, complete the following steps:

1. In the Data Builder, enter a symbol and press **Enter**.
2. Check **Custom Contract**.
3. Select the **Edit Rollover**  button. The **Edit Rollover** window displays:



The different tab options include **Presets**, **Rollover Date**, **Date Offset**, **Expiration**, **Prices** and **Modify Prices**.

Presets

MIMIC includes the following **Presets** options in the **Edit Rollover** window:

Option	Function/Description
Volume Crossover	Allows users to define when the volume is greater in the next contract. Many traders believe the best time to roll is when the volume becomes greater in the next contract (volume crossover) because this usually means the following contract is the more liquid contract.
Open Interest Crossover	Allows users to define when the open interest is greater in the next contract. Many traders believe the best time to roll is when open interest becomes greater in the next contract (open_interest crossover) because this usually means the following contract is the more liquid contract.
Backwards Adjusted Prices	Allows users to perform a backwards adjustment on prices from the list of presets. The main difference between backward adjusted and forward adjusted is that the current contract is unadjusted. This means that the previous history is adjusted by the difference between the new contract and the current contract. After the roll occurs the most current contract is the same as actual prices; however, the past prices will be adjusted (and can become negative).
# Day(s) Before Expiration	Allows users to control when the contract will roll before expiration.

Rollover Date

MIMIC includes the following **Rollover Date** options in the **Edit Rollover** window:

Option	Function/Description
Last Data Day	Rolls the contract on the last day that there is data for the symbol.
First Notice Day	Not currently available; however, in case the need arises, this functionality has been added to the MIMIC interface.
Expiration Day	Rolls the contract on the expiration day.
Expiration Month	Rolls the contract on a specific day in the expiration month.
Volume Crossover	Defines when the volume is greater in the next contract. Many traders believe the best time to roll is when the volume becomes greater in the next contract (volume crossover) because this usually means the following contract is the more liquid contract.
Open Interest Crossover	Defines when the open interest is greater in the next contract. Many traders believe the best time to roll is when open interest becomes greater in the next contract (open_interest crossover) because this usually means the following contract is the more liquid contract.

Date Offset

Users can select the **Date Offset** option in the **Edit Rollover** window to specify when the contract rolls relative to the expiration date.

Expiration

Users can select the **Expiration** option in the **Edit Rollover** window to select the month that the contract expires.

Prices

MIMIC includes the following **Prices** options in the **Edit Rollover** window:

Option	Function/Description
Actual Prices	Displays the actual prices of the historical series. The advantage is that the prices shown are the actual ones traded. However, large gaps can appear in the series because of the difference from one contract to the next during the roll. This type of gap can cause spikes in some “momentum-type” technical indicators, which is misleading in most cases.
Adjusted Prices	<p>Indicates the adjusted prices. Options include Forward, Backward and Cash. All three of these options eliminate possible gaps, which occur when rolling from one contract to the next; however, each accomplishes this in a different manner.</p> <p>Basics of Adjusted Prices:</p> <p>For Forward Adjusted Prices, the adjustment takes place each time the contracts roll forward by taking the difference between the closing price of the current contract and that of the new contract (on that day) and then adjusting by subtracting the difference from all prices (Open, High, Low, Close) throughout the new contract.</p> <p>Note: Users cannot define when the forward adjustment starts. Forward adjustment takes place from the beginning of the entire data series.</p>
Backward Adjusted Prices	Indicates the backward adjusted prices. The main difference between backward adjusted and forward adjusted is that the current contract is unadjusted. This means that the previous history is adjusted by the difference between the new contract and the current contract. After the roll occurs, the most current contract is the same as the actual prices; however, the past prices will be adjusted and can become negative.
Cash Adjusted Prices	Indicates the cash adjusted prices and removes the gaps by raising or lowering the price levels, so that the closing and cash correspond. The difference between the current contracts daily close and the cash prices is subtracted from each day’s daily bar.
Perpetual	<p>Indicates a perpetual policy. Users must define a certain set time period. The example below uses three months as the set time period.</p> <p>3-Month Linear Perpetual Example:</p> <p>If users define the time period as three months, then the perpetual policy analyzes three months into the future to pick two contracts that are involved with the calculation. The first contract is the contract that expires just before the 3 months. The second contract is the contract that expires the soonest after the 3 months. Basically, the two contracts will form a bracket around the date (the last contract that expires before the time frame and the contract that expires soonest after the time frame).</p> <p>Then, MIMIC counts the number of days to the expiration day for each contract. MIMIC uses these two counts as weights in the perpetual calculation. The first weight is the number of days from the first contract’s expiration to the set date in the future. The second weight is the number</p>

Option	Function/Description
	<p>of days from the set date in the future until the second contract's expiration. The closer the first contract is to expiration the less it is weighed in the calculation. The perpetual policy can define the calculation in three ways: Linear, Logarithmic, or Geometric.</p> <p>(x1 = contract 1) (x2 = contract 2) (w1 = # of days from expiration to set date in the future for contract 1) (w2 = # of days from set date in future until expiration day for contract 2)</p> <p>Linear: $\frac{x1 * w2 + x2 * w1}{w1 + w2}$</p> <p>Logarithmic: $\frac{w1 * \ln x2 + w2 * \ln x1}{w1 + w2}$</p> <p>Geometric: $\sqrt[w1+w2]{x1^{w2} * x2^{w1}}$</p>

Smoothed	<p>Allows users to average many consecutive contracts at once. There are three ways to calculate this average: Linear, Logarithmic and Geometric.</p> <p>Linear: $\frac{x1 + x2}{2}$</p> <p>Logarithmic: $e^{\frac{\ln x1 + \ln x2}{2}}$</p> <p>Geometric: $\sqrt{x1 * x2}$</p>
----------	---

For example, if users want to create a series from three of the most current contracts while using the linear smoothing function, then the policy must be similar to the example below.

3-Contract Linear Smoothed Example:


The calculation above would look like “(front + back + far) / 3”, depending on the rollover date.

Modify Prices

MIMIC includes the following **Modify Prices** options in the **Edit Rollover** window:


Option	Function/Description
Top Section	<p>Allows users to specify which contract to use (i.e. front, back, far). The nearby modifier can also specify the front, back, or far contracts.</p> <p>Refers to the front contract:</p> <ul style="list-style-type: none"> ● ROLLOVER_POLICY="1 nearby, Actual Prices" <p>Refers to the back contract:</p> <ul style="list-style-type: none"> ● ROLLOVER_POLICY="2 nearby, Actual Prices" <p>Refers to the far contract:</p> <ul style="list-style-type: none"> ● ROLLOVER_POLICY="3 nearby, Actual Prices"
Middle Section	<p>Allows users to roll from one contract to the next contract for a specified length of time. Users can interpolate the series for any number of days before the ROLLOVER_DATE. The interpolate modifier uses the number of days until expiration as an important weight. This means the farther away the contract is from rolling the more weight is placed on the current contract.</p>
Bottom Section	<p>Allows users to create Gann-style continuous contracts. The Gann-style continuous contract rolls from one contract to the next contract of the same month (i.e. for the next year).</p> <p>The statement below creates a series that rolls from the March contract into the following years March contract:</p> <ul style="list-style-type: none"> ● ROLLOVER_POLICY="March, Actual Prices" <p>The statement below uses the nearby modifier in combination with the year-to-year modifier. MIMIC creates the series with the "back" April contract, and it rolls accordingly (when the front contract expires).</p> <ul style="list-style-type: none"> ● ROLLOVER_POLICY="2 nearby, April Actual Prices"

Edit Chart Stats

Users can select the **Edit Chart Stats**  button in the Data Builder to open the **Stat Config** window and display the Maximum (Max), Minimum (Min), Average, Last or Standard Deviation (Std Dev) for a chart. Checking **Apply to All Items** applies the selections for any future items that are added.

CHAPTER 5

Formula Tab – Data Builder


The **Formula** tab is the second tab in the Data Builder. MIMIC represents a formula in the Worksheet with the **Formula**  icon.

The **Formula** tab in the Data Builder includes the following options:

Option	Function/Description
Formula	Allows users to create a formula from the labels representing each series. A formula is written in algebra using the basic operators: +, -, *, and /. For example, to subtract row 'B' from row 'A' (or A – B).
Description	Indicates the description of the formula. The description displays in the legend for the chart and under the Column heading for the table.
Show in Table	Displays the results of the selected row in a table.
Show in Chart	Displays the results of the select row in a chart.
Chart Type	Indicates a line chart, bar chart, or anchor a symbol as a baseline in a chart. The Invisible setting means that MIMIC does not chart the selected row.
Chart Label	Indicates the chart label displays in the legend of the chart.
Precision	Indicates the number of decimal places that the series will be quoted in.
Edit Chart Stats	Displays the maximum, minimum, average, last or standard deviation in a chart. Checking Apply to All Items applies the selections to any future series.

CHAPTER 6

Curve Tab – Data Builder

The **Curve** tab is the third tab in the Data Builder. The MIMIC **Curve** tab allows users to chart futures as a forward curve by extracting information from the LIM database about the expiration dates and quoted prices for a futures contract and transforming that data into a forward curve. The forward curve can display curves for different dates on the same chart with the underlying prompt month contract. MIMIC represents a curve in the Worksheet with the **Curve**  icon.




For information on forward curves, see [Chapter 7, “Forward Curve Tab – Data Builder”](#).

The **Curve** tab in the Data Builder includes the following options:



Option	Function/Description
Symbol	Indicates the symbol name. Users select the Enter button to populate the symbol information in the Worksheet.
Description	Displays a description of the symbol. The description name for a series is in the format: exchange: symbol description (units): session.
Column	Indicates the data series that relates to the symbol. Every symbol name has a listed of associated columns and a default column.
Chart Label	Indicates the chart label, which MIMIC displays in the legend of the chart.
Curve Date	Indicates the date for the curve. Users can check Last Data Date to apply the last data date, or select the Calendar button to choose a date from the calendar.
Edit Chart Stats	Displays the maximum, minimum, average, last or standard deviation in a chart. Checking Apply to All Items applies the selections to any future series.

CHAPTER 7

Forward Curve Tab – Data Builder

The **Forward Curve** tab is the fourth tab in the Data Builder. The **Forward Curve** tab allows users to retrieve, analyze and display data that has a forward dimension, including futures data. MIMIC represents a forward curve in the Worksheet with the **Forward Curve**  icon.

The **Forward Curve** tab in the Data Builder includes the following options:

Option	Function/Description
Category	Indicates the category of a forward curve. Users must include the entire path in the Category field. Users can select the Search Database  button to choose the desired category, or folder, and then select the “+” to open the folders. Users can then right-click on the folder and choose Select to add the folder to the Category field. The entire path displays in the Category field.
Column	Indicates the column that relates to the symbol. Every symbol name has a list of associated columns and a default column. Users can select the pull-down to select a column or select the Search Database  button to enter a symbol and a column.
Description	Indicates a description of the symbol. The description name for a series displays in the format: exchange: symbol description (units): session. Users can enter a different description.
Show in Table	Displays the results for the selected row in a table.
Show in Chart	Displays the results for the select row in a chart.
Chart Type	Indicates the chart type. Options include Line , Bar , Baseline , Invisible . MIMIC does not chart a series with the Invisible setting.
Chart Label	Indicates the chart label, which displays in the legend of the chart.
Precision	Indicates the number of quoted decimal places for the series.

Forward Curve Parameters

The **Forward Curve** tab in the Data Builder includes the following forward curve parameters:

Parameter	Options/Description
Date	None (no date entry) Date (enter a date or select the Calendar button to select a date) Date w/Time Users can select either Today for today's date, or Expiration for the expiration date, or users can select the Calendar button to select a date.
Aggregate	None Daily Average Daily High Daily Low Monthly Average Monthly High Monthly Low Quarterly Average Quarterly High Quarterly Low
Fill	None Fill Forward - Uses the last valid value in the series and copies it forward, eliminating the NaNs until the next valid value occurs. Fill Backward - Uses the first valid value after a run of NaNs and fills the value back in time to the previous valid value. Fill Linear Interpolation - Creates synthetic values for the span of NaN values based on the last known value and the next known value by creating linear interpolated values between them. Formula: $x1 = \text{last known value}$ $x2 = \text{next known value}$ $w1 = \# \text{ of days from } x1 \text{ to the missing date}$ $w2 = \# \text{ of days from } x2 \text{ to the missing date}$ Examples: Without Fill Interpolate Linear: Date Day 1 09/02/2001 Sun 11.7500 09/03/2001 Mon NaN 09/04/2001 Tue NaN 09/05/2001 Wed NaN 09/06/2001 Thu NaN 09/07/2001 Fri 17.0000 With Fill Interpolate Linear: Date Day 1

Parameter	Options/Description
	09/02/2001 Sun 11.7500 --- x1 09/03/2001 Mon 12.8000 09/04/2001 Tue 13.8500 09/05/2001 Wed 14.9000 09/06/2001 Thu 15.9500 09/07/2001 Fri 17.0000 --- x2
	<p>For 9/03/2001:</p> x1 = 11.75 x2 = 17 w1 = 1 (# of days missing date is from the first value) w2 = 4 (# of days missing date is from the second value) $9/03/2001 = (11.75*4 + 17*1)/5 = 12.8$ $9/04/2001 = (11.75*3 + 17*2)/5 = 13.85$
	<p>Fill Up - Fills from generated curve, same position for a previous day/year. If value found at this generated curve is NaN, MIMIC does not proceed to find a value past four generated curves. This is the limit set. For example, if there are forward curve values for June 20th, the "fill up" value is the value found on June 19th. If a NaN is in this location on June 19th, MIMIC generates the curve for June 18th. We will go back 4 days only.</p> <p>The reason MIMIC limits the search for a non NaN value is because we do not know how many days back we will have to search for a non NaN value. Same is true for monthly and quarterly values. If there is a NaN value for the January 2001 monthly average, MIMIC can fill upward from the January 2000 monthly average. If there is a first quarterly average of 2001 that was a NaN value MIMIC can fill upward from the first quarterly average of 2000. The value MIMIC retrieves several days/years ago may not have any meaning to this curve and therefore a limit of four curve generations is in place.</p> <p>Fill Down - Fills from a generated curve, same position for the next day/year. If the value found at this generated curve is NaN, MIMIC does not proceed to find a value past four generated curves. There is a limit set. For example, if there are forward curve values for June 20th, the Fill Down value is the value found on June 21st. If a NaN is present, users can look up to June 24th, but then stop if we cannot find a value.</p> <p>The reason it is necessary to limit the search for a non-NaN value is because it is not evident how many days forward you will have to search for a non-NaN value. Same is true for monthly and quarterly values. If there is a NaN value for the January 2001 monthly average, users can fill downward from the January 2002 monthly average. If users have the first quarterly average of 2001 that was a NaN value, users can fill downward from the first quarterly average of 2002. The value users retrieve several days/years ago may not have any meaning to this curve, and, therefore, a limit of four curve generations is in place.</p> <p>Fill Vertical Interpolation - Takes an average from two generated curves to fill in the missing data for our curve. If users look at a NaN value in our forward curve for Wednesday June 20th at 10:00am which has a M-F trading pattern, users take the average of the values stored on the forward curves of up to Thursday June 14th and Tuesday June 26th. If one of these values is a NaN, then MIMIC stores the non-NaN value in the generated forward curve.</p> <p>If both values are a NaN, users can leave the generated forward curve with a NaN value since MIMIC was unable to generate a value. Same is true for monthly and quarterly values. If there is a NaN value for January 2001, users can take the average of the January 2000 and January 2002 results. If there is a first quarter average of 2001 and it was a NaN, users can generate a result from the first quarter average of 2000 and 2002.</p>

Parameter	Options/Description
Units	Days Hours
Period	Multiple selections are available and change the subsequent criteria for the Period setting.
Offset	Number of offsets (using list) Minutes, hours, days, weeks, months, quarters, years Later, ago, before

CHAPTER 8

Date Options and Worksheet Options – Data Builder

The Date Options and Worksheet Options appear in separate panes at the bottom of the **Configuration** window and are part of the Data Builder.

The **Date Options** pane in the Data Builder includes the following options:


Option	Function/Description
Start	Indicates a start date for the analysis. By default, the start date is disabled. By unchecking Relative , users can enter or select a start date, or select the Calendar button to enter a start date.
End	Indicates an end date for the analysis. By default, the end date is disabled. By unchecking Today , users can enter or select an end date, or select the Calendar button to enter an end date.
Change Period	Indicates the change period. By default, MIMIC selects Years . Options include Days , Weeks , Months , Years , and All Data . Users can select All Data to pull from all the data for the series.

The **Worksheet Options** pane in the Data Builder includes the following options:

Option	Function/Description
Chart Title	Indicates a title for the chart. MIMIC centers the chart title above the chart.
Skip all NaN	When checked, skips all NaN values for the analysis.
Skip Weekends	When checked, skips all weekend dates for the analysis.
Table Summary Stats	When checked, includes the summary statistics at the bottom of the table results. Summary statistics include the sum, average, etc.
Seasonal Analysis	When checked, enables Seasonal Analysis , allowing users to select a seasonal analysis based on seasons or averages.

Seasonal Analysis

The **Seasonal Analysis** option is available in the **Worksheet Options** pane and allows users to configure worksheet data based on the season or seasonal averages. This option is available by checking **Seasonal**

Analysis, and then selecting the **Seasonal Analysis Configuration**  button. The **Seasonal Analysis Configuration** window opens and includes two tabs: the **Seasons** tab and the **Averages** tab.

Seasons Tab

The **Seasons** tab in the **Seasonal Analysis Configuration** window includes the following options:

Option	Function /Description
Start First Season	Indicates a start date for the season. Users can enter or select a start date, or select the Calendar button to enter a start date.
End Last Season	Indicates an end date for the season. Users can enter or select an end date, or select the Calendar button to enter an end date.
Lock included seasons with date range.	When checked, adds changes to the start and end season entries. By default, Lock periods with date range is checked. When unchecked, users must select the Add button to choose the desired dates.
Seasons included in analysis	When checked, displays the results for the period in the resulting chart or table.
Execution Units	Sets the execution units for the seasonal analysis.

Averages Tab

The **Averages** tab in the **Seasonal Analysis Configuration** window includes the following options:

Option	Function/Description
Averages of all Seasons	When checked, displays the average in a chart or table for all seasons entered under the Seasons tab.
Custom Averages	When checked, enables the lower section of the tab. This option allows users to customize the years used for the average. Users can select the Add button to add years to the average, select the Edit button to modify the years chosen, or select the Delete button to delete the custom average.
Execution Units	Sets the execution units for the average.

Missing Data NaNs

The **Missing Data NaNs** option is available in the **Worksheet Options** pane and allows users to manage missing data values.

To select a **Missing Data NaNs** option, users must first uncheck **Seasonal Analysis**, if checked, and must also uncheck **Skip All NaN**. MIMIC then enables **Missing Data Nans**.

