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Contents

CHAPTER: 1 - Introduction 1
What is EasyLanguage? 2
What Can You Create? 2
EasyLanguage Resources and Support 2

CHAPTER: 2 - The Basic EasyLanguage Elements 3
How EasyLanguage is Evaluated 4
About the Language 5
Referencing Price Data 7
Expressions and Operators 8
Referencing Previous Values 13
Manipulating Dates and Times 15
Using Variables 20
Using Inputs 25
EasyLanguage Control Structures 28
Writing Alerts 34
Understanding Arrays 40
Understanding User Functions 44
Output Methods 58
Drawing Text on Price Charts 69
Drawing Trendlines on Price Charts 81
Multimedia and EasyLanguage 99

CHAPTER: 3 - EasyLanguage for TradeStation 6 103
Writing Strategies 104
The Trading Strategy Testing Engine 105
Order Placement 119
Understanding Built-in Stops 132
Writing Indicators and Studies 136

Writing ShowMe and PaintBar Studies 140
Writing ProbabilityMap Studies 145
Writing ActivityBar Studies 153

CHAPTER: 4 - EasyLanguage and Custom DLLs 169
Defining a DLL Function 170
Using Functions from DLLs 173
Keeping Track of Analysis Techniques 174
More About the EasyLanguage DLL Extension Kit 177

APPENDIX A: - EasyLanguage Syntax Errors 179
APPENDIX B: - EasyLanguage Colors, Widths & Codes 209
APPENDIX C: - Reserved Words Quick Reference 211
APPENDIX D: - EasyLanguage Tool Kit Library 263

Index 277

CHAPTER 1

Introduction

This book is a comprehensive reference for EasyLanguage, TradeStation Technologies' industry-standard computer language. It explains in detail the capabilities of the language and its structure, using examples throughout to illustrate the concepts and syntax presented.

This book first covers the basic elements of EasyLanguage and then delves more deeply into the EasyLanguage specifically for use with TradeStation.

This book covers EasyLanguage concepts in the context of the product; it does not provide procedural information on using the EasyLanguage PowerEditor or TradeStation 6. All procedural instructions are covered in the TradeStation Help.

The appendixes at the back of the book contain two useful references: a reserved word quick reference and the EasyLanguage syntax errors. The reserved word quick reference is a complete list of the EasyLanguage reserved words, listed alphabetically. The syntax error list is a complete list of the verification syntax errors generated by the PowerEditor, listed by error number. Both of these items also are available online in the TradeStation Help, as you will find these items useful when troubleshooting EasyLanguage.

In This Chapter

- What is EasyLanguage? 2
- What Can You Create?............................. 2
- EasyLanguage Resources and Support 2

What is EasyLanguage?

EasyLanguage is a simple, but powerful, computer language that enables you to create your own custom trading and technical analysis tools. By combining common trading terminology with simple decision statements, EasyLanguage makes it easy for you to write your own trading rules and actions in a clear and straightforward manner.

Simply put, TradeStation reads your EasyLanguage statements, evaluates them based on the price data that has been collected, and performs the specified actions.

What Can You Create?

EasyLanguage enables you to create your own trading strategies, indicators, studies, and functions. Or, if you choose, you can copy and modify any of the hundreds of built-in trading strategies, analysis techniques, and functions that are included with TradeStation.

The types of trading and technical analysis tools you can create for TradeStation are:

- Indicators (chart-based)
- ShowMe Studies
- PaintBar Studies
- ActivityBar Studies
- ProbabilityMap Studies
- Strategies
- Functions

TradeStation can store an unlimited number of analysis techniques.

EasyLanguage Resources and Support

To help ease the learning curve for EasyLanguage, there are several methods of support available. From the **Help** menu in TradeStation, you can access the TradeStation Help, Tutorials, FAQs, and Knowledge Base. All of these support tools contain information to help you create your own trading and technical analysis tools. You can also email TradeStation Support for assistance with EasyLanguage at the address below:

EasyLanguage@TradeStation.com

CHAPTER 2

The Basic EasyLanguage Elements

EasyLanguage is the industry standard language used to describe trading ideas, and it is the most powerful, versatile, and easy to use customization tool used by traders world wide. But how does it work? This chapter answers that question, and introduces you to the syntax, grammar, control structures, and general concepts that are the foundation for EasyLanguage.

This chapter discusses how EasyLanguage performs its calculations, and provides a solid foundation for you to begin working with TradeStation.

In This Chapter

- How EasyLanguage is Evaluated 4
- About the Language 5
- Referencing Price Data 7
- Expressions and Operators 8
- Referencing Previous Values 13
- Manipulating Dates and Times 15
- Using Variables 20
- Using Inputs 25
- EasyLanguage Control Structures 28
- Writing Alerts 34
- Understanding Arrays 40
- Understanding User Functions 44
- Output Methods 58
- Drawing Text on Price Charts 69
- Drawing Trendlines on Price Charts 81
- Multimedia and EasyLanguage 99

How EasyLanguage is Evaluated

Regardless of the type of trading or technical analysis tool you're writing—an indicator, trading strategy, search strategy, etc.—the first step is understanding how EasyLanguage evaluates data.

EasyLanguage and Price Charts

A price chart typically consists of a number of bars built from price data associated with a specified trading instrument. Each bar summarizes the prices for a trading interval—a time period such as five minutes or one day—and includes values such as the open, high, low, and closing prices for that period. Other bar data such as the date and time of the bar's close, the volume, and in the case of futures the open interest is also available for each bar.

One of the main uses of EasyLanguage is to evaluate price data from one bar and compare it to data from other bars; therefore, it is important to understand how an EasyLanguage trading strategy, analysis technique or function evaluates the price data on a price chart and performs its analysis.

Let's look at a simple one-line trading strategy:

```
If the Close > High of 1 Bar Ago Then Buy at Market;
```

This simple statement is instructing EasyLanguage to compare the closing price of one bar with the high price of the previous bar, and to generate a buy order for the open of the next bar when the close is greater than the high. This comparison is made on the closing price of every bar in the chart, each time referencing the high price of the preceding bar.

Assume you have incorporated the above trading strategy into a trading strategy that you've applied to a chart. Even though your trading strategy is applied to a chart filled with many different bars, the information that is evaluated for each bar is always the same (i.e., close price, volume, high price, etc.). Remember, a chart is a visual representation of a period of trading history for a symbol, where individual bars represent trading intervals.

To evaluate your chart, EasyLanguage evaluates the price data from the very first bar in the chart to the most recent bar on the chart. In terms of your trading strategy, analysis technique, or function, the bar being evaluated is considered the *current bar* (thus, at some point, every bar on the chart is considered to be the current bar). The EasyLanguage statements in your procedure are always evaluated relative to the current bar.

Now, on the first bar of the chart, there are no previous bars so the comparison in the example above cannot be performed. Thus, the trading strategy would have to wait until the second bar of the chart in order to perform any calculation. This is called 'maximum number of bars the study will reference' or *MaxBarsBack*. This concept is discussed in detail under "Maximum Number of Bars a Study will Reference, or MaxBarsBack" on page 14.

When your procedure is done evaluating the current bar, EasyLanguage steps forward to the next bar in the chart, making it the bar on which the statements in your procedure are evaluated, or the *current bar*.

Typically, a trading strategy, analysis technique or function includes a number of instructions, each of which can result in an action; for example, an indicator will display a value, and a trading strategy will generate a buy or sell order. Once all the EasyLanguage instructions are processed for the current bar, the price data from the next bar is read and the instructions are evaluated using the new prices. This continues across the chart from left to right, until all of the bars from the chart are read and analyzed. Using the trading strategy example, the result is that for a 500-bar chart, the instructions are evaluated a total of 499 times, once for each bar (except the first bar, when there is not enough data to perform the calculation).

For example, look at the chart shown in Figure 2-1, consisting of bars A through H, to which we applied an indicator named *HiLoPlot*. Each statement within the indicator is evaluated from the first line of EasyLanguage to the last, and for every bar of the chart, one at a time, starting with the price data from bar A, then from bar B, etc. across all of the bars in the chart.

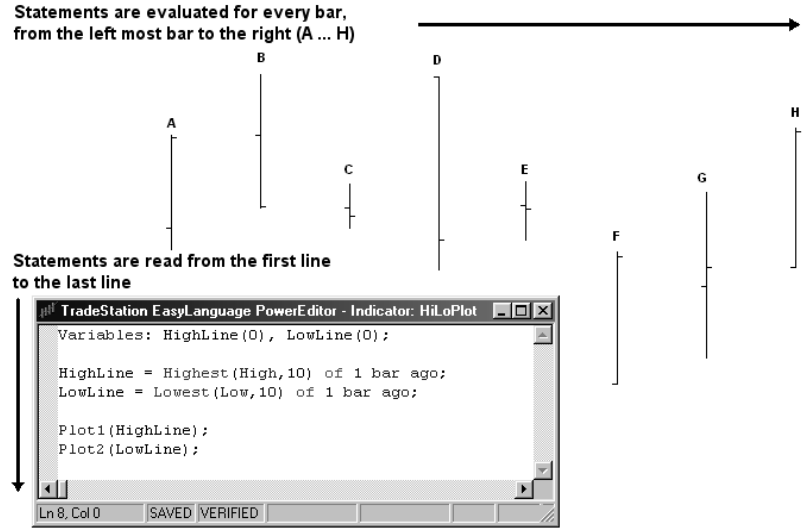


Figure 2-1. Evaluating bars from the first line to the last, and left to right

Even though the EasyLanguage instructions might not be clear at this time, it's important that you understand that each instruction is evaluated, in order from the first line to the last, for every bar of the chart, one at a time.

About the Language

There are certain basic elements in EasyLanguage that apply regardless of what type of trading or technical analysis tool you are writing; you'll use these elements whenever you work with EasyLanguage. Once we cover these basics, we'll move on to the specifics of writing EasyLanguage trading strategies, indicators, studies, and functions.

Statements

An EasyLanguage statement represents a complete instruction. Statements can contain reserved words, operators, and punctuation marks, and always end in a semicolon. For example:

```
Buy 100 Shares on the Next Bar at 100 Stop ;
```

Reserved Words

The basic vocabulary of EasyLanguage consists of a set of pre-defined words, which we call *reserved words*. Reserved words each have a specific meaning or purpose; for example, to display values or create objects in a window, perform a trading action, or evaluate and manipulate data.

As we cover each topic, we will introduce and describe the reserved words required to use the particular EasyLanguage feature.

Operators

Operators are symbols that represent an operation; for example, a plus sign is an operator representing the addition of two values. There are many different kinds of operators available for your use in EasyLanguage: *mathematical*, *relational*, *string*, and *logical*. These are described in detail in the section titled, "Expressions and Operators" on page 8.

Punctuation Marks

There are a number of punctuation marks that you will use often as you write EasyLanguage to establish statements, define parameters, delimit words, and establish order of precedence.

For example, EasyLanguage uses the semicolon (;) to mark the end of each statement. Punctuation marks are considered reserved words, because they are a part of the structure of the language. The following punctuation marks are recognized in EasyLanguage:

Symbol	***Name***	***Description***
;	Semicolon	Ends a statement.
( )	Parentheses	Groups values and forces them to be calculated first. Also, surrounds the set of parameters or inputs required by a reserved word.
,	Comma	Separates each parameter or input in a set required by a reserved word. Also, separates a list of declared inputs or variables.
:	Colon	Used in declaration statements to begin the list of inputs or variables. Also, used with Print statements to format numeric expressions.

Symbol	*Name*	*Description*
" "	Quotation Marks	Defines a text string.
[ ]	Square (Hard) Brackets	Used as a modifier, to reference a value from a previous bar. Also, specifies elements in an array variable.
{ }	Curly Brackets	Surrounds text that is to be ignored by EasyLanguage. Enables you to include comments.

You will find examples of the usage of these punctuation marks throughout this reference guide.

Referencing Price Data

The main objective of any trading or technical analysis tool is to evaluate price data. Therefore, EasyLanguage provides a set of reserved words to refer to the price data available for each bar.

These reserved words match the common verbiage used in everyday trading (e.g., Open, High, Low, Close, Volume). The following table lists the reserved words used to refer to the prices and other bar data, along with the abbreviations you can use in place of the words:

Reserved Word	*Abbreviation*	*Description*
Close	C	Last traded price of a bar.
Date	D	Date of the close of a bar.
Time	T	Time of the close of a bar.
Open	O	First traded price of a bar.
High	H	Highest traded price of a bar.
Low	L	Lowest traded price of a bar.
Volume	V	Number of shares or contracts traded in a bar.
OpenInt	OI	Number of outstanding contracts at the close of a bar (available with futures only).
Ticks	--	Total number of trades in a bar.
UpTicks	--	Number of trades in which price was higher than the previous trade, or unchanged tick after an uptick.
DownTicks	--	Number of trades in which price was lower than the previous trade, or unchanged tick after a downtick.

You can use any or all of these reserved words in your trading strategies, analysis techniques, and functions to refer to information regarding the current bar being evaluated. Remember that trading strategies, analysis techniques and functions are evaluated for every bar, from oldest to most current, and results are obtained for every bar.

Also, since trading decisions are rarely made on just one bar's worth of price information, EasyLanguage makes it easy to obtain price data from any bar older than the current bar by adding a modifier after the appropriate reserved word. For a detailed description of the modifier to add, refer to the section titled, "Referencing Previous Values" on page 13.

Skip Words

There is a subset of reserved words called *skip words*. Skip words are optional words that can be included in any statement with the intent of making the statement easier to read. Skip words have no meaning and are in fact 'skipped' by EasyLanguage when evaluating the trading strategy, analysis technique, or function. Following is a list of the EasyLanguage skip words.

a	an	at	based	by	does	from
is	of	on	place	than	the	was

For examples using these skip words, please refer to Appendix C, "Reserved Words Quick Reference" on page 211.

Expressions and Operators

An expression is any combination of reserved words and operators that represent a value. The value can be of three different types:

- numeric
- true/false (also called logical or boolean)
- text string

As you work with EasyLanguage, you will use all three types of expressions extensively to create your procedures.

Numeric expressions can be literal; in other words, a number. Or, they can be a reserved word that represents a numeric value; for example, *Close*. The following are all examples of numeric expressions.

```
15

Volume

(High + Low) / 2
```

True/false expressions can be either the value *True* or *False*, or an expression that evaluates to True or False. True/false expressions invariably involve a comparison. The following is a true/false expression; it evaluates to a value of True or False:

```
Close > Open
```

A text string expression is any characters within quotation marks. The following is an example of a text string expression:

```
"This is a text string expression"
```

Operators

EasyLanguage provides a variety of operators that enable you to manipulate reserved words and values to create more complex numeric, true/false, and text string expressions. The four different types of operators available in EasyLanguage are *string*, *mathematical*, *relational,* and *logical*.

String Operator

There is only one operator available to manipulate text string expressions, and its purpose is to concatenate two text string expressions. The symbol used is the plus sign (+), and it is used as follows:

```
"This is expression 1 " + "and this is expression 2"
```

The result will be one text string expression with the value of "This is expression 1 and this is expression 2".

Mathematical Operators

These operators are used to perform mathematical operations. The five mathematical operators are:

Math Operator	*Meaning*
+	Addition
-	Subtraction
*	Multiplication
/	Division
( )	Parentheses

These operators are always evaluated in a specific order. Division and multiplication are evaluated first, and addition and subtraction are evaluated second. If there is more than one division and/or multiplication (or addition and/or subtraction) these are resolved from left to right.

For example, the numeric expression:

```
High + 2 * Range / 2
```

...will multiply the range of the bar by two first, then divide that value by two. It will then add the result to the high. In an effort to find the midpoint of a bar, you might try to write the following numeric expression:

```
High + Low / 2
```

...but this will divide the low by two first, and then add the result to the high, giving a completely different result than what you intended.

In order to perform the calculation as expected and calculate the midpoint of the bar, you need to use parentheses to control the order in which the calculations are performed. Anything inside parentheses is evaluated first, before all the operators and expressions outside of the parentheses. Therefore, to obtain the midpoint of the bar, you can write:

```
(High + Low) / 2
```

This will result in the high and the low being added and then divided by two.

Advanced Tip: "Division by Zero"

Whenever EasyLanguage finds a division sign, it performs an internal check to ensure that the trading strategy, analysis technique, or function is not attempting a division by zero.

In order to improve your trading strategies, analysis techniques, and functions for speed, whenever dividing by a fixed number (a literal), use multiplication instead of division. This allows EasyLanguage to skip the division by zero check.

For example, when finding the midpoint of the bar, you can write:

```
(High + Low) / 2
```

Given that we know dividing by two forces EasyLanguage to check for division by zero, we can use the following expression to improve the speed of the same calculation:

```
(High + Low) * 0.5
```

Relational Operators

Relational operators enable the following standard comparisons: *greater than*, *less than*, *equal to*, *greater than or equal to*, *less than or equal to*, and *not equal to*. EasyLanguage also provides two trading-specific operators, *crosses over* and *crosses under,* which enable you to identify the bar on which two numeric expressions cross.

The relational operators available in EasyLanguage are:

Relational Operator	***Meaning***
<	Less than
>	Greater than
<=	Less than or equal to
>=	Greater than or equal to
=	Equal to
<>	Not equal to

Relational Operator	***Meaning***
crosses over	Greater than on current bar but less than or equal to on the previous bar; you can also use *crosses above.*
crosses under	Less than on current bar but greater than or equal to on the previous bar; you can also use *crosses below.*

Using these relational operators, you can compare two numeric or text string expressions. For example, the following expression finds a bar that closed higher than the high of one bar ago:

```
Close > High of 1 bar ago
```

When comparing text string expressions, each character is substituted with its equivalent ASCII value and the first character of both expressions is compared, then the second character of each expression is compared and so on, until all characters of both expressions have been evaluated.

Consider the following expression:

```
“abcd” < “zyxw”
```

The first character of the first text string expression is compared to the first character of the second expression. The letter “a” has a smaller ASCII value than “z” so this expression returns a value of True.

Logical Operators

Logical operators are used to combine two true/false expressions. There are two logical operators:

- AND
- OR

AND is used when both true/false expressions must be true; *OR* is used when either one or both of the two expressions must be true. Following is a table that shows the possible resulting values when using AND and OR:

Expression 1	*Expression 2*	*Expression 1 AND Expression 2*
True	True	True
True	False	False
False	True	False
False	False	False

Expression 1	*Expression 2*	*Expression 1 OR Expression 2*
True	True	True
True	False	True
False	True	True
False	False	False

As seen in the tables, the use of *OR* increases the likelihood of the overall expression being true as only one of the two expressions needs be true in order for the overall expression to be true.

More complex true/false expressions can be written using logical operators. For example, in order to find a key reversal bar, you can use the following expression:

```
Low < Low of 1 bar ago AND Close > High of 1 bar ago
```

Given that we are using *AND*, this expression is true only when both conditional expressions are true, these are: the current bar's low is lower than the low of the previous bar, AND the close of the current bar is greater than the high of one bar ago.

As another example, you can use the following expressions to look for stocks that have either a price equal to or greater than $50 a share or a volume greater than two million shares:

```
Close >= 50 OR Volume > 2000000
```

Given that we used *OR*, the above expression will be true when either the closing price is greater than 50 OR the volume is greater than two million shares. It will only be false if the closing price is under 50 and the volume is under two million shares.

When you use multiple *OR*s and *AND*s in an expression, EasyLanguage will evaluate them in the order they appear, from left to right. If necessary, use parentheses to group expressions and alter the order in which EasyLanguage evaluates the expressions.

For example, assume you write an indicator and want to find either a key reversal with volume greater than the previous bar's volume, or an outside bar. You can accomplish this by writing one expression using *AND*s, *OR*s, and parentheses.

The portion highlighted in gray finds the key reversal with volume greater than the previous bar's, and the boxed portion finds the outside bar. Notice the placement of parentheses:

```
(Low < Low[1] AND Close > High[1] AND Volume > Volume[1])
OR (High > High[1] AND Low < Low[1])
```

Notice that instead of writing out "of 1 bar ago", we used the shorthand [1]. See "Referencing Previous Values" on page 13 for more information.

Advanced Tip: "Writing Conditional Expressions"

EasyLanguage is optimized for speed, and one optimization relates to evaluating true/false expressions that include logical operators. When an expression is being evaluated it may be determined that if the first part of the expression is false (or true), the remainder of the expression is not evaluated. For example:

```
5 < 4 AND Close > Open
```

Because 5 < 4 is false, and we are using the AND operator, EasyLanguage will not evaluate the second half of the expression because regardless of the result of this second part, the entire expression will evaluate to False.

Similarly, in the expression:

```
5 > 4 OR Close > Open
```

The second half of the expression will not be evaluated because 5 > 4 is always true and we are using the OR operator. Therefore, regardless of the result of the second half of the operation, the expression will evaluate to True.

Therefore, to write your trading strategies, analysis techniques, and functions as efficiently as possible, place the most restricting criterion of your expression first.

Referencing Previous Values

You can reference the value of an expression for any previous bar by adding either of the two qualifiers listed below after the expression:

of *N* bars ago

[*N*]

N is the number of bars ago to reference. For example, consider the following EasyLanguage expression:

```
Low of 1 bar ago
```

This expression is referencing the low price of the previous bar. The reference is relative to the current bar (bar currently being evaluated). For example, if your trading strategy, analysis technique, or function is being evaluated for the 12th bar of a chart, the following expression refers to the traded volume of the 9th bar, or 3 bars back from the current bar:

```
Volume of 3 bars ago
```

The alternate method for referring to data from a previous bar is to enclose the number *N* between square braces after a reserved word, input, or variable, where *N* is the number of bars ago. For example, the following expression is referencing the opening price from 2 bars ago:

```
Open[2]
```

Keep in mind that when talking about trading strategies, analysis techniques, or functions, we are always referring to bars; all trading strategies, analysis techniques, and functions are based on bars and not on days, minutes, or ticks. This allows the trading strategy, analysis technique, or function to analyze a daily, minute, or even tick chart without any modifications.