MIMIC includes the following **Missing Data NaNs** settings:

Option	Function/Description																														
Fill NaN	Inserts NaN values where there is no data.																														
Fill Forward	Takes the last valid value in the series and copies it forward, eliminating the NaNs until the next valid value occurs.																														
Fill End	Fills the missing data using the last known value for a symbol for a specified date range. For instance, on a Monday morning, you might want the last known value for the Close of CL. Using Fill End with a few other settings, the value returned will be Friday's closing unless Friday is a holiday and then MIMIC returns the last known value. The following graphic displays the last known value for the Close of NG for February 25, 2005.																														
	<table border="1"> <thead> <tr> <th>Dates</th> <th>NG - Close</th> </tr> </thead> <tbody> <tr> <td></td> <td>NYMEX: Henry ...</td> </tr> <tr> <td>02/25/2005</td> <td>6.7150</td> </tr> <tr> <td>Sum</td> <td>6.7150</td> </tr> <tr> <td>Average</td> <td>6.7150</td> </tr> <tr> <td>Average ...</td> <td>6.7150</td> </tr> <tr> <td>Average (-)</td> <td>0.0000</td> </tr> <tr> <td>Percent (+)</td> <td>100.0000</td> </tr> <tr> <td>Percent (-)</td> <td>0.0000</td> </tr> <tr> <td>Maximum</td> <td>6.7150</td> </tr> <tr> <td>Minimum</td> <td>6.7150</td> </tr> <tr> <td>Std Devia...</td> <td>0.0000</td> </tr> <tr> <td>Zstat</td> <td>NaN</td> </tr> <tr> <td>Variance</td> <td>0.0000</td> </tr> <tr> <td>Last</td> <td>6.7150</td> </tr> </tbody> </table>	Dates	NG - Close		NYMEX: Henry ...	02/25/2005	6.7150	Sum	6.7150	Average	6.7150	Average ...	6.7150	Average (-)	0.0000	Percent (+)	100.0000	Percent (-)	0.0000	Maximum	6.7150	Minimum	6.7150	Std Devia...	0.0000	Zstat	NaN	Variance	0.0000	Last	6.7150
Dates	NG - Close																														
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Average ...	6.7150																														
Average (-)	0.0000																														
Percent (+)	100.0000																														
Percent (-)	0.0000																														
Maximum	6.7150																														
Minimum	6.7150																														
Std Devia...	0.0000																														
Zstat	NaN																														
Variance	0.0000																														
Last	6.7150																														
	<p>To create the results above, users can select the End Date 02/25/2005, uncheck Skip All NaN and select Fill End for the Missing Data NaNs. Users must set the Change Period to 0 Days. If today is 02/25/2005 (before the market closes) then the value returned in the tabled results is the value from the closing the day before on 02/24/2005.</p> <p>To find the last known value for a date range (for instance, the last known value for the last 3 days) users can enter 2 Days for the Change Period.</p>																														
Fill Backward	Takes the first valid value after a run of NaNs and fills the value back in time to the previous valid value.																														
Fill Blank	Fills missing data values with a blank.																														
Fill Interpolate Linear	Creates synthetic values for the span of NaN values based on the last known value and the next known value by creating linear interpolated values between them.																														

$$\frac{x1 * w2 + x2 * w1}{w1 + w2}$$

Formula: $w1 + w2$

where:

x1 = last known value

x2 = next known value

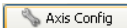
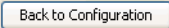

w1= the number of days from x1 to the missing date

Option	Function/Description
	w2 = the number of days from x2 to the missing date
Fill Interpolate Geometric	Creates synthetic values for the span of NaN values based on the last known value and the next known value by creating geometric interpolated values between them. Formula: $\sqrt[w1+w2]{x1^{w2} * x2^{w1}}$
Fill Interpolate Logarithmic	Creates synthetic values for the span of NaN values based on the last known value and the next known value by creating logarithmic interpolated values between them. Formula: $\sqrt[w1+w2]{x1^{w2} * x2^{w1}}$
Fill Nearest	Fills Saturday with Friday and fills Sunday with Monday.

Execution Units

The **Execution Units** option is available in the **Worksheet Options** pane and determines the time-frequency over which queries range through the database looking for answers. The default frequency is **Daily**, but may be changed to any frequency from 1 minute to any number of years.

Axis Config

Axis Config is a button in the **Worksheet Options** pane and allows users to edit the position of a series in a chart. By selecting the **Axis Config**  button, users open the **Axis Config** tab and can change the axis of a series by checking the appropriate axis selection. Users can return to the **Configuration** window by selecting the **Back to Configuration**  button, or by selecting the **Configuration**  button from the toolbar.

CHAPTER 9

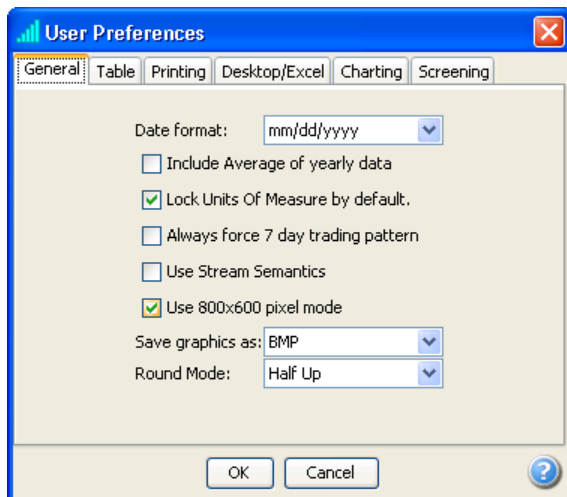
User Preferences

User preferences are set in the **User Preferences** window. To open the **User Preferences** window, select **Options>User Preferences** from the menu bar.

The different tabs at the top of the **User Preferences** window include **General**, **Check/Clean Table Data**, **Printing**, **Desktop/Excel**, **Charting** and **Screening**.



For some of the user preference changes to take effect, you must either restart the program or start a new worksheet.



General Tab

The following options are available when the **General** tab is selected on the **User Preferences** window:

Option	Function
Date format	Use the pull-down to change the order of the date display.
Include Average of yearly data	Includes the average of yearly data in a chart.
Lock Units of Measure by default	Converts the unit of measure for a symbol to the same unit of measure as a previously entered symbol when conversion factors are available.
Always force 7 day trading pattern	Always use a seven-day trading pattern versus a five-day pattern.
Use Stream Semantics	This is a future enhancement to accommodate display of millisecond data.
Use 800x600 pixel mode	Sets the screen display to 800x600 pixels. If you have your monitor resolution set to 800x600 and you select the box for 800x600, then the whole MIMIC chart will fit on your monitor.
Save Graphics as	Saves graphics as BMP, PNG or as a JPG file.
Round Mode	<p>The round mode determines how MIMIC will treat rounding when the user selects a precision for the series that is less than the number of decimals in the value returned (e.g. precision selected is 2 decimals, the number is 3 or more decimals).</p> <p>In such cases, the user can now specify the rounding technique used by choosing between 3 alternatives:</p> <ul style="list-style-type: none"> ● Half Even (the default) - Rounds any trailing 5 up or down to the nearest even number (e.g. if the decimal precision is two decimals and the number to be rounded is 2.345, the calculation rounds down to the nearest even value at 2.34, whereas if the number to be rounded is 2.355, the calculation rounds up to the nearest even value at 2.36.) ● Half Up - Always rounds the trailing 5 up. ● Half Down - Always rounds the trailing 5 down.

Table Tab

The **Table** tab on the **User Preferences** window includes the following options:

Option	Function
Warn if table data includes zero or NaN values	Displays a warning if there is null or no data values for a date.
Remove data in table if row has a zero or NaN values	Removes null or no data, if it exists.
Show summary stats	Selected by default. Includes summary statistics, such as the sum, averages, percentages, and the standard deviation.
Skip weekends	Excludes weekend data (data for a Saturday or a Sunday).
	Note: This feature can only be selected when using the following Execution Units in the Worksheet Options pane: Days, Hours, Minutes, Seconds and Milliseconds.
Sort by: Date Ascending	Sorts the table data by the oldest date first.
Sort by: Date Descending	Sorts the table data by the most recent date first.

Printing Tab

The **Printing** tab allows users to select the page orientation for printing tables.

Option	Function
Orientation	This option allows you to select the page orientation for printing tables. Options include Landscape and Portrait (default). These options are for table printing only.

Desktop/Excel Tab

The following options are available when the **Desktop/Excel** tab is selected on the **User Preferences** window:

Option	Function
Copy table results to clipboard	Copies the table results to the clipboard, so you can use them in another application.
Send New Worksheet/paste command to Excel	Creates a new worksheet in Excel and pastes the results of a MIMIC table.
Send Paste command to Excel	Pastes the results of a table into an open Excel worksheet.

Charting Tab

The following options are available when the **Charting** tab is selected on the **User Preferences** window:

Option	Function
Use description as chart label	The description entered for a symbol is used as the chart label.
Show Grids	Places a grid line behind the chart.
Show Chart Controls	Turns on the chart controls at the bottom of a chart. Sets trendlines and zoom. Use the Mouse Pick feature to display the symbol data on a specific date, as well as delta and percent change data.
Show Legend	Display the legend stacked vertically or spread out horizontally. Use the Legend Anchor settings to position the legend in the North, South, East or West quadrant of the chart.
Show Chart Symbol	The lines in a chart are given a unique symbol. This setting helps when printing charts in black and white so the user can distinguish between symbols.

Screening Tab

The **Screening** tab allows users to set a screen server URL.

Option	Function
Screen Server URL	Complete URL address of the Screen Server.

CHAPTER 10

Searching in MIMIC

MIMIC offers a flexible means of database searching. Using the functionality of the **Tree View** and **Search** tabs, you can tailor the level of refinement in your searches according to symbol name or description in several different ways.

Searching Methods

The following shows how to begin a search:

1. Select the **Search Database** button on the **Configuration** window.



The Data Builder changes to include two tabs: **Tree View** and **Search**.

2. On the **Tree View** tab, drill down through the data listings by clicking the plus or minus signs to expand/collapse the folder and symbol icons.
3. Double-click on a column to add the desired symbol to the Worksheet. Multiple symbol selections can be added to the worksheet by using either the **Ctrl** or **Shift** key in combination with a mouse click.



You do not have to go down to the column level to add symbols. To use the default columns for the symbols, right-click and choose **Select**.

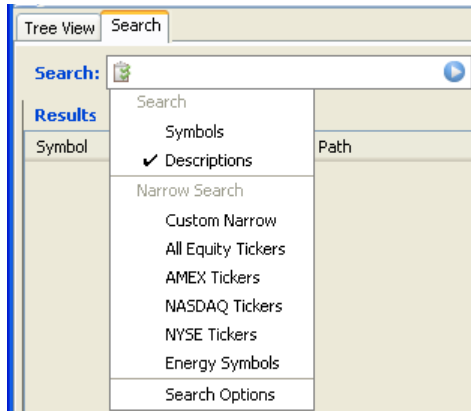
Alternatively, you can search the MIMIC database using the **Search** tab functionality:

1. On the **Search** tab, enter a symbol name in the **Search** field and select the **Start search** button.



By default, entries are not case-sensitive.

2. Select the **Search Options** button to see a list of search options:



You can either search for a symbol name or search in the description field by selecting **Symbols** or **Description** from the pull-down list (**Symbols** is selected by default).

Searching by Symbol

If you already know the symbol name and simply want to locate the directory path, you can perform a refined search to search for a specific symbol. A maximum of 100 results are returned.

1. On the **Search** tab, enter the symbol name in the **Search** field. To search by symbol, select the **Search Options** button and ensure that the **Symbols** option is selected.
2. Select the **Start search** button to start the search.

Adding Result(s) to the Worksheet

The search results are listed by symbol, path and description. There are several methods for adding the results to a worksheet.

1. To add a single symbol result to a worksheet, double-click on the entry (default column will be used).
2. To add multiple selections, use the **Shift** and **Ctrl** keys. Right-click and choose **Select Items**.



The default columns will be used.

3. To add a symbol with a column other than the default, double-click the entry from the columns list.



Instead of double-clicking on a column name, another selection option is to right click and select **choose selected column**.

Mapping a Result in the Tree View

To have a particular result mapped in the Tree View, select the desired result, right-click and select **Locate in Tree**. The Tree View displays with the path to the symbol.

Searching by Description

If you have a description, you can search by entering the keyword word or phrase in the search field and choosing **Descriptions** from the pull-down menu. Select the **Start search** button (or press **Enter** on your keyboard) to start the search.

Narrowing a Search

Searching on a broad description will yield a maximum of 100 results. To narrow the results choose from one of the pre-defined narrowed lists (All Equity Tickers, AMEX Tickers, NASDAQ Tickers, NYSE Tickers, Energy Symbols) or use the **Custom Narrow** feature to browse the hierarchy, then select the category you want to refine.

The following example searches for an instance of “Henry Hub” as a spot price off the *Platts* publication, and uses the **Custom Narrow** feature to browse the hierarchy and only search in the **Energy>NaturalGas** folder.

1. Enter **henry hub** in the **Search** field.
2. Select the **Search Options** button and choose **Descriptions** and **Custom Narrow** from the pop-up menu.
3. In the **Custom Narrow** list, open the **Energy** folder, and then open the **NaturalGas** folder. Make sure the **NaturalGas** folder is highlighted.
4. Select the **Start search** button (or press **Enter** on your keyboard) to start the search.

5. Scroll down the list of results and select the appropriate symbol. Double-click on a column to add the symbol information to the worksheet. To add multiple symbols and columns use the **Shift** or **Ctrl** keys to select the columns, then double-click and press **Enter**, or right-click and select **Choose Selected Columns** to add the selections to the worksheet.

Search Options

To open the Search Options, select the **Search Options** button from the search field. The last entry in the pop-up list is **Search Options**.

The following search options and rules may be applied when searching by description or by symbol:


Option	Function
Case Sensitive	The search will only match the supplied case.
Include Symbols	The symbol is included in the criteria.
Include Categories	The category description is included in the criteria.
Show Path in Table	The path to the symbol is included in the results.

The following search criteria may be used:


Criteria	Function
Asterisk "*"	The asterisk is a wildcard. Note that typing "Henry Hub*" without a wildcard at the beginning will return strings that begin with "Henry Hub" versus strings that include "Henry Hub".
Period "."	Do not use as a wildcard; it will be interpreted as a period.
Question mark "?"	The question mark is a wild card to change a single character.

CHAPTER 11

Charts

A chart is a visual representation of data over a specified period of time. You can create a chart of the Worksheet data you entered in the **Configuration** window. To chart this Worksheet data, select **View > Chart** from the menu bar, or select the **Chart**  button from the toolbar. MIMIC displays a chart in the **Chart** window.



To return to the **Configuration** window, select the **Configuration**  button from the toolbar.

In a chart, there are certain options, features and settings you can make. These settings can apply to the following:

- The current or active chart displayed in MIMIC.
- All future charts you create in MIMIC.

To select options and settings for the current chart, select **View > Chart Options** from the MIMIC menu bar. To select options and settings for all future charts, select **Options>User Preferences** from the menu bar, and then select the **Charting** tab.



For more information on the **Charting** tab, see [“Charting Tab”](#) in this guide.

To print a chart, select **File>Print Chart** from the MIMIC menu bar, or select the **Print**  button from the toolbar.

Chart Options

For a current or active chart, you can set or display a grid, chart symbols, chart controls, the legend, the legend anchor and the legend orientation. To access the chart options, select **View>Chart Options** from the MIMIC menu bar. If a chart option is selected, MIMIC displays a check mark or a radio button to the left of the option.

MIMIC includes the following chart options:

Option	Function
Grid	Displays a gridline on the chart.
Symbols	Displays a separate and distinct icon for each symbol when charting more than one symbol. This option does not function when charting only one symbol.
Controls	<p>Displays the Chart Controls at the bottom of the Chart window. Use these controls to set trendlines, select the Mouse Pick feature and enable zoom.</p> <ul style="list-style-type: none"> • Trendlines - Create trendlines by toggling the Trendline Off button to Trendline On. On the chart, use the mouse to click and drag a line that connects a series of peaks or troughs. You can hide/show trendlines by toggling the Hide Trendlines/Show Trendlines button. You can reset all trendlines by selecting Reset>Trendlines, or you can delete the last trendline created by selecting Erase Trendline. • Mouse Pick - Compare two points in a chart by toggling the Mouse Pick Off button to Mouse Pick On. This feature opens a table at the bottom of the chart and provides data such as dates, values, delta and percent change. • Zoom - Zoom in on a certain period for the data by toggling the Zoom Off button to Zoom On. On the chart, use the mouse to click and drag a rectangle around the desired time period. Select Reset>Zoom to return to the original view.
Legend	Displays the symbols in a legend on the chart.
Legend Anchor	Displays the legend North, East, South or West of the chart. North = above the chart, East = to the right of the chart, South = below the chart, and West = to the left of the chart. MIMIC displays a radio button before the selected legend anchor in View > Chart Options .
Legend Orientation	Displays the legend vertically (one symbol above another) or horizontally (side-by-side). MIMIC displays a radio button before the selected legend orientation in View > Chart Options .


Color Configuration

By default, MIMIC displays a chart in color. MIMIC assigns default color palettes for the chart viewed as part of the application and for printing in color. MIMIC also assigns default grayscale palettes for printing in black and white. MIMIC sets the palettes for the Background, Foreground, Trendline, Average, and for each symbol. Symbols are represented as Data1, Data2, etc. For example, the first symbol you have in the Worksheet (in row 'A') is represented as Data1, the second symbol you have (in row 'B') is represented as Data2, and so on.


To change a palette, select **Options>Color Configuration** from the MIMIC menu bar. The **Color Configuration** window displays. Click the color you want to change, the **Pick a Color** window appears where you can select a new palette.

CHAPTER 12

Tables

A table is a statistical representation of data for a future or commodity over a specified period of time. You can create a table of the Worksheet data you entered in the **Configuration** window. To table this Worksheet data, select **View > Table** from the MIMIC menu bar, or select the **Table**  button from the toolbar. MIMIC displays the table in the **Table** window.



To return to the **Configuration** window, select the **Configuration**  button from the toolbar.

A table contains a **Dates** column and then a column of data for each symbol. For example, row 'A' from the Worksheet is the first column of data, row 'B' the second column of data, and so on. A table contains data for the dates indicated in the **Date Options** pane. At the bottom of a table, MIMIC displays table summary statistics.

In a table, there are certain options, features and settings you can make. These settings can apply to the following:

- The current or active table displayed in MIMIC.
- All future tables you create in MIMIC.

The options and settings for the current table are set in the **Worksheet Options** pane. To select options and settings for all future tables, select **Options>User Preferences** from the menu bar, and then select the **Table** tab.



For more information on the **Table** tab, see [“Table Tab”](#) in this guide.