For example, a 10-bar average indicator will calculate a 10-day average if applied to a daily chart, or a 10-minute average if applied to a 1-minute chart, or a 10-tick average if applied to a 1-tick chart.

Maximum Number of Bars a Study will Reference, or *MaxBarsBack*

All trading strategies, analysis techniques, and functions that refer to past data will need to wait a certain number of bars before they can start performing calculations. This waiting period can be adjusted for any analysis technique, and it is called *Maximum number of bars a study will reference*, or *MaxBarsBack.*

This concept is best explained through an example. Let's use the *Momentum* Indicator, which plots the difference between any price of the current bar and the same price *N* bars ago. Using 10 as the number of bars ago, if we scroll all the way to the beginning of the chart, we will see that we cannot calculate this indicator until we have 10 bars of data on the chart. The indicator will start showing results on the 10th bar. Again, this is because it needs to refer to the price of the previous 10 bars, as shown in Figure 2-2.

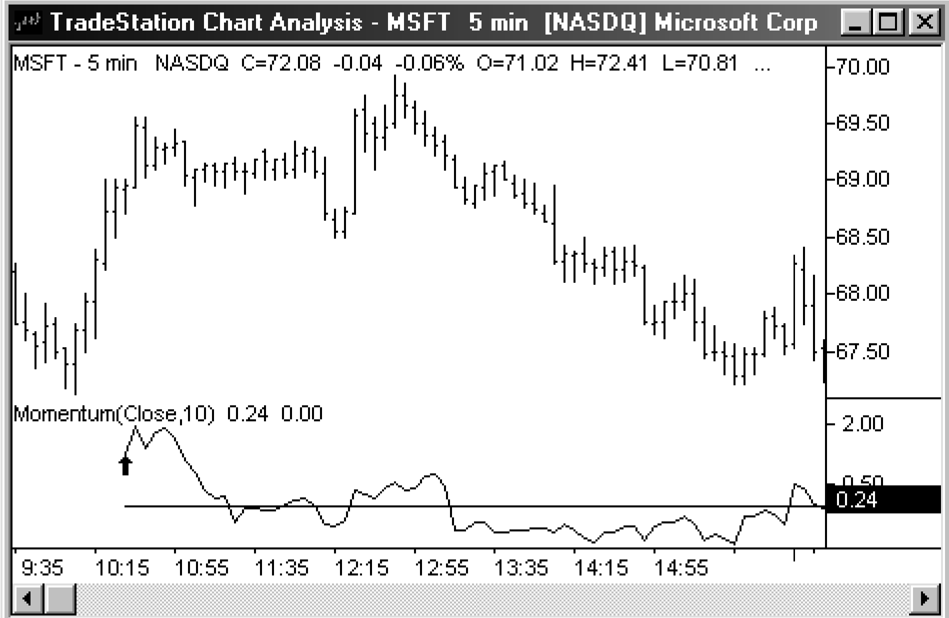


Figure 2-2. Momentum indicator *waiting* 10 bars before returning a value

Refer to section in this chapter titled, "How EasyLanguage is Evaluated" on page 4 for information on how EasyLanguage performs its calculations.

Advanced Tips: "Understanding the Auto-Detect Loop"

*When you apply an analysis technique to a price chart and use the **Auto-Detect** MaxBarsBack setting, the application looks for the largest data offset used by the trading strategy or analysis technique, and uses that number for the MaxBarsBack setting. However, if the analysis technique uses a variable offset (e.g.,* Close[Value1]*), then it is possible that the value initially chosen by the application will not be sufficient to apply the trading strategy or analysis technique to all the data in the chart.*

For example, an indicator is applied to a chart, and the application initially determines that the maximum offset is 5. However, as the application evaluates the indicator on the chart, it determines that the analysis technique actually requires 25 bars to perform its calculation, so the application removes the analysis technique from the chart, and applies it a second time with 25 as the MaxBarsBack setting. This process is repeated until the indicator is evaluated for the entire chart without having to be removed.

*This can cause Print statements and other debugging tools, as well as DLL calls to be executed repeatedly for the first few bars in the chart when the trading strategy or analysis technique is first applied. If this behavior is not desired, you will need to change the MaxBarsBack setting to **User-defined**.*

More information on how the Auto-Detect and User-defined formatting settings work is available in the TradeStation Help.

Manipulating Dates and Times

You'll be using dates and times often when writing your trading strategies, analysis techniques, and functions. This section covers how to work with dates and times.

Working with Dates

Dates in EasyLanguage are represented as a numeric expression in the form YYYMMDD where YYY are years since 1900, MM is a 2-digit month, and DD corresponds to the day of the month. For example, the EasyLanguage date corresponding to December 17, 1999 is 991217, whereas January 13, 2000 is written as 1000113.

One of the advantages of representing dates as numeric expressions is that it allows the comparison of dates. For example, 1000113 is greater (i.e., it is a later date) than 991217, and the following comparison evaluates to True: *1000113 > 991217*.

A second way of representing dates in EasyLanguage is Julian Dates. The Julian Date system assigns a date a number *n*, and the next calendar day has the Julian date *n+1* (all calendar days, not just trading days). The Julian Date system begins on January 1, 1900, which is assigned the number *2*. January 2, 1900 becomes the number *3*, December 31, 1999 is *36,525,* and January 1, 2000 is *36,526,* etc.

This allows us to perform mathematical calculations with dates—such as addition and subtraction—without having to worry about 'rolling over' months and years. For example, if we have the EasyLanguage date 991013 (13 of October of 1999) and we want to find the date of 20 days ago, we could (incorrectly) try to subtract 20 from the date:

```
991013 - 20
```

However, we would end up with 990993, which is not a valid EasyLanguage date. Instead, we can subtract 20 from the Julian equivalent of the date:

```
36,446 - 20
```

This results in 36,426, which is correct because it is the Julian Date that corresponds to September 23, 1999.

Using the reserved words *Date* or *ELDate* whenever referring to a date will ensure compatibility regardless of any future changes in date format. The reserved words that will allow you to reference and manipulate dates are listed next.

Date

This reserved word returns a numeric expression representing the EasyLanguage date of the closing price of the bar being analyzed. The date is an EasyLanguage date, so it is a numeric expression of the form YYYMMDD, where YYY is years since 1900, MM is the month, and DD is the day of the month.

Syntax:
`Date`

Parameters:
None.

Example:
See the example for the reserved word *ELDate*.

ELDate(*YYYY, MM, DD*)

This reserved word returns a numeric expression representing the EasyLanguage date (YYYMMDD) equivalent to the standard date specified (YYYY, MM, DD).

Syntax:
`ELDate(YYYY, MM, DD)`

Parameters:
YYYY is the 4-digit numeric expression representing the year, *MM* is the 2-digit expression representing the month, and *DD* is the 2-digit numeric expression representing the day of the month.

Notes:
We highly recommend you use the reserved words *Date* or *ELDate* whenever referring to a date. This will ensure compatibility regardless of any future changes in date format.

Example:
To verify that the date of the current bar is December 17, 1999, you can use the following IF-THEN statement:

```
If Date = ELDate(1999, 12, 17) Then
   { EasyLanguage instruction } ;
```

DateToJulian(*eDate*)

This reserved word returns a numeric expression representing the Julian Date equivalent to the specified EasyLanguage date.

Syntax:
`DateToJulian(eDate)`

Parameters:
eDate is the EasyLanguage date (YYYMMDD format) to be converted into a Julian Date.

Example:
You can use the following statement to obtain the Julian Date equivalent to the EasyLanguage date of the current bar and assign it to a variable (in this case *Value1*):

```
Value1 = DateToJulian(Date);
```

JulianToDate(*jDate*)

This reserved word returns a numeric expression representing the EasyLanguage date equivalent to the specified Julian Date.

Syntax:
`JulianToDate(jDate)`

Parameters:
jDate is a numeric expression representing the Julian Date to convert into an EasyLanguage date (YYYMMDD format).

Example:
The following statement obtains the Julian Date of the day 20 calendar days ahead of the date of the current bar, and converts the result into an EasyLanguage date:

```
Value1 = JulianToDate(DateToJulain(Date) + 20);
```

The expression inside parentheses (the reserved word *DateToJulian*) is evaluated first. It converts the date of the current bar to a Julian Date. Then, the number 20 is added to the resulting Julian Date. This Julian Date is then the parameter for the reserved word *JulianToDate*, which converts the Julian Date to an EasyLanguage date, in the format YYYMMDD. This EasyLanguage date is stored in the variable *Value1*.

CurrentDate

This reserved word returns a numeric value representing the EasyLanguage date (YYYMMDD format) corresponding to the date and time of your computer (or datafeed, if you are connected to a datafeed).

Syntax:
```
CurrentDate
```

Parameters:
None.

Example:
To have a trading strategy, analysis technique, or function perform its calculations only before January 1, 2000 (or any other date for that matter), you can write:

```
If CurrentDate < ELDate(2000, 01, 01) Then Begin
    { EasyLanguage instruction(s) }
End;
```

Working with Times

In EasyLanguage, times are expressed as numeric expressions in the form *HHMM,* where *HH* is the hour and *MM* is the minutes. The hours are managed in what is commonly called 24-hour or military format, so 1:30pm is represented as 1330 and 10:05am is represented as 1005. EasyLanguage does not allow for references to seconds.

In addition, when you work with time, to facilitate mathematical operations such as addition and subtraction, you can refer to the time as minutes past from midnight. For instance, 1:00am is 60 (60 minutes after midnight), and 10:30am is 630 (630 minutes after midnight).

For example, if the current time is 10:30am (or 1030), and you want to add 60 minutes to the current time, you may think that you simply add 60 to 1030:

```
1030 + 60
```

However, doing so results in a total of 1090, which is not a valid time. Therefore, to add 60 minutes to a time, use minutes after midnight. You would write:

```
 630 + 60
```

Doing so results in 690. When you convert this number back into time in 24-hour format, the result is 1130, which is the desired value. Reserved words are provided for you to convert times back and forth automatically.

The reserved words used to reference and manipulate times are listed next.

Time

This reserved word returns a numeric expression representing the EasyLanguage time (HHMM format) of the closing price of the current bar.

Syntax:
```
Time
```

Parameters:
None.

Example:
For example, you can write your trading strategy, analysis technique, or function such that it only evaluates the EasyLanguage instructions when the trade time is less than 11:00am:

```
If Time < 1100 Then
   { EasyLanguage instruction } ;
```

TimeToMinutes(*eTime*)

This reserved word returns a numeric value representing the number of minutes elapsed since midnight for the EasyLanguage time (HHMM format) specified.

Syntax:
```
TimeToMinutes(eTime)
```

Parameters:
eTime is a numeric expression representing the EasyLanguage time to be converted into minutes past midnight.

Example:
The following statement converts the current bar's time into minutes past midnight, and assigns the numeric value to a variable (in this case, *Value1*):

```
Value1 = TimeToMinutes(Time);
```

MinutesToTime(*mTime*)

This reserved word returns a numeric expression representing the EasyLanguage time (HHMM format) equivalent to a specific number of minutes from midnight.

Syntax:
```
MinutesToTime(mTime)
```

Parameters:
mTime is a numeric expression representing the minutes past midnight to be converted into the equivalent EasyLanguage time.

Example:
The following statement converts the current time into minutes past midnight, adds 20 to it, and then converts the resulting number back into an EasyLanguage time:

```
Value1 = MinutesToTime(TimeToMinutes(Time) + 20);
```

The expression within parentheses is evaluated first (the reserved word *TimeToMinutes*). It converts the time of the current bar to minutes past midnight. Then, 20 is added to the minutes past midnight, and the resulting number is used as the parameter for the reserved word *MinutesToTime*, which converts the number back into an EasyLanguage time (HHMM format).

CurrentTime

This reserved word returns a numeric value representing the EasyLanguage time (HHMM format) corresponding to the time of your computer (or TradeStation Network, if you are working online).

Syntax:
`CurrentTime`

Parameters:
None.

Example:
To have a trading strategy, analysis technique, or function perform its calculations only if it is before 2:00pm, you can write:

```
If CurrentTime < 1400 Then Begin
    { EasyLanguage instruction(s) }
End;
```

Using Variables

Variables are placeholders that hold a value; once you assign a value to the variable, you can reference the value throughout the trading strategy, analysis technique, or function by using the name of the variable. You can also recalculate the value of the variable within the procedure.

The definition of *variable* by Webster is *a symbol that may have an infinite number of values; that which is subject to change.* Like the definition states, the value stored by the variables can change any number of times throughout the procedure, even from bar to bar.

The main use of a variable is to store the result of a calculation or comparison in order to refer to the result of this operation later without having to repeat the formula or expression.

For example, in variable *X* you can store the value of the high price of the bar plus 33% of the average true range. Once this value is calculated and assigned to the variable, there is no need to type the formula again; you can use *X* instead to refer to this value.

Variables help with the speed and efficiency of the procedure. This is because the application does not have to reference repeatedly the values that compose the statement (e.g., pric-

es and other values), or perform the math or comparisons that are required by the expression. Therefore, using variables in place of frequently-used expressions speeds up the procedure and uses less memory.

Another very important fact about variables is that the value of a variable at the end of a bar is used as the initial value of the variable for the next bar. In other words, the values of all variables are carried over from bar to bar, thus allowing an easier manipulation of information. For instance, you can use a variable to keep a counter of the number of bars that have passed since a certain market condition, or the number of bars that you've been in a certain market position.

For example, the following instructions keep a counter of the number of bars since the last key reversal:

```
Variable: Counter(-1);

If Counter <> -1 Then
   Counter = Counter + 1 ;

If Low < Low[1] AND Close > High[1] Then
   Counter = 0 ;
```

The variable *Counter* starts with a value of -1 (which is assigned in the Variable Declaration statement), and is incremented by one on every bar once its value changes from -1.

This indicator changes the *Counter* variable from -1 to 0 the first time a key reversal is found, and subsequently resets it to 0 each time a new key reversal is found. Note how the instructions *Counter = Counter + 1* assigns to the variable *Counter* its current value and adds one. This would not be possible unless variables carried forward their values from bar to bar.

Also, using variables helps avoid typing errors and makes your procedure more legible. For example, consider the following statement:

```
If Close > High[1] + Average(Range,10) * 0.5 Then
   Buy Next Bar at High[1] + Average(Range,10) * 0.5 Stop;
```

The expression highlighted in the gray boxes can be assigned to a variable. By using a variable (in this example the variable is *Value1)*, we can simplify the statement to the following:

```
Value1 =  High[1] + Average(Range,10) * 0.5 ;

If Close > Value1 Then
   Buy Next Bar at Value1 Stop;
```

This second example is much easier to read because of the use of a variable. If you are going to use an expression throughout a procedure, you should assign it to a variable.

***Note**: If you use an expression very frequently and in more than one trading strategy or analysis technique, you may want to create a function. Variables can only be used*

in the procedure where they are declared and are not shared between trading strategies and analysis techniques, whereas functions can be referenced by other trading strategies and analysis techniques, and even other functions. The section later in this chapter, titled, "Understanding User Functions" on page 44 covers functions in detail.

When working with variables, you declare them, assign values to them, and reference their values. How to do each is discussed next.

Declaring Variables

Before you can use a name as a variable, you must 'tell' EasyLanguage that the name is to be used as a variable; this is known as *declaring* the variable(s). To declare a variable, you use a Variable Declaration statement. When you declare a variable, you also specify its type and initial value.

Syntax:

```
Variable: Name(Value) ;
```

Name is the name of the variable. The name must start with a letter, and can be a maximum of 20 characters in length. The name can contain letters, numbers, dashes, or periods. *Value* is any numeric, true/false, or text string value; it is the initial value for the variable.

You can declare one or more variables using the same statement by separating the variables with commas. For example, the following statement declares three variables, each of a different type:

```
Variables: Number(0), Condition(False), TextStr("Text");
```

There is no limit to the number of variables that you can declare with one statement, although if you prefer, you can use multiple variable declaration statements. There is no limit to the number of Variable Declaration statements you can use, either.

Also, the reserved words *Var*, *Vars*, and *Variables* are synonyms to *Variable* and can be used interchangeably. For example, you could rewrite the statement above as:

```
Vars: Number(0), Condition(False) ;
Var: TextStr("Text");
```

The values in parentheses serves two purposes. First, it indicates the type of variable it is: *numeric*, *true/false,* or *text string*. If you use a numeric expression, the variable is a numeric variable; if you use a true/false expression, then it is a true/false variable; and likewise, if you use a text string expression, the variable is a text string variable.

Second, the value in parentheses assigns the initial value to the variable. As explained earlier in this reference guide, all the instructions in EasyLanguage are read from top to bottom, and they are interpreted for every bar on the chart from left to right. On the first bar, the variable takes the value in parentheses as its initial value.

***Note**: For your convenience, EasyLanguage provides a number of pre-declared numeric and true/false variables. You can use these variables in your trading*

strategies, analysis techniques, and functions without declaring them or setting their initial value. The numeric variables available for you to use are Value0 *through* Value99*, and their initial value is zero (0). You'll notice that in most of our examples, we use* Value1. *The true/false variables available for you to use are* Condition0 *through* Condition99*, and their initial value is False. There are no pre-declared text string variables. The only advantage to using pre-declared variables is that you don't need to declare them. The disadvantages are that the name(s) will be less intuitive and you cannot set their initial values yourself.*

Assigning Values to Variables

Once you have declared your variable(s) (or if you are using pre-declared variable(s)), you can assign values to them throughout the trading strategy, analysis technique, or function.

Syntax:

```
Name = Expression ;
```

Name is the name of the variable and *Expression* is either a numeric, true/false, or text string expression. The expression type must match the variable type. If the statement is assigning a value to a numeric variable, the expression must be a numeric expression.

For example, the following statement assigns the average true range of the last 10 bars to the variable *Value1*:

```
Value1 = Average(TrueRange, 10);
```

The following statements declare a true/false variable called *KeyReversal*, and then assign the result of a comparison to the variable:

```
Variable: KeyReversal(False);

KeyReversal = Low < Low[1] AND Close > High[1];
```

Referencing the Value of a Variable

Once you have declared a variable, and a value has been assigned to it, you can reference its value by using the name of the variable in place of the expression. For example, the following statements calculate an entry price, assign it to a numeric variable called *EntryPrc,* and then reference the value of the variable in the buy order:

```
Variable: EntryPrc(0);

EntryPrc = Highest(High,10);

If MarketPosition <> 1 Then
   Buy Next Bar at EntryPrc Stop;
```

In the following example, the statements calculate the highest high of the last 10 bars, compare it to the current high, and assign the result to a true/false variable called *Condition1*. We then use an IF-THEN statement to determine if *Condition1* is true, and if it is, then an alert is triggered:

```
Condition1 = High > Highest(High, 10)[1];
```

```
If Condition1 Then
   Alert("New 10-bar high");
```

Notice that we do not have to use the comparison *Condition1 = True*; it is assumed. If, however, you want to find when the expression is false, then you must state the comparison, as follows:

```
Condition1 = High < Highest(High, 10)[1] AND Low >
   Lowest(Low,10)[1];

If Condition1 = False Then
   Alert("New high or low");
```

Normally, you would write the expression such that you want it to evaluate to true; however, it is up to you which way you want to write the expressions and statements.

It is also possible to refer to the value of a variable on a previous bar; to do so, include the square brackets and number after the name of the variable. For example, the following statements refer to the value of a variable called *EntryPrc* five bars ago:

```
Variable: EntryPrc(0);

EntryPrc = Highest(High, 10);

If EntryPrc > EntryPrc[5] Then
   Buy Next Bar at EntryPrc Stop;
```

Advanced Tip: "Working with Series Variables"

EasyLanguage automatically determines if a variable is referenced historically at any point in the trading strategy, analysis technique, or function, and will store the historical values of the variable only if required. Variable values are not stored and cannot be referenced within the initial MAXBARSBACK buffer.

MaxBarsBack is the minimum number of referenced historical bars required, at the beginning of a chart, to begin calculating a trading strategies, analysis techniques, and functions.

For example, consider the following indicator:

```
Value1 = Close * 1.05;

Value2 = Close - Close[10];

Value3 = Value1[5] + Value2;

Plot1(Value3);
```

A historical value of Value1 *is referenced in the third line (the value of five bars ago); also, the MaxBarsBack setting for the indicator is 10 (since the close of 10 bars ago is referenced and that is the most history required). Therefore, the indicator will store the values for Value1 for the last 10 bars. The variables* Value2 *and* Value3 *do not require that history be saved (they are simple), thus historical values of these variables are not stored.*

Variables can be either series or simple. When they are series, history is stored for them; when they are simple, history is not stored for them. This becomes important when accessing the values of variables from third-party languages through DLLs, because there may or may not be historical data stored for the variable, or not as much as desired by the third-party developer. In this scenario, you can force a variable to be a series variable by referencing a previous value of the variable in the trading strategy, analysis technique, or function (i.e., by using a 'dummy' statement). Or, you may want to consider working with functions; you can force a function to be a series function. See the section later in this chapter titled, "Understanding User Functions" on page 44.

Using Inputs

Inputs are placeholders that hold a value; you can define the value of the input once at the beginning of the procedure and then reference the value throughout the trading strategy or analysis technique by using the name of the input.

The value of an input cannot be changed *within* the EasyLanguage procedure; its value remains constant throughout the procedure. The advantage of using an input is that you can redefine the value of the input when you use the trading strategy or analysis technique.

For example, the Indicator *Mov Avg 1 Line* is written with an input called *Length*, which is the number of bars to include in the average. This input is assigned the default value of 9, but you can change it to any number when you apply the indicator to a chart, thereby having the analysis technique calculate the moving average using a different number of bars.

Inputs allow for maximum flexibility and user-control of the trading strategy or analysis technique without having to go to the EasyLanguage PowerEditor to modify the instructions themselves. Also, you can use the same EasyLanguage procedure more than once in a Chart Analysis window (or in different Chart Analysis windows), using different input values in each.

For example, you can apply the *Mov Avg 1 Line* Indicator to a Microsoft chart to calculate a 10-bar average, and you can apply the same indicator to an IBM chart to calculate an 18-bar average. Inputs allow the same indicator to perform these different calculations; you don't have to create a new indicator or even modify it in the EasyLanguage PowerEditor.

Another important advantage is that when you use inputs in your trading strategies, you can then use TradeStation's optimization feature to fine tune your trading strategy(ies). For information on optimizing your trading strategies, search the TradeStation Help for *Understanding Optimization*.

Input Types

Inputs can be one of three types: *numeric*, *true/false,* or *text string*. Numeric inputs represent numeric values, true/false inputs represent expressions that evaluate to True or False, and text string expressions hold text strings.

Inputs can be literal expressions such as a specific number or a text string, or they can be expressions whose values will change from bar to bar; for example, an input can be set to

the close of the bar, in which case, the value will change with each bar. Or, it can be set to the range of the bar, using the function *Range*. The value of an input cannot change within a bar.

To use inputs, you first have to declare them; once you declare them, you can reference them in your trading strategy or analysis technique. There is no Assignment statement for inputs (since their value cannot be changed within the procedure).

Declaring Inputs

Before using any name as an input, it is necessary to tell EasyLanguage that this name will be used as an input, or to *declare* the inputs you will be using. To do so, you use an Input Declaration statement.

Syntax:

```
Input: Name(Value);
```

Name is the name of the input. The name has to start with a letter, and it can be a maximum of 42 characters in length. The name can contain letters, numbers, dashes, or periods. *Value* is any numeric, true/false, or text string value that will be used as the default value for the input.

You can declare more than one input using the same statement by separating the inputs with commas. For example, the following Input Declaration statement declares three different inputs:

```
Inputs: MyNumber(0), MyCondition(False), MyText("Text");
```

There is no limit to the number of inputs that you can declare with one statement; however, you can also use as many Input Declaration statements as you want in your procedure.

***Note**: The reserved word* Inputs *is a synonym to* Input*; they can be used interchangeably.*

The value provided in parentheses serves two purposes: first, it defines the type of the input. If a numeric expression is used, it is a numeric input; if a true/false expression is used, it is a true/false input; and, if a text string expression is used, the input is a text string input.

Second, it assigns the default value to the input. The value specified for each input can be altered when you apply or format the trading strategy or analysis technique, but this is the value for the input each time it is applied.

Referencing the Value of an Input

Once you have declared an input, you can reference its value simply by using the name of the input in place of a numeric, true/false, or text string expression. For example, the following statements calculate an entry price using an input as the multiplying factor:

```
Input: Mult(1.3);

Variable: EntryPrc(0);

EntryPrc = Highest(High,10) * Mult ;
```

```
If MarketPosition <> 1 Then
   Buy Next Bar at EntryPrc Stop;
```

First, we declare the input. Then, we declare a variable, to which we assign the highest high price of the last 10 bars, multiplied by the input (whose value is set to 1.3). Once we have calculated the entry price (*EntryPrc*), we place an order. If we are not currently in a long position, we place a stop order to buy on the next bar at the entry price we've calculated or higher. Notice that we reference the value of the input simply by using the input in place of a value.

In EasyLanguage, you use true/false expressions in IF-THEN statements and in *While* loops (these are described in the section titled "EasyLanguage Control Structures" on page 28). These statements perform their actions when the true/false expression evaluates to True. The following instructions show an example of referencing the value of a true/false input:

```
Input: DrawLine(False);

Plot1(Momentum(Close, 10), "Momentum");

If DrawLine Then
   Plot2(0, "Zero");
```

This indicator plots a momentum line using the closing price of the last 10 bars. In addition, it allows for the plotting of a zero line, which by default, will not be drawn (the input *DrawLine* is set to False by default). If, however, you change the *DrawLine* input to True as you apply the indicator or when you format it, then the zero line will be drawn on the chart.

It is also possible to refer to the value of an input on a previous bar; to do so, include the square brackets and number after the name of the input. For example, the following statements calculate and plot a momentum value:

```
Inputs: Price(Close), Length(5) ;

Value1 = Price - Price[Length]

Plot1( Value1, "Momentum" );
```

We use an input to refer to the price we want to use to calculate the momentum as well as the number of bars to use. In this case, the value of the input 5 bars ago may be different because the input is a price, which varies from bar to bar. If the value of the input does not vary, referencing a previous value is not necessary.

Advanced Tip: "Assigning Series Values to Inputs"

Inputs are evaluated every instance they are referenced in the body of a trading strategy or analysis technique; this is similar to simple functions. However, series functions are NOT calculated each instance. For example, if you use the AverageFC function (a series function) four times in your procedure, it is evaluated once and then the resulting value is referenced during the procedure.

However, there may be instances where you want to use a series function but want it to be recalculated every instance; to force it to recalculate, you can assign the series function to an input. The function will be called (i.e., recalculated) every instance that the input is used.

To illustrate how inputs are calculated, we wrote a simple indicator using the function Random. *When we write the indicator without inputs, both print statements return different values (*Random *is a simple function):*

```
Print(Random(1));
Print(Random(1));
```

When we write this indicator using an input, to which we assign the value Random(1)*, and then print the value of the input twice, the result is the same as using the function twice. Since the input is recalculated each time it is used, each print statement returns a different result:*

```
Input: Val(Random(1));
Print(Val);
Print(Val);
```

EasyLanguage Control Structures

EasyLanguage has three types of statements that control the actions that are performed under different circumstances. These statements enable you to perform actions: only when certain conditions are true, for a period during which certain conditions are true, or for a fixed number of iterations.

In EasyLanguage, the three main control structures are:

- *IF-THEN* statement
- *While* loop
- *For* loop

Each is described next.

IF-THEN Statement

The IF-THEN statement allows you to specify operations that will be performed only when a certain condition is true.

Syntax:

```
If Condition1 Then
   { EasyLanguage instruction };
```

Condition1 is any true/false expression, and *{EasyLanguage instruction}* is any EasyLanguage statement.

For example, you can keep a count of how many times a gap up has occurred in a chart (the open is greater than the previous bar's high) by having an IF-THEN statement add 1 to a variable each time a gap up is found:

```
If Open > High[1] Then
   Value1 = Value1 + 1 ;
```

In this example, every time a bar gaps up, the variable *Value1* is incremented by one. As another example, you can place a buy order only when the fast moving average crosses over the slow moving average:

```
If Average(Close,10) Crosses Over Average(Close,20) Then
   Buy Next Bar at Market ;
```

IF-THEN statements are used extensively in EasyLanguage; for example, ShowMe studies are written exclusively with IF-THEN statements. The objective of a ShowMe study is to identify a certain scenario, and mark any bar on which this scenario occurs. The following example shows a typical one-statement ShowMe study, which finds and marks each outside bar in a price chart:

```
If High > High[1] AND Low < Low[1] Then
   Plot1(High, "Outside Bar") ;
```

If an outside bar is found, a mark is placed at the high price of the bar.

Keep in mind that only the first EasyLanguage statement after the reserved word *then* is included in the IF-THEN statement. For example, take the following ShowMe study:

```
If High > High[1] AND Low < Low[1] Then
   Plot1(High, "Outside Bar");
Alert;
```

The Alert statement is not included as part of the IF-THEN statement, and is therefore executed on every bar. You can, however, include more than one statement in the IF-THEN statement. To do so, use a Block IF-THEN statement.

Block IF-THEN Statement

Block IF-THEN statements enable you to specify any number of statements to be executed by the IF-THEN statement. You include the statements by using the reserved words *Begin* and *End* around them. For example, to have the ShowMe study mark the bar and trigger an alert each time a gap up bar is found, you can use a Block IF-THEN statement:

```
If High > High[1] AND Low < Low[1] Then Begin
   Plot1(High, “OutSide Bar”);
   Alert;
End ;
```

All statements within the Begin-End block must end with a semicolon. You can include as many statements as you want within the block.

IF-THEN-ELSE Statement

Also, you can structure an IF-THEN statement so that it performs a certain action if the condition is met, and an alternate action if the condition is not met. You do this using the IF-THEN-ELSE statement. Consider the following statement:

```
If Close > Close[1] Then
   Value1 = Value1 + Volume
Else
   Value1 = Value1 - Volume;
```

In this example, *Value1* will keep the summation of the volume of the days with a positive net change minus the summation of the volume of the days with negative net change. Notice that there is no semicolon used until the end of the last line; in effect, the above example is one complete statement.

Combining Block IF-THEN and IF-THEN-ELSE Statements

When you use an IF-THEN-ELSE statement, you can also use a Block IF-THEN statement for either the IF-THEN or the ELSE instructions (or both). The following three variations are valid forms of these IF-THEN statements:

1. Block IF-THEN with ELSE

```
If Condition1 Then Begin
   { EasyLanguage instruction(s) } ;
End
Else
   { EasyLanguage instruction } ;
```

2. Block IF-THEN with Block ELSE

```
If Condition1 Then Begin
   { EasyLanguage instruction(s) } ;
End
Else Begin
   { EasyLanguage instruction(s) } ;
End;
```

3. IF-THEN with Block ELSE

```
If Condition1 Then
   { EasyLanguage instruction } ;
Else Begin
   { EasyLanguage instruction(s) } ;
End;
```

Nesting an IF-THEN Statement

You can also nest IF-THEN statements. *Nesting* is a term used when one control structure is included within another; therefore, a *nested IF-THEN* statement simply means that there are one or more IF-THEN statements within another IF-THEN statement.

For example, a trading strategy might state that it will either buy or sell when the market gaps up. If the market closes greater than the open, the strategy places an order to buy 100 shares; if the market closes lower than the open, the strategy sells short 100 shares.

This instruction is written best using nested IF-THEN statements, as follows:

```
If Open > High[1] Then Begin
   If Close > Open Then
      Buy 100 shares This Bar on Close
   Else
      Sell 100 shares This Bar on Close ;
End ;
```

Notice that in order to nest an IF-THEN statement, we generally use the Begin-End block, as highlighted by the gray boxes above.

While Loop

The While loop repeats the specified instructions as long as the control expression has a value of True. When market conditions change and the control expression becomes False, the loop is exited.

Syntax:

```
While Condition1 Begin
   { EasyLanguage instruction(s) } ;
End;
```

Condition1 is any true/false expression and is called the *control expression*. *{ EasyLanguage instruction(s) }* is any number of valid EasyLanguage statements.

For example, the following While loop is used to count the number of bars generating a total volume of 1,000,000 shares:

```
Variables: SumVolume(0), Counter(0) ;

SumVolume = 0 ;
Counter = 0 ;

While SumVolume < 1000000 Begin
   SumVolume = SumVolume + Volume[Counter] ;
   Counter = Counter + 1 ;
End ;
```

First, we declare two variables, *SumVolume* and *Counter*. Although we initialize the variables to zero (0) when we declare them, we also reset the variables to zero on each new bar. This is so that once the total volume is reached, and the procedure moves to the next bar, the values are reset and the loop starts over again.

The statements inside the While loop are repeated until the control expression (*SumVolume* < 1000000) returns a value of False. In this particular example, the While loop adds the volume of the historical bars, one at a time, starting with the current bar (*Counter* = 0), and moving backward (*Counter* = 1, *Counter* = 2, and so on) until the summation is greater than 1,000,000 shares.

Infinite Loops

When using a While loop, there is a possibility that the control expression may never evaluate to False, resulting in an *infinite loop* (i.e., one that never exits). To avoid this, when a loop iterates for more than 5 seconds, TradeStation generates a runtime error and the trading strategy or analysis technique is turned off.

Using the above example, if the summation of the volume does not reach 1,000,000, the loop would continue indefinitely until it runs out of data. Therefore, it is always advisable to provide a fail-safe way for the loop to exit.

Using the above example again, we can modify the control expression so it evaluates to False after looking at 20 bars, thus forcing the loop out either when the volume reaches the target number or when 20 bars have been evaluated:

```
Variables: SumVolume(0), Counter(0);

SumVolume = 0;
Counter = 0;
```

```
While SumVolume < 1000000 AND Counter < 20 Begin
   SumVolume = SumVolume + Volume[Counter];
   Counter = Counter + 1;
End;
```

For Loop

A For loop enables you to repeat the instructions a specified number of times.

Syntax:

```
For Value1 = N To {or DownTo} M Begin
   { EasyLanguage instruction(s) } ;
End;
```

Value1 is any numeric variable, *N* and *M* are any numeric expressions, and *{ EasyLanguage instruction(s) }* is one or more valid EasyLanguage statements.

The number of times the loop iterates through the instructions is determined by the *Value1* variable, which is called the *control variable*. Again, this can be any declared numeric variable.

The value of the control variable is set to *N* the first time the statement is evaluated, and the value is then incremented or decremented automatically on every iteration. If the word *To* is used in the syntax, the variable is increased by one on every iteration. If the word *Downto* is used, then the variable is decremented on every iteration.

Internally, the expression that is evaluated each time the loop is about to start executing the statements is *Value1 <= M*, when the word *To* is used, and *Value1 >= M,* when *Downto* is used. Therefore, if the For loop is incrementing the control variable and *N* is greater than *M,* the instructions in the loop will not be evaluated. Likewise, if the loop is decreasing the control variable and *N* is lower than *M,* the instructions are not evaluated.

For example, the following loop iterates through the instructions a total of 5 times:

```
For Value1 = 1 To 5 Begin
   { EasyLanguage instruction(s) } ;
End;
```

Value1 will start at 1 for the first iteration, then 2, 3, 4, and 5 and before the sixth iteration will exit from the loop since *Value1* will then be greater than 5.

For loops are usually used to look back a specific number of bars. For example, the following loop is used to add the volume of the last 5 bars:

```
Variable: SumVolume(0);

For Value1 = 0 To 4 Begin
      SumVolume = SumVolume + Volume[Value1];
End;
```

Notice that this loop also uses the control variable as the bar offset for the reserved word *Volume*, as highlighted in gray. Also, since we want to consider the volume of the current bar (*Volume[0]*), we use the values 0 to 4 for our loop, instead of 1 to 5 as we did in the previous example. This is a common and effective practice.

You can terminate the loop early by modifying the value of the control variable. Using the previous example, if you want to stop the summation once it reaches 500,000, you can use the following instructions:

```
Variable: SumVolume(0);

For Value1 = 0 To 4 Begin
    SumVolume = SumVolume + Volume[Value1];
    If SumVolume > 500000 Then
        Value1 = 5;
End;
```

For loops are used in many of the default trading strategies, analysis techniques, and built-in functions in TradeStation. Among the most common are the built-in functions (e.g., *Average*, *Summation*, *Highest*, *Lowest*, *MRO)*.

Writing Alerts

When creating analysis techniques in TradeStation, you have the option of enabling an audio or visual alert, as well as e-mail and/or pager messaging. You can use a single alert notification method or a combination. When an alert is triggered, the alert is logged in the TradeStation Message Center and a dialog box appears, as shown in Figure 2-3. A notification sound is also played at the same time.

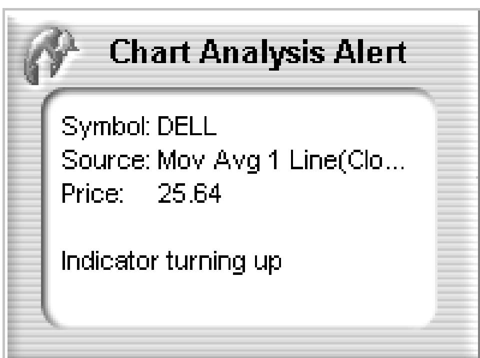


Figure 2-3. Alert Dialog Box

The dialog box displays the name of the symbol, the name of the analysis technique, the price of the symbol at the time the alert was triggered and a description of the alert. All this information is also logged in the Message Center.

To include an alert in an analysis technique, you use alert statements. The alert description that is displayed is written into the EasyLanguage alert statement, contained within the analysis technique that triggered the alert.

You can include alert statements in:

- Indicators
- ShowMe studies
- PaintBar studies
- ActivityBar studies
- ProbabilityMap studies

You can use any of the reserved words described in this section with indicators and studies. When the EasyLanguage criteria is met on the last bar in the price chart, an alert is triggered.

Alerts are only triggered if the **Enable Alert** check box is selected for an indicator or study. The **Enable Alert** box is located on the Alerts tab on the **Format [Analysis Technique]** dialog box.

It is very important to remember that the criteria specified by the alert statement(s) must be met on the last bar of the price chart. Historical instances of alerts are not logged in the Message Center, nor is the **Alert** dialog box displayed.

Alerts can be thought of as a switch that can be turned on or off throughout the analysis technique by using different statements. Once all instructions are read, the final state of this switch determines if the alert is triggered or not.

For example, say that the fourth line of an indicator triggers an alert; however, the very last line of the indicator is a statement that disables the alert. In this case, the indicator will not trigger an alert.

Alerts are not triggered at the moment they are read, but after all the EasyLanguage statements have been analyzed for the last bar of the price chart. This gives you the ability to enable and/or disable an alert based on changing market conditions.

Following are the alert-related reserved words you'll be using to include alerts in your indicators and/or studies.

Alert

This reserved word triggers an alert and enables you to provide a description of the conditions that triggered the alert.

Syntax:

```
Alert("Description") ;
```

Description is any user-defined text string. You use the text string to provide information about the alert such as the market conditions that triggered it. This text string appears in the **Alert** dialog box (shown in Figure 2-3) and in the Message Center. You do not have to provide a description, in which case the **Alert** dialog box and the description for the alert entry in the Message Center are left blank.

If you include more than one Alert statement in your indicator or study, and more than one alert is triggered, the description included with the last alert triggered is the description shown. For example, assume the following indicator is applied to a price chart:

```
Plot1(Average(Close, 10), "Avg");

If Close Crosses Over Plot1 Then
   Alert("Price crossed over average");

If Volume > Average(Volume,10) Then
   Alert("Volume Alert");
```

If on the last bar of the price chart both conditions are true, both alerts are evaluated. In this case, only one alert is actually triggered and logged, and it will have the last description, which in the above example is the alert with the description "Volume Alert".

Cancel

This reserved word is used to cancel an alert; it turns off any alerts triggered during the current bar.

Syntax:
`Cancel Alert`

For example, if you write an indicator with two alert criteria, but you only want the alert to be triggered after 11:00am, you can use the following statements:

```
If Close Crosses Over Average(Close,10) Then
   Alert("Average Cross Over");

If Volume > Average(Volume, 10) Then
   Alert("Volume Spike");

If Time <= 1100 Then
   Cancel Alert;
```

If an alert is triggered by either one of the Alert statements, it is turned off by the Cancel Alert statement unless it is after 11:00am. Once it is after 11:00am, the alert is triggered when either Alert statement is true.

CheckAlert

This reserved word determines whether or not the current bar is the last bar on the price chart and whether or not the alert is enabled for the indicator or study.

When the alert is enabled and it is the last bar on the chart, this reserved word returns a value of True. This reserved word will return a value of False for all other bars on the price chart, and on the last bar of the price chart if the alert is not enabled.

This allows you to optimize your indicators and studies for speed; you can have the indicator or study skip all statements relating to the alert unless it is the last bar of the price chart and the alert is enabled.

Syntax:
`CheckAlert`

For example, the following statements can be used to trigger an alert when the volume is twice the average volume, and to display the ratio between the current volume and the average. Because *CheckAlert* is used, the calculations are ignored for all historical bars as well as when the alert is not enabled.

```
If CheckAlert Then Begin
   Value1 = Volume / Average(Volume, 10);
   If Volume >= 2 * Average(Volume, 10) Then
      Alert ("Volume is" + Value1 );
End ;
```

***Note**: Using* CheckAlert *in an IF-THEN statement to optimize your analysis technique is effective; however, even when the statements that follow are ignored, the indicator or study still takes into account the statements in order to determine the number of bars necessary for the indicator or study to perform its calculations (*MaxBarsBack*), and any series functions are calculated. Refer to the section "Using Alert Compiler Directives" on page 38 for information on other reserved words you can use to have the statements ignored completely.*

AlertEnabled

This reserved word returns a value of True when the alert is enabled for the indicator or study applied to a price chart (and False when it is not). This allows you to optimize the indicator or study for speed; the statements after this reserved word are evaluated only when the alert is enabled.

The difference between this reserved word and the *CheckAlert* reserved word is that *AlertEnabled* returns a value of True for all bars when the alert is enabled whereas *CheckAlert* returns a value of True only for the last bar on the chart.

Syntax:
`AlertEnabled`

For example, the following statements calculate a cumulative advance/decline line and an alert is triggered when the cumulative advance/decline line hits a 50-bar high:

```
If AlertEnabled Then Begin
   If Close > Close[1] Then
      Value1 = Value1 + Volume
```

```
        Else
            Value1 = Value1 - Volume;

        If Value1 > Highest(Value1,50)[1] Then
            Alert("New A/D line high");
    End;
```

In this example, the advance/decline line will only be calculated if the alert is enabled, and it will be calculated for all bars on the price chart, not just the last bar.

***Note**: Although the statements that follow this reserved word are sometimes ignored, the indicator or study still takes into account the statements when it determines the number of bars necessary for the indicator or study to perform its calculations (*MaxBarsBack*), also any series functions within the statements are calculated. See the section "Using Alert Compiler Directives" on page 38 for information on additional reserved words you can use to have the statements ignored completely.*

Using Alert Compiler Directives

These reserved words are compiler directives that cause your indicator or study to completely ignore the statements that follow the reserved word unless the alert is enabled for the indicator or study. The indicator or study will not take into account the statements following these words when it determines the number of bars necessary to perform its calculations (*MaxBarsBack*), nor will any series functions within the statements be calculated.

#BeginAlert

The statements between this compiler directive (*#BeginAlert*) and the reserved word *#End* are evaluated only when the alert is enabled for the analysis technique. You must use the reserved word *#End* with this reserved word.