To print a table, select **File>Print Table** from the MIMIC menu bar, or select the **Print**  button from the toolbar.

Table Options in the Worksheet Options Pane

For a current or active table, you can set the table data to skip all NaN values, skip weekend values, include table summary statistics, and set the display to ascending order. By default, all these options are selected.

MIMIC includes the following table options in the **Worksheet Options** pane:

Option	Function
Skip All NaN	Removes null data values for a date, if they exist.
Missing Data NaNs	Fills table with specified data for all NaN values.
Skip Weekends	Excludes weekend data (data for a Saturday or a Sunday).
<p>Note: This feature can only be selected when using the following Execution Units in the Worksheet Options pane: Days, Hours, Minutes, Seconds and Milliseconds.</p>	
Table Summary Stats	Includes summary statistics, such as the sum, averages, percentages, and the standard deviation.
Table Date Sort Ascending	Sorts the table data by the oldest date first.



You can also include seasonal analysis information in your table. For more information on Seasonal Analysis, see “[Seasonal Analysis](#)” in this guide.

Sorting Table Data

By default, MIMIC sorts table data in ascending order, with the oldest date first and the most recent date last. You can easily sort any column in ascending or descending order by clicking on any column heading. MIMIC displays an up-arrow symbol in the column heading you clicked to indicate descending order, and displays a down-arrow symbol in the column heading you clicked to indicate ascending order:

Descending

Ascending



Once you exit the **Table** window, MIMIC clears your sort order.

Table Summary Statistics

MIMIC includes the following table summary statistics:

Table Statistic	Description
Sum	Indicates the sum total of the values returned in the answers.
Average	Indicates the average of the data for a column.
Average (+)	Indicates the average of all the values in the answers.
Average (-)	Indicates the average of the negative answers to the query.
Percent (+)	Percent positive. Indicates the number, as a percentage of the total number of occurrences, of positive answers to the query
Percent (-)	Percent negative. Indicates the number, as a percentage of the total number of occurrences, of negative answers to the query.
Maximum	Indicates the maximum of all the query answers.
Minimum	Indicates the minimum of all the query answers.
Std Deviation	Measures the mean deviation from the average of the answers. This can be a particularly valuable tool to interpret the answers to the query. For example, if the average return on a query is 3%, but the Standard Deviation on that is 10%, then it indicates a poor signal. It is best to have a standard deviation that is lower than the absolute value of the average value returned in the query.
Zstat	Indicates the Z-score of the results. This measures the goodness of the average.
Variance	This is related to the standard deviation calculation, which is actually the square root of the variance.
Last	Repeats the last value of the column data.



MIMIC does not sort table summary statistics.

CHAPTER 13

Stored Formulas

The functionality of the MIMIC **Stored Formula** tab allows you to create custom formulas that can be saved as names in the database for reuse in MIMIC queries and shared among other users. Since a formula is stored as a relation, the formula can be used in MIMIC just like any other relation, thus providing time management savings. A custom formula can save time anywhere there is a need to reuse a query expression.



Activation of this feature requires additional fees.

MIM Schema Browser

Use the **MIM Schema Browser** pane to browse and select a symbol (**Import item as Variable**) or edit your formula by browsing for a formula (**Import item as Formula**).

Use the **Refresh** button located in the bottom right-hand corner of the **MIM Schema Browser** to close all the folders in the browser window.

Import Item as Variable

Select **Import item as Variable** to use the browser to locate and add a symbol and column for creating a formula. Open the folders and locate the desired symbol name. Open the symbol and highlight the desired column, then right-click and choose **Select** to add the symbol and column to the Worksheet.

Import Item as Formula

Select **Import item as Formula** to browse for, locate and select a formula for editing.

Symbol Information

When a formula is selected from the **MIM Schema Browser** pane, the fields in the **Symbol Information** pane populates with the relation name, column units of measure and time units. When a new formula is created, fields may be entered manually.

MIMIC includes the following symbol information in the **MIM Schema Browser** pane:

Option	Function
Symbol	Enter a symbol name or use the MIM Schema Browser: Import as Variable to select a symbol and column.
Column	Select a column from the pull-down or use the MIM Schema Browser: Import as Variable to select a symbol and column.
Units of Measure	Use this field to modify the units of measure for the symbol.
Time Units	Select a time unit: Minutely, Hourly, Daily, Weekly, Avg Weekly, Monthly, Avg Monthly.

Formula Specifications

Use this area to define the formula expression, providing a name and description for the formula and using the different options available.

MIMIC includes the following formula specifications:

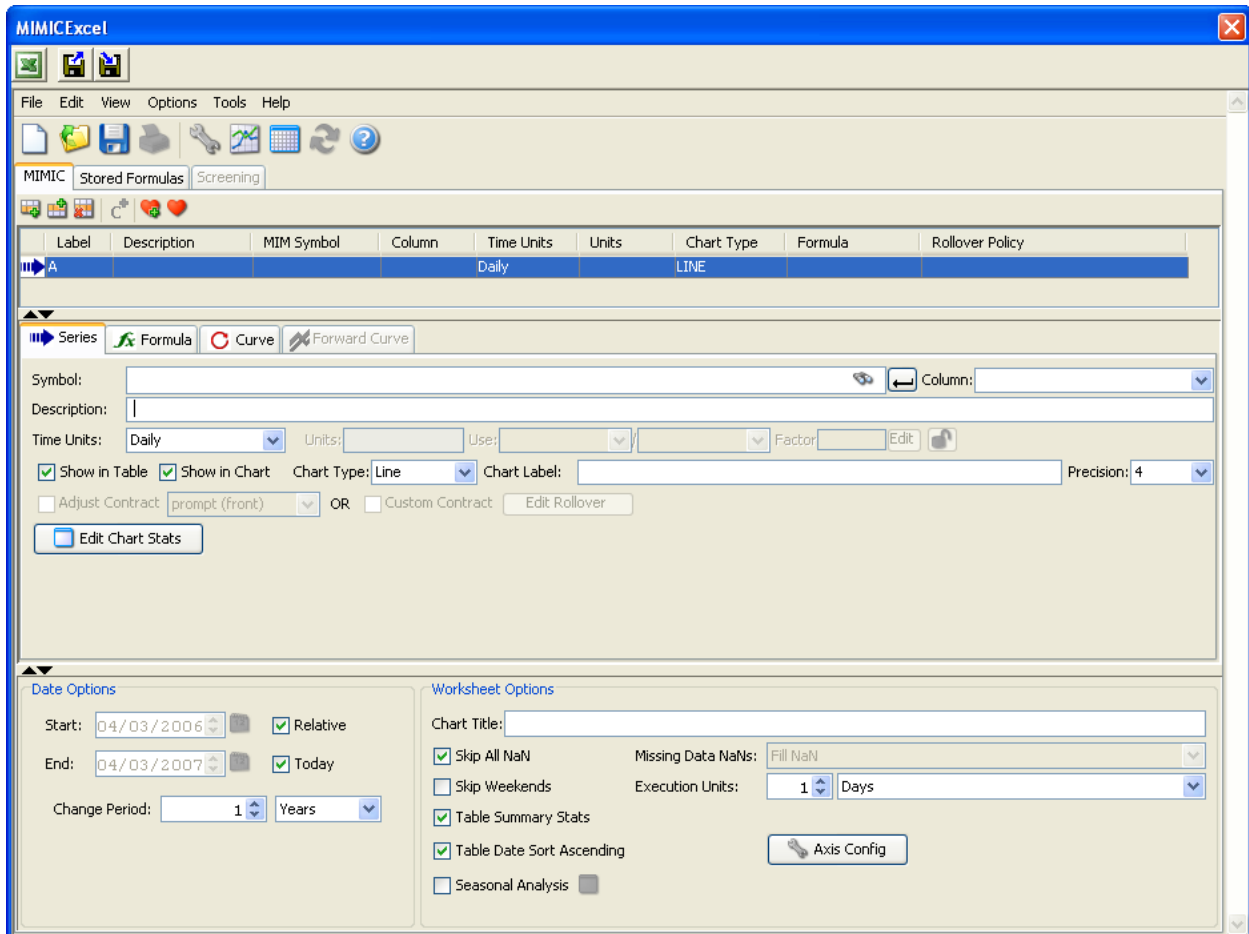
Option	Function
Relation	<p>Assigns a name to the relation. This name displays when Import as Formula is selected from the MIM Schema Browser.</p> <p>The expression name will become the MIM symbol by which the formula is known, once it is created. The name must conform to some basic MIM symbol naming rules. Since the formula expression must be a unique name, it is important to be careful when assigning names.</p> <p>Note: Always use your name or a similar recognized prefix at the front of your formula expression name. This will ensure the unique identity of the formula expression name and will reduce the risk of naming conflicts. For example, "MYNAME.FORMULA_1" where "MYNAME" is followed by a period. It is not possible to use the same name within your own Formula folder (will simply overwrite your formula) or any other user's Formula folder.</p> <p>The name must conform to the following rules:</p> <ul style="list-style-type: none"> ● Must be a unique name. ● Use uppercase characters. <p>Note: You are not permitted to type lowercase characters in the Relation name field.</p> <ul style="list-style-type: none"> ● No spaces in the name. ● Only letters and numbers are permitted—characters such as "-" or "@" and others are not allowed.

Option	Function
	<ul style="list-style-type: none">• The underscore is permitted.• Periods are allowed. If the name assigned does not follow these rules, then an error message will display when you try to save the expression.
Description	Enter a description for the formula. The description for the formula displays after the symbol name in the MIM Schema Browser.
Relation Column	The Relation Column field is always Value , so there is no need to edit this field.
Trade Pattern	For trading pattern, select whether the symbol trades 5 days a week or every day of the week.
Expression	This is the area where the formula expression is entered.

CHAPTER 14

MIMICExcel

MIMICExcel is an application that users can run from within Microsoft Excel. Users first open Excel and then from within Excel, MIMICExcel can be opened.



The main purpose for using MIMICExcel is to table the query results in an Excel spreadsheet, use Excel functionality with the query results, and to be able to automatically refresh or update the query results.

MIMIC vs. MIMICExcel

MIMIC is a stand-alone product and application that allows users to create queries, and to display the query results in a chart or table. MIMICExcel is a program that is used from within Excel. On the interface, differences in MIMICExcel include the title bar and the addition of the MIMICExcel toolbar above the menu bar.

The following shows the differences between the two applications:

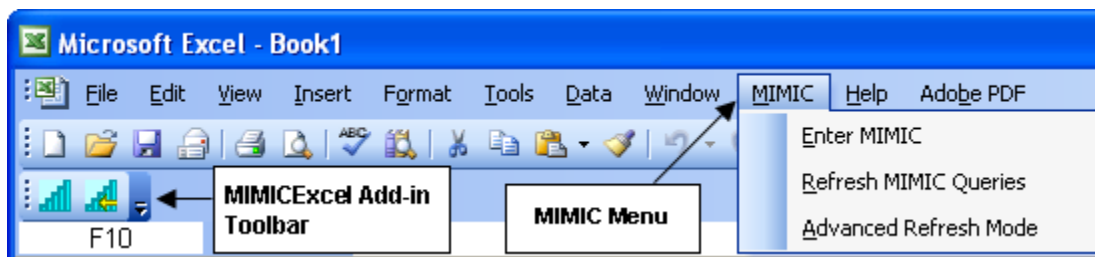
MIMIC	MIMICExcel
Is a stand-alone application.	Is a program that runs within Microsoft Excel.
Can create a single query.	Can create multiple queries.
Saves queries with a .llc file extension.	Saves or embeds queries in MIMICExcel, and saves each query separately with a .llc file extension for use in MIMIC.
Tables query results in the Table window.	Tables query results in an Excel spreadsheet.
Cannot refresh or update query results from the server.	Can refresh or update query results from the server.

Toolbars for MIMICExcel



There are two toolbars associated with using MIMICExcel: the **MIMICExcel Add-in** toolbar and the **MIMICExcel** toolbar.

MIMICExcel Add-in Toolbar

The **MIMIC Add-in** toolbar appears in Microsoft Excel and is combined with the MIMIC menu:



The **MIMICExcel Add-in** toolbar contains two buttons:




Button	Description	Function
	Enter MIMIC	Opens MIMICExcel.
	Refresh MIMIC Queries	Connects with the server and updates the data for all queries.

The **MIMIC** menu includes three options.

Menu Option	Function
Enter MIMIC	Opens MIMICExcel.
Refresh MIMIC Queries	Connects with the server and updates the data for all queries.
Advanced Refresh Mode	Once selected, allows users to refresh MIMIC queries using specific start and end dates for either the active worksheet or for all worksheets.

MIMICExcel Toolbar

The **MIMICExcel** toolbar appears at the top of the **MIMICExcel** interface and contains three buttons.

Button	Description	Function
	Back to Excel	Closes MIMICExcel.
	Query Manager	Opens the Query Manager, allowing users to edit, copy, rename or delete a query.
	Embed Query	Saves and embeds a query within MIMICExcel.

Queries in MIMICExcel

Queries in MIMICExcel are created the same way as they are created in MIMIC. Users enter criteria for a query in the **Configuration** window. Each query can contain more than one item or row in the Worksheet. Unlike MIMIC, MIMICExcel allows users to create more than one query, and these queries can be embedded or stored in MIMICExcel. This type of query is called an embedded query. Users can enter a name and description for each embedded query, and set the starting cell location where the query results will be posted in Excel. When posted, each query occupies a column for the date, and another for the results.

Query results appear in a chart the same way in both MIMIC and MIMICExcel; however, for tables, query results in MIMICExcel are posted to an Excel spreadsheet instead of to the **Table** window.

In MIMICExcel, users can save queries in different ways:



- Users can save or embed a query within MIMICExcel. When saving a query in this manner, users must also save the Excel spreadsheet. The spreadsheet will be saved with an Excel .xls file extension. Users can embed multiple queries. Other users can open the Excel spreadsheet to view the query results, and then open MIMICExcel to view the details of the query or queries and manage them.
- Users can save or export a query in MIMICExcel. This type of query is saved with a .llc file extension and referred to as a MIMIC worksheet file or a LLC worksheet. Other users can open this file or query in MIMIC or in MIMICExcel.

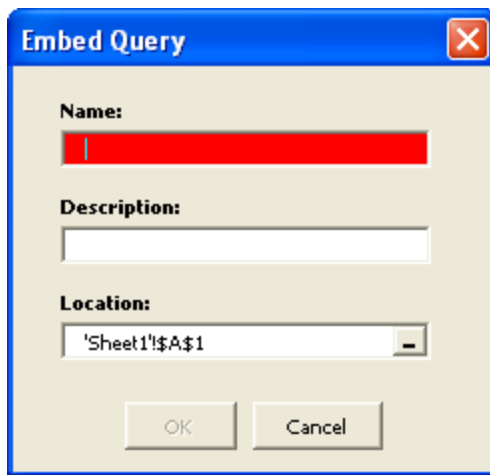



Users cannot export multiple embedded queries as one LLC worksheet. Each embedded query in MIMICExcel must be exported as a separate and independent LLC worksheet. For example, if MIMICExcel contains three embedded queries, the user must select each query separately and save each query as its own LLC worksheet.

Embedding a Query

In MIMICExcel, users can create and embed more than one query. Embedding a query is another way to describe saving a query within MIMICExcel.

Users must embed a query before they can table the query results to an Excel spreadsheet. To save or embed a query, users can select the **Embed Query**  button from the MIMICExcel toolbar, or select the **Table**  button and be prompted by MIMICExcel. MIMICExcel prompts users to embed the query, if the query has not been saved and they try to table the results. Embedded queries are saved using the **Embed Query** window:




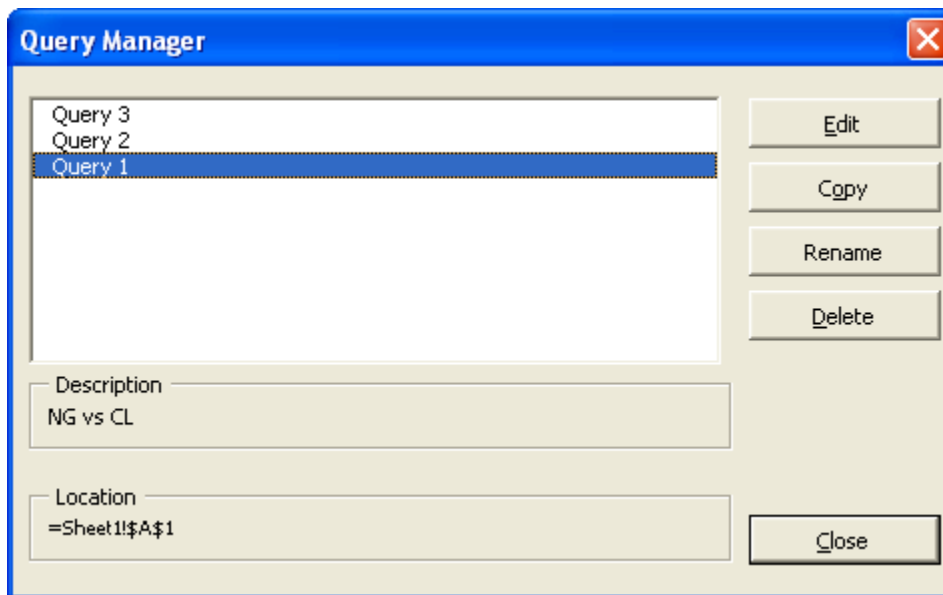
Users can enter a name and a description for the query, and specify the starting location or cell in Excel where the query results will post. To specify a location, users can select the **Browse**  button.



It is recommended that users select a different starting cell location for each embedded query, and ensure that subsequent embedded queries are separated by at least two columns to allow for the date and results of each query.

Query Manager


More than one query can be saved or embedded in MIMICExcel, and embedded queries are stored by MIMICExcel in the Query Manager. To open the Query Manager, users can select the **Query Manager**  button from the MIMICExcel toolbar. The Query Manager allows users to manage embedded queries:



Users can only access embedded queries by using the Query Manager. Users cannot open a query from the menu bar or from any toolbar.


In the Query Manager, users can select an embedded query and view its description and starting location. Users can also edit, copy, rename or delete a query.



To edit the description or location of a query, users must first open the query and then re-save the query by selecting the **Embed Query**  button. Then in the **Embed Query** window, users can enter a new description or location.

Refreshing MIMICExcel Queries

In MIMICExcel, query results are tabled to an Excel spreadsheet. Users can refresh or update the query results. When refreshing, MIMICExcel connects to the server and receives the latest data, and then replaces the old data in the Excel spreadsheet with the new data. MIMICExcel refreshes the results for all embedded queries.

To refresh the queries, users can select **MIMIC>Refresh MIMIC Queries** from the Excel menu bar, or select the **Refresh MIMIC Queries**  button from the **MIMICExcel Add-in** toolbar.