Syntax:

```
#BeginAlert ;
   {EasyLanguage instruction(s) } ;
#End ;
```

For example, an indicator that calculates the 10-bar momentum of the closing price needs ten bars in order to start plotting results. However, if an alert is added to this indicator and the alert uses a 50-bar average of the volume, then the bar requirement is upped to fifty. However, the 50-bar average is only used for the alert calculations, so there is no need to have the indicator *wait* fifty bars before returning results unless the alert is enabled.

Therefore, to have the indicator plot results after ten bars and ignore the 50-bar requirement, use *#BeginAlert* in your indicator, as follows:

```
Plot1(Close - Close[10], "Momentum") ;

#BeginAlert ;
  If Plot1 Crosses Over 0 AND Volume > Average(V, 50)* 2 Then
      Alert("Momentum is now positive") ;
#End ;
```

The above indicator plots the momentum and triggers an alert if the momentum becomes positive while experiencing volume that is greater than twice the 50-bar average. When the indicator is applied without enabling the alert, it requires only ten bars to start calculating. When the alert is enabled, the indicator is recalculated; the statements within the compiler directives are evaluated and the new requirement is 50 bars.

#BeginCmtryOrAlert

When the commentary and alert statements are intertwined, and the commentary and alert statements are not necessary for the normal plotting of the indicator or study, use the reserved word *#BeginCmtryOrAlert*. The statements between this compiler directive and the reserved word *#End* are evaluated only when either commentary is generated or the alert is enabled. You must use the reserved word *#End* with this reserved word.

Syntax:

```
#BeginCmtryOrAlert ;
   {EasyLanguage instruction(s) } ;
#End ;
```

For example, the following indicator plots the 10-bar momentum of the close, and triggers an alert when the momentum becomes positive while experiencing volume that is greater than twice the 50-bar average. In addition, commentary is written to help point out the market conditions bar by bar.

```
Plot1(Close - Close[10], "Momentum");

#BeginCmtryOrAlert ;
   If Plot1 > 0 Then
      Commentary("Momentum is positive, ")
   Else
      Commentary("Momentum is negative, ");

   If Volume > Average(Volume, 50) Then Begin
      Commentary("and volume is greater than average.");
      If Volume > Average(Volume, 50) * 2 Then
         Alert;
```

```
        End
        Else
           Commentary("and volume is lower than average.");
     #End ;
```

Understanding Arrays

Arrays are variables that store multiple values simultaneously. Think of an array as being like a spreadsheet, which has a predetermined number of cells. For example, an array called *MyArray* that has 6 cells (which in an array are called elements) will look like a one-column spreadsheet document, as shown in Figure 2-4.

0	2
1	3
2	5
3	0
4	4
5	3

Figure 2-4. Array with one dimension

The example array in Figure 2-4 is said to have one dimension and 6 elements; you reference the information in the array using one number. For example, in the above array, element 1 contains a value of 3, and element 2 contains a value of 5.

However, you can define arrays with multiple dimensions. For example, you can define a two-dimensional array, which will look like multiple rows and columns in a spreadsheet document, as shown in Figure 2-5.

	0	1	2	3
0	980301	1400	100.25	1000500
1	980503	1200	105.5	1554000
2	980812	1105	98.75	1238900
3	981209	1015	95.625	2103200
4	990225	1345	101.75	1980300
5	990511	955	103.125	2103700
6	990725	1540	105.375	1600300

Figure 2-5. Array with two dimensions

In this case, you use two numbers to reference each element [row, column]. For example, the illustration above shows a two-dimensional array containing 27 elements. Element [1, 0] contains the value 980503, and element [5, 2] contains the value 103.125.

Or, you can define an array with three dimensions, which we can envision as looking more like a cube, with rows, columns, and multiple layers. To reference the element of a three dimensional array, you'll use three numbers (e.g., element [1,0,1]).

You can define an array with up to 10 dimensions. It is hard to envision an array with more than three dimensions, let alone 10 dimensions; instead, just understand that to reference an element in a 4-dimensional array, you'll need to specify four numbers (e.g., element [2, 1, 1, 3]) and to reference an element in a 10-dimensional array, you'll need to specify 10 numbers (e.g., element [1, 3, 6, 1, 0, 4, 5, 2, 1, 1]). The numbers are the address where a value is stored.

Like variables, arrays are place holders that can hold values, although instead of being able to hold only one value, they can hold as many values as the number of elements they have available.

Arrays are used for many different purposes, the most common being to store information about relevant market conditions during the analysis of price data—to store information about what happened during previous bars.

For example, Figure 2-5 illustrates a multi-dimensional array with four columns and seven rows that was used to store information on seven different bars; each row corresponds to a bar, and each column corresponds to a piece of information for that bar (date, time, price, and volume for each bar).

Arrays can store either numeric, true/false, or text string expressions, but they can only store one type of expression at a time. Also, the values in all elements of the array are carried forward from bar to bar.

When working with arrays, you declare an array, assign values to the elements of the array, and reference the values of the elements within an array. How to do each is discussed next.

Declaring Arrays

Before you can use a name as an array, you must 'tell' EasyLanguage that the name is to be used as an array; this is known as *declaring* the array(s). To declare an array, you use an Array Declaration statement. When you declare an array, you also specify the array's dimensions (and the number of elements in each dimension), and the initial value for all the elements.

Syntax:

```
Array: MyArray[M](N);
```

MyArray is a user-defined name for the array, which can be a total of 20 characters in length, *M* is a number (or numbers) specifying both the dimensions of the array and the number of elements in each dimension, and *N* is the initial value of all the elements in the array.

For example, the following statement declares a one-dimensional array with a total of 6 elements:

```
Array: MyArray[5](0);
```

The array called *MyArray* will have elements 0, 1, 2, 3, 4, and 5. The elements in this array will start with a value of zero (0).

The following Array Declaration statement declares a 3-dimensional array with a total of 726 elements:

```
Array: MyBigArray[10, 10, 5](0);
```

The array *MyBigArray* will hold a maximum of 726 elements (11x11x6) and all elements will begin with a value of zero (0).

Once declared, the size of the array cannot be changed; whatever dimensions the array is created with will be constant throughout the EasyLanguage trading strategy, analysis technique, or function.

You cannot use inputs, variables, or any other numeric expressions when defining the size of the array in the Array Declaration statement. You must use a numeric literal (i.e., a number).

Arrays can hold all three types of EasyLanguage expressions: numeric, true/false, and text string. In order to create arrays that hold each different type of expressions, set the initial value of the elements using the desired type of expression. For example, to create an array that holds true/false values, you can use the following Array Declaration statement:

```
Array: MyTFArray[10](False);
```

The above statement creates a single dimension array with a total of 11 elements, all of which are set to False to begin with. Likewise, to create an array that will contain text string expressions, you can use the following statement:

```
Array: MyTextArray[10]("");
```

Assigning Values to Elements in an Array

Once you have declared your arrays(s), you can assign values to the elements in the array at any point in your trading strategy, analysis technique, or function.

Syntax:

```
MyArray[M] = EasyLanguage expression ;
```

MyArray is the name of the array and *M* is a numeric expression representing the element in the array to which you are assigning the value. *EasyLanguage expression* is the value that you are assigning to the element.

For example, the following statement assigns a value of 10 to element 5 of the one-dimensional array called *MyArray*:

```
MyArray[5] = 10 ;
```

The following instructions store the closing prices and volume for each of the last 10 bars in a two-dimensional array:

```
Array: MyArray[9, 1](0) ;

For Value1 = 0 To 9 Begin
   MyArray[Value1, 0] = Close[Value1] ;
   MyArray[Value1, 1] = Volume[Value1] ;
End ;
```

Loops are often used to populate arrays. In the above instructions, an array called *MyArray* is declared. It is a two-dimensional numeric array, with a total of 20 elements, all of which are initialized to a value of 0.

The loop uses the pre-declared variable *Value1* as the control variable, and the loop will iterate through the instructions 10 times (0 to 9). On the first iteration, the close of the current bar (*Close[0]*) is assigned to *MyArray[0,0]*, and the volume of the current bar (*Volume[0]*) is assigned to *MyArray[0,1]*. *Value1* is incremented to 1 for the second iteration through the loop, so now the close and volume of one bar ago are stored in the array, in *MyArray[1, 0]* and *MyArray[1,1]*, respectively. Again, this loop iterates a total of 10 times, and the result is that the closing prices and volume for the current and previous 9 bars are stored in the array, for reference at any time.

Referencing Values of Array Elements

Once you have declared an array, and you have assigned values to elements in the array, you can reference the values of the elements by using the name of the array and the element number in place of the numeric, true/false, or text string expression.

For example, the following statement assigns the value held in element 10 to the numeric variable *Value1*:

```
Value1 = MyArray[10];
```

Also, arrays can be used wherever an expression can be used. For example, you can plot the value held in element 0 of an array:

```
Plot1(MyArray[0]);
```

Or, you can use the true/false value of an element in an array as the true/false expression in an IF-THEN statement:

```
If MyConditionArray[7] Then
   {EasyLanguage instruction } ;
```

You can also reference the previous value of an array. For example, the following statement references the value that element 5 of an array called *MyArray* held 10 bars ago:

```
Value1 = MyArray[5][10];
```

It is important to keep in mind the size of the array because the application to which you've applied the trading strategy or analysis technique will generate a runtime error and turn off

the analysis technique if you reference or assign a value to an element that does not exist in the array.

For example, the indicator below uses a loop to reference element 11 in an array that only has elements 0 through 8, the application to which you applied the indicator will generate a runtime error and turn off the indicator:

```
Array: MyArray[8](0);

For Value1 = 1 To 11 Begin
   MyArray[Value1] = Value1;
End;
```

Advanced Tip: "Working with Series Arrays"

As a memory optimization, EasyLanguage automatically determines if a prior value of any element of an array is accessed at any point in the trading strategy, analysis technique, or function, and then, if required, stores the historical values for the array. EasyLanguage stores only as much history as it needs to fulfill the MaxBarsBack setting. For example:

```
Value1 = MyArray[5][10] * 1.05;

Value2 = MyOtherArray[6] - Value1 ;

Plot1( Value2 );
```

The indicator stores all the prior values of MyArray*, given that a historical value of the array is referenced in the first line. The variable* Value2 *and* MyOtherArray *are both simple, thus historical values for this variable and array are not stored.*

In other words, arrays can be either series or simple structures. This is important when you want to access the values of array elements from third-party languages through DLLs because depending on the state of the array, there will be more or less historical data stored than you require. In this scenario, you can force an array to be a series array by referencing a previous value of an element in the array in your trading strategy, analysis technique, or function (i.e., by using a 'dummy' statement). Or, you may want to consider working with functions; you can force a function to be a series function. Refer to the next section in this chapter titled, "Understanding User Functions" on page 44 for more information.

Understanding User Functions

A user function is a defined set of instructions that you reference by name, and that return a value. The value returned by functions can be numeric, true/false, or text string, and you can use functions in any part of a statement that requires a value.

For example, in trading, it is very common to calculate the range of a bar (the high minus the low). Every time EasyLanguage users need to calculate the range of a bar, they don't need to write out the expression *(High - Low)* because EasyLanguage provides a function

called *Range.* Whenever you need the calculation for the range of a bar, you can use the EasyLanguage user function *Range* instead of writing out the expression. *Range* is one of the simplest functions available in EasyLanguage; there are hundreds of functions available for your use, plus you can write your own.

Another concept you need to understand when working with functions is the concept of parameters. When necessary, user functions are written with parameters (also referred to as inputs or arguments). Parameters allow the person using the function to provide pieces of information that the function needs to perform its calculations.

For example, the user function *Average* is written with a parameter called *Length*. Therefore, instead of having one function for a 10-bar average, another for a 12-bar average, and another for a 15-bar average, etc., there is only one *Average* user function, and the user can specify the number of bars the function will use to calculate the average.

Also, creating a function to calculate the average of the close, another for the average of the open, another of the average of the volume, etc. would be very inefficient. Therefore, the *Average* function also has a parameter called *Price* which enables the user to specify the price or data that will be averaged.

The following statement calculates the average of the closing prices of the last 10 bars and assigns the result to the variable *Value1*:

```
Value1 = Average(Close, 10);
```

The parameters for user functions are enclosed in parentheses after the function, and each parameter is separated by a comma. Depending on the function, parameters can be required or optional. Parameters are discussed in detail in “Understanding Parameters and Parameter Types” on page 52.

Using Existing Functions

For your convenience, the EasyLanguage PowerEditor provides the EasyLanguage Dictionary—which is a tool that lists all the EasyLanguage reserved words and existing user functions, grouped by category. The EasyLanguage Dictionary allows you to browse and/or search through the list of words and functions, and provides definitions for reserved words and functions. You can access the EasyLanguage Dictionary through the **Tools - EasyLanguage Dictionary** menu sequence from any EasyLanguage PowerEditor Document.

TradeStation is provided with a vast library of built-in user functions, which range from commonly-used industry calculations (e.g., ADX, DMI, CCI) to common mathematical and statistical operations (e.g., AbsValue, Sine, Square). Whenever you need to perform a calculation, instead of writing the calculation yourself in EasyLanguage, first use the EasyLanguage Dictionary’s **Find** feature to search for an existing function that will perform the calculation. You can also use the functions as a reference or learning tool when writing your own functions.

If you are not sure if a function will do exactly what you want, highlight the function in the EasyLanguage Dictionary and click the **Definition** button for a description of the user function and its usage.

The EasyLanguage Dictionary is an indispensable reference that you will be using often as you work with EasyLanguage.

Referencing Previous Values of Functions

You can reference the values of functions on previous bars. For example, the following statement refers to the value of the 10-bar average of the volume one bar ago:

```
Value1 = Average(Volume, 10)[1];
```

In the above example, the function itself is being offset.

Using Previous Values as Parameters

You can also offset the value that you pass as the parameter. For example, you can also write the following statement:

```
Value1 = Average(Volume[1], 10);
```

What is offset is the value that is passed into the function as the parameter, not the function itself. In the above example, the function will use the previous bar's volume to perform the calculation. In this instance, the results are the same for both of the above statements. However, the difference in the results can be significant depending on the calculation being performed.

For example, suppose there is a function called *OpenDiff* that calculates the difference between the open of the current bar and the value passed to the function through the parameter. The function takes the value passed and subtracts it from the open of the current bar using the following formula: *OpenDiff* = *Open* - *Price* where *Open* is the opening price of the bar and *Price* is the parameter for the function. Assume you write the following statement:

```
Value1 = OpenDiff(Close)[1];
```

EasyLanguage obtains the value of the function on the previous bar. The value returned is equal to the open of the previous bar minus the close of the previous bar. However, assume you write the following statement instead:

```
Value1 = OpenDiff(Close[1]);
```

The function will subtract the close of the previous bar from the open of the current bar, yielding a completely different result than the previous statement.

Using Data Aliases

When applying a trading strategy or analysis technique to a price chart, the procedure is applied to a *data stream*.

By default, all trading strategies and analysis techniques are based on the data stream to which the procedure is applied and all calculations default to using the data from it. However, you can refer to any available data stream.

For example, you can apply an indicator to a price chart of IBM and MSFT that references both symbols.

To refer to a data stream other than the one to which the trading strategy or analysis technique is applied on a chart, you add the data alias *of dataN* after the function. For example, the following statement calculates the 20-bar average of the close of the second symbol in a price chart even though the indicator is applied to the first symbol:

```
Value1 = Average(Close, 20) of data2 ;
```

For example, when an indicator is applied to a stock that is plotted as Data1, and the second data stream is the Dow 30, the indicator can calculate the 10-day average volume of the Dow 30 and incorporate this calculation into the analysis of the stock. The statement would be written as follows:

```
Value1 = Average(Volume, 20) of data2 ;
```

Again, when no data alias is specified, EasyLanguage assumes the function is meant to be based on the data stream to which the procedure is applied. So, if an indicator is applied to a price chart that has three stocks, and the following statement is used in an indicator:

```
Value1 = Average(Volume, 20);
```

...the average of the volume will be calculated based on the symbol to which the indicator is applied.

***Note**: When formatting the indicator on a price chart, under the **Data** tab there is an option to choose what symbol the indicator is based on, as shown in Figure 2-6. This selection displays the data stream to which the indicator is currently applied.*

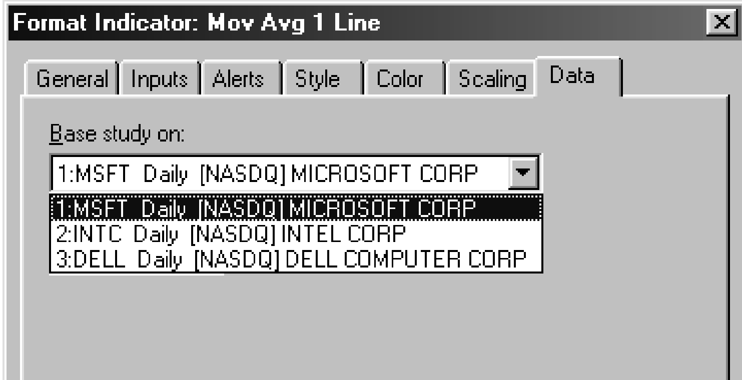


Figure 2-6. Indicator Properties tab

When working with price charts, you can also base only the parameter for a function on another data stream as opposed to the entire function. Consider the following statement:

```
Value1 = Average(Volume of data2, 10);
```

In the above statement, the data alias is used in the parameter of the function.

As with bar offsets, the difference between using a data alias for the entire function versus the parameter is subtle, but it can result in significantly different results depending on the calculation being performed.

For example, let's use the function we used earlier to discuss bar offsets, *OpenDiff*. This function calculates the difference between the open of the bar and a value passed to the function. The function subtracts the value from the open of the current bar: *OpenDiff = Open - Price*. Assume we write the following statement:

```
Value1 = OpenDiff(Close) of data2;
```

EasyLanguage bases the entire calculation of the function on the second data stream; it uses both the open and the close of the second data stream, and it returns the difference. Now, assume we rewrite the statement as follows:

```
Value1 = OpenDiff(Close of data2);
```

The function is based on the first data stream, but will calculate the *OpenDiff* function using the open of the current bar of data1 and the close of the current bar of data2. The value returned would be the value of the first data stream's open minus the second data stream's close.

Writing User Functions

The only statement required in a function is the one that specifies what value the function will return. This statement is called the Function Value Assignment statement, and it consists of the name of the function followed by an equal to sign (=) and then the expression representing the value of the function.

For example, if there is a function called *One* that returns the numeric value 1, all the function needs is the statement:

```
One = 1;
```

Likewise, a function named *HigherHigh* that returns true if the current bar's high is greater than the previous bar's high can be written using the following statement:

```
HigherHigh = High > High[1];
```

The value of True or False is assigned to the function *HigherHigh* by means of the Function Value Assignment statement, and this value is returned as the value of the function.

Or, a function called *TenBarAvg* that calculates the 10-bar average of the volume using a For loop would look like this:

```
Value2 = 0;
For Value1 = 0 To 9 Begin
    Value2 = Value2 + Volume[Value1];
End;
TenBarAvg = Value2 / 10;
```

A function can return a numeric, true/false, or text string value. You specify what type of value the function will return when you create the function or format its properties in the EasyLanguage PowerEditor, as shown in Figure 2-7.

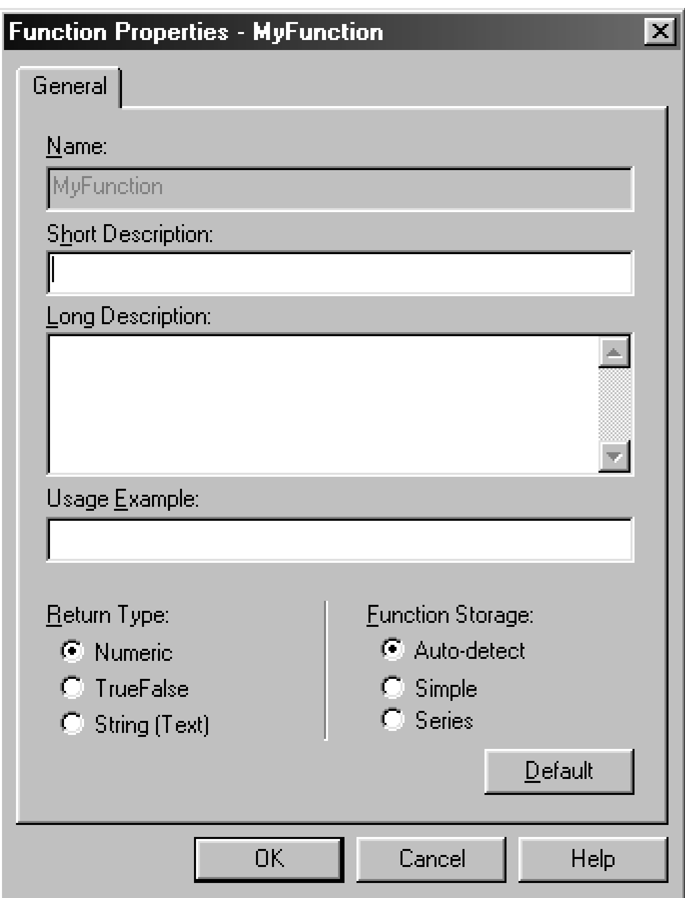


Figure 2-7. Function Properties in the EasyLanguage PowerEditor

Any of the EasyLanguage components explained in this chapter; for example, IF-THEN statements, loops, variables, arrays, math and relational operators, and even other EasyLanguage functions can be used to perform calculations within an EasyLanguage function, and once you calculate the desired resulting value, you assign the value to the function name using a Function Value Assignment statement.

Understanding Function Types: Simple & Series

Most functions are *simple functions*. These functions perform a calculation and return a value. However, some functions are *series function*s. Series functions reference previous val-

ues of the function itself, variables and/or arrays within the function. When the function includes counters and accumulation operations from bar to bar, they are series functions.

Using a previous value of the function within the function itself is a commonly used technique, and in fact, many industry standard indicators—exponential averages, ADX, MACD—use this technique. Let's look at the considerations involved with each type of function.