Advanced Refresh Options


MIMICExcel has advanced refresh options which allow users to indicate a specific start and end date for a query, and if the the advanced refresh options apply to the active worksheet, or to all worksheets.

To use the Advanced Refresh Options in MIMICExcel, users must first select **MIMIC>Advanced Refresh Mode** from the **Excel** menu bar. Once selected, this option is indicated with a check mark in the **MIMIC** menu. Then, users can select **MIMIC>Refresh MIMIC Queries**. The **Advanced Refresh Options** window displays, where users can modify the start and end dates for the queries, and specify that the advanced options apply to the active worksheet or to all worksheets.

LLC Worksheets

In MIMIC, users can save a query, so that other MIMIC users can open it. Saved queries are called MIMIC worksheet files, or LLC worksheets and have a .llc file extension.

In MIMICExcel, users can save or export an embedded query as a LLC worksheet. Users can have more than one embedded query, but each embedded query must be saved as a separate and distinct LLC worksheet.

To export an embedded query from MIMICExcel, users can select **File>Save** or **File>Save As** from the menu bar, or select the **Save**  button from the toolbar.

To open a LLC worksheet, users can select **File>Load** from the menu bar, or select the **Open**  button from the toolbar.

CHAPTER 15

Formula Table

Overview

The following tables are provided to outline the structure or format of commonly used mathematical **Formulas** that may be typed directly into the **Formula** text field of the **Data Builder**. In addition, several examples of these **Formulas** have been provided in the body of each table.

Formulas for Built-ins

% Move or Move

Percent Move is the difference, expressed as a percentage, between a specified starting value and an ending specified value. Move calculates the difference between a specified starting value and an ending specified value.

$$percentMove(X, n) \equiv 100 \frac{X - X_n}{|X_n|}$$

If either X or X_n is a NaN, the immediately preceding value will be considered instead, i.e., X₁ or X_{n+1}. If these values are also NaN, the percent move will be NaN as well. For example, when computing a 2 day percent move, if X is a NaN, but X₂ is not, then XMIM will return X₁ - X₂ instead of X - X₂. But, if X₁ is also NaN, then XMIM will return NaN.



Note that percentMove is negative precisely when the move is negative; i.e., the percent move from -10 to -12 is -20, not 20.

Constant (Number)	Time-Period (day/mth/yr)	"% move" or "move"	of	Series
4	day	% move	of	HO
1	month	move	of	CL
2	Quarter	% move	of	(HO - CL)
1	Month	move	of	(1 week average of HO)

Absolute Value

This study returns the absolute value for a specified Attribute. Where the value is a holiday or missing data series (expressed as NaN) the return will be NaN.

$$absoluteValue(X) \equiv |X|$$

If X is NaN, absoluteValue returns NaN as well.

“absolute_value”	of	Series
absolute_value	of	HO

Adjust Contract

MIMIC will adjust all studies using futures contract so that the artificial price jump associated with the expiration of a contract will not be factored into the study. For example, if a study using the front continuous contract captured a time period which included a roll or expiration date, by default, that price difference between the old or expiring contract and the new contract would be subtracted or backed out of the equation as of the expiration date. The adjust_contract function is used so that the jump or price difference associated with expiration (cost of carry) is not adjusted out of the study. There are four fields that are required to be specified within this study- the Attribute or series, the deferred number of the contract chosen (i.e., 1 represents the contract nearest to expiration or the front contract, 2 represents the second nearest contract to expiration, etc.), the number of days until expiration that the contract should be followed (i.e., 0 specifies that the contract will be active until expiration, 1 specifies that the contract will be active or followed up until 1 day before expiration, etc.) and contract month which is the parameter which specifies the contract month of interest (i.e., setting the field to 0 will disable this field thereby allowing the contract to roll to the regularly traded serial months, setting the field to 1 will specify only January contracts, etc.).

$$adjustContract(X, c, d, m) \equiv \hat{X}$$

where \hat{X} is computed by offsetting each relation of type futures in X with an appropriate amount so that the expiration-day boundaries do not introduce an artificial jump.

adjust_contract	“Series”	Contract Number	Days to Expiration	Month of Interest
adjust_contract	(HO,	1,	0,	0)
adjust_contract	(CL,	2,	5,	1)
adjust_contract	(NG,	3,	3,	0)



In the examples above the first example would create a series that when used in a **Formula** within another row of the worksheet would unadjust the continuous price series for the nearest to expire (or front) month. This series is set up to ‘roll’ on the expiration day. The next example, when used in a **Formula** within another row of the worksheet, would unadjust the continuous price series for the second nearest to expire (or back) January month (connects only January contracts). This series is set up to ‘roll’ five days before the expiration day of the contract. The last example, when used in a **Formula** within another row of the worksheet, would unadjust the continuous price series for the third nearest to expire (or back) contract. This series is set up to ‘roll’ three days before the expiration day of the contract.

The following shows further examples to demonstrate the use of adjust contract.

Example 1: Consider the trading day of 10/8/2002 for the following scenarios. The “prompt” crude oil contract would be Nov 2002, CL_2002X .

Data Table:

Date	LIM SYMBOL	adjust_contract version
10/8/2002	CL_2002Z - Close	adjust 1st December contract out adjust_contract (CL, 1, 0, 12)
	29.51	29.51
	CL_2003J - Close	adjust 6th contract month out adjust_contract (CL, 6, 0, 0)
	27.6	27.6
	CL_2004H - Close	adjust 2nd March contract out adjust_contract (CL, 2, 0, 3)
	23.86	23.86
	CL_2005F - Close	adjust 3rd January contract out adjust_contract (CL, 3, 2, 1)
	23.03	23.03

Let’s look closer at each of these to see how the adjust_contract function chooses the correct contract.

December 2002 contract: This is the nearest December contract right now. The explicit LIM symbol is CL_2002Z. To ask for the closest contract month using adjust_contract you fill in adjust_contract (CL, 1, 0, 12), where:

- CL = base commodity symbol of choice.
- 1 = N nearest. 3 would imply the 3rd nearest, 6 the 6th nearest.
- 0 = This is “Number of days before Expiration”. Setting this number to “0” indicates the series will locate the next nearest contract when the contract expires. Setting this number to “4” would mean that the contract should roll to the next one 4 days before expiration of the current contract.

- 12 = This is the contract month, 12 equals December, 5 equals May, 7 equals July. Note: Setting this number to “0” makes the parameter inactive, meaning the other parameters will determine the behavior.

April 2003 contract: This is the 6th nearest contract out. The explicit LIM symbol is CL_2003J. To ask for the literal N contract out using adjust_contract, you fill in adjust_contract (CL, 6, 0, 0), where:

- CL= base commodity symbol of choice.
- 6 = N nearest. 6 points to the 6th closest or nearest to expiration active contract.
- 0 = This is “Number of days before Expiration”. Setting this to “0” indicates the series will locate the next nearest contract when the contract expires. Setting this to “4” would mean that the contract should roll to the next one 4 days before expiration of the current contract.
- 0 = Normally, this is where you put in the contract month. However, since we want the exact 6th closest contract, this is set to “0”.

March 2004 contract: This is the 2nd nearest March contract. The 1st nearest is the March 2003 contract. The 3rd nearest would be March 2005. To ask for the 2nd nearest March using adjust_contract, you would fill in adjust_contract (CL, 2, 0, 3) where:

- CL = base commodity symbol of choice.
- 2 = 2nd nearest
- 0 = This is “Number of days before Expiration”. Setting this to “0” indicates the series will locate the next nearest contract when the contract expires.
- 3 = March contract.

January 2005 contract: This is the 3rd nearest January contract. The closest or first nearest would be January 2003. To ask for the 3rd nearest using adjust_contract, you will fill in adjust_contract (CL, 3, 2, 1), where:

- CL = base commodity symbol of choice
- 3 = 3rd nearest
- 2 = This is “Number of days before Expiration”. Setting this to “2” indicates the series will roll 2 days before the contract expires and choose the next 3rd nearest contract.
- 1 = January contract.

Example 2: More Real-World Examples

How do you ask for?

1. Spread between the 2nd December and the 1st December contract. Often times this is referred to as a Dec – Red Dec spread.

`adjust_contract (CL, 1, 0, 12) – adjust_contract (CL, 2, 0, 12)`

- The spread between the 1st and 2nd nearby contracts.

`adjust_contract (CL, 1, 0, 0) – adjust_contract (CL, 2, 0, 0)`

- The 3rd nearest November contract.

`adjust_contract (CL, 3, 0, 11)`

- The 15th closest contract out.

`adjust_contract (CL, 15, 0, 0)`

Average

Calculates a simple moving average of values in the specified time period. When calculating an N day average, XMIM will display a moving N day average for any executable date; however, where there is a holiday or missing data point (expressed as NaN) a moving average of less than N days will be displayed. For example, if a 5 day average was calculated and our executable dates include December 25, a holiday, the study would calculate a 4 day average for this date because no data point exists for December 25. Likewise, on December 26 a 4 day average will be displayed because of the missing data associated with the holiday. On December 25, a 5 value average will display (NaN) because no data exists to perform the calculation. However on December 26, or the next date where data exists, the study include the data on December 26 and will search back for the other 4 values to perform the calculation (skipping over December 25). To ensure that N actual ‘values’ are used in the calculation the term value should be substituted instead of day in the formula.

$$average(X, n) \equiv \frac{sum(X, n)}{count(X, n)}$$

Constant (Number)	Time Period (day/mth/yr)	“average”	of	Series
5	value	Average	of	HO
3	month	Average	of	CL
2	quarter	Average	of	NG
1	year	Average	of	HU
4	week	Average	of	PN



The term “value” may be used to anchor 5 absolute values to be used in the calculation for the above example. If one the five values were unavailable for the 5-day average, MIMIC would substitute a 4-day average. To ensure that 5 actual ‘values’ are used in the calculation the term value should be substituted instead of day in the formula. Also, on a day without data the use of ‘value’ in the formula would return a “NaN” (not a number, indicating that no values existed on that day for the calculation).

Bollinger High/Bollinger Low

Bollinger_high and Bollinger_low studies return values that are derived from a moving average plus (high) or minus some relative percent of the moving average. The relative value, subtracted or added to the moving average, is the standard deviation for the time window. These price bands can be defined so that they encompass most of the price activity with the ceiling (bollinger_high) coinciding with the relative highs and the floor (bollinger_low) coinciding with relative lows. These significant high and low thresholds can be used to measure overbought or oversold levels in the market. There are three fields that are required to be specified within this study- the Attribute or series, the relevant time period for the study and the width of the band (1 denotes 1 standard deviation, 2 denotes 2 standard deviations and 3 denotes 3 standard deviations).

$$bollingerLow(X, n, w) \equiv average(X, n) - w * standardDeviation(X, n)$$

$$bollingerHigh(X, n, w) \equiv average(X, n) + w * standardDeviation(X, n)$$

“bollinger_high/ bollinger_low”	Series	Constant (Number)	Time Period (day/mth/yr)	Constant (Number)
bollinger_high/bollinger_low	(HO,	1	day,	Standard Deviation)

Compound_return

Compound_return is the accumulated return of a specified relation column, between a specified start and end date. Since the formula relies on multiplication, all NaN values should be skipped at all times. If the relation column value is zero, then the value is 1. If the relation column is all NaN then the return value is NaN. For this study, it is practical to use % move as the attribute.

$$C_0 = 1$$

$$C_N = \left(1 + \frac{R_N}{100}\right) * C_{N-1}$$

where C = compound_return and R = relation column

“compound_return”	Constant (Number)	Time Period (day/mth/yr)	Attribute of Series	Time Period (day/mth/yr)	Time Period (day/mth/yr)
compound_return	1	day	% move of (GII.DELL.NASDAQ)	1 year ago	today

Construct Date

This study returns XMIM's mathematical value corresponding to the date month/day/year format.

$$\text{constructDate}(m, d, y) \equiv D$$

where D is an integer corresponding to the date $m/d/y$ (*month/day/year format*). The number D is guaranteed to be in the standard date representation of XMIM, as given by the XMIM construct current date.

"construct_date"	Constant (Number)	Year
construct_date	(month, day,	1996)

Coregression

Returns the statistical co-regression of two series where X is the Independent variable and Y is the dependent variable.

$$\text{coregression}(X, Y, n) \equiv \alpha + \beta X$$

where α and β are the regression coefficients, computed as follows:

$$\Delta \equiv n \sum_{i=1}^n X_{n-i}^2 - \left(\sum_{i=1}^n X_{n-i} \right)^2$$

$$\alpha \equiv \frac{\sum_{i=1}^n X_{n-i}^2 \sum_{i=1}^n Y_{n-i} - \sum_{i=1}^n X_{n-i} \sum_{i=1}^n X_{n-i} * Y_{n-i}}{\Delta}$$

$$\beta \equiv \frac{n \sum_{i=1}^n X_{n-i} * Y_{n-i} - \sum_{i=1}^n X_{n-i} \sum_{i=1}^n Y_{n-i}}{\Delta}$$

As in the case for linear regression, the formulas above are unstable and prone to round-off errors, so we replace them with the mathematically equivalent ones below:

$$\beta \equiv \frac{1}{\sum_{i=1}^n \left(X_{n-i} - \sum_{j=1}^n X_{n-j} / n \right)^2} \sum_{i=1}^n \left(X_{n-i} - \sum_{j=1}^n X_{n-j} / n \right) Y_{n-i}$$

$$\alpha \equiv \frac{\sum_{i=1}^n Y_{n-i} - \beta \sum_{i=1}^n X_{n-i}}{n}$$

NaNs are handled exactly as in the case for linearRegression.

Constant (Number)	Time-Period (day/mth/yr)	“coregression”	of	Series
1	day	coregression	of	HO and CL

Coregression_intercept

Returns the statistical co-regression intercept of two series where X is the independent variable and Y is the dependent variable.

$$\text{coregression_intercept}(X, Y, n) \equiv \alpha$$

where α is the regression intercept, computed as follows:

$$\Delta \equiv n \sum_{i=1}^n X_{n-i}^2 - \left(\sum_{i=1}^n X_{n-i} \right)^2$$

$$\alpha \equiv \frac{\sum_{i=1}^n X_{n-i}^2 \sum_{i=1}^n Y_{n-i} - \sum_{i=1}^n X_{n-i} \sum_{i=1}^n X_{n-i} * Y_{n-i}}{\Delta}$$

As in the case for linear regression, the formulas above are unstable and prone to round-off errors, so we replace them with the mathematically equivalent ones below:

$$\beta \equiv \frac{1}{\sum_{i=1}^n \left(X_{n-i} - \sum_{j=1}^n X_{n-j} / n \right)^2} \sum_{i=1}^n \left(X_{n-i} - \sum_{j=1}^n X_{n-j} / n \right) Y_{n-i}$$

$$\alpha \equiv \frac{\sum_{i=1}^n Y_{n-i} - \beta \sum_{i=1}^n X_{n-i}}{n}$$

NaNs are handled exactly as in the case for linearRegression.

Constant (Number)	Time-Period (day/mth/yr)	“coregression_intercept”	of	Series
1	day	coregression_intercept	of	HO and CL

Coregression_slope

Returns the statistical co-regression slope of two series where X is the Independent variable and Y is the dependent variable.

$$\text{coregression_slope}(X, Y, n) \equiv \beta$$

where β is the regression slope, computed as follows:

$$\Delta \equiv n \sum_{i=1}^n X_{n-i}^2 - \left(\sum_{i=1}^n X_{n-i} \right)^2$$

$$\beta \equiv \frac{n \sum_{i=1}^n X_{n-i} * Y_{n-i} - \sum_{i=1}^n X_{n-i} \sum_{i=1}^n Y_{n-i}}{\Delta}$$

As in the case for linear regression, the formulas above are unstable and prone to round-off errors, so we replace them with the mathematically equivalent ones below:

$$\beta \equiv \frac{1}{\sum_{i=1}^n \left(X_{n-i} - \sum_{j=1}^n X_{n-j} / n \right)^2} \sum_{i=1}^n \left(X_{n-i} - \sum_{j=1}^n X_{n-j} / n \right) Y_{n-i}$$

NaNs are handled exactly as in the case for linearRegression.

Constant (Number)	Time-Period (day/mth/yr)	“coregression_slope”	of	Series
1	day	coregression_slope	of	HO and CL

Correlation

This study returns the statistical correlation coefficient between two series. This study will return values between the range of 1 (perfect correlation) and -1 (perfectly negative correlation).

$$\text{correlation}(X, Y, n) \equiv \frac{\sum_{i=0}^{n-1} (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=0}^{n-1} (X_i - \bar{X})^2 \sum_{i=0}^{n-1} (Y_i - \bar{Y})^2}}$$

where \bar{X} is equal to average (X, n) and similarly for \bar{Y} . NaNs are handled exactly as in the case for covariance.

Constant (Number)	Time-Period (day/mth/yr)	“correlation”	of	Series
100	day	correlation	of	HO and CL
1	month	correlation	of	HO and NG
4	week	correlation	of	(HO + CL) and NG

Count

This study counts the number of occurrences for which a value is returned for a given time period. This function will not include holidays or other NaN (Not a Number) values in its count.

$$\text{count}(X, n) \equiv \sum_{i=0}^{n-1} \text{defined}(X_i)$$

where $\text{defined}(X)$ returns a 0 if X is NaN and 1 otherwise.

Constant (Number)	Time-Period (day/mth/yr)	"count"	of	Series
1	day	count	of	HO

Covariance

A statistical covariance measure is the measure of the relationship between two series whose values are observed over a moving time window.

$$\text{covariance}(X, Y, n) \equiv \frac{\text{sum}((X - \bar{X}) * (Y - \bar{Y}), n)}{n - 1}$$

where \bar{X} is equal to average (X, n) and similarly for \bar{Y} . As in the variance study, if n is less than or equal to 1, covariance returns NaN.

Constant (Number)	Time-Period (day/mth/yr)	"covariance"	of	Series
1	day	covariance	of	HO and CL

Dividend Adjusted Return

Dividend_adjusted_return is the overall percentage return of a dividend paying stock when it is assumed additional shares (or fractions of shares) are purchased with the dividend gains on Ex-Dividend date at the current stock's closing price. On each Ex-Dividend date, the amount of shares increases, but the initial investment remains the same. The formula assumes a purchase of 1 share at the start date at the then current closing price (this is the initial investment).

$$\left[\frac{((\text{accumulated_no_shares} * \text{current_share_price}) - \text{initial_investment})}{\text{initial_investment}} \right] * 100$$

“dividend_adjusted_return”	Attribute	of	Series	Time Period (day/mth/yr)	Time Period (day/mth/yr)
dividend_adjusted_return	(Close	of	GII.C.NYSE,	1 year ago	today)

Ease of Move

This study is derived from Richard Arms’ Ease of Movement indicator and is a momentum indicator that incorporates range and volume to signal certain trends evolving within the markets. This indicator was developed in order to quantify volume and price changes in order to determine the ease, or lack thereof, with which price is able to move up or down. The formula for this study is the difference of the today's midpoint minus a previous midpoint multiplied by today's range all divided by today's volume.

$$easeOfMove(S) \equiv \frac{(M - M_1) * range(S)}{Volume\ of\ X}$$

where M is equal to midpoint (S) and M₁ is the previous value of midpoint (S).

“ease_of_move”	of	Series
ease_of_move	of	HO

Exponential Average

There exists a school of thought that says that using a simple moving average system, where all days are weighted equally, doesn’t properly acknowledge the impact of more recent prices on future price movement. Hence, it is argued that it would be preferred to ‘weight’ the more recent days more heavily in a ‘moving average’ equation. This study is calculated as of the sum of the current price multiplied by a ‘weight’ or smoothing constant and the previous day’s study is multiplied by (1 - weight). The weight of a prior day’s price will decrease the further back in time, relevant to today’s price, it is. There are two fields that are required to be specified within this study- the Attribute or series and weight. There are two acceptable ways to calculate weight: 1 / n (where n represents the number of days) or 2 / n + 1. For example, if we were to use a 14 day equivalent, we could type in either 1 / 14 or 2 / 14 + 1 into the ‘weight’ field for our study.

$$exponentialAverage(X, w) \equiv w * X + (1 - w)exponentialAverage_1(X, w)$$

where *w* is restricted to lie in the range $w \in [0,1]$ and *exponentialAverage₁*(*X*, *w*) is the previous value of *exponentialAverage*(*X*, *w*) (or NaN if none). ExponentialAverage ignores any NaNs in X. That is, if a given value is NaN, then the exponentialAverage is simply equal to the previous value of the exponentialAverage.

Although exponential average takes into account the entire history of X, it is sometimes useful to compare it to an “n-day” average. The closer *w* is to 1, the shorter term the exponential average becomes. From the

formula, it is clear that for w equal to 1, the exponential average of X is precisely X . Conversely, the closer w is to zero, the longer term the exponential average becomes.

“exponential_average”	Series	Constant (Number)
exponential_average	(HO,	Weight)

Extract Day

This study returns XMIM's mathematical value corresponding to the day as encoded within the software.

$$\text{extractDay}(D) \equiv d$$

where d is the day encoded in XMIM date D . See the entry for “Construct Date” for an explanation.

“extract_day”	from	Date
extract_day	from	1996

Extract Month

This study returns XMIM's mathematical value corresponding to the month as encoded within the software.

$$\text{extractMonth}(D) \equiv m$$

where m is the month encoded in the XMIM date D . See the entry for “Construct Date” for an explanation.

“extract_month”	from	Date
extract_month	from	1996

Extract Year

This study returns XMIM's mathematical value corresponding to the year as encoded within the software.

$$\text{extractYear}(D) \equiv y,$$

where y is the year encoded in the XMIM date D . See the entry for “Construct Date” for an explanation.

“extract_year”	from	Date
extract_year	from	1996

Greatest Integer

This study returns a ceiling for a series using the some units specified as “steps”. There are two fields that are required to be specified within this study- the Attribute or series (this may also be a constant/number or variable) and step. This study will return a value that is greater or equal to the Attribute and that is a multiple of the number specified in the steps field. For example, if the Close of US was specified as the Attribute and ‘2’ was specified in the steps field, the study would return a number that was divisible by 2 and that was greater than the daily closing price.

$$greatestInteger(N, s) \equiv s * \left\lceil \frac{N}{s} \right\rceil$$

“greatest_integer”	Series	Constant (Number)
greatest_integer	(HO,	Step)

Highest

Returns the highest value in a data series during a specified period of time.

Identification of a succession of higher highs and higher lows is a technical method commonly used to designate an uptrend and may be used to identify certain trending patterns within your studies.

$$highest(X, n) \equiv \max_{i=0}^{n-1} X_i$$

This study will ignore any NaN values. If all the X values are NaN, it will return NaN. Otherwise, it will return the maximum of the non-NaN values.

Constant (Number)	Time Period (day/mth/yr)	“highest”	of	Series
1	day	highest	of	HO

If-Then Statement

This language structure lets you assign a **Series** based on time, date, event or price conditions. It creates a logical structure so that if the condition in the ‘If’ clause is true, the **Series** represented by the ‘Then’ clause is assigned on that date.

if	Condition	then	Series	endif
if	Date is NG expiration_day	then	HO	endif
if	HO is more than CL	then	CL	endif
if	1 week % move of HO is more than 10	then	1 week % move of HO	endif

Inverse Log

This study returns the inverse logarithm for a specified Attribute or series.

$$\text{inverseLog}(X) \equiv e^x$$

If X is NaN, its inverseLog is also NaN.

"inverse_log"	of	Series
Inverse_log	of	HO

Linear Regression

Returns a value for a given attribute based on a linear regression (fitting data to a line, such as $y=ax + b$) over a specified time period. Linear regression is a statistical method of following trends. According to industry authorities, the results of linear regression studies are quite similar to the moving averages. This study performs a linear regression over a specified time period.

$$\text{linearRegression}(X,n) \equiv \alpha + \beta n$$

where α and β are the linear regression coefficients, computed as follows:

$$\Delta \equiv n \sum_{i=1}^n i^2 - \left(\sum_{i=1}^n i \right)^2$$

$$\alpha \equiv \frac{\sum_{i=1}^n i^2 \sum_{i=1}^n X_{n-i} - \sum_{i=1}^n i \sum_{i=1}^n i * X_{n-i}}{\Delta}$$

$$\beta \equiv \frac{n \sum_{i=1}^n i * X_{n-i} - \sum_{i=1}^n i \sum_{i=1}^n X_{n-i}}{\Delta}$$

The formulas stated above are the standard formulas for linear regression; however, they are not well-suited to a computer implementation, because they suffer from severe round-off errors. To alleviate this, XMIM implements the equivalent formulas below instead:

$$\beta \equiv \frac{1}{\sum_{i=1}^n \left(i - \sum_{j=1}^n j/n \right)^2} \sum_{i=1}^n \left(i - \sum_{j=1}^n j/n \right) X_{n-i}$$

$$\alpha \equiv \frac{\sum_{i=1}^n X_{n-i} - \beta \sum_{i=1}^n i}{n}$$

Note that some of the expressions above are actually simple functions of n , i.e.,

$$\sum_{i=1}^n i \equiv \frac{n(n+1)}{2}$$

In general, XMIM will pre-compute these expressions, and so the formulas above are greatly simplified (and largely unrecognizable). LinearRegression ignores any NaN values in X. That is, if 3 values are NaN in the computation of linearRegression(X, 10), XMIM computes linearRegression(X' 7) instead, where the X' are derived from X by “stripping” away the NaN values. Note in particular that the placement of NaNs throughout the X time series is not significant.

Constant (Number)	Time Period (day/mth/yr)	“linear_regression”	of	Series
1	day	linear_regression	of	HO

Lowest

Returns the lowest value in a data series during a specified period of time. This function is helpful in identifying lower highs and lower lows, characterizing an downward trend pattern.

$$lowest(X, n) \equiv \min_{i=0}^{n-1} X_i$$

This study will ignore any NaN values. If all the X values are NaN, it will return NaN. Otherwise, it will return the minimum of the non-NaN values.

Constant (Number)	Time Period (day/mth/yr)	“lowest”	of	Series
1	day	lowest	of	HO

Macd_osc

This study’s name is short hand for moving average convergence divergence oscillator. This indicator was developed by Gerald Appel and is widely employed to measure market momentum as well as detecting and following trends. This study measures the rate of convergence and divergence between two exponentially smoothed moving averages (or the rate of acceleration or deceleration between a faster or shorter period moving average and a slower or longer period moving average). There are three fields that must required to be specified within this study- the Attribute or series and two fields representing the weights for the faster and slower exponentially smooth moving averages. This study will return the difference between the two moving

averages. A value of '0' would indicate that the averages are exactly the same whereas a positive value (where the faster average was the first defined weight field) would indicate acceleration and a negative value would indicate deceleration.

$$macdOsc(X, w_1, w_2) \equiv exponentialAverage(X, w_1) - exponentialAverage(X, w_2)$$

For an explanation of the w_1 , w_2 and w_3 arguments, see the discussion about [“Exponential Average”](#).

“macd_osc”	Series	Constant (Number)	Constant (Number)
macd_osc	(HO,	Weight 1	Weight 2)

Macd_signal

This study incorporates a ‘signal’ line into the study, macd_osc, listed above. Where the first two fields represent the faster and slower moving averages in the macd_osc study, the third weight represents the exponential weight of this macd_osc study. So in effect this study is an exponential study, as defined by the third weight, of macd_osc created by the first two weight fields. The basic method of incorporating this study into a trading program is to look for buy signals when the macd_osc crosses above the macd_signal and to look for sell signals upon the reverse.

$$macdSignal(X, w_1, w_2, w_3) \equiv exponentialAverage(macdOsc(X, w_1, w_2), w_3)$$

For an explanation of the w_1 , w_2 , and w_3 arguments, see the discussion about [“Exponential Average”](#).

“macd_signal”	Series	Constant (Number)	Constant (Number)	Constant (Number)
macd_signal	(HO,	Weight 1	Weight 2	Weight 3)

Median

Returns the median value in a data series. Median function first sorts the data series, and then returns the median value. If the data item number in the series is odd, it returns the middle data item in the series. Otherwise, it returns the middle two data item average. For example, if the data series is (10, 4, 7), the median value is 7. If the data series is (10, 2, 3, 27), the median value is $(3+10)/2=6.5$

$$Median(X, n) = y$$

This study will ignore any NaN values. If all the X values are NaN, it will return a NaN. Otherwise, it will return the non-NaN median value.

“median”	Constant (Number)	Time Period (day/mth/yr)	“median”	of	“Close”	of	Series
	3	day	median	of	Close	of	CL

Midpoint or Mid_point

This study returns the mathematical midpoint for a specified Attribute and is calculated by dividing the sum, of the High of the Attribute and the Low of the Attribute, by 2. A popular method of employing this study is to gauge a 50% market retracement (as defined as some point below the midpoint), off from some specified high, as potential entry points for a trading program. The syntax “midpoint” or “mid_point” may be used.

$$\text{Midpoint}\left(\frac{X + Y}{2}\right)$$

Where X is the High of the Attribute and Y is the Low of the Attribute.

“midpoint” or “mid_point”	of	Series
midpoint	of	HO
mid_point	of	HO

Move

Returns the difference between the start and end values over a specified time period.

$$\text{move}(X, n) \equiv X - X_n$$

If either X or X n is a NaN, the immediately preceding value will be considered instead, i.e., X₁ or X_{n+1}. If these values are also NaN, the move will be NaN as well. For example, when computing a 2 day move, if X₁ is a NaN, but X₂ is not, then XMIM will return X₁ - X₂ instead of X - X₂. But, if X₁ is also NaN, then XMIM will return NaN.

Constant (Number)	Time-Period (day/mth/yr)	“move”	of	Series
1	day	move	of	HO

Natural Log

This study returns the natural logarithm for a specified Attribute or series.

$$\text{naturalLog}(X) \equiv \ln X$$

If X is NaN or less than or equal to 0, naturalLog returns NaN

“natural_log”	of	Series
natural_log	of	HO

Nearest Integer

This study will return either the smallest integer or the greatest integer, depending upon which value is closest to the value of the Attribute or series selected. This study may be used to calibrate where the value of the Attribute is relative to some ceiling (greatest integer) or floor (smallest integer).

$$nearestInteger(N, s) \equiv greatestInteger(N, s)$$

or

$$nearestInteger(N, s) \equiv smallestInteger(N, s)$$

depending on which of the two values is closer to N . If N is the midpoint of these two values, XMIM chooses $greatestInteger(N, s)$ arbitrarily.

“nearest_integer”	Series	Constant (Number)
Nearest_integer	(HO	Step)

Negative Value

This study will only return the value of the Attribute specified where the value is a negative number. Where the value is positive or zero the value returned is '0'.

$$negativeValue(X) \equiv \min(X, 0)$$

Notice that this function never returns a positive number. If X is NaN, $negativeValue$ returns NaN as well.

“negative_value”	of	Series
Negative_value	of	HO

Net Change

This study is the same as the “move study”, but the sign of the change is removed. Net change is the absolute value of the move.

$$netChange(X, n) \equiv |X - X_n|$$

This study treats NaNs analogously to move. It also performs the same special cases.

Constant (Number)	Time-Period (day/mth/yr)	“net_change”	of	Series
1	day	net_change	of	HO

Net Percent Change

This study returns the absolute value of the percentage move over some time period specified.

$$netPercentChange(X, n) \equiv 100 \left| \frac{X - X_n}{X_n} \right|$$

This study treats NaNs analogously to move. It also performs the same special cases.

Constant (Number)	Time-Period (day/mth/yr)	"net_percent_change"	of	Series
1	day	net_percent_change	of	HO

On Balance Volume

This study quantifies the trend in volume over time and is most closely identified with research conducted by Joseph Granville. There are several methods by which this study may be analyzed. The primary methods are trend assessment and divergence analysis. The study returns a cumulative value representing the running total equated to the sum of (daily or periodic volume multiplied by 1, where the daily or periodic move is positive, or by -1, where the move is negative). This study is a ‘running’ calculation based on market direction and volume. The only field required to be specified for the study is the Attribute.

$$onBalanceVolume(S) \equiv onBalanceVolume_1(S) + sign * Volume \text{ of } S$$

where *sign* is 1 if Close of S is up and -1 otherwise. The expression onBalanceVolume1(S) refers to the previous value of onBalanceVolume(S).

"on_balance_volume"	of	Series
on_balance_volume	of	HO

Periods in Range

This study returns the number of periods (days, weeks, etc.) in some specified window time. The most interesting use of this study is to calibrate the number of periods or days between two given conditions. For example, the periods in range from the time when some value crosses above a moving average to when the value crosses below. This example could assist in identifying the period of time a certain trade would be active based on a moving average system.

$$periodsInRange(n) \equiv \#n$$

where *#n* counts the number of periods (days, weeks, etc.) in the time period *n*. If this time period is specified as a from/to range, and the boundaries are reversed (i.e., the “from” occurs after the “to”), periodsInRange returns a negative number.

"periods_in_range"	Constant (Number)	Time Period (day/mth/yr)
periods_in_range	1	day

Positive Value

This study will only return the value of the Attribute specified where the value is a positive number. Where the value is negative or zero the value returned is '0'.

$$positiveValue(X) \equiv \max(X, 0)$$

If X is NaN, positiveValue returns NaN as well.

"positive_value"	of	Series
positive_value	of	HO

Product

This study will return the product (the multiplication of some values to each other) of those values of an Attribute as defined over some period of time. Where there exists a holiday or missing data (expressed by NaN) the equation is multiplied by '1'. There are two fields that must be specified within this study- the Attribute or series and time period.

$$product(X, n) \equiv \prod_{i=0}^{n-1} X_i$$

This study will ignore any values that are NaN. That is, it returns the product of the non-NaN values in the given range. If all the X values are NaN, product returns a NaN.

"product"	Series	Time Period (day/mth/yr)
product	(HO,	day)

Range

This study will return the range for some specified Attribute by subtracting the High of the Attribute - the Low of the Attribute. Trading ranges, performed for certain key periods (i.e. calendar month or 6 months), are used to establish the upper and lower boundaries that are essential to defining levels of support and resistance. Breakouts from established trading ranges provide important trading signals.

$$\text{range}(S) \equiv \text{High of } S - \text{Low of } S$$

“range”	of	Series
range	of	HO

Rel Strength

This study returns the difference between the period percent move of one data series versus another defined series. This study is useful for attribution analysis (research that defines what portion of a security’s price is ‘attributable’ to the broad market moves). The most interesting use of this study is to compare the price of a security or market sector versus its comparable broad market index to see whether the security or sector is outpacing or under-performing the index.

$$\text{relStrength}(S, I, n) \equiv \text{percentMove}(S, n) - \text{percentMove}(I, n)$$

“rel_strength”	Sec Series	Index Series	Constant (Number)
rel_strength	(HO,	CL,	NumDays)

Select Contract

The MIM will adjust all studies using futures contract so that the artificial price jump associated with the expiration of a contract will not be factored into the study. For example, if a study using the front continuous contract captured a time period which included a roll or expiration date, by default, that price difference between the old or expiring contract and the new contract would be subtracted or backed out of the equation as of the expiration date. The select_contract function is used so that the jump or price difference associated with expiration (cost of carry) is not adjusted out of the study. This is accomplished by ‘anchoring’ the current contract that satisfies our expiration requirements (i.e. if the front contract is the March 1998 contract, the studies will be performed exclusively on this contract and will ignore all previous contracts that meet our expiration requirement). There are four fields that are required to be specified within this study- the Attribute or series (select your futures series), the deferred number of the contract chosen (i.e., 1 represents the contract nearest to expiration or the front contract, 2 represents the second nearest contract to expiration, etc.), the number of days until expiration that the contract should be followed (i.e., 0 specifies that the contract will be active until expiration, 1 specifies that the contract will be active or followed up until 1 day before expiration, etc.) and contract month which is the parameter which specifies the contract month of interest (i.e., setting the field to 0 will disable this field thereby allowing the contract to roll to the regularly traded serial months, setting the field to 1 will specify only January contracts, etc.).

$$\text{selectContract}(X, c, d, m) \equiv \hat{X}$$

where \hat{X} is computed by replacing all references to a relation in X with the corresponding “current” contract. The current contract is selected as in adjustContract.

“select_contract”	Series	Constant (Number)	Constant (Number)	Constant (Number)
select_contract	(HO,	DeferredNum,	NumDays,	ContractMonth)

The following shows further examples to demonstrate the use of select_contract.

Example 1:

Consider the trading day of 10/8/2002 for the following scenarios.

The “prompt” crude oil contract would be Nov 2002, CL_2002X .

Data Table

Date	LIM SYMBOL	adjust_contract version
10/8/2002	CL_2002Z - Close	adjust 1st December contract out select_contract (CL, 1, 0, 12)
	29.51	29.51
	CL_2003J - Close	adjust 6th contract month out select_contract (CL, 6, 0, 0)
	27.6	27.6
	CL_2004H - Close	adjust 2nd March contract out select_contract (CL, 2, 0, 3)
	23.86	23.86
	CL_2005F - Close	adjust 3rd January contract out select_contract (CL, 3, 2, 1)
	23.03	23.03

Let’s look closer at each of these to see how the select_contract function chooses the correct contract.

December 2002 contract: This is the nearest December contract right now. The explicit LIM symbol is CL_2002Z. To ask for the closest contract month using select_contract you fill in select_contract (CL, 1, 0, 12), where:

- CL = base commodity symbol of choice.
- 1 = N nearest. 3 would imply the 3rd nearest, 6 the 6th nearest.
- 0 = This is “Number of days before Expiration”. Setting this number to “0” indicates the series will locate the next nearest contract when the contract expires. Setting this number to “4” would mean that the contract should roll to the next one 4 days before expiration of the current contract.
- 12 = This is the contract month, 12 equals December, 5 equals May, 7 equals July.