Simple Functions

Simple functions cannot refer to previous values of the function itself, or previous values of any variables or arrays declared in the function when performing its calculations.

Simple functions require less memory and calculate faster than series functions. This is because the resulting values of these functions, and all their variables and arrays, are not calculated and stored on a bar by bar basis. These functions are calculated only when they are called by the trading strategy or analysis technique.

The built-in function called *Summation* is included in TradeStation and is an example of a simple function. It is shown below:

```
Inputs: Price(NumericSeries), Length(NumericSimple) ;
Variables: Counter(0), Sum(0) ;

Sum = 0 ;

For Counter = 0 To Length - 1 Begin
    Sum = Sum + Price[Counter];
End;

Summation = Sum ;
```

Even though the function references previous values of a parameter (*Price*), it is a simple function because it does not reference previous values of itself, or of any variables or arrays.

Series Functions

A series function can refer to previous values of itself, or previous values of any variables or arrays declared in the function when performing its calculations. Series functions are executed on a bar by bar basis even if the function is not explicitly called on each bar. When variables or arrays are used as parameters, the series functions are calculated each and every time they are called. Otherwise, the function is calculated once per bar, at the end of the procedure.

To illustrate why series functions are executed on each bar, let's look at the *BarNumber* function, which is included in the EasyLanguage PowerEditor. This function counts the number of bars that have passed since the trading strategy or analysis technique started its calculations. This function is written using only one statement, as follows:

```
BarNumber = BarNumber[1] + 1;
```

To obtain the current bar's value, this function will read the value of itself from one bar ago, and add one to that value. This way the function will keep a running total of the number of bars. Assume we use this function in an indicator, as follows:

```
If Close > Open Then
      Plot1( BarNumber );
```

Following is a table that illustrates the first eight bars of a chart.

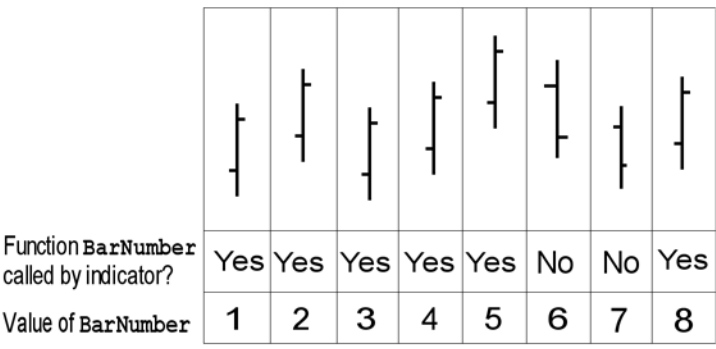


Figure 2-8. Series function example - BarNumber

As seen in Figure 2-8, the function is called during bars one through five (because the close is greater than the open) yet the condition necessary to call the function is not true for bars six and seven. If the function were not calculated during those bars, it could not increment its value to keep an accurate count of the bar number. Furthermore, if on bar eight, the function referred to *BarNumber[1],* it would not be clear to what value the function is referring.

Again, if a series function is not called on a specific bar, it is executed at the end of the procedure in order to perform the calculations and store all values—of the function itself and any variables and/or arrays in the function—for later reference by the function itself.

Also, if the same series function is called two or more times in a bar using the same parameters, and the function does not use variables or arrays as parameters, then the function is only calculated once per bar, and the value resulting from this initial calculation is used for the other times the function is called (to maximize calculation speed). However, if a function uses a variable or array as a parameter, or has different parameters, then the function is calculated each and every time it is called within the bar. For example, assume you wrote the following indicator:

```
MyValue1 = MySeriesFunction(Close, 25);
MyValue2 = MySeriesFunction(Close, 25);

MyValue3 = 10;
If Condition1 Then
   Value1 = XAverage(Close, MyValue3);
```

```
MyValue3 = 20;
If Condition2 Then
   Value1 = XAverage(Close, MyValue3);
```

The first two lines call the same series function, and they do not use variables or arrays as parameters; therefore, the function *MySeriesFunction* is calculated only once and the value is assigned both to *MyValue1* and to *MyValue2*.

However, the function *XAverage* uses a variable as a parameter; therefore, the function is calculated twice each bar. This is to make sure that the function is calculated with the most current value of the variable that is used as the parameter. In the above example, the value stored in *MyValue3* does indeed change for the second calculation of the function. Parameters are discussed in detail in the next section.

Also, when you're receiving data and have the **Update on every tick** option enabled for an analysis technique, EasyLanguage evaluates the analysis technique as well as any series functions that are referenced by the analysis technique for each new tick. To keep accumulated values accurate, each time a new tick is received, all variables, arrays and function values are "pushed-back" to their values from the previous bar, and the calculation based on the most recent tick is performed. This ensures that the analysis techniques and functions perform their calculations as though each tick were the last tick of the bar.

Advanced Tip: Speeding Up Calculation Time

When you use a series function as a parameter for a simple function, and that particular parameter is used repeatedly throughout the simple function, the calculation time for the trading strategy or analysis technique can increase noticeably. This situation produces an increase in overhead because the series function must be calculated each time that the simple function is referenced. To avoid this situation, assign the series function to a variable and then use the variable as the parameter for the simple function. This simple adjustment eliminates the overhead, since the series function is only called once, when it is assigned to the variable.

Understanding Parameters and Parameter Types

Many functions are written such that they ask you provide certain information to them when you use them. You provide information to a function by means of parameters.

There are three types of parameters: *numeric*, *true/false*, and *text string*:

- **Numeric** - When a parameter is defined as numeric, the user of the function can pass any number (e.g., 5, 10, or 100) or numeric expression as the parameter into the function. This parameter will be used within the function as a numeric expression.
- **True/false** - When a parameter is defined as true/false, the user of the function can pass any true/false expression (or the words True or False) as the parameter into the function. These parameters can then be used within the function as a true/false expression.

- **Text string** - Text string parameters allow the user of the function to pass any text string value (e.g., “ABC”) or text string expression as a parameter into the function. These parameters can then be used within the function as a text string expression.

Like the function itself, a parameter can be of subtype *simple*, *series*, or it can be of another subtype, type *reference*. Each subtype is described next.

Simple Parameters

Simple parameters are constant values that are set in the trading strategy or analysis technique that calls the function. Simple parameters require less memory and improve speed. They retain their values within the function; simple parameters cannot have values assigned to them within the body of the function.

When the user is expected to provide a number, for instance (i.e., 10, 15, or 20), you should define the parameter as numeric simple. For example, the *Average* function provides a parameter called *Length*, which enables you to specify the number of bars to use when calculating the average. Since this number does not change from bar to bar (it is a fixed number such as 9, 18, or 50) there is no need to store previous values of it. Therefore, to improve speed and memory usage of the function, *Length* is defined as a *numericsimple* parameter.

When the function calls for a simple parameter, the user can supply any value, function, variable, or array.

Series Parameters

Like simple parameters, series parameters are constant values that are set in the trading strategy or analysis technique that calls the function. However, when the function refers to previous values of the value you use as the parameter (e.g., *Value1*, *Condition1,* or *Close)*, then this parameter must be defined as a series parameter.

The values of series parameters are stored for each bar, and current and historical values are accessible from within the body of the function. This allows the function to refer to the previous bar’s value of the parameter (regardless of whether the function itself is of type simple or series). Series parameters consume more memory and impact the speed of your calculations to some extent, but they are needed to refer to historical values of the parameter.

For example, the *Average* function provides a parameter called *Price,* which enables you to specify what value is going to be averaged. To calculate a 10-bar average of the close, the function will need to access the last 10 closing prices of the symbol; therefore, the parameter *Price* is defined as a *numeric series* parameter.

However, series parameters cannot have values assigned to them within the body of the function. When the function calls for a series parameter, the user can supply any value, function, variable, or array.

Reference Parameters

Parameters can be passed by value or by reference. When the parameter passes information by value, as is the case with simple and series type parameters, the function creates a copy of the information passed into it, and whatever is done with the parameter in the function does not affect the value of the parameter within the trading strategy or analysis technique that called the function.

However, when information is passed by reference, the function uses the original information from the trading strategy or analysis technique that called the function, and any calculations the function performs on the parameter are reflected in the value of the parameter within the trading strategy analysis technique that called the function as well as within the function.

This is best visualized using an example. Suppose that you have added a picture to a word processor document. If a picture is added by value, a copy of the picture is created in the word processor document. If the original picture is modified, the picture in the word processor document remains unchanged, and vice versa.

However, if the picture is inserted by reference, the document uses the original picture, and if the picture is modified in the word processor document, the original picture is modified as well. Also, if the original picture is modified, the picture in the word processor document reflects the change.

When a parameter passes information by value, it can be either *simple* or *series*. When it passes information by reference, it must be of type *reference*. You can use variables, functions, and arrays when the function calls for reference parameters.

When a variable is passed by reference, the function will use the variable from the analysis technique that called the function, so any operations the function performs on the parameters will be reflected in the variable in the or analysis technique as well as in the function.

For example, suppose there is an indicator that calculates two numbers representing the upper and lower values of a channel. Instead of creating two functions, one to calculate the upper band and one to calculate the lower band, a function can accept two variables by reference. Then, the function can calculate these two values and assign the result to each one of the variables passed by reference. Once the function is called, the variables in the indicator will have the values corresponding to the upper and lower bands.

Figure 2-9 shows the EasyLanguage for the *Bands* Indicator. The function we wrote to calculate the two bands is called *MyBands*. Notice how the variables for the indicator are also the parameters we passed by reference to the *MyBands* function.

TradeStation EasyLanguage PowerEditor - Indicator: Bands

```
Variables: UpperBand(0), LowerBand(0);

Value1 = MyBands(UpperBand, LowerBand);

Plot1(UpperBand, "UB");
Plot2(LowerBand, "LB");
```

Ln 8, Col 0 | SAVED | VERIFIED

Figure 2-9. Indicator using a function with inputs passed by reference

The *MyBands* function is shown next. This function defines the upper band as the highest high of the last 10 bars, and the lower band as the lowest low of the last 10 bars.

```
Inputs: UpperBand(NumericRef), LowerBand(NumericRef);
UpperBand = Highest(High, 10);
LowerBand = Lowest(Low, 10);
MyBands = 1;
```

Notice that the function assigns a value of 1 to *MyBands*. This is a required statement, and in the indicator, the value (1) is assigned to the variable *Value1*. Remember that every function must contain an assignment statement, and will return the value assigned. However, the purpose of the function in the example is to calculate and assign the values to the *UpperBand* and *LowerBand* variables, and these values *are* used by the indicator.

Given that the values of variables and arrays are stored on a bar by bar basis, reference parameters allow the reference of previous values using bar offsets.

The first line in the above function is an Input Declaration statement, which specifies the parameters that must be supplied by the user when using the function. The next section covers how to declare the parameters when writing a function.

Defining Parameters

As discussed in the previous section, parameters can be of type *numeric*, *truefalse*, or *string*, and they can be of subtype *simple*, *series* or *reference*.

When writing a function, you must define what parameters the function will require from the user of the function. To do so, you use the Input Declaration statement. You can declare multiple parameters (of same or different types) using one Input Declaration statement. For example:

```
Input: MyNumber(NumericSimple);
```

The above Input Declaration statement declares a numeric simple parameter. To define a numeric series parameter, you use:

```
Input: MyNumber(NumericSeries);
```

To define a numeric reference parameter, you use:

```
Input: MyNumber(NumericRef);
```

The prefix determines the type: *Numeric*, *TrueFalse*, or *String*, and the suffix determines the subtype, *Simple*, *Series*, or *Ref*. For example, to define two true/false parameters, one series and one reference, you would use the following Input Declaration statement:

```
Inputs: MyValue(TrueFalseSeries), MyValue1(TrueFalseRef);
```

Or, to define a string simple parameter:

```
Input: MyString(StringSimple) ;
```

***Note**: You can define the parameter as* Numeric*,* TrueFalse*, or* String*, without specifying the subtype. In this case, EasyLanguage automatically detects whether the parameter is simple or series (however, if the parameter is subtype reference, you must explicitly define it as such).*

Working with Arrays

Declaring a parameter as an array is a little different. To declare an array, you must specify whether it is numeric, true/false, or string, that it is an array, and whether or not it is of subtype reference.

Syntax:

```
Input: MyArray[M](Input Type);
```

MyArray is the name of your array, *M* is the expression representing the size and dimensions of the array, and *Input Type* is one of the array parameter types:

- *NumericArray*
- *NumericArrayRef*
- *TrueFalseArray*
- *TrueFalseArrayRef*
- *StringArray*
- *StringArrayRef*

***Note**: The suffix '*Ref*' is used when you are passing the array by reference; those without are expecting an array passed by value.*

When the array used has more than one dimension, use a corresponding list of letters separated by commas. For example, the following Input Declaration statement means the function is expecting a numeric array with three dimensions:

```
Input: MyNumericArray[X,Y,Z](NumericArray);
```

When the array is sent from the trading strategy or analysis technique to the function, these letters (in the above example, the letters X, Y, Z) will take the numeric values corresponding to the size of the array, and you can use the words within the body of the function to work with the array. For example, if a function receives a one dimensional true/false array, the following statements can be used to traverse the array using a For loop:

```
Input: MyArray[M](TrueFalseArray);

Value2 = 0 ;

For Value1 = 0 To M Begin
   Value2 = Value2 + MyArray[Value1] ;
End;
```

Given that the contents of the array are stored for every bar (to allow trading strategies, analysis techniques, and functions to refer to previous values of the array elements), it is possible to refer to previous values of the array.

For example, assume you want the function to refer to a value 10 bars ago of the first element of an array passed into a function, in order to compare it to the current bar's high. To do so, you can use the following statements:

```
Input: MyArray[M](NumericArray);

If MyArray[0][10] > High Then
   { EasyLanguage instruction } ;
```

When an array is passed by value (i.e., when it is not passed by reference), it is not possible to assign or modify the values of the elements of the array. However, the values can be read and used within the body of the function, and you can refer to previous values of the elements.

For example, the following statements make up a function called *MaxValArray*, which will find the maximum value stored in the array (but it doesn't change the values of any of the elements within the array):

```
Input: MyNumericArray[M](NumericArray);

Variable: Result(0);

Result = MyNumericArray[0];

For Value1 = 1 To M Begin
    If MyNumericArray[Value1] > Result Then
       Result = MyNumericArray[Value1];
End;

MaxValArray = Result;
```

When an array is passed by reference, all its values can be modified in the body of the function; any changes made in the function will be reflected in the trading strategy or analysis technique that called the function.

For example, the following statements make up a function called *SortMyArray* that accepts an array and sorts it using the 'bubble sort' technique (i.e., drops the value in the last element of the array, fills each element with the value in the element before it, and places the latest value in the first element):

```
Input: MyArray[N](NumericArrayRef);
Variables: Done(False), Counter(0);

Done = False;

While Done = False Begin
   Done = True;
   For Counter = 0 To N - 1 Begin
      If MyArray[Counter] > MyArray[Counter+1] Then Begin
         Value1 = MyArray[Counter];
         MyArray[Counter] = MyArray[Counter+1];
         MyArray[Counter+1] = Value1;
         Done = False;
      End;
   End;
End;

SortMyArray = 1 ;
```

Notice that a dummy statement is included in the above function (highlighted in gray). The function returns the value 1; however, in this example, the true purpose of the function is the manipulation of the array that you pass by reference. This array is changed by the function, and the change is reflected in the trading strategy or analysis technique that called the function, regardless of the value the function returns.

The following statement calls the function in the above example.

```
Value1 = SortMyArray(MyArray) ;
```

This statement could be included in any trading strategy or analysis technique. Again, in this case, the value stored in *Value1* is of no importance. However, once the function is called, the array *MyArray* is modified (in this case, a value has been added to the array, and the existing elements bubble sorted).

Output Methods

In addition to the conventional means of plotting information, EasyLanguage provides many ways of displaying information about the data being analyzed. Among the most useful methods are Analysis Commentary, the **Print Log** tab (of the EasyLanguage Output Bar), and writing to a file. This section discusses these three alternative output methods.

Working with Commentary

The objective of creating commentary for a trading strategy, analysis technique, or function is to send additional information about the specific price bar selected by the user of the procedure to the Analysis Commentary window. The information sent can

be anything you want; for example, market commentary or debugging messages can be included in commentary text for the user to review. An example of commentary is shown in Figure 2-10.

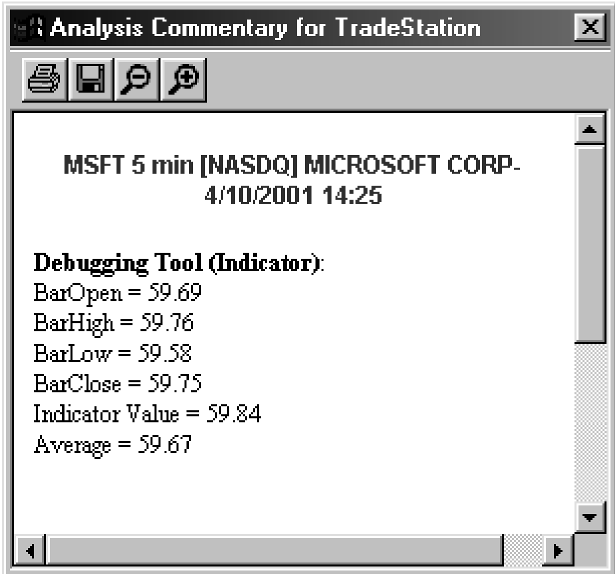


Figure 2-10. The Analysis Commentary window

It is important to remember that when commentary is requested for a bar, the trading strategy or analysis technique is recalculated for the entire chart (similar to turning the status of the trading strategy or analysis technique off and then on). This is needed because due to the optimization routines used by EasyLanguage, certain calculations are only performed when commentary is obtained; therefore, when commentary is requested, these calculations need to be performed from the beginning of the chart.

The reserved words used to work with commentary are described next.

Commentary

This reserved word sends the expression (or list of expressions) to the Analysis Commentary window for whatever bar is selected on the price chart.

You can use this reserved word multiple times, but it does not add a carriage return after the expression or list of expressions.

Syntax:

```
Commentary( MyExpression );
```

MyExpression is the numeric, text string, or true/false expression that is to be sent to the Analysis Commentary window. You can send multiple expressions; they must be separated by commas.

To include a carriage return in your Commentary, use the reserved word *NewLine* as a Commentary expression where needed. You can also use the reserved word *CommentaryCL* instead (discussed next).

For example, the following statements produce the commentary shown in Figure 2-11:

```
Commentary("This is commentary ");
Commentary("written in one line");
```

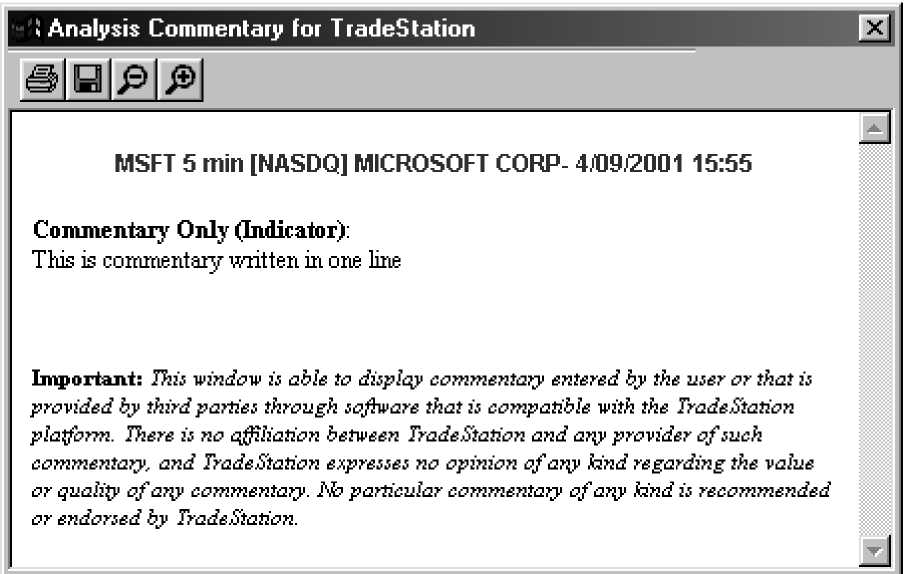


Figure 2-11. Analysis Commentary window

As mentioned above, to include line breaks in the commentary, you need to use the *NewLine* reserved word. For example, the following statements produce two lines of commentary text:

```
Commentary("The 10-bar avg of the close", NewLine);
Commentary(" is:", Average(Close, 10));
```

Also, you can create links in your Commentary text to the Windows Media Player (to play an audio clip) and to definitions in the TradeStation Help. The links are words in your Commentary that appear in a different color and that when clicked, play an audio clip or bring up the specified definition in the TradeStation Help. These words are referred to as *jump words*.

To create a jump word that plays a music (.WAV) file, enclose the complete file name and path of the sound file using the following syntax:

```
\wb<path\filename>\we
```

For example, to link your commentary to the file *c:\ding.wav*, you could write the following statement:

```
Commentary("This links to a file: \wbc:\ding.wav\we");
```

To create a jump word that brings up the existing definition in the TradeStation Help, enclose the word using the following syntax:

```
\pb<word>\pe
```

The Analysis Commentary window uses the HELP_KEY WinHelp API call and retrieves the specified topic from the TradeStation Help. The text string between \pb and \pe is used as the keyword, and " **(Indicator)**" (space, open parenthesis, Indicator, close parenthesis) is appended to the text string. For example, the following syntax retrieved the topic *ADX (Indicator)* from the TradeStation Help.

```
\pbADX\pe
```

Before creating a jump word, make sure the definition exists in the TradeStation Help. To determine that it exists, search the Index. You can create jump words for any index entry that has the suffix or " **(Indicator)**".

CommentaryCL

This reserved word sends the expression (or list of expressions) to the Analysis Commentary window for whatever bar is selected by the Analysis Commentary pointer.

You can use this reserved word multiple times, and it will include a carriage return at the end of each expression (or list of expressions) sent.