Setting this number to “0” makes the parameter inactive, meaning the other parameters will determine the behavior.

April 2003 contract: This is the 6th nearest contract out. The explicit LIM symbol is CL_2003J. To ask for the literal N contract out using select_contract, you fill in select_contract (CL, 6, 0, 0), where:

- CL= base commodity symbol of choice.
- 6 = N nearest. 6 points to the 6th closest or nearest to expiration active contract.
- 0 = This is “Number of days before Expiration”. Setting this to “0” indicates the series will locate the next nearest contract when the contract expires. Setting this to “4” would mean that the contract should roll to the next one 4 days before expiration of the current contract.
- 0 = Normally, this is where you put in the contract month. However, since we want the exact 6th closest contract, this is set to “0”.

March 2004 contract: This is the 2nd nearest March contract. The 1st nearest is the March 2003 contract. The 3rd nearest would be March 2005. To ask for the 2nd nearest March using select_contract, you would fill in select_contract (CL, 2, 0, 3) where:

- CL = base commodity symbol of choice.
- 2 = 2nd nearest
- 0 = This is “Number of days before Expiration”. Setting this to “0” indicates the series will locate the next nearest contract when the contract expires.
- 3 = March contract.

January 2005 contract: This is the 3rd nearest January contract. The closest or first nearest would be January 2003. To ask for the 3rd nearest using select_contract, you will fill in select_contract (CL, 3, 2, 1), where:

- CL = base commodity symbol of choice
- 3 = 3rd nearest
- 2 = This is “Number of days before Expiration”. Setting this to “2” indicates the series will roll 2 days before the contract expires and choose the next 3rd nearest contract.
- 1 = January contract.

Example 2:

```
SHOW
  NGjan: select_contract ( NG, 1, 0, 0 )
  NGfeb: select_contract ( NG, 2, 0, 0 )
  NGmar: select_contract ( NG, 3, 0, 0 )
  avg:
    (select_contract ( NG, 1, 0, 0 ) + select_contract ( NG, 2, 0, 0 ) +
     select_contract ( NG, 3, 0, 0 )
     ) / 3
WHEN
  Date is December
```

Simple_rsi

Simple relative strength index is a variation of Welles Wilder's Relative Strength Index indicator and is a popular overbought-oversold measure. These measures are intended to reflect situations when prices have risen or fallen too sharply and are thus vulnerable to a market reaction. Wilder's version uses a form of exponential smoothing where `simple_rsi` uses a simple moving average. This study compares the relative strength of prices gains (closes that are higher than the previous day's close) versus price losses (closes that are lower than the previous day's close) by averaging these values for some specified period of time. `Simple_rsi` may be performed for any time period. Wilder originally suggested 14 days, however, technicians sometimes prefer a shorter/more sensitive period of time such as 5 or 7 days. Industry standards derive the overbought and oversold indicators at levels that range around 70 (overbought) and 30 (oversold).

$$\text{simpleRSI}(X, n) \equiv 100 - \frac{100}{1 + U/D}$$

where U and D are the average of the 1-period up-and down-moves of X, respectively, over the period *n*. That is, U and D are given by

$$U \equiv \text{average}(\text{positiveValue}(\text{move}(X,1)), n)$$

$$D \equiv -\text{average}(\text{negativeValue}(\text{move}(X,1)), n)$$



Note in the definition of *D* that *D* is always positive, since `negativeValue` is never positive.

"simple_rsi"	Series	Constant (Number)	Time Period (day/mth/yr)
<code>simple_rsi</code>	(HO,	1	day)

Smallest Integer

This study returns the floor for a series using units specified as 'steps'. There are two fields that are required to be specified within this study- the Attribute or series (this may also be a constant/number or variable) and step. This study will return a value that is lesser or equal to the Attribute and that is a multiple of the number specified in the steps field. For example, if the Close of US was specified as the Attribute and '2' was specified in the steps field, the study would return a number that was divisible by 2 and that was lesser than or equal to the daily closing price.

$$\text{smallestInteger}(N, s) \equiv s * \left\lfloor \frac{N}{s} \right\rfloor$$

That is, `smallestInteger` returns the floor of N using the units in s . For example, `smallestInteger(5, 2)` is equal to 4, because 4 is the largest multiple of 2 less than or equal to 5. Similarly, `smallestInteger(5.3, .25)` is equal to 5.25.

“smallest_integer”	Series	Constant (Number)
<code>smallest_integer</code>	(HO,	step)

Standard Deviation

This study provides the standard deviation of a population based on the sample as defined by the values included in the specified time period. Standard deviation measures the spread from the mean (or measures how far from the center or mean the data tends to range). This study is a commonly used statistic used to measure the degree of dispersion in the data.

$$standardDeviation(X, n) \equiv \sqrt{variance(X, n)}$$

This corresponds to the standard deviation used for population samples.

Constant (Number)	Time Period (day/mth/yr)	“standard_deviation”	of	Series
1	month	<code>standard_deviation</code>	of	HO
1	quarter	<code>standard_deviation</code>	of	(2 * CL)
2	year	<code>standard_deviation</code>	of	1 day move of HO

Standard Deviation Population

Returns a moving population standard deviation of values in the time period (uses n as a divisor) based on the population itself, that is, the values in the period.

$$standardDeviationPopulation(X, n) \equiv \sqrt{\frac{sum((X - average(X, n))^2, n)}{n}}$$

For efficiency and stability, this formula is actually computed as follows:

$$standardDeviationPopulation(X, n) \equiv \sqrt{\frac{sum(X^2, n) - sum(X, n) * average(X, n)}{n}}$$

Constant (Number)	Time Period (day/mth/yr)	“standard_deviation_population”	of	Series
1	day	<code>standard_deviation_population</code>	of	HO

Sum

Returns the sum total of all the values in the series during some specified time period. Holidays and missing values (expressed as Nan) have no effect on the sum. As with any study, if you want the sum to always include a set number of periods or days than use the term 'value' in lieu of day.

$$sum(X, n) \equiv \sum_{i=0}^{n-1} X_i$$

This study will ignore any values that are NaN. That is, it returns the sum of all the non-NaN values in the period n . If all the X values are NaN, sum returns a NaN.

Constant (Number)	Time Period (day/mth/yr)	"sum"	of	Series
1	day	sum	of	HO

True Midpoint

This study is very similar to the 'midpoint' study except 'High' is defined as the true High or the greater of either today's or yesterday's High and 'Low' is defined as the true Low or lesser of either today's or yesterday's Low. For most days, the true High will be identical to today's High and the true Low will be identical to today's low. The differences, where the previous day's value is selected, will occur on downside gap days (the range is below yesterday's range) or conversely upside gap days (the range is above yesterday's range). By using the 'true' value, we can factor in the downside or upside gap in price.

$$trueMidpoint(S) \equiv \frac{H + L}{2}$$

where H is the higher of the High of S and the previous Close of S , and L is the lower of the Low of S and the previous Close of S .

"true_midpoint"	of	Series
true_midpoint	of	HO

True Range

The True Range indicator is the greatest of the following:

- The current High less the current Low
- The absolute value of: current High less the previous Close
- The absolute value of: current Low less the previous Close

$trueRange(S) = \text{maximum}((High-Low), (|High-Close 1 day ago|), (|Low-Close 1 day ago|))$

“true_range”	of	Series
true_range	of	HO

Variance

This study returns the statistical variance of a population based on the values specified in the time period. Variance is the square of the standard deviation, which is a measure of data dispersion. A data series that has values that are widely dispersed will have a high standard deviation and variance.

$$\text{variance}(X, n) \equiv \frac{\text{sum}((X - \text{average}(X, n))^2, n)}{n - 1}$$

We choose to use a different but equivalent formula to compute the above expression, so that it can be computed in a single pass. The actual formula used is:

$$\text{variance}(X, n) \equiv \frac{\text{sum}(X^2, n) - \text{sum}(X, n) * \text{average}(X, n)}{n - 1}$$

In the cases where there are less than two non-NaN values in *n*, variance returns NaN.

Constant (Number)	Time Period (day/mth/yr)	“variance”	of	Series
1	day	variance	of	HO

Wilders_rsi

Returns the Welles Wilder’s Relative Strength Index indicator, a popular overbought-oversold measure. This study is very similar to simple_rsi, except Wilder’s version uses a form of exponential smoothing where simple_rsi uses a simple moving average.

This study compares the relative strength of prices gains (closes that are higher than the previous day’s close) versus price losses (closes that are lower than the previous day’s close) by using an exponentially smooth average of these values for some specified period of time.

Like simple_rsi, wilders_rsi may be performed for any time period. Wilder originally suggested 14 days, however, technicians sometimes prefer a shorter/more sensitive period of time such as 5 or 7 days. This study will range between 0 and 100.

Industry standards derive the overbought and oversold indicators at levels that range around 70 (overbought) and 30 (oversold).

$$\text{wildersRSI}(X, w) \equiv 100 - \frac{100}{1 + U/D}$$

where U and D are the exponential average of the 1-period up-and down-moves of X , respectively, using the weight w . That is, U and D are given by

$$U \equiv \text{exponentialAverage}(\text{positiveValue}(\text{move}(X,1)),w)$$

$$D \equiv -\text{exponentialAverage}(\text{negativeValue}(\text{move}(X,1)),w)$$

For an explanation of the weight w , see the discussion in “Exponential Average”.

$$\text{williamsR}(S) \equiv 100 \frac{\text{Close of } S - \text{Low of } S}{\text{High of } S - \text{Low of } S}$$

“wilders_rsi”	Series	Constant (Number)
wilders_rsi	(HO,	weight)

Williamsr

This study is a momentum indicator and is used to calibrate the position of the Close relative to the High for some period. Successive values of 100 for the study may indicate an upward trend since the price of a series closes at its High. Conversely, successive values of 0 may indicate a downward trend since the price of the series closes at its Low.

“williamsr”	of	Series
williamsr	of	HO

Formulas for Server Macros



When creating formulas with server macros, use the symbol names. Using Row Labels with server macros when constructing formulas is not supported.

_CoolingDegreeDays

Originally designed to evaluate energy demand and consumption, degree days are based on how far the average temperature departs from a human comfort level of 65 °F *. Simply put, each degree of temperature above 65 °F is counted as one “cooling degree day”. For example, a day with an average temperature of 80 °F will have 15 cooling degree days. Source: www.weather2000.com/dd_glossary.html.

_CoolingDegreeDays (Series)

Example:



The Series input is always the symbol for a city.

```
SHOW
  cdd: _CoolingDegreeDays ( HOUSTON.TX )
WHEN
  Date is August
```

The query above will calculate the daily cooling degree days during the month of August in Houston,TX . As you can see it gets quite warm.

“_CoolingDegreeDays”	City
_CoolingDegreeDays	(HOUSTON.TX)

HeatingDegreeDays

Originally designed to evaluate energy demand and consumption, degree days are based on how far the average temperature departs from a human comfort level of 65 °F*. Simply put, each degree of temperature *below* 65 °F is counted as one “heating degree day”. For example, a day with an average temperature of 60 °F will have 5 heating degree days. Source: www.weather2000.com/dd_glossary.html.

_HeatingDegreeDays (Series)

Example:



The Series input is always the symbol for a city.

```
SHOW
  hdd: _HeatingDegreeDays ( CHICAGO.OHARE.IL )
WHEN
  Date is February
```

The query above will calculate the daily heating degree days during the month of February in Chicago,IL . Bring a jacket!

“_HeatingDegreeDays”	City
_HeatingDegreeDays	(CHICAGO.OHARE.IL)

OffPeakAverage

This macro is designed to calculate the Off Peak Average as it relates to hourly power prices. Many ISO data feeds are available from LIM. (PJM, NYISO, NEPOOL, IMO, and many European ones as well).

OffPeakAverage (Series)

Example:



The Series input will be the symbol for a particular zone/node. Run this using “hourly” execution units.

```
SHOW
  1: _OffPeakAverage ( PJM.WESTERNHUB.HUB.RT )
WHEN
  Date is within 1 week
```

The query above will calculate the Off Peak Average for the real-time LMP prices on the Western Hub area of PJM. There are some assumptions being made in the calculation. These have been collected from the industry and seem to be standard. Namely, on NERC holidays the Off Peak Average uses all hours in the day. On normal days (non-NERC holidays) hours 1-7 and hour 24 is used in the calculation.

“_OffPeakAverage”	Series
<u>OffPeakAverage</u>	(PJM.WESTERNHUB.HUB.RT)

OnPeakAverage

This macro is designed to calculate the On Peak Average as it relates to hourly power prices. Many ISO datafeeds are available from LIM. (PJM, NYISO, NEPOOL, IMO, and many European ones as well).

OnPeakAverage (Series)

Example:



The Series input will be the symbol for a particular zone/node. Run this using “hourly” execution units.

```
SHOW
  1: _OnPeakAverage ( NYISO_DUNWOD_TWRT )
WHEN
  Date is within 3 weeks
  AND
  Date is from Monday to Friday
  AND
  Time is 03:00 pm
```

The query above will calculate the On Peak Average for the real-time LMP prices in ZONE I (Dunwoodie) of NYISO. There are some assumptions being made in the calculation. These have been collected from the industry and seem to be standard. The On Peak average is calculated during Monday to Friday only. Hours 8 – 23 are considered in the average. Notice that you can have 1 number per day returned if you anchor the WHEN condition with a time. This is only an anchor and will not affect the results of the query.

“_OnPeakAverage”	Series
_OnPeakAverage	(NYISO_DUNWOD_TWRT)

These macros below (_2x8Average through _7x16Average) will only be relevant when looking at intraday data (e.g. hourly) in the electricity markets. The typical sources of this data from LIM are the Independent System Operators (ISO’s) in North America, which include PJM, (Pennsylvania Jersey Maryland), NYISO (New York), NEISO (New England) and MISO (Midwest) – in particular the macros will only work in those markets that use LMP pricing methods. The user should note that different US regions have different concepts of peak and off-peak and that generally speaking, the Western region treats Saturday as a peak period and the Eastern region does not.

These types of calculation may also be relevant for European Electricity markets with intra-day pricing as well, although definitions of peak and off-peak pricing again will vary by region.

_2x8Average

This macro is designed to calculate the average for Saturday and Sunday from 12am – 6pm and 11pm.

_2x8Average (Series)

Example:



The Series input will be the symbol for a particular zone/node. The column “lmpVal” is assigned to each Series in the macro script. Therefore only symbols with the column, LmpVal can be used in this macro. Run this using “hourly” execution units.

```
SHOW
  1: _2X8Average ( A418.138KV.TR7212.PJMRT )
WHEN
  Date is within 1 week
```

The query above will calculate the average for hours 1-7 and hour 24 on Saturday and Sunday for the real-time LMP prices for the Pnode ID: 32408579 for PJM. Notice in the macro code below, there are some assumptions being made in the calculation. These have been collected from industry and seem to be standard.

“_2x8Average”	Series
_2x8Average	(A418.138KV.TR7212.PJMRT)

Macro Code:

```
ATTR MACRO _2X8Average ( SECURITY PricePoint)
RETURN
IF Date is Saturday
OR Date is Sunday
THEN average from 12:00 am to 11:00 pm of
IFTime is from 12:00 am to 06:00 am
OR Time is 11:00 pm
THEN lmpval of PricePoint ENDIF ENDIF
ENDMACRO
```

_2x16Average

This macro is designed to calculate the average for Saturday and Sunday from 7am – 10pm.

_2x16Avaerage (Series)

Example:



The Series input will be the symbol for a particular zone/node. The column “lmpVal” is assigned to each Series in the macro script. Therefore only symbols with the column, LmpVal can be used in this macro. Run this using “hourly” execution units.

```
SHOW
1: _2X16Average ( NEPOOL.Z.CONNECTICUT.DA )
WHEN
  Date is within 3 months
AND
  Time is 04:00 pm
AND
  Date is from Saturday to Sunday
```

The query above will calculate the average for hours 8-23 on Saturday and Sunday for the real-time LMP prices for the New England ISO LMP LOAD ZONE Day Ahead Market. Notice in the macro code below, there are some assumptions being made in the calculation. These have been collected from industry and seem to be standard.

“_2x16Average”	Series
_2x16Average	(NEPOOL.Z.CONNECTICUT.DA)

Macro Code:

```
ATTR MACRO _2X16Average ( SECURITY PricePoint)
RETURN
IF Date is Saturday
OR Date is Sunday
THEN average from 07:00 am to 10:00 pm of lmpval of
PricePoint ENDIF
ENDMACRO
```

_5x8Average

This macro is designed to calculate the average for Monday through Friday from 12am-6am and 11pm.

`_5x8Average (Series)`

Example:



The Series input will be the symbol for a particular zone/node. The column “ImpVal” is assigned to each Series in the macro script. Therefore only symbols with the column, LmpVal can be used in this macro. Run this using “hourly” execution units.

```
SHOW
  1: _5X8Average ( NYISO_GENESE_DA )
WHEN
  Date is within 2 years
AND
  Date is from Monday to Friday
```

The query above will calculate the average for hours 1-7 and hour 24 Monday thru Friday for the real-time LMP prices for the NYISO Load Zone Genesee Real Time Market. Notice in the macro code below, there are some assumptions being made in the calculation. These have been collected from industry and seem to be standard.

“_5x8Average”	Series
<code>_5x8Average</code>	<code>(NYISO_GENESE_DA)</code>

Macro Code:

```
ATTR MACRO _5X8Average ( SECURITY PricePoint)
RETURN
IF Date is from Monday to Friday
THEN average from 12:00 am to 11:00 pm of IF
Time is from 12:00 am to 06:00 am
OR
Time is 11:00 pm
THEN lmpval of PricePoint
ENDIF
ENDMACRO
```

_5x16Average

This macro is designed to calculate the average for Monday through Friday from 7am – 10pm.

`_5x16Average (Series)`

Example:



The Series input will be the symbol for a particular zone/node. The column “lmpVal” is assigned to each Series in the macro script. Therefore only symbols with the column, LmpVal can be used in this macro. Run this using “hourly” execution units.

```
SHOW
  1: _5X16Average ( DELAWARECT11.AGGREGATE.PJMDA )
WHEN
  range of DELAWARECT11.AGGREGATE.PJMDA is less than 0.25
AND
  Date is from Monday to Friday
```

The query above will calculate the average for hours 8-23 on Monday through Friday for the real-time LMP prices for the Day Ahead Locational Marginal Price in Delaware. Notice in the macro code below, there are some assumptions being made in the calculation. These have been collected from industry and seem to be standard.