Syntax:

```
CommentaryCL( MyExpression );
```

MyExpression is a single or a comma separated list of numeric, text string, or true/false expressions that are sent to the Analysis Commentary window.

For example, the following statements produce the commentary shown in Figure 2-12.

```
CommentaryCL("The close of today is:", Close);

CommentaryCL("The 10-day average of the close is:",
   Average(Close,10));
```

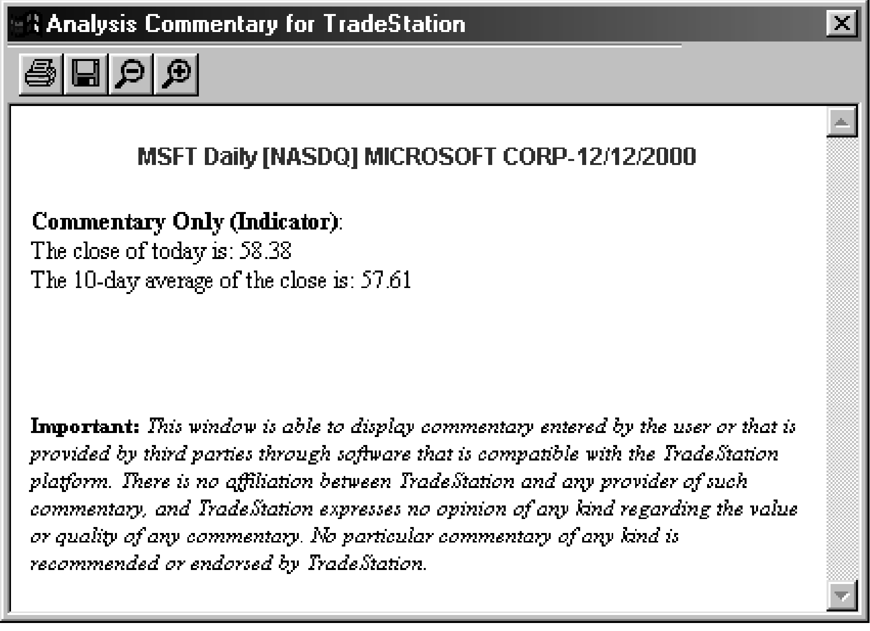


Figure 2-12. Analysis Commentary window

You can also create links in your Commentary text to the Windows Media Player (to play a video or audio clip) using the *CommentaryCL* reserved word. Refer to the discussion of jump words in the description of the *Commentary* reserved word.

AtCommentaryBar

This reserved word returns a value of True on the bar clicked by the user with the Analysis Commentary pointer. It will return a value of False for all other bars. This allows you to optimize your trading strategies, analysis techniques, and functions for speed, as it will allow EasyLanguage to skip all commentary-related calculations for all bars except for the one where the commentary is requested.

Syntax:
`AtCommentaryBar`

The difference between *AtCommentaryBar* and *CommentaryEnabled* (discussed next) is that *CommentaryEnabled* returns a value of True for ALL bars when the Analysis Commentary window is open, while the *AtCommentaryBar* returns a value of True only for the bar clicked with the Analysis Commentary pointer.

For example, the following statements display a 50-bar average of the volume in the Analysis Commentary window but avoids calculating this 50-bar average for every other bar of the chart:

```
If AtCommentaryBar Then
   Commentary("The 50-bar vol avg: ", Average(Volume, 50));
```

***Note**: Although the statements that follow this reserved word are sometimes ignored, the trading strategy, analysis technique, or function still takes into account the statements when it determines the number of bars necessary for the indicator or study to perform its calculations (*MaxBarsBack*), also any series functions within the statements are calculated. See the section "Using Commentary Compiler Directives" on page 64 for information on additional reserved words you can use to have the statements both ignored completely.*

CommentaryEnabled

This reserved word returns a value of True only when the Analysis Commentary window is open and Commentary has been requested. This allows you to optimize your trading strategies, analysis techniques, and functions for speed, as it allows EasyLanguage to perform commentary-related calculations only when the Analysis Commentary window is open.

Syntax:
`CommentaryEnabled`

The difference between *CommentaryEnabled* and *AtCommentaryBar* is that *CommentaryEnabled* returns a value of True for ALL bars when the Analysis Commentary window is open, while the *AtCommentaryBar* returns a value of True only for the bar clicked with the Analysis Commentary pointer.

For example, the following statements calculate a cumulative advance/decline line to be displayed in the Analysis Commentary window:

```
If CommentaryEnabled Then Begin
   If Close > Close[1] Then
      Value1 = Value1 + Volume
   Else
      Value1 = Value1 - Volume;
   Commentary("The value of the A/D line is: ", Value1);
End;
```

***Note**: Although the statements that follow this reserved word are sometimes ignored, the trading strategy, analysis technique, or function still takes into account the statements when it determines the number of bars necessary for the indicator or study to perform its calculations (MaxBarsBack), also any series functions within the*

statements are calculated. See the section "Using Commentary Compiler Directives" on page 64 for information on additional reserved words you can use to have the statements both ignored completely.

Using Commentary Compiler Directives

These reserved words are complier directives that cause your trading strategy, analysis technique, or function to completely ignore the statements that follow the reserved word unless commentary is enabled for the indicator or study. The trading strategy, analysis technique, or function will not take into account the statements following these words when it determines the number of bars necessary to perform its calculations, nor will it calculate any series functions.

#BeginCmtry

When the commentary statements are not necessary for the normal calculation of the trading strategy, analysis technique or function, use this reserved word, *#BeginCmtry*. The statements between this compiler directive and the reserved word *#End* are evaluated only when the commentary is requested. You must use the reserved word *#End* with this reserved word.

Syntax:

```
#BeginCmtry ;
   {EasyLanguage instruction(s) } ;
#End ;
```

For example, an indicator that calculates the 10-bar momentum of the closing price needs ten bars in order to start plotting results. However, if commentary is added to this indicator and the commentary uses a 50-bar average of the volume, then the *MaxBarsBack* setting is increased to fifty. However, the 50-bar average is only used for the commentary, so there is no need to have the indicator *wait* fifty bars before giving results unless Commentary is requested.

To have the indicator plot after 10 bars and ignore the 50-bar requirement, the indicator can be written as follows:

```
Plot1( Close - Close[10], "Momentum");
#BeginCmtry;
   If Plot1 > 0 Then
      Commentary("Momentum is positive, ")
   Else
      Commentary("Momentum is negative, ");
  If Volume > Average(Volume, 50) Then
      Commentary(" and volume is greater than average.")
   Else
      Commentary(" and volume is lower than average.");
#End;
```

This indicator plots the momentum and the commentary states whether the momentum is positive or negative, and if the volume is over or under the 50-bar average of the volume. When the indicator is applied without using commentary, it will require only 10 bars to start calculating. When commentary is requested, the indicator is recalculated, the statements within the compiler directives are evaluated, and the new minimum number of bars required is 50. Any series functions within these reserved words are also ignored.

#BeginCmtryOrAlert

When the commentary and alert statements are intertwined, and the commentary and alert statements are not necessary for the normal calculation of the trading strategy, analysis technique, or function, use this reserved word, *#BeginCmtryOrAlert*. The statements between this compiler directive and the reserved word *#End* are evaluated only when either commentary is requested or the alert is enabled. The statements are not considered when determining the *MaxBarsBack* setting, and any series functions within these reserved words are ignored. You must use the reserved word *#End* with this reserved word.

Syntax:

```
#BeginCmtryOrAlert ;
   {EasyLanguage instruction(s) } ;
#End ;
```

For example, the following uses the same indicator as described in the previous reserved word, but an alert is triggered when the volume is twice its average:

```
Plot1( Close - Close[10], “Momentum”);
#BeginCmtryOrAlert;
   If Plot1 > 0 Then
      Commentary(“Momentum is positive, ")
   Else
      Commentary(“Momentum is negative, ");
   If Volume > Average(Volume, 50) Then Begin
      Commentary(“ and volume is greater than average.”);
      If Volume > 2 * Average(Volume, 50) Then
         Alert;
   End
   Else
      Commentary(“ and volume is lower than average.”);
#End;
```

Sending Information to the Print Log, File, or Printer

You can send information from any trading strategy, analysis technique, or function to the **Print Log** tab of the EasyLanguage Output Bar. The EasyLanguage Output Bar is available through the **View - EasyLanguage Output Bar** menu sequence when in an EasyLanguage PowerEditor window, and can be used to send text that would help you see intermediate calculations that are not shown in the end results of the trading strategy, analysis technique, or function, or any message that would help determine the exact behavior of an EasyLanguage statement.

The Print Log does not offer an API, nor can it be included in a workspace as it is part of the EasyLanguage Output Bar, but it is very efficient and easy to use for debugging purposes.

Note: *The* ***Print Log*** *tab was added to the EasyLanguage Output Bar, replacing the Message Log in TradeStation 2000*i.

The same reserved word used to send information to the Print Log can be used to send information to a file or printer instead.

Print

This reserved word sends information to the EasyLanguage Print Log, a file, or the default Windows printer. Regardless of where you send the information, the *Print* reserved word always adds a carriage return at the end of the expressions, so each new statement is placed on a new line.

Syntax:

```
Print( [Printer, | File("<File Name>"),] Expression );
```

<File Name> is the complete path and name of the file to which the Print statement is to send the expression(s), and *Expression* is any expression, or a comma-separated list of expressions. The expressions can be numeric, true/false, or text string (or any combination).

<u>To use the EasyLanguage Print Log as the output method</u>, include the list of expressions without any additional information. For example, the following statement sends the date, time, and close to the Print Log:

```
Print(Date, Time, Close);
```

You can format the numeric expressions displayed using the *Print* reserved word. To do so, use the following syntax:

```
Print( Value1:N:M );
```

Value 1 is any numeric expression, *N* is the minimum number of integers to use, and *M* is the number of decimals to use. If the numeric expression being sent to the Print Log has more integers than what is specified by *N,* the *Print* statement uses as many digits as necessary, and the decimal values are rounded to the nearest value.

For example, assume *Value1* is equal to 3.14159 and we have written the following statement:

```
Print(Value1:0:4);
```

The numeric expression displayed in the Print Log would be 3.1416. As another example, to format the closing prices, you can use the following statement:

```
Print(ELDateToString(Date), Time, Close:0:4);
```

To send information to the default printer, *Printer* needs to be the first expression included in the parentheses of the reserved word. For example, the following statement sends the date, time, and the close of every bar of a chart to the default printer:

```
Print( Printer, Date, Time, Close);
```

Print statements for historical bars print multiple lines per page; however, Print statements for data that is collected real-time print at the close of each bar.

For example, if the trading strategy or analysis technique is applied to a chart with 500 bars, and the trading strategy or analysis technique sends one line to the printer for every bar on the chart, the first printout will consist of 500 lines, with as many lines per page as each page can hold. Then, as data is collected real-time, one line will be sent to the printer at the close of each bar (one line per page each time the bar closes). The same holds true when sending the information to a file, and for all applications.

To send information to a file, the first expression included in parentheses of the reserved word must be *File* along with the full path and name of the file enclosed in quotation marks. For example, the following statement sends the EasyLanguage date, time, and the close of every bar of a chart to a file instead of the printer:

```
Print( File("c:\TradeStation\MyText.txt"),
   Date, Time, Close);
```

***Important**: Every time the trading strategy, analysis technique, or function is recalculated, or deleted and reapplied to the chart, the target file is overwritten. Also, you cannot use a text string expression as the file name, it must be the actual path and name of the file. Refer to the discussion of the reserved word* FileAppend *(below) for information on appending to the file instead of overwriting it. When sending information to the printer or a file, we recommend you use the* FileAppend *reserved word instead of Print.*

FileAppend

This reserved word creates and appends text string expressions to the specified file. When sending information to a file, we recommend you use this reserved word instead of *Print*.

Syntax:
```
FileAppend( "<FileName>", Text );
```

<*FileName*> is a text string expression representing the full path and name of the file to write to, and *Text* is a text string expression to append to the file.

This reserved word accepts a text string expression for the file name, it will not delete the target file when the trading strategy or analysis technique is applied to the chart or recalculated, it will not add a carriage return at the end of the expression sent to the file, and finally, it only accepts text string expressions.

The fact that it will allow a text string expression as the file name enables users to specify the file name to be written to through a variable and/or inputs. For example, the following statements use the symbol name as a file name:

```
Variable: Txt(" ");
Txt = "c:\My Documents\" + GetSymbolName + ".txt";
FileAppend( Txt, "This will be sent to a file" );
```

This reserved word provides an alternative to the *Print* statement that does not delete the target file every time the trading strategy or analysis technique is applied or recalculated. This target file grows until it is manually edited or deleted.

Note*: You can use the reserved word* FileDelete *to delete the file and simulate the behavior of the Print statement.*

A carriage return is not added to the end of each expression sent; use the reserved word *NewLine* whenever you want to include a carriage return. For example, the following statement writes the text to the file, one line for each bar on the chart:

```
FileAppend("c:\My Documents\text.txt", "This text will be
   sent to a file" + NewLine);
```

Also, because this reserved word accepts only text string expressions, any dates or numbers must be converted to text strings. For example, the following statement sends the date and the closing price of every bar to the file:

```
FileAppend("c:\My Documents\text.txt",
   ELDateToString(Date) + NumToStr(Close,2));
```

Notice that the date of the current bar is included, but as a parameter to the reserved word *ELDateToString*, which converts an EasyLanguage date (YYYMMDD format) to

a text string expression. Likewise, the closing price is included as the parameter for the *NumToStr* reserved, which converts numbers to text string expressions.

Drawing Text on Price Charts

Another way to display information on screen is to write text on a price chart. The first concept you need to understand to start working with text is that each instance of a text drawing object on a chart, called a *text object*, has a distinct identification (ID) number. All EasyLanguage reserved words use the ID number to refer to a specific text object.

You can draw text objects using trading strategies, analysis techniques (indicators and studies) or functions, or by using the drawing object tool. When you use trading strategies, analysis techniques, or functions to draw text objects, they are added to a chart using the default size, color, and alignment of the Chart Analysis window. These attributes can be modified using the EasyLanguage text object reserved words.

In order to place text on the chart, you need to define the specific point on the chart to draw the text. You define the point by specifying a date and time (x-axis) and a price (y-axis). This is the basic information that you manipulate when working with text objects; additional information that you manipulate with the reserved words is the color, text string, and alignment of the text.

All of the reserved words used to work with text objects return a numeric value representing the result of the operation they performed. If the reserved word was able to carry out its task successfully, it will return a value of 0; however, if an error occurred, the reserved word will return a numeric value representing the specific error. The following table lists the possible return values of the text object reserved words.

Value	Explanation
-2	*The identification number used was invalid (i.e., there is no object on the chart with this ID number).*
-3	*The data number (Data2, Data3, etc.) passed to the function was invalid. There is no symbol (or data stream) on the chart with this data number.*
-4	*The value passed to a SET function was invalid (for example, an invalid color or line thickness was used).*
-5	*The beginning and ending points were the same (only when working with trendlines). Can occur when you relocate a trendline or change the begin/end points.*
-6	*The function was unable to load the default values for the tool.*
-7	*Unable to add the object. Possibly due to an out of memory condition. Your system resources have been taxed and it cannot process the request.*
-8	*Invalid pointer. Your system resources have been taxed and it cannot process the request.*

Value	Explanation
-9	*Previous failure. Once an object returns an error code, no additional objects can be created by the trading strategy, analysis technique, or function that generated the error.*
-10	*Too many trendline objects on the chart.*
-11	*Too many text objects on the chart.*

Whenever any of the text object reserved words is unable to perform its task and returns an error, the trading strategy, analysis technique, or function will stop manipulating all text objects from that bar forward. The trading strategy, analysis technique, or function itself will continue to be evaluated, but all statements that include text object reserved words will return a value of -9 (Previous failure error) and will not perform the intended action.

Also, it is very important that you store the ID number of the text objects drawn in the price chart; if you have any intention of modifying or referring to this object in any way, you need the ID number. If you are adding multiple text objects to the price chart, we recommended you use arrays to store their ID numbers (refer to “Understanding Arrays” on page 40 for information on using arrays).

Text Object Reserved Words

Following is the list of all the text object reserved words available in EasyLanguage.

Text_New

This reserved word adds the specified text string to a price chart, at the specified bar and price value. It returns a numeric expression corresponding to the ID number of the text object added to the chart. If you want to modify the text object in any way, it is very important that you capture and keep this number; the ID number is the only way of referencing a specific text object.

Syntax:

```
Value1 = Text_New(BarDate, BarTime, Price, “MyText”)
```

Parameters:
BarDate and *BarTime* are numeric expressions corresponding to the date and time, respectively, for the bar on which you want to anchor the text object, *Price* is a numeric expression representing the price value at which to anchor the text object, and *MyText* is the text string expression to add to the price chart.

All text objects are anchored at a specific bar and price value on the price chart. You need to provide this information to the *Text_New* reserved word in order for the trading strategy, analysis technique, or function to add a text object to the chart.

Notes:
Value1 is any numeric variable or array, and holds the ID number for the new text object.

Text objects are added to the chart using the default color, and vertical and horizontal alignment of the Chart Analysis window. As you will see, you can change any of these properties using the reserved words listed in this section.

Example:
For example, the following statements add a text string “Key” to a price chart every time there is a key reversal pattern:

```
Variable: ID(-1);

If Low < Low[1] AND Close > High[1] Then
     ID = Text_New(Date, Time, Low, “Key”);
```

Text_Delete

This reserved word removes from the chart the text object with the ID number that matches the one specified. It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any text objects by the trading strategy, analysis technique, or function that generated the error.

Syntax:
`Value1 = Text_Delete(Text_ID)`

Parameters:
Text_ID is a numeric expression representing the identification number of the text object to delete.

Notes:
Value1 is any numeric variable or array. You must assign the text object reserved word to a numeric variable or array in order to determine whether or not the reserved word performed its operation successfully.

Example:
The following statements write the text string “Key” wherever there is a key reversal pattern on the price chart, and delete old text from the chart as new key reversals are found:

```
Variables: OldKeyID(-1), ID(-1);

If Low < Low[1] AND Close > High[1] Then Begin
   OldKeyID = ID;
   ID = Text_New(Date, Time, Low, “Key”);
   If OldKeyID <> -1 Then
      Value1 = Text_Delete(OldKeyID);
End;
```

In the above example, we declare two variables to hold the Text IDs for the existing and new text objects. When we find a new key reversal, we assign the ID number of the current text object to the variable *OldKeyID*. We then create a new text object at the new key reversal. Finally, we delete the text object with the ID number held in the variable *OldKeyID*. We first check for *OldKeyID* to be -1, because it will be -1 until we

draw the second text object on the chart, and we don't want to reference a text object that doesn't exist.

Text_GetColor

This reserved word returns a numeric expression corresponding to the color assigned to a specified text object. It is important to remember that if an invalid ID number is used, it will return a value of -2 and no additional operations will be performed on any text objects by the trading strategy, analysis technique, or function that generated the error.

Syntax:
`Value1 = Text_GetColor(Text_ID)`

Parameters:
Text_ID is a numeric expression representing the ID number of the text object for which to obtain the color.

Notes:
Value1 is any numeric variable or array. You must assign the text object reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

For a list of the supported colors, refer to Appendix B of this reference guide.

Example:
For example, the following statements write the text string "Key" wherever there is a key reversal pattern on the price chart, and compares the color of the text object with the background of the price chart. If the colors match, the indicator draws the text string using a different color:

```
Variables: ID(-1), TxtColor(0);

If Low < Low[1] AND Close > High[1] Then Begin
   ID = Text_New(Date, Time, Low, "Key");
   TxtColor = Text_GetColor(ID);
   If TxtColor = GetBackGroundColor Then
      Value1 = Text_SetColor(ID, TxtColor + 1);
End;
```

In the above example, we first declare two variables, one to hold the text object ID number, the second to hold the number representing the color of the text object. Then, when we find a key reversal, we draw the text object at the low of the bar. We also obtain the color of the text object, and then compare the text object color to the color of the chart background. If it is the same, we change the color of the text object (add one to the existing color number).

Text_GetDate

This reserved word returns a numeric expression corresponding to the EasyLanguage date of the bar on which the specified text object is drawn. It is important to remember that if an invalid ID number is used, it will return a value of -2 and no additional operations will be performed on any text objects by the trading strategy, analysis technique, or function that generated the error.

Syntax:
`Value1 = Text_GetDate(Text_ID)`

Parameters:
Text_ID is a numeric expression representing the ID number of the text object whose date you want to obtain.

Notes:
Value1 can be any numeric variable or array. The EasyLanguage date obtained is assigned to this variable or array.

Example:
The following statement assigns to the variable *Value1* the EasyLanguage date of the bar where the text object with the ID number 5 is drawn:

```
Value1 = Text_GetDate(5);
```

Text_GetFirst

You can draw text objects using trading strategies, analysis techniques (indicators and studies) or functions, or by using the drawing object tool. EasyLanguage enables you to search for text objects based on how they were created.

This reserved word returns the ID number of the oldest text object on the price chart (the first drawn). It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any text objects by the trading strategy, analysis technique, or function that generated the error.

Syntax:
`Value1 = Text_GetFirst(Num)`

Parameters:
Num is a numeric expression representing the origin type of the text object. The possible values for *num* are:

Value of *num*	Description
1	*Text created by a trading strategy, analysis technique, or function.*
2	*Text created by the text drawing object tool only.*
3	*Text created by either the text drawing object tool or a trading strategy, analysis technique, or function.*

If a value different than 1, 2, or 3 is used, EasyLanguage will assume a value of 3.

Notes:
Value1 is any numeric variable or array that holds the ID number of the desired text object.

Example:
The following statements delete the oldest text object on a price chart drawn by a trading strategy, analysis technique, or function:

```
Value1 = Text_GetFirst(1);
Value2 = Text_Delete(Value1);
```

***Note**: When the oldest (first) text object is deleted, the next oldest (second) text object becomes the first drawn on the price chart, and so on.*

Text_GetHStyle

A text object is always anchored to a specific bar. Because of this, there are three possible ways to horizontally align a text object: to the left of the bar where it is drawn, to the right, or centered. This reserved word returns a numeric value indicating the horizontal alignment of the text object.

Syntax:
```
Value1 = Text_GetHStyle(Text_ID)
```

Parameters:
Text_ID is a numeric expression representing the ID number of the text object whose horizontal alignment value you want to obtain.

Notes:
Value1 is any numeric variable or array that holds the horizontal alignment of the desired text object. The reserved word can return one of these three values:

Value	*Placement*
0	*Left*
1	*Right*
2	*Centered*

Example:
The following instructions obtain the horizontal alignment of text object #10 and align it to right of the bar:

```
If Text_GetHStyle(10) <> 1 Then
   Value1 = Text_SetHStyle(1);
```

Text_GetNext

You can draw text objects using trading strategies, analysis techniques (indicators and studies) or functions, or by using the drawing object tool. EasyLanguage enables you to search for text objects based on how they were created.

The Chart Analysis window stores the chronological order of all text objects added to a chart, and this information is made available to EasyLanguage. This reserved word returns the ID number of the text object on the price chart added immediately after the text object specified. You can use this reserved word together with the reserved word *Text_GetFirst* to traverse all the text objects in a price chart.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any text objects by the trading strategy, analysis technique, or function that generated the error.

Syntax:
```
Value1 = Text_GetNext(Text_ID, Num)
```

Parameters:
T*ext_ID* is a numeric expression representing the ID number of the text object, and *Num* is a numeric expression representing the origin type of the text object. The possible values for *Num* are:

Value of *num*	Description
1	*Text created by a trading strategy, analysis technique, or function.*
2	*Text created by the text drawing object tool only.*
3	*Text created by either the text drawing object tool or a trading strategy, analysis technique, or function.*

If a value different than 1, 2, or 3 is used, EasyLanguage will assume a value of 3.

Notes:
Value1 is any numeric variable or array, and holds the ID number of the text object added after the text object specified.

Example:
The following statements set the color of all text objects in the chart to yellow:

```
Value1 = Text_GetFirst(3);
While Value1 <> -2 Begin
   Value2 = Text_SetColor(Value1, Yellow);
```

```
    Value1 = Text_GetNext(Value1, 3);
End;
```

In the above example, we obtain the ID number for the first text object drawn on the chart. Then, we set its color to yellow. We then obtain the ID number of the next text object and set that to yellow. This loop continues until *Text_GetNext* returns -2, indicating that there are no more text objects on the chart. Keep in mind that once the trading strategy, analysis technique, or function returns -2, it cannot draw any more text objects on the chart. In this situation, you may want to use one trading strategy, analysis technique, or function to draw the text objects, and another to change their color.

Text_GetString

This reserved word returns the text string expression corresponding to the text object specified. It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any text objects by the trading strategy, analysis technique, or function that generated the error.

Syntax:
`MyText = Text_GetString(Text_ID)`

Parameters:
Text_ID is a numeric expression representing the ID number of the text object whose text string expression you want to obtain.

Notes:
MyText is any text variable or array, and holds the text string expression corresponding to the text object with the ID number specified.

Example:
The following statements print the contents of text object #5 to the Print Log:

```
Variable: MyText (" ") ;

Print( Text_GetString(5) );
```

Text_GetTime

This reserved word returns a numeric expression corresponding to the EasyLanguage time of the bar on which the specified text object is anchored. It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any text objects by the trading strategy, analysis technique, or function that generated the error.

Syntax:
`Value1 = Text_GetTime(Text_ID)`

Parameters:
Text_ID is a numeric expression representing the ID number of the text object for which you want to obtain the time.

Notes:
Value1 is any numeric variable or array, and holds the time of the specified text object.

Example:
The following statement assigns the EasyLanguage time of the bar where the text object with the ID number 5 is drawn to the variable *Value1* :

```
Value1 = Text_GetTime(5);
```

Text_GetValue

Text objects are drawn at a specific price value on the price chart. This reserved word returns a numeric value corresponding to the price at which the specified text object is anchored. It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any text objects by the trading strategy, analysis technique, or function that generated the error.

Syntax:
```
Value1 = Text_GetValue(Text_ID)
```

Parameters:
Text_ID is a numeric expression representing the ID number of the text object whose price value you want to obtain.

Notes:
Value1 is any numeric variable or array, and holds the price value at which the specified object is anchored.

Example:
For example, the following statement can be used to print to the Print Log the value at which text object 10 is drawn:

```
Print( Text_GetValue(10) ) ;
```

Text_GetVStyle

A text object is always anchored at a specific price value on a price chart, and there are three possible ways to align the text object vertically: the top being at the specified price, the bottom being at the specified price, or centered. This reserved word returns a numeric value representing the vertical alignment of the specified text object.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any text objects by the trading strategy, analysis technique, or function that generated the error.

Syntax:
```
Value1 = Text_GetVStyle(Text_ID)
```

Parameters:
Text_ID is a numeric expression representing the ID number of the text object whose vertical alignment you want to obtain.

Notes:
Value1 can be any numeric variable or array, and holds the price value at which the specified object is anchored.

This reserved word returns one of three values:

Value	***Placement***
0	*Top*
1	*Bottom*
2	*Centered*

Example:
The following instruction sets the vertical alignment of text object #10 and to Bottom:

```
If Text_GetHStyle(10) <> 1 Then
   Value1 = Text_SetVStyle(1);
```

Text_SetColor

This reserved word sets the color of the specified text object.

Syntax:
`Value1 = Text_SetColor(Text_ID, Color)`

Parameters:
Text_ID is a numeric expression representing the ID number of the text object, and *Color* is an EasyLanguage color or its numeric equivalent.

For a list of the available colors, refer to Appendix B of this reference guide.

Notes:
Value1 is any numeric variable or array. You must assign the text object reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any text objects by the trading strategy, analysis technique, or function that generated the error.

Example:
The following indicator displays the word “Key” wherever there is a key reversal pattern on the price chart, and compares the color of the text object with the background of the price chart. If the colors match, the indicator sets the text object to a different color (it adds 1 to the current color):

```
Variables: ID(-1), TxtColor(0);
If Low < Low[1] AND Close > High[1] Then Begin
   ID = Text_New(Date, Time, Low, “Key”);
```

```
      TxtColor = Text_GetColor(ID);
      If TxtColor = GetBackgroundColor Then
         Value1 = Text_SetColor(ID, TxtColor + 1);
   End;
```

Text_SetLocation

All text objects are anchored at a specific bar and price value on the price chart. This reserved word modifies the point at which the specified text object is anchored.

Syntax:
```
Value1 = Text_SetLocation(Text_ID, BarDate, BarTime, Price)
```

Parameters:
Text_ID is a numeric expression representing the ID number of the text object to modify; *BarDate* and *BarTime* are numeric expressions representing the new EasyLanguage date and time, respectively, at which to anchor the text object; and *Price* is the new price value at which to anchor the text object.

Notes:
Value1 is any numeric variable or array. You must assign the text object reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any text objects by the trading strategy, analysis technique, or function that generated the error.

We recommend that you change the location of the text object rather than delete the text object and draw a new one. Relocating an existing object is faster and generates fewer ID numbers to keep track of.

Example:
These statements display the name of the symbol above the first bar in the chart (after *MaxBarsBack*) and then change the location of the text to always display it on the last bar of the chart:

```
If BarNumber = 1 Then
   Value1 = Text_New(Date, Time, High *1.01, GetSymbolName);
Value2 = Text_SetLocation(Value1, Date, Time, High * 1.01);
```

Text_SetString

This reserved word changes the text string expression of the specified text object.

Syntax:
```
Value1 = Text_SetString(Text_ID, “MyText”)
```

Parameters:
T*ext_ID* is a numeric expression representing the ID number of the text object whose text string expression you want to modify, and *MyText* is the new text string expression for the text object.

Notes:
Value1 is any numeric variable or array. You must assign the text object reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any text objects by the trading strategy, analysis technique, or function that generated the error.

We recommend that you change the text string expression of the text object rather than delete the text object and draw a new one. Changing an existing text object is faster and generates fewer ID numbers to keep track of.

Example:
These statements display the closing price of the symbol above the first bar in the chart (after *MaxBarsBack*) and then change the location of the text and the text to always display the closing price of the last bar on the chart:

```
If BarNumber = 1 Then
 Value1 = Text_New(Date, Time, High + 1, NumToStr(Close,2));

Value2 = Text_SetLocation(Value1, Date, Time, High + 1);
Value3 = Text_SetString(Value1, NumToStr(Close,2));
```

Text_SetStyle

A text object is always anchored at a specific bar and price value. There are three horizontal alignment settings: to the left of the bar where it is drawn, to the right, or centered. Also, there are three vertical alignment settings: the top being at the specified price, the bottom being at the specified price, or centered.

This reserved word changes the horizontal and vertical alignment of the specified text object.

Syntax:
```
Value1 = Text_SetStyle(Text_ID, HVal, VVal)
```

Parameters:
Text_ID is a numeric expression representing the ID number of the text object whose alignment you want to change, and *HVal* and *VVal* are numeric expressions representing the horizontal and vertical alignment of the text object, respectively.

You can use one of three horizontal alignment values (*HVal*):

Value	***Placement***
0	*Left*
1	*Right*
2	*Centered*

You can use one of three vertical alignment values (*VVal*):

Value	***Placement***
0	*Top*
1	*Bottom*
2	*Centered*

If there are no text objects with the ID number you specify, or if the operation fails in any way, this reserved word will return a numeric expression corresponding to one of the EasyLanguage drawing objects error codes, and no additional operations will be performed on any text objects by the trading strategy, analysis technique, or function that generated the error.

Notes:
Value1 is any numeric variable or array. You must assign the text object reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

Example:
The following statement changes the alignment of text object #3 so it is right aligned and sits above the specified price:

```
Value1 = Text_SetStyle(3, 1, 1) ;
```

Drawing Trendlines on Price Charts

You can draw and manipulate trendlines on a price chart from a trading strategy, analysis technique (indicators and studies) or function. The very first concept you need to understand to start working with trendlines is that each instance of a trendline drawing object on a chart has a distinct identification (ID) number. All EasyLanguage commands use the ID number to refer to a specific trendline.

Trendlines are added to a chart using the default properties (i.e., color, thickness, line style, extension status, and alert status) of the Chart Analysis window. You can modify these attributes using the trendline-related reserved words.

To place a trendline on the chart, you need to define its start and end points. Each point is defined using a date and time (x axis) and a price value (y axis). This is the basic information that you manipulate when working with trendlines; additional information that you manipulate using reserved words includes the color, thickness, and line style, as well as extension and alert status.

All of the reserved words used to work with trendlines return a numeric value representing the result of the operation they performed. If the reserved word was able to carry out its task successfully, it will return a value of 0; however, if an error occurred, the reserved word returns a numeric value representing the specific error. The following table lists the possible return values of the trendline reserved words:

Value	Explanation
-2	*The identification number used was invalid (i.e., there is no object on the chart with this ID number).*
-3	*The data number (Data2, Data3, etc.) passed to the function was invalid. There is no symbol (or data stream) on the chart with this data number.*
-4	*The value passed to a SET function was invalid (for example, an invalid color or line thickness was used).*
-5	*The beginning and ending points were the same (only when working with trendlines). Can occur when you relocate a trendline or change the begin/end points.*
-6	*The function was unable to load the default values for the tool.*
-7	*Unable to add the object. Possibly due to an out of memory condition. Your system resources have been taxed and it cannot process the request.*
-8	*Invalid pointer. Your system resources have been taxed and it cannot process the request.*
-9	*Previous failure. Once an object returns an error code, no additional objects can be created by the trading strategy, analysis technique, or function that generated the error.*
-10	*Too many trendline objects on the chart.*
-11	*Too many text objects on the chart.*

Whenever any of the trendline reserved words is unable to perform its task and returns an error, the trading strategy, analysis technique, or function will stop manipulating all trendlines from that bar forward. The trading strategy, analysis technique, or function itself will continue to be evaluated, but all statements that include trendline reserved words will return a value of -9 (Previous failure error) and will not perform the intended action.

If you have any intention of modifying or referring to the trendline drawn in the price chart in any way, you must store the ID number of the trendline. If you are adding multiple trendlines to the price chart, we recommended you use arrays to store their ID numbers.

Trendline Reserved Words

Following is a list of all the trendline reserved words available in EasyLanguage.

TL_New

This reserved word adds a trendline with the specified starting and ending points to a price chart. It returns a numeric expression corresponding to the ID number of the trendline added to the chart. If you want to modify the trendline in any way, it is very important that you capture and keep the number; the ID number is the only way of referencing a specific trendline.

Syntax:
```
Value1 = TL_New(iBarDate, iBarTime, iPrice, eBarDate,
   eBarTime, ePrice)
```

Parameters:
iBarDate, iBarTime, and *iPrice* are numeric expressions corresponding to the date, time, and price, respectively, of the starting point; *eBarDate, eBarTime,* and *ePrice* are numeric expressions corresponding to the date, time, and price, respectively, of the end point of the trendline.

Notes:
Value1 is any numeric variable or array, and holds the ID number for the new trendline.

A minimum of two different points are needed in order to draw any trendline on a price chart, and this is the information that you need to provide to the *TL_New* reserved word to draw a trendline on the price chart from a trading strategy, analysis technique, or function.

Trendlines are added to the chart using the default properties set in TradeStation. As you will see, you can change any of these properties using the reserved words listed in this section.

For example, the following statements add a trendline to the price chart (and extend it to the right) every time there is a key reversal pattern:

```
Variable: ID(-1);

If Low < Low[1] AND Close > High[1] Then Begin
  ID = TL_New(Date[1], Time[1], Low, Date, Time, Low);
  Value1 = TL_SetExtRight(ID, True);
End;
```

TL_Delete

This reserved word deletes the specified trendline from the price chart.

Syntax:
```
Value1 = TL_Delete(Tl_ID)
```

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline to delete.

Notes:
Value1 is any numeric variable or array. You must assign the trendline reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statements draw a trendline at the low of a key reversal and extend it to the right, and in addition, delete the old trendline from the chart when a new key reversal is found:

```
Variables: OldKeyID(-1), ID(-1);

If Low < Low[1] AND Close > High[1] Then Begin
   OldKeyID = ID;
   ID = TL_New(Date[1], Time[1], Low, Date, Time, Low);
   Value1 = TL_SetExtRight(ID, True);
   If OldKeyID <> -1 Then
      Value1 = TL_Delete(OldKeyID);
End;
```

In the above example, first we declare two variables, one to hold the ID number of the old trendline, and one to hold the ID number for the new trendline. When we find a new key reversal, we store the existing trendline's ID number in *OldKeyID*, and create a new trendline at the low of the key reversal bar and extend it to the right. Then, we delete the old trendline. Before deleting the old trendline, we first check to make sure the ID number in *OldKeyID* is not -1, which it will be until the second trendline is drawn. This way, we don't reference an invalid ID number.

TL_GetAlert

This reserved word obtains the alert setting for the specified trendline.

Syntax:
`Value1 = TL_GetAlert(Tl_ID)`

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose alert status you want to obtain.

Notes:
Value1 can be any numeric variable or array, and holds the alert status. This reserved word returns one of these three values:

Value	***Description***
0	*None - no alert enabled*
1	*Breakout Intrabar*
2	*Breakout on Close*

An alert set to *Breakout on Close* is triggered when on the previous bar, the close of the symbol was lower than the trendline, and on the current bar, the close is higher than the trendline. This type of alert is only evaluated once the bar is closed.

An alert set to *Breakout Intrabar* is triggered if the high crosses over the trendline or if the low crosses under the trendline. This alert is triggered at the moment the trendline is broken.

Example:
The following statement checks the alert status for trendline #10 and if it is not set to *Breakout on Close*, it enables it and sets it to *Breakout on Close*:

```
If TL_GetAlert(10) <> 2 Then
   Value1 = TL_SetAlert(10, 2);
```

TL_GetBeginDate

This reserved word returns the date of the starting point of the trendline. The start point is the one with the earlier date. If the trendline is vertical, the lower of the two points is considered to be the starting point.

Syntax:
```
Value1 = TL_GetBeginDate(Tl_ID)
```

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose start date you want to obtain.

Notes:
Value1 is any numeric variable or array, and holds the date of the starting point.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statement assigns the EasyLanguage date of the bar used as the start point for the trendline with the ID number 5 to the variable *Value1*:

```
Value1 = TL_GetBeginDate(5);
```

TL_GetBeginTime

This reserved word returns the time of the starting point of the trendline. The start point is the one with the earlier date. If the trendline is vertical, the lower of the two points is considered to be the starting point.

Syntax:
```
Value1 = TL_GetBeginTime(Tl_ID)
```

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose starting time you want to obtain.

Notes:
Value1 is any numeric variable or array, and holds the time of the starting point.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statement assigns the EasyLanguage time of the bar used as the start point for the trendline with the ID number 5 to the variable *Value1*:

```
Value1 = TL_GetBeginTime(5);
```

TL_GetBeginVal

This reserved word returns a numeric expression corresponding to the price value used as the starting point of the trendline. The starting point of the trendline is the one with the earlier date; if the trendline is vertical, the lower of the two points is considered to be the starting point.

Syntax:
```
Value1 = TL_GetBeginVal(Tl_ID)
```

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose starting price value you want to obtain.

Notes:
Value1 is any numeric variable or array, and holds the price value of the starting point of the trendline.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statement assigns the price value of the starting point of trendline #5 to the variable *Value1*:

```
Value1 = TL_GetBeginVal(5);
```

TL_GetColor

This reserved word returns a numeric expression corresponding to the color assigned to the specified trendline.

Syntax:
```
Value1 = TL_GetColor(Tl_ID)
```

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose color you want to obtain.

Notes:
Value1 is any numeric variable or array, and holds the EasyLanguage color or numeric equivalent of the specified trendline.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

For a list of supported colors, refer to Appendix B of this reference guide.

Example:
The following statements draw a trendline at the low of each key reversal pattern. If the color of the trendline matches the background color of the chart, the indicator sets the trendline to a different color (it adds 1 to the current color):

```
Variable: ID(-1);

If Low < Low[1] AND Close > High[1] Then Begin
   ID = TL_New(Date[1], Time[1], Low, Date, Time, Low);
   Value1 = TL_GetColor(ID);

   If Value1 = GetBackGroundColor Then
      Value2 = TL_SetColor(ID, Value1 + 1);
End;
```

TL_GetEndDate

This reserved word returns the date of the ending point of the trendline. The ending point of the trendline is the one with the later date; if the trendline is vertical, the higher of the two points is considered to be the ending point.

Syntax:
```
Value1 = TL_GetEndDate(Tl_ID)
```

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose end date you want to obtain.

Notes:
Value1 is any numeric variable or array, and holds the date of the starting point.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statement assigns the EasyLanguage date of the bar used as the end point for the trendline with the ID number 5 to the variable *Value1*:

```
Value1 = TL_GetEndDate(5);
```

TL_GetEndTime

This reserved word returns the time of the ending point of the trendline. The ending point of the trendline is the one with the later date; if the trendline is vertical, the higher of the two points is considered to be the ending point.

Syntax:
```
Value1 = TL_GetEndTime(Tl_ID)
```

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose ending time you want to obtain.

Notes:
Value1 is any numeric variable or array, and holds the time of the ending point.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statement assigns the EasyLanguage time of the bar used as the end point for the trendline with the ID number 5 to the variable *Value1*:

```
Value1 = TL_GetEndTime(5);
```

TL_GetEndVal

This reserved word returns a numeric expression corresponding to the price value used as the ending point of the trendline. The ending point of the trendline is the one with the later date; if the trendline is vertical, the higher of the two points is considered to be the ending point.

Syntax:
```
Value1 = TL_GetEndVal(Tl_ID)
```

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose ending price value you want to obtain.

Notes:
Value1 is any numeric variable or array, and holds the price value of the ending point of the trendline.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statement assigns the price value of the ending point of trendline #5 to the variable *Value1*:

```
Value1 = TL_GetEndVal(5);
```

TL_GetExtLeft

Trendlines can be extended to the right or left. This reserved word returns a value of True or False. If the trendline is extended to the left, it will return a value of True; otherwise, it will return a value of False.

Syntax:
```
Condition1 = TL_GetExtLeft(Tl_ID)
```

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose extension status you want to obtain.

Notes:
Condition1 can be any true/false variable or array, and holds the true/false value determining whether or not the trendline is extended. If an invalid ID number is used, the value False is returned.

Example:
The following instructions extend the trendline #10 to the left if it is not already extended:

```
If TL_GetExtLeft(10) = False Then
   Value1 = TL_SetExtLeft(10, True);
```

TL_GetExtRight

Trendlines can be extended to the right or left. This reserved word returns a value of True or False. If the trendline is extended to the right, it will return a value of True; otherwise, it will return a value of False.

Syntax:
```
Condition1 = TL_GetExtRight(Tl_ID);
```

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose extension status you want to obtain.

Notes:
Condition1 can be any true/false variable or array, and holds the true/false value determining whether or not the trendline is extended. If an invalid ID number is used, the value False is returned.

Example:
The following instructions extend the trendline #10 to the right if it is not already extended:

```
If TL_GetExtRight(10) = False Then
   Value1 = TL_SetExtRight(10, True);
```

TL_GetFirst

You can draw trendlines using trading strategies, analysis techniques (indicators and studies) or functions, or by using the drawing object tool. EasyLanguage enables you to search for trendlines based on how and in what order they were created.

The Chart Analysis window stores the chronological order of all trendlines added to a chart, and this information is made available to EasyLanguage. This reserved word returns the ID number of the first trendline added to the price chart (by a trading strategy, analysis technique, or function, or by a drawing tool, or by either).

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Syntax:
`Value1 = TL_GetFirst(Num)`

Parameters:
Num is a numeric expression representing the origin type of the trendline. The possible values for *Num* are:

Value of *Num*	Description
1	*Trendline created by a trading strategy, analysis technique, or function.*
2	*Trendline created by the trendline drawing object tool only.*
3	*Trendline created by either the trendline drawing object tool or a trading strategy, analysis technique, or function.*

If a value different than 1, 2, or 3 is used, EasyLanguage will assume a value of 3.

Notes:
Value1 is any numeric variable or array that holds the ID number of the desired trendline.

Example:
The following statements delete the oldest trendline on a price chart drawn by a trading strategy, analysis technique, or function:

```
Value1 = TL_GetFirst(1);
Value2 = TL_Delete(Value1);
```

***Note**: When the oldest (first) trendline is deleted, the next oldest (second) trendline becomes the first drawn on the price chart, and so on.*

TL_GetNext

You can draw trendlines using trading strategies, analysis techniques (indicators or studies), or functions, or by using the drawing object tool. EasyLanguage enables you to search for trendlines based on how they were created.

The Chart Analysis window stores the chronological order of all trendlines added to a chart, and this information is made available to EasyLanguage. This reserved word returns the ID number of the trendline on the price chart added immediately after the trendline specified. You can use this reserved word together with the reserved word *TL_GetFirst* to traverse all the trendlines in a price chart.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Syntax:
```
Value1 = TL_GetNext(TL_ID, Num)
```

Parameters:
TL_ID is a numeric expression representing the ID number of the trendline, and *Num* is a numeric expression representing the origin type of the trendline. The possible values for *Num* are:

Value of *Num*	Description
1	*Trendline created by a trading strategy, analysis technique, or function.*
2	*Trendline created by the trendline drawing object tool only.*
3	*Trendline created by either the trendline drawing object tool or a trading strategy, analysis technique, or function.*

If a value different than 1, 2, or 3 is used, EasyLanguage will assume a value of 3.

Notes:
Value1 is any numeric variable or array, and holds the ID number of the trendline added after the trendline specified.

Example:
The following statements set the color of all trendlines in the chart to yellow:

```
Value1 = TL_GetFirst(3);
While Value1 <> -2 Begin
   Value2 = TL_SetColor(Value1, Yellow);
   Value1 = TL_GetNext(Value1, 3);
End;
```

In the above example, we obtain the ID number for the first trendline drawn on the chart. Then, we set its color to yellow. We then obtain the ID number of the next trendline and set that to yellow. This loop continues until *TL_GetNext* returns -2 indicating that there are no more trendlines on the chart. Keep in mind that once the trading strategy, analysis technique, or function returns -2, it cannot draw any more trendline on the chart. In this situation, you may want to use one trading strategy, analysis technique, or function to draw the trendlines, and another to change their color.

TL_GetSize

This reserved word returns a numeric expression representing the thickness of the trendline, where 0 is the thinnest, and 6 is the thickest.

Syntax:
`Value1 = TL_GetSize(Tl_ID)`

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose thickness setting you want to obtain.

Notes:
Value1 can be any numeric variable or array, and holds the thickness setting.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statement assigns the thickness of trendline #10 to the variable *Value1*:

```
Value1 = TL_GetSize(10);
```

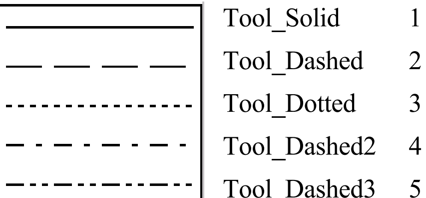
TL_GetStyle

This reserved word returns a numeric expression representing the line style used for the specified trendline.

Syntax:
`Value1 = TL_GetStyle(Tl_ID)`

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose line style you want to obtain.

Notes:
Value1 is any numeric variable or array, and holds the numeric expression representing the line style of the specified trendline. Following are the possible return values and their numeric equivalents:



Tool_Solid	1
Tool_Dashed	2
Tool_Dotted	3
Tool_Dashed2	4
Tool_Dashed3	5

You can use either the numbers or the EasyLanguage reserved word.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following IF-THEN statement verifies that a trendline is solid before executing the EasyLanguage instruction:

```
If TL_GetStyle(10) = Tool_Solid Then
    {EasyLanguage instruction } ;
```

TL_GetValue

This reserved word returns a numeric expression corresponding to the value of a trendline at a specific bar. It is important to remember that this reserved word returns a value even if the trendline is not shown on or projected through the bar specified. For example, if a trendline is drawn from December 1st to January 5th, and the following statement is used:

```
Value1 = TL_GetValue(10, 990203, 1400);
```

Even though the date specified is in February, the *TL_GetValue* reserved word will return the trendline value as if the trendline were extended to that particular bar (along the same slope).

Syntax:
`Value1 = TL_GetValue(Tl_ID, TLDate, TLTime)`

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose price value you want to obtain. *TLDate* and *TLTime* are the date and time, respectively, of the bar for which you want to obtain the trendline's value.

Notes:
Value1 is any numeric variable or array. You must assign the trendline reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statement triggers an alert when the close crosses over trendline #10:

```
If Close Crosses Over TL_GetValue(10, Date, Time) Then
      Alert("Trendline is broken");
```

TL_SetAlert

This reserved word changes the alert status for a trendline.

Syntax:
`Value1 = TL_SetAlert(Tl_ID, AlertVal)`

Parameters:
Tl_ID is a numeric expression representing the identification number of the trendline, and *AlertVal* is a numeric expression representing the alert setting for the trendline. You can specify one of these three values:

Value	***Description***
0	*None - no alert enabled*
1	*Breakout Intrabar*
2	*Breakout on Close*

An alert set to *Breakout on Close* is triggered when on the previous bar, the close of the symbol was lower than the trendline, and on the current bar, the close is higher than the trendline or vice-versa. This type of alert is only evaluated once the bar is closed.

An alert set to *Breakout Intrabar* is triggered if the high crosses over the trendline or if the low crosses under the trendline. This alert is triggered at the moment the trendline is broken.

Notes:
Value1 is any numeric variable or array. You must assign the trendline reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statement checks the alert status for trendline #10 and if it is not set to *Breakout on Close*, it enables it and sets it to *Breakout on Close*:

```
If TL_GetAlert(10) <> 2 Then
   Value1 = TL_SetAlert(10, 2);
```

TL_SetBegin

This reserved word changes the start point of the specified trendline. It is very important to know which is the starting point and which is the ending point for a trendline; the start point has an earlier date and time. If the trendline is vertical, the point with the lower price value is considered the starting point.

However, if the starting point of a trendline is changed (by EasyLanguage or by using the drawing tool) such that it has a later date than the ending point, the starting point then becomes the old ending point of the trendline.

Syntax:
```
Value1 = TL_SetBegin(Tl_ID, iDate, iTime, iVal)
```

Parameters:
Tl_ID is a numeric expression representing the identification number of the trendline, and iDate, iTime, and iVal are numeric expressions representing the trendline's starting point date, time, and value respectively.

Notes:
Value1 is any numeric variable or array. You must assign the trendline reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

This reserved word returns zero (0) when it successfully changes the beginning point of a trendline, and it returns one of the EasyLanguage drawing object errors when it fails. For example, if the start point of the trendline is set to exactly the same value as the ending point, the reserved word will return the error -5. Also, it is important to remember that if an invalid ID number is used, the reserved word will return a value of -2, and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statement sets the start point of trendline #5 to the high price 10 bars ago:

```
Value1 = TL_SetBegin(5, Date[10], Time[10], High[10]);
```

TL_SetColor

This reserved word changes the color of the specified trendline.

Syntax:
```
Value1 = TL_SetColor(Tl_ID, Color)
```

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose color you want to change, and *Color* is one of the EasyLanguage supported colors.

For a list of supported colors, refer to Appendix B of this reference guide.

Notes:
Value1 is any numeric variable or array. You must assign the trendline reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statements draw a trendline at the low of a key reversal, and compare the color of the trendline with the background of the chart. If the colors match, the EasyLanguage instructions add 1 to the color, and set the trendline to this new color:

```
Variables: ID(-1), TLColor(0);

If Low < Low[1] AND Close > High[1] Then Begin
   ID = TL_New(Date[1], Time[1], Low, Date, Time, Low);
   TLColor = TL_GetColor(ID);
   If TLColor = GetBackgroundColor Then
      Value1 = TL_SetColor(ID, TxtColor+1);
End;
```

TL_SetEnd

This reserved word changes the end point of the specified trendline. It is very important to know which is the starting point and which is the ending point for a trendline; the end point has a later date and time. If the trendline is vertical, the point with the higher price value is considered the ending point.

However, if the ending point of a trendline is changed (by EasyLanguage or by using the drawing tool) such that it has an earlier date than the starting point, the ending point then becomes the original starting point of the trendline.

Syntax:
`Value1 = TL_SetEnd(Tl_ID, eDate, eTime, eVal)`

Parameters:
Tl_ID is a numeric expression representing the identification number of the trendline, and *eDate, eTime,* and *eVal* are numeric expressions representing the trendline's new ending point date, time, and price value, respectively.

Notes:
Value1 is any numeric variable or array. You must assign the trendline reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

This reserved word returns zero (0) when it successfully changes the end point of a trendline, and one of the EasyLanguage drawing object errors when it fails. For example, if the end point of the trendline is set to exactly the same value of the start point, the reserved word will return an error -5. Also, it is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statement sets the end point of trendline #5 to the current bar's high price:

```
Value1 = TL_SetEnd(5, Date, Time, High);
```

TL_SetExtLeft

Trendlines can be extended to the left or right. This reserved word enables you to toggle the trendline between extended to the left and not extended.

Syntax:
`Value1 = TL_SetExtLeft(Tl_ID, Extend)`

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline, and *Extend* is a true/false expression that either extends the trendline to the left or not.

Notes:
Value1 is any numeric variable or array. You must assign the trendline reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statements draw a trendline at the low of a key reversal bar and extend it to the right:

```
Variable: ID(-1);

If Low < Low[1] AND Close > High[1] Then Begin
   ID = TL_New(Date[1], Time[1], Low, Date, Time, Low);
   Value1 = TL_SetExtRight(ID, True);
End;
```

TL_SetExtRight

Trendlines can be extended to the left or right. This reserved word enables you to toggle the trendline between extended to the right and not extended.

Syntax:
`Value1 = TL_SetExtRight(Tl_ID, Extend)`

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline, and *Extend* is a true/false expression that either extends the trendline to the right or not.

Notes:
Value1 is any numeric variable or array. You must assign the trendline reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statements draw a trendline at the low of a key reversal bar and extend it to the left and right:

```
Variable: ID(-1);

If Low < Low[1] AND Close > High[1] Then Begin
   ID = TL_New(Date[1], Time[1], Low, Date, Time, Low);
   Value1 = TL_SetExtRight(ID, True);
   Value1 = TL_SetExtLeft(ID, True);
End;
```

TL_SetSize

This reserved word changes the thickness of the specified trendline. Zero (0) is the thinnest and six (6) is the thickest setting.

Syntax:
```
Value1 = TL_SetSize(Tl_ID, Num)
```

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline, and *Num* is a numeric expression representing the thickness of the trendline, 0 - 6.

Notes:
Value1 is any numeric variable or array. You must assign the trendline reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statement sets the line style of trendline #10 to the thinnest line style setting:

```
Value1 = TL_SetSize(10, 0);
```

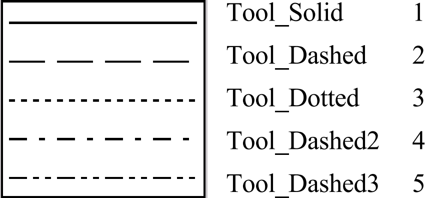
TL_SetStyle

This reserved word enables you to modify the style of the specified trendline.

Syntax:
```
Value1 = TL_SetStyle(Tl_ID, Style);
```

Parameters:
Tl_ID is a numeric expression representing the ID number of the trendline whose style you want to change, and *Style* is a numeric expression representing the new line style for the trendline.

The possible styles are:



Tool_Solid	1
Tool_Dashed	2
Tool_Dotted	3
Tool_Dashed2	4
Tool_Dashed3	5

You can use either the number or the reserved word. The style only applies when the trendline is set to the thinnest size, which is zero (0).

Notes:
Value1 is any numeric variable or array. You must assign the trendline reserved word to a numeric variable or array so that you can determine whether or not the reserved word performed its operation successfully.

It is important to remember that if an invalid ID number is used, the reserved word will return a value of -2 and no additional operations will be performed on any trendlines by the trading strategy, analysis technique, or function that generated the error.

Example:
The following statement changes the line style of trendline #10 to a dotted line:

```
Value1 = TL_SetStyle(10, Tool_dotted);
```

Multimedia and EasyLanguage

You can include a sound (.wav) file or a video file (.avi) in any of your trading strategies, analysis techniques, or functions. Common uses of audio and video include alerts and commentary. You can write your analysis techniques such that when an alert is triggered, a video and/or a sound file is played.

The reserved words you use to include sound and video files are described next.

Playing Sound Files

There is only one reserved word you use to play sounds; it is described below.

PlaySound

This reserved word finds and plays the specified sound file (.wav file). This reserved word returns a value of True if it was able to find and play the sound file, and it returns a value of False if it is not able to find or play it.

Syntax:

```
Condition1 = PlaySound(FileName);
```

Parameters:
Condition1 is any true/false variable or array, and *FileName* is any text string expression that represents the full path and file name of the sound file to be played. Only .wav files can be played.

Notes:
We recommended that you use this reserved word only on the last bar of the chart or on bars where the commentary is obtained. Otherwise, you may find that the .wav file is played more often than you intended. For example, if your intention is to play a .wav file whenever a certain bar pattern occurs, and this pattern occurs 50 times in the price chart, the trading strategy, analysis technique, or function will play the .wav file 50 times when it is applied to the price chart. Also, the .wav file is only played once per bar, even if the event occurs more than once intrabar (unless the **Update on every tick** option is enabled, in which case, the .wav file will play with each new tick while the event is True).

Example:
The following statements play the sound file Ding.wav when there is a key reversal pattern on the last bar of the chart:

```
If LastBarOnChart AND Low < Low[1] AND Close > High[1] Then
   Condition1 = PlaySound("c:\windows\sounds\ding.wav");
```

Playing Video Files

You can play a video file (.avi file) using a combination of three reserved words.

EasyLanguage allows you to build video clips out of many different .avi files, and it allows you to mix and match video clips at will.

First, you obtain a video clip ID number for each video clip that you will be using in your trading strategy, analysis technique, or function, then you specify what .avi files will make up that video clip. You can play the resulting video clip at any time.

The three reserved words necessary to create video clips are described next.

MakeNewMovieRef

This reserved word creates a new video clip and returns a numeric value representing the ID number of the new video clip created.

Syntax:
```
Value1 = MakeNewMovieRef;
```

Parameters:
Value1 is any numeric variable or array.

Notes:
Once you create the video clip using this reserved word, you can add one or more .avi files to it using the reserved word *AddToMovieChain*. You must save the ID number of the video clip as it will be the way to reference the video clip in order to add .avi files as well as play it.

Example:
The following statement creates a new video clip and assigns the ID number to the variable *Value1*:

```
Value1 = MakeNewMovieRef;
```

AddToMovieChain

This reserved word adds .avi files to an existing video clip and returns a true/false value representing the success of the operation. If the reserved word was able to add the .avi file to the video clip, it returns a value of True; if it was not, it returns a value of False.

Syntax:
```
Condition1 = AddToMovieChain(Movie_ID, File);
```

Parameters:
Condition1 is any true/false variable or array, *Movie_ID* is a numeric expression representing the ID number of the video clip to which you're adding the .avi file, and *File* is a text string expression representing the full path and file name of the .avi file to add to the video clip.

Notes:
When a video clip is played, it will play all the .avi files in the order they were added to the video clip.

Example:
The following statements create a video clip and add two .avi files to it:

```
Variable: ID(-1);
ID = MakeNewMovieRef ;
Condition1 = AddToMovieChain(ID, "c:\MyMovie.avi");
Condition2 = AddToMovieChain(ID, "c:\MyOtherMovie.avi");
```

PlayMovieChain

This reserved word plays a video clip and returns a true/false expression representing the success of the operation. If the reserved word was able to play the video clip, it returns a value of True, if it was not, it returns a value of False.

Syntax:

```
Condition1 = PlayMovieChain(Movie_ID);
```

Parameters:
Condition1 is any true/false variable or array, *Movie_ID* is a numeric expression representing the ID number of the video clip.

Notes:
Once you have created a video clip using the reserved word *MakeNewMovieRef* and added .avi files to the video clip, you are ready to play it. We recommend you use the reserved word *PlayMovieChain* only on the last bar of the chart or on bars where the commentary is obtained (using the *AtCommentaryBar* or *LastBarOnChart* reserved words). Otherwise, you may find that the video clip is played more often than you need it to.

If your intention is to play the video clip when a certain bar pattern occurs, and this pattern occurs 50 times the price chart, the trading strategy, analysis technique, or function will play the video clip 50 times when applied to the price chart.

Example:
The following statements create and play a video clip on the bar where commentary is obtained:

```
Variable: ID(-1);
If BarNumber = 1 Then Begin
  ID = MakeNewMovieRef;
  Condition1 = AddToMovieChain(ID, "c:\MyMovie.avi");
  Condition2 = AddToMovieChain(ID, "c:\MyOtherMovie.avi");
End;

If AtCommentaryBar Then
    Condition1 = PlayMovieChain(ID);
```

Notice that the video clip is created and the video files are added to it only once by using an IF-THEN statement to check for the first bar of the chart. If we don't use this IF-THEN statement, the indicator will create as many video clips as there are bars in the chart.

Note*: You can also use the reserved word* LastBarOnChart *instead of* AtCommentaryBar.

CHAPTER 3

EasyLanguage for TradeStation 6

This chapter covers EasyLanguage specifically for use with TradeStation. You will be introduced to the syntax for writing Strategies as well as the Trading Strategy Testing Engine, which is the engine that performs the backtesting and automation of your Strategies. This chapter also describes the reserved words for use with indicators and studies (ShowMe, PaintBar, ActivityBar, and ProbabilityMap) when working with TradeStation.

In This Chapter

- Writing Strategies................................ 104
- The Trading Strategy Testing Engine .. 105
- Order Placement.................................. 119
- Understanding Built-in Stops............... 132
- Writing Indicators and Studies............. 136
- Writing ShowMe and PaintBar Studies 140
- Writing ProbabilityMap Studies 145
- Writing ActivityBar Studies................. 153

Writing Strategies

EasyLanguage enables you to express your trading ideas very specifically using TradeStation Strategies. An example of a statement within a Strategy is:

```
Buy 100 Shares Next Bar at Market;
```

The statements used to create entires and exits have two parts, which are very similar to the language you would use to communicate with your broker. The first part of the statement is the *trading order,* which is a description of the action you want to perform; for example, *buy 100 shares*. The second part of the statement is the *execution method*, which is exactly how (when and at what price) the order should be carried out; for example, *next bar at market*.

There are four reserved words you can use to express your trading ideas when writing Strategies. We refer to these words as *trading verbs*, and these are:

Order Type	*Description*
`Buy`	Cover all short positions and initiate a long position
`Sell`	Close a long position
`SellShort`	Cover all long positions and initiate a short position
`BuyToCover`	Close a short position

Figure 3-1. Order Types

Each one of these orders can have four different execution methods:

```
... this bar on close

... next bar at market

... next bar at price Stop

... next bar at price Limit
```

As with all other EasyLanguage statements, the statements created using these trading verbs are evaluated at the end of every bar, at which point an order is placed.

When an order is executed *this bar on close* (i.e., at the close of the current bar), it is executed immediately when the bar is closed. If it is specified as a *next bar at market* order, it is executed at the opening price of the next bar. Stop and limit orders are left as open orders that remain active throughout the next bar, until the price specified is met or the bar is closed (completed).

Depending on the trading verb used, stop and limit orders translate into *or higher* or *or lower* than the specified price. The statement *Buy next bar at 100 limit* opens a long position during the next bar at the first price available at or under 100. Similarly, the statement *BuyToCover next bar at 50 stop* closes a short position during the next bar at the first traded price at or over 50. It is possible for stop and limit orders not to be filled (i.e., price never reached); in this case, the orders are canceled at the close of the bar.

Figure 3-2 shows the meaning of the different orders.

Order Type	*Stop*	*Limit*
`Buy`	or Higher	or Lower
`Sell`	or Lower	or Higher
`SellShort`	or Lower	or Higher
`BuyToCover`	or Higher	or Lower

Figure 3-2. Stop and Limit orders

Each component of a trading order is discussed in the section "Order Placement" on page 119.

The Trading Strategy Testing Engine

To reproduce as accurately as possible how a Strategy would have performed in the past, and to keep track of your trading rules as new data is collected, TradeStation uses a powerful Trading Strategy Testing Engine. This engine takes all the orders generated by the Strategy applied to the chart and creates the Strategy Performance Report.

This section covers all the different procedures that the Trading Strategy Testing Engine uses, and the assumptions it makes in order to evaluate the trading strategy applied to a chart.

The Trading Strategy Testing Engine performs two functions, backtesting and automation. Backtesting is the process of analyzing historical data and deriving historical profitability results, and automation is the process of monitoring and analyzing new data as it is obtained. This section describes each process in detail.

Overview

Once you create a price chart and apply a Strategy to it, TradeStation evaluates all the Strategy rules for the very first (oldest) bar on the chart—as it does with all EasyLanguage procedures—and generates the trading orders (to enter or exit) to be executed either at the close of that first bar or on the next bar.

Once TradeStation evaluates all instructions for the first bar on the chart, it reads the second bar of data and evaluates any orders that were left active from the first bar with the prices of the second bar, looking for possible fills. If set to use a finer data resolution, TradeStation can review the price behavior at an interval more precise than the bar interval of the chart, and determine the price at which the orders would have been filled, or if they would have been filled at all. If TradeStation is not set to use a finer data resolution, TradeStation simulates the fill prices using several market assumptions explained