“_5x16Average”	Series
_5x16Average	(DELAWARECT11.AGGREGATE.PJMDA)

Macro Code:

```
ATTR MACRO _5X16Average ( SECURITY PricePoint)
RETURN
IF Date is from Monday to Friday
THEN average from 07:00 am to 10:00 pm of lmpval of
PricePoint
ENDIF
ENDMACRO
```

_7x8Average

This macro is designed to calculate the average for Monday through Friday from 12am-6am and 11pm.

_7x8Average (Series)

Example:



The Series input will be the symbol for a particular zone/node. The column “lmpVal” is assigned to each Series in the macro script. Therefore only symbols with the column, LmpVal can be used in this macro. Run this using “hourly” execution units.

```
SHOW
  1: _7X8Average ( NYISO_ALLEGHENY_COGEN_DA )
WHEN
  Date is before 7/27/2001
```

The query above will calculate the average for hours 1-7 and hour 24 on Sunday thru Saturday for the real-time LMP prices for the NYISO Generator ALLEGHENY___COGEN Real Time Market . Notice in the

macro code below, there are some assumptions being made in the calculation. These have been collected from industry and seem to be standard.

“_7x8Average”	Series
_7x8Average	(NYISO_ALLEGHENY_COGEN_DA)

Macro Code:

```
ATTR MACRO _7X8Average ( SECURITY PricePoint)
RETURN
average from 12:00 am to 11:00 pm of IF
{Time is from 12:00 am to 06:00 am
OR
Time is 11:00 pm}
THEN Impval of PricePoint
ENDIF
ENDMACRO
```

_7x16Average

This macro is designed to calculate the average for Monday through Friday from 7am – 10pm.

_7x16Average (Series)

Example:



The Series input will be the symbol for a particular zone/node. The column “ImpVal” is assigned to each Series in the macro script. Therefore only symbols with the column, LmpVal can be used in this macro. Run this using “hourly” execution units.

```
SHOW
1: _7X16Average ( NEPOOL.LD.ASHCREEK115.DA )
WHEN
Date is 1 week before any holiday
```

The query above will calculate the average for hours 8-23 on Sunday through Saturday for the real-time LMP prices for the New England ISO LMP NETWORK NOD Day Ahead Market. Notice in the macro code below, there are some assumptions being made in the calculation. These have been collected from industry and seem to be standard.

“_7x16Average”	Series
_7x16Average	(NEPOOL.LD.ASHCREEK115.DA)

Macro Code:

```
ATTR MACRO _7X16Average ( SECURITY PricePoint)
RETURN
average from 07:00 am to 10:00 pm of Impval of
PricePoint
ENDMACRO
```

AccDist

The Accumulation/Distribution is a momentum indicator that associates changes in price with the daily range. Divergences between the Accumulation/Distribution and the security's price imply a change is imminent. When a divergence does occur, prices usually change to confirm the Accumulation/Distribution. For example, if the indicator is moving up and the security's price is going down, prices will probably reverse and start going up. If the days price change is positive then the difference in the daily high and low price is added to the total, and conversely if the daily change is negative then the daily range is subtracted from the total.

AccDist (Series)

Example:

"AccDist"	Series
AccDist	(DELL)

Macro Code:

```
COLUMN MACRO AccDist ( SECURITY Sec )
  RETURN
  Sum from begin_of_time to today of
    if Close of Sec > Close of Sec 1 unit ago then
      absolute_value ( Close of Sec -
        if Low of Sec < Close of Sec 1 unit ago
          then Low of Sec
          else Close of Sec 1 unit ago
        endif )
    else
      if Close of Sec < Close of Sec 1 unit ago then
        0 -
          absolute_value ( Close of Sec -
            if High of Sec > Close of Sec 1 unit ago
              then High of Sec
              else Close of Sec 1 unit ago
            endif )
      else
        0
      endif
    endif
  ENDMACRO
```

Aspect

Returns the difference in ecliptic longitude degrees between any two planets (except Earth). Choose planets (including Sun & Moon) relations from the "Other: Astronomy" menu in the **Search Database** window.

Aspect (Planet1, Planet2)

Example:

Aspect (MERCURY, SATURN)

“Aspect”	Planet 1	Planet 2
Aspect	(MERCURY,	SATURN)

AspectEquatorial

Returns the difference in equatorial right ascension between any two planets (except Earth, the Sun, or the Moon).

AspectEquatorial (Planet1, Planet2)

Example:

AspectEquatorial (MERCURY, SATURN)

“AspectEquatorial”	Planet 1	Planet 2
AspectEquatorial	(MERCURY,	SATURN)

AspectHelio

Returns the difference in heliocentric longitude between any two planets.

AspectHelio (Planet1, Planet2)

Example:

AspectHelio (MERCURY, SATURN)

“AspectHelio”	Planet 1	Planet 2
AspectHelio	(MERCURY,	SATURN)

AspectPlot

The following are all used in the same manner. These all plot vertical lines on the chart on days when any astrological aspect is in force. Astrologers are especially interested in the locations of solar system objects relative to other solar system objects - numbers called “aspect” angles with the centers of the Earth or Sun (depending on which coordinate system, geocentric or heliocentric, is used) located at the vertex of the measured angle. Significant aspect angles have names associated with them listed below in order of supposed importance and influence, along with the Orb - the number of degrees of tolerance often used with the aspect, and the usual symbols used to denote the angles in printed Ephemeris tables.

No. Glyphs	Aspect	Abbrev.	Aspect Angle	Orb (tolerance)	Description of Standard
1	Conjunct	(Con)	0.00	+/-7 deg.	Circle with extending line

No. Glyphs	Aspect	Abbrev.	Aspect Angle	Orb (tolerance)	Description of Standard
2	Opposite	(Opp)	180.00	+/- 7 deg.	Two circles joined by line
3	Square	(Squ)	90.00	+/- 7 deg.	Quadrilateral
4	Trine	(Tri)	120.00	+/- 7 deg.	Triangle
5	Sextile	(Sex)	60.00	+/- 6 deg.	Six pointed asterisk
6	Inconjunct	(Inc)	150.00	+/- 3 deg.	'K' rotated clockwise
7	Semisextile	(Ssx)	30.00	+/- 3 deg.	'K' rotated counter-clockwise
8	Semisquare	(Ssq)	45.00	+/- 3 deg.	Acute angle
9	Sesquisquare	(Ses)	135.00	+/- 3 deg.	Square with extending lines

Minor Aspects (not included in macro set - use “AspectX” macros which let you specify any arbitrary aspect angle.)

PlotAspectX

Plots vertical lines on the chart on days when any astrological aspect is in force.

PlotAspectX (Planet1, Planet2, aspect, orb)

Example:

PlotAspectX (MARS, NEPTUNE, 90, 0)

“PlotAspectX”	Planet 1	Planet 2	Aspect (Number)	Orb (Number)
PlotAspectX	(MARS,	NEPTUNE,	90,	0)

The following are all used in the same manner:

- PlotConjunct
- PlotInconjunct
- PlotOpposite
- PlotSemisextile
- PlotSemisquare
- PlotSesquisquare
- PlotSextile
- PlotSquare
- PlotTrine

These all plot vertical lines on the chart on days when any astrological aspect is in force.

Example:

PlotConjunct (SATURN, MARS, 0)

“PlotConjunct”	Planet 1	Planet 2	Orb (Number)
PlotConjunct	(SATURN,	MARS,	0)

BackContract

Returns the price of the back contract. This functionality is now built into the language itself. The default selection for a parent futures contract (i.e., US) is the front continuous contract. The button labeled ‘continuous’ located directly above the Symbol Browser may be toggled to ‘back’ to perform the same feature. This macro is included for backward compatibility with older versions of the XMIM software.

BackContract (Series, NumDays, ContractMth)

Example:

```
BackContract (NG, 0, 0)
```

“BackContract”	Series	NumDays (Number)	ContractMth (Number)
BackContract	(HO,	1,	1)

BlackScholesOptionPrice

Computes the option price based on the Black Scholes model for a European option. The interest rate must be expressed as a decimal fraction. For example, 2% will be 0.02. The sigma argument must also be expressed as decimal fraction: e.g. 16% is 0.16. The days to expiration are in actual days and will be divided by 365 to convert to fractions of a year. For a 252 day year adjust the days input by 252/365.

BlackScholesOptionPrice (@underlying_price, @strike, @interest_rate, @sigma, @days_expiration, @is_call)

Example:

```
BlackScholesOptionPrice ( Close of SP_2004Z, 1100,FRH_DGS1 / 100,
(30 day std_dev of Close of SP_2004Z) / 100,
periods_in_range from today to SP_2004Z.C1100 last_data_day, 1 )
```

@underlying_price	@strike	@interest_rate	@sigma	@days_expiration	@is_call
Close of SP_2004Z,	1100,	FRH_DGS1/100,	(30 day std_dev of Close of SP_2004Z) / 100,	periods_in_range from today to SP_2004Z.C1100 last_data_day,	1

ChannelIndex

Returns an index of bollinger bands, a statistical version of the stochastic.

Donald Lambert developed this price momentum indicator - Commodity Channel Index (CCI). It shows how the most recent close relates to the standard deviation range over the recent time period.

ChannelIndex (Series, TimePeriod)

Example:

ChannelIndex (SP, 22 days)

“ChannelIndex”	Series	Constant (Number)	Time Period (day/mth/yr)
ChannelIndex	(HO,	22	days)

ChoppinessIndex

Returns an indicator that measures the sum of all the ranges in a time period to the range over the time period as a measure of the trendiness or choppiness of a price series. Inspired by chaos theory, it is similar to Wilder’s Directional Movement Index but with simpler calculations and less lag. The Choppiness Index varies between 0 and 100, the higher the index the choppier the price action is and the lower the index the more trending the price action

ChoppinessIndex (Series, TimePeriod)

Example:

ChoppinessIndex (JY, 10 days)

“ChoppinessIndex”	Series	Constant (Number)	Time Period (day/mth/yr)
ChoppinessIndex	(HO,	22	days)

DeMarker

Returns Tom DeMark’s Oscillator. The DeMarker identifies potential price bottoms and tops. The indicator fluctuates between 0 and 1.

DeMarker (Series, TimePeriod)

Example:

DeMarker (Close of SPX, 15 days)

“DeMarker”	Attribute	of	Series	Constant (Number)	Time Period (day/mth/yr)
DeMarker	(Close	of	HO,	22	days)

DeferredContract

This study provides a generalized macro for dealing with futures contracts. The DeferredContract function is used to identify certain back contract relationships within the software.

There are two methods to identify a futures contract:

1. You may identify the ‘specific’ contract (i.e., the March 1998 30 year U.S. Treasury Bond contract or US_1998H)
2. You may identify a ‘generic’ contract based upon the contracts expiration (i.e., the front continuous adjusted 30 year U.S. Treasury Bond contract or US). If a user wanted to test a trading strategy that involved the sixth contract on the board, or some contract expiring later than the front, far and back contracts (these selections are available under the ‘continuous’ button above the Symbol Browser), DeferredContract would be used to define contract.

There are four fields that are required to be specified within this study:

1. The Attribute or series (select your futures series).
2. The deferred number of the contract chosen (i.e., 1 represents the contract nearest to expiration or the front contract, 2 represents the second nearest contract to expiration, etc.).
3. The number of days until expiration that the contract should be followed (i.e., 0 specifies that the contract will be active until expiration, 1 specifies that the contract will be active or followed up until 1 day before expiration, etc.).
4. Contract month that is the parameter that specifies the contract month of interest (i.e., setting the field to 0 will disable this field thereby allowing the contract to roll to the regularly traded serial months, setting the field to 1 will specify only January contracts, etc.).

DeferredContract (Series, DeferredNum, NumDays, ContractMth)

Example 1:

```
DeferredContract (US, 3, 0, 0)
```

“DeferredContract”	Attribute	Deferred Number	NumDays till expire (Number)	Contract Month (Number)
DeferredContract	(US,	3,	0,	0)

The following shows further examples to demonstrate the use of DeferredContract.

Example 2:

As the macro code below shows, the deferred contract macro is using the adjust_contract built-in. Therefore, the properties that are required entry for the adjust contract are the same for the deferred contract.

Assuming the 10/8/2002 trade date, the prompt/front contract for the NYMEX natural gas futures is the November 2002 contract (NG_2002X). If we wanted to use the deferred contract macro to modify the continuous NG contract to show the 5th contract out instead of the prompt contract, we could use the following syntax:

```
SHOW
1: DeferredContract ( NG, 5, 0, 0 )
```

This will modify NG to the 5th contract out. (Prompt +4). This will now show the price for the March 2003 NG contract. (NG_2003H)

- NG= base commodity symbol of choice.
- 5 = N nearest. 5 points to the 5th closest or nearest to expiration active contract.
- 0 = This is “Number of days before Expiration”. Setting this to “0” indicates the series will locate the next nearest contract when the contract expires. Setting this to “4” would mean that the contract should roll to the next one 4 days before expiration of the current contract.
- 0 = Normally, this is where you put in the contract month. However, since we want the exact 6th closest contract, this is set to “0”.

*Any of the 4 parameters can be modified to adjust the continuous contract as described in the adjust_contract built-in definition.

Here is an example of the data:

Date	Day	Deferred	NG_2003H
10/08/2002	Tue	4.023	4.023

Example 3:

```
SHOW
twoSixAvg:
(DeferredContract ( NG, 2, 0, 0 ) + DeferredContract ( NG, 3, 0, 0 )
+ DeferredContract ( NG, 4, 0, 0 ) + DeferredContract ( NG, 5, 0,
0 ) + DeferredContract ( NG, 6, 0, 0 )
) / 5
frontNG: NG
WHEN
Date is within 2 years
AND
NG is DEFINED
```

Macro Code:

```
ATTR MACRO DeferredContract ( ATTR Series, CONSTANT DeferredNum = 1,
CONSTANT NumDays = 0, CONSTANT ContractMth = 0 )
RETURN
adjust_contract ( Series, DeferredNum, NumDays, ContractMth )
ENDMACRO
```

DirMove

DirMove returns the Welles Wilder’s Directional Movement indicator. To be used in conjunction with DirMoveIdx (below), which returns the Welles Wilder’s Directional Movement Index. DirMove uses an exponential average in its calculation, while DirMoveIdx uses simple moving average.

Example:

DirMove (Close of MSFT, 0.071428571)

“DirMove”	Attribute	of	Series	Constant Weight
DirMove	(Close	of	HO,	0.071428571)

DirMoveldx

Returns the Welles Wilder's Directional Movement Index.

Example:

`DirMoveIdx (Close of INTC, 78 days)`

"DirMoveldx"	Attribute	of	Series	Constant (Number)	Time Period (day/mth/yr)
DirMoveldx	(Close	of	HO,	78	days)

FarContract

Returns the price of the third nearest-to-delivery futures contract in a futures market. This functionality is now built into the language itself. The default selection for a parent futures contract (i.e., US) is the front continuous contract. The button labeled 'continuous' located directly above the Symbol Browser may be toggled to 'far' to perform the same feature. This macro is included for backward compatibility with older versions of the XMIM software.

`FarContract (Series, NumDays, ContractMth)`

Example 1:

`FarContract (Close of CL, 4, 11)`

"FarContract"	Attribute	of	Series	NumDays (Number)	ContractMth (Number)
FarContract	(Close	of	HO,	4,	11)

Example 2:

As the macro code below shows, The FarContract macro is using the `adjust_contract` built-in. Therefore, the properties that are required entry for the `adjust_contract` are the same for the far contract with the exception of the second `adjust_contract` parameter which indicates the *N* month out. This is always set to 3.

A user can utilize the FarContract macro to modify a continuous contract to pull the far (3rd) closest contract to expiration.

Assuming the 10/8/2002 trade date, the prompt/front contract for the NYMEX natural gas futures is the November 2002 contract (NG_2002X). If we wanted to use the FarContract macro to modify the continuous NG contract to show the 3rd contract out instead of the prompt contract, we could use the following syntax:

```
SHOW
1: FarContract ( NG, 0, 0 )
```

This will always modify NG to the 3rd contract out. (Prompt +2). This will now show the price for the January 2003 NG contract. (NG_2003F).

- NG= base commodity symbol of choice.

- 0 = This is “Number of days before Expiration”. Setting this to “0” indicates the series will locate the next nearest contract when the contract expires. Setting this to “4” would mean that the contract should roll to the next one 4 days before expiration of the current contract.
- 0 = Normally, this is where you put in the contract month. However, since we want the exact 6th closest contract, this is set to “0”.

*Any of the 3 parameters can be modified to adjust the continuous contract as described in the `adjust_contract` built-in definition.

Here is an example of the data:

Date	Day	Far	NG_2003F
10/08/2002	Tue	4.243	4.243

Example 3:

```
SHOW
  macro: FarContract ( CL, 0, 0 )
  xmlmlanguage: far CL
WHEN
  Date is 2001
```

Macro Code:

```
ATTR MACRO FarContract (ATTR Series, CONSTANT NumDays = 0,
                        CONSTANT ContractMth = 0)
RETURN
  adjust_contract (Series, 3, NumDays, ContractMth)
ENDMACRO
```

FrontContract

Returns the price of the nearest-to-delivery futures contract in the futures market. This functionality is now built into the language itself. The default selection for a parent futures contract (i.e. US) is the front continuous contract. The button labeled ‘continuous’ located directly above the Symbol Browser may be toggled to ‘front’ to perform the same feature. This macro is included for backward compatibility with older versions of the XMIM software.

FrontContract (Series, NumDays, ContractMth)

Example 1:

```
FrontContract (Close of NG, 4, 11)
```

“FrontContract”	Attribute	of	Series	NumDays (Number)	ContractMth (Number)
FrontContract	(Close	of	HO,	4,	11)

Example 2:

As the macro code below shows, the FrontContract macro is using the `adjust_contract` built-in. Therefore, the properties that are required entry for the `adjust_contract` are the same for the FrontContract macro with

the exception of the second `adjust_contract` parameter which indicates the N month out. This is always set to 1.

A user can utilize the `FrontContract` macro to modify a continuous contract to pull the prompt or closest contract to expiration.

Assuming the 10/8/2002 trade date, the prompt/front contract for the NYMEX natural gas futures is the November 2002 contract (NG_2002X). If we wanted to use the `FrontContract` macro to pull the front contract, we could use the following syntax:

```
SHOW
  Front: FrontContract ( NG, 0, 0 )
```

This will always modify NG to the front contract (Prompt). This will now show the price for the November 2002 NG contract. (NG_2002X)

- NG= base commodity symbol of choice.
- 0 = This is “Number of days before Expiration”. Setting this to “0” indicates the series will locate the next nearest contract when the contract expires. Setting this to “4” would mean that the contract should roll to the next one 4 days before expiration of the current contract.
- 0 = Normally, this is where you put in the contract month. However, since we want the exact 6th closest contract, this is set to “0”.

*Any of the 3 parameters can be modified to adjust the continuous contract as described in the `adjust_contract` built-in definition.

Here is an example of the data:

Date	Day	Front	NG_2002X
10/08/2002	Tue	3.862	3.862

Example 3:

```
SHOW
  macro: FrontContract ( US, 0, 0 )
  xmlmlanguage: front US
WHEN
  Date is 2002
```

Macro Code:

```
ATTR MACRO FrontContract (ATTR Series, CONSTANT NumDays = 0,
  CONSTANT ContractMth = 0)
  RETURN
adjust_contract (Series, 1, NumDays, ContractMth)
ENDMACRO
```

HistVolLog

Returns the historical volatility of a series: the standard deviation of the logarithmic price changes measured at regular intervals of time. The default time period is 20 days. The default number of units per year is 250.

HistVolLog (Series, NumUnits, UnitsPerYear)

Example:

HistVolLog (Close of front CL, 20 days, 250)

"HistVolLog"	Attribute	of	Series	NumUnits (Number)	Time Period (day/mth/yr)	UnitsPer Year (Number)
HistVolLog	(Close	of	HO,	20	days,	250)

HistVolPct

Returns the historical volatility of a series: the standard deviation of the percent price changes measured at regular intervals of time. The default time period is 20 days. The default number of units per year is 250.

HistVolPct (Series, NumUnits, UnitsPerYear)

Example:

HistVolPct (Close of front NG, 20 days, 250)

"HistVolPct"	Attribute	of	Series	NumUnits (Number)	Time Period (day/mth/yr)	UnitsPer Year (Number)
HistVolPct	(Close	of	HO,	20	days,	250)

MoneyFlowIndex

The Money Flow Index measures the amount of money flowing in and out of a security. It is an oscillator not unlike RSI that incorporates Volume into its calculation. The values range between 0 and 100. Market tops generally occur around 80 and bottoms around 20.

MoneyFlowIndex (Series, TimePeriod)

"MoneyFlowIndex"	Series	NumUnits (Number)	Time Period (day/mth/yr)
MoneyFlowIndex	(HO,	50	days)

NegVolIndex

Returns an accumulated sum of the close-to-close percent moves of the security when the volume is lower than the volume one period ago.

NegVolIndex (Series)

Example:

NegVolIndex (INTC)

"NegVolIndex"	Series
NegVolIndex	(HO)

NetHedgers

Returns the net open interest held by traders in the commercial hedgers category of futures traders in a market. The calculation is net long minus net short positions.

NetHedgers (Series)

Example:

NetHedgers (NG)

"NetHedgers"	Futures Contract
NetHedgers	(HO)

NetHedgersPct

Returns the net open interest holdings of the commercial hedger category as a percentage of total open interest in the market.

NetHedgersPct (Series)

Example:

NetHedgersPct (SP)

"NetHedgersPct"	Futures Contract
NetHedgersPct	(HO)

NetLargeSpecs

Returns the net open interest held by traders in the large speculator category of futures traders in a market. That is, the net long minus net short positions.

NetLargeSpecs (Series)

Example:

NetLargeSpecs (JY)

"NetLargeSpecs"	Futures Contract
NetLargeSpecs	(HO)

NetLargeSpecsPct

Returns the net open interest holdings of the large speculator category as a percentage of total open interest in the market.

NetLargeSpecsPct (Series)

Example:

NetLargeSpecsPct (US)

"NetLargeSpecsPct"	Futures Contract
NetLargeSpecsPct	(HO)

NetSmallTraders

Returns the remaining net open interest held by traders with positions smaller than reporting thresholds.

NetSmallTraders (Series)

Example:

NetSmallTraders (HO)

"NetSmallTraders"	Futures Contract
NetSmallTraders	(HO)

NetSmallTradersPct

Returns the net open interest of the Small Traders category as a percentage of total open interest.

NetSmallTradersPct (Series)

Example:

NetSmallTradersPct (HO)

“NetSmallTradersPct”	Futures Contract
NetSmallTradersPct	(HO)

NormalDist

NormalDist(n) returns the percent of area under the normal distribution curve commonly called the z-table. The parameter n is the number of standard deviations from the mean. The macro NormalDist(n) returns the percent of the curve below parameter n. This is commonly used to compute probability.

Example:

NormalDist (5)

“NormalDist”	Number of Standard Deviations from the Mean (Number)
NormalDist	(5)

RangeExpIndex

Returns Tom DeMark's REI2 indicator as explained in his book *“The New Science of Technical Analysis”*.

RangeExpIndex (Series, TimePeriod)

Example:

RangeExpIndex (GE, 15 days)

“RangeExpIndex”	Series	Constant (Number)	Time Period (day/mth/yr)
RangeExpIndex	(HO,	15	days)

RealSum

Here Counter is a number which is the # of days to start the look back. Returns the sum of the last N days.

RealSum (Attribute, Counter)

Example:

RealSum (DELL, 3)

is the same as

sum from 2 days ago to today of DELL

Both are considering 3 days of data for the calculation.

"RealSum"	Series	Counter (N) (Number)
RealSum	(HO,	3)

Stochastics

KStochastic

Stochastics is a momentum or price velocity indicator developed by George C. Lane. This macro is sometimes referred to as "%K" in the market. This is the normal stochastic.

KStochastic (Security, TimePeriod)

Example:

KStochastic (DELL, 18 days)

"KStochastic"	Series	Constant (Number)	Time Period (day/mth/yr)
KStochastic	(HO,	18	days)

SDStochastic

This macro is an average of the "SKStochastic" macro.

SDStochastic (Security, TimePeriod, TimePeriod2)

Example:

SDStochastic (MPPP, 24 days, 10 days, 6 days)

"SDStochastic"	Series	Constant (Number)	Time Period1	Constant (Number)	Time Period2	Constant (Number)	Time Period3
SDStochastic	(HO,	24	days,	10	days,	6	days)

SKStochastic

This macro is sometimes referred to as "%D" in the market. It is the slower moving stochastic.

SKStochastic (Security, TimePeriod, TimePeriod2)

Example:

SKStochastic (OAT, 14 days, 4 days)

"SKStochastic"	Series	Constant (Number)	Time Period1 (day/mth/yr)	Constant (Number)	Time Period2 (day/mth/yr)
SKStochastic	(HO,	14	days,	4	days,

Trendline

Returns drawing of a line to connect a series of peaks or troughs on a Chart. Both uptrends and downtrends in a market can be defined in terms of trendlines.

Trendline (Price1, Date1, Price2, Date2)

"Trendline"	Price 1	Date 1	Price 2	Date 2
Trendline	(21.20,	1/1/2001	17.85,	2/3/2002)

VolPriceTrend

Returns an index which takes the distance of the close of the day from the midpoint of the day, multiplies that times the volume and sums the results over time.

VolPriceTrend (Series, TimePeriod)

Example:

VolPriceTrend (DELL, 68 days)

"VolPriceTrend"	Sec Series	Constant (Number)	Time Period (day/mth/yr)
VolPriceTrend	(HO,	68	days)

Volatility

Returns the high of the period divided by the low.

Volatility (Series)

Example:

Volatility (RAD)

“Volatility”	Sec Series
Volatility	(HO)

VolatilityIdx

Returns the exponential moving average of the true range.

Refer to Exponential Average notes for weight info.

VolatilityIdx (Security, Weight)

Example:

VolatilityIdx (IO, 0.0714)

“VolatilityIdx”	Sec Series	Weight
VolatilityIdx	(HO,	0.0714)

WildersADX

The familiar average directional movement index is simply the directional movement index (WildersDX) averaged for the time period chosen for study related to the previous day’s average directional movement index.

WildersADX (Series, Weight)

Example:

WildersADX (JO, 0.071428571)

“WildersADX”	Sec Series	Weight
WildersADX	(HO,	0.071428571)

WildersADXR

Returns an exponentially smoothed version of the WildersADX study discussed above.

WildersADXR (Series, Weight)

Example:

WildersADXR (CME.DB, 0.071428571)

“WildersADX”	Series	Weight
WildersADX	(HO,	0.071428571)

WildersDIMinus

Returns a momentum indicator typically used to identify downtrend directional behavior in the market and developed by Welles Wilder. This study is calculated by dividing the exponentially Positive Directional Movement (those days when the difference between today’s low minus the previous day’s low is greater than the difference between today’s high minus the previous day’s high) by the smoothed True Range.

WildersDIMinus (Series, Weight)

Example:

```
WildersDiMinus ( DS, 0.071428571)
```

“WildersDIMinus”	Series	Weight
WildersDIMinus	(HO,	0.071428571)

WildersDIPlus

Returns a momentum indicator typically used to identify up-trend directional behavior in the market and developed by Welles Wilder. This study is calculated by dividing the exponentially smoothed Positive Directional Movement (those days when the difference between today’s high minus the previous day’s high is greater than the difference between today’s low minus the previous day’s low) by the smoothed True Range.

WildersDIPlus (Series, Weight)

Example:

```
WildersDIPlus ( CNDL, 0.071428571)
```

“WildersDIPlus”	Series	Weight
WildersDIPlus	(HO,	0.071428571)

WildersDX

WildersDX returns the equivalent to Welles Wilder’s Directional Movement equation. This calculation divides the difference between DI+ and DI- (true directional movement) and sum of DI+ and DI- (total percentage of directional movement), and then multiplies this value by 100%.

The directional movement index (DX) is thus an accounting or a scoring between 0 - 100 of the power of the trend, be the trend up or down, a high score means the market is strongly trending (up or down) and a low score bespeaks of weak or no trend.

WildersDX (Series, Weight)

Example:

WildersDX (BO, 0.071428571)

"WildersDX"	Series	Weight
WildersDX	(BO,	0.071428571)

WildersRSI

Returns the Welles Wilder's Relative Strength Index indicator, a popular overbought-oversold measure. This study is very similar to `simple_rsi`, except Wilder's version uses a form of exponential smoothing where `simple_rsi` uses a simple moving average.

This study compares the relative strength of prices gains (closes that are higher than the previous day's close) versus price losses (closes that are lower than the previous day's close) by using an exponentially smooth average of these values for some specified period of time.

Like `simple_rsi`, `wilders_rsi` may be performed for any time period. Wilder originally suggested 14 days, however, technicians sometimes prefer a shorter/more sensitive period of time such as 5 or 7 days. This study will range between 0 and 100.

Industry standards derive the overbought and oversold indicators at levels that range around 70 (overbought) and 30 (oversold).

WildersRSI (Series, Weight)

Example:

WildersRSI (Close of MSFT, 0.095)

"WildersRSI"	Attribute	of	Series	Weight
WildersRSI	(Close	of	HO,	0.095)

WilliamsVolAD

Returns the Larry Williams Volume Accumulation-Distribution indicator.

WilliamsVolAD (Security, TimePeriod)

Example:

WilliamsVolAD (HU, 17 days)

"WilliamsVolAD"	Sec Series	Constant (Number)	Time Period (day/mth/yr)
WilliamsVolAD	(HO,	17	days)

Index

Symbols

% Move, 57
_2x16Average, 88
_2x8Average, 87
_5x16Average, 89
_5x8Average, 89
_7x16Average, 91
_7x8Average, 90
_CoolingDegreeDays, 84
_HeatingDegreeDays, 85
_OffPeakAverage, 86
_OnPeakAverage, 86

A

Absolute Value, 58
AccDist, 92
Actual Prices, 17
Adjust Contract, 13, 14, 58
Adjusted Prices, 17
Always Force 7 Day Trading Pattern, 34
Aspect, 92
AspectEquatorial, 93
AspectHelio, 93
AspectPlot, 93
Average, 61

B

BackContract, 95
Backward Adjusted Prices, 17
Backwards Adjusted Prices, 16
BlackScholesOptionPrice, 95
Bollinger High/Bollinger Low, 62
Built-ins, 57

C

Cash Adjusted Prices, 17
Category, 25
ChannelIndex, 95
Chart Label, 13, 21, 23, 25
Chart Options, 10

Controls, 42
Grid, 42
Legend, 42
Symbols, 42
Chart Type, 5, 13, 21, 25
Charting, 33, 36, 41
Charts, 1
ChoppinessIndex, 96
Column, 5, 13, 23, 25, 48
Compound_return, 62
Configuration Window, 3
Construct Date, 62
Controls, 10, 42
Copy table results to clipboard, 35
Coregression, 63
Coregression_intercept, 64
Coregression_slope, 64
Correlation, 65
Count, 66
Covariance, 66
Currency Conversion, 1
Curve
Description, 23
MIM Symbol, 23
Curves, 23
Column, 23
Curve Date, 23
Edit Chart Stats, 23

D

Data Builder, 3, 4, 7
Curves, 23
Date and Worksheet Options, 29
Formulas, 21
Forward Curves, 25
Series, 13
Date Format, 34
Date Offset, 16
Date Options, 29
Change Period, 29
End, 29
Start, 29
DeferredContract, 96
DeMarker, 96
Description, 5, 39, 49
Desktop/Excel, 33, 35

DirMove, 98
DirMoveIdx, 99
Dividend Adjusted Return, 66

E

Ease of Move, 67
Edit Axis Config, 32
Edit Chart Stats, 19, 21
Edit Menu, 10
 Cut/Copy/Paste, 10
Edit Rollover
 Options, 14
Execution Units, 30, 30, 32
Exit, 9
Expiration Day, 16
Expiration Month, 16
Exponential Average, 67
Expression, 49
Extract Day, 68
Extract Month, 68
Extract Year, 68

F

Factor, 13
FarContract, 99
File Menu, 9
 Exit, 9
 Print Table, 9
 Save Table As, 9
 XML Converter, 9
Fill Backward, 26, 31
Fill Down, 27
Fill Forward, 31, 31
Fill Linear Interpolation, 26
Fill Up, 27
Fill Vertical Interpolation, 27
First Notice Day, 16
Formula, 21
Formula Specifications, 48
 Description, 49
 Expression, 49
 Relation, 48
 Relation Column, 49
 Trade Pattern, 49
Formula Table, 57
Formula Variables

Chart Type, 5
Column, 5
Description, 5
Formula, 5
Label, 5
MIM Symbol, 5
Time Units, 5
Units, 5
Formulas, 2, 21
 for Built-ins, 57
Forward Adjusted Prices, 17
Forward Curve Parameters, 26
 Aggregate, 26
 Date, 26
 Fill, 26
 Offset, 28
Forward Curves, 1, 25
 Category, 25
 Chart Label, 25
 Chart Type, 25
 Column, 25
 Description, 25
 Precision, 25
 Show in Chart, 25
 Show in Table, 25
FrontContract, 100

G

Greatest Integer, 69
Grid, 42

H

Help Menu, 11
 About, 11
 Java Console, 11
Highest, 69
HistVolLog, 101
HistVolPct, 102

I

If-Then Statement, 69
Import Item as Formula, 47
Import Item as Variable, 47
Include Average of Yearly Data, 34
Inverse Log, 70

L

Last Data Day, 16
Legend, 10, 42
Linear Regression, 70
Lock, 13
Lock Units of Measure by Default, 34
Lowest, 71

M

Macd_osc, 71
Macd_signal, 72
Median, 72
Mid_point, 73
Midpoint, 73
MIM Schema Browser, 47
MIM Symbol, 5, 13
MIMIC Toolbar, 4
Missing Data NaNs, 30
Modify Prices, 19
MoneyFlowIndex, 102
Move, 57, 73

N

Natural Log, 73
Nearest Integer, 74
Negative Value, 74
NegHedgersPct, 103
NegVolIndex, 102
Net Change, 74
Net Percent Change, 75
NetHedgers, 103
NetLargeSpecs, 103
NetLargeSpecsPct, 104
NetSmallTraders, 104
NetSmallTradersPct, 104
NormalDist, 105

O

On Balance Volume, 75
Open Interest Crossover, 16, 16
Options Menu, 11
 Axis Font, 11
 Color Configuration, 11
 Color Print, 11
 Mixed Case Symbols, 11
 Server Config, 11

User Preferences, 11

P

Periods in Range, 75
Perpetual, 17
PlotAspectX, 94
Positive Value, 76
Precision, 13, 21, 25
Presets, 16
 #Day(s) Before Expiration, 16
 Backwards Adjusted Prices, 16
 Open Interest Crossover, 16
 Volume Crossover, 16
Print Table, 9
Printing, 35
Product, 76

R

Range, 76
RangeExpIndex, 105
RealSum, 105
Rel Strength, 77
Rollover Date, 16
Rollover policy, 14
Rows
 Copying, 6
 Pasting, 6
 Repositioning, 6
 Right-Click Menu, 6

S

Save Chart As, 9
Save Graphic As, 34
Save Table As, 9
Screening, 36
Searching, 7, 37
 by Description, 39
 by Symbol, 38
 Search Options, 40
Seasonal Analysis, 1, 29, 29
 Edit Axis Config, 32
 Execution Units, 32
 Missing Data NaNs Options, 30
Select Contract, 77
Send New Worksheet/past command to Excel, 35
Send Paste Command to Excel, 35

Series, 13
 Adjust Contract, 13
 Chart Label, 13
 Chart Type, 13
 Column, 13
 Description, 13
 Factor, 13
 Lock, 13
 MIM Symbol, 13
 Precision, 13
 Show in Table/Chart, 13
 Time Units, 13
 Units, 13

Server Macros, 84

Show Chart Controls, 36

Show Grids, 36

Show in Chart, 21

Show in Table, 21, 25

Simple_rsi, 80

Skip all NaN, 29

Smallest Integer, 80

Smoothed, 18

Standard Deviation, 81

Standard Deviation Population, 81

Stochastics, 106

Stored Formulas, 47

Stream Semantics, 34

Sum, 82

Symbol
 Column, 48
 Time Units, 48
 Units of Measure, 48

Symbol Information, 48

Symbols
 Exporting, 9
 Importing, 9

T

Table Summary Stats, 29

Table Tab, 35

Tables, 1, 43

Tools Menu, 11
 Curve Matrix, 11
 Validate Formulas, 11

Tree View, 37

Trendline, 107

Trendlines, 42

True Midpoint, 82

True Range, 82

U

Units, 1, 5

Use 800x600 Pixel Mode, 34

Use description as chart label, 36

User Preferences, 33
 Charting, 36
 Desktop/Excel, 35
 Printing, 35
 Screening, 36

V

Variance, 83

View Menu, 10
 Chart, 10
 Chart Options, 10
 Configuration, 10
 Query, 10
 Table, 10

Volatility, 107

VolatilityIdx, 108

VolPriceTrend, 107

Volume Crossover, 16

W

Wilders_rsi, 83

WildersADX, 108

WildersADXR, 108

WildersDIMinus, 109

WildersDIPlus, 109

WildersDX, 109

WildersRSI, 110

Williamsr, 84

WilliamsVolAD, 110

Worksheet, 4, 5
 Shortcuts, 6
 Synchronizing, 6

Worksheet Toolbar, 5

Z

Zoom, 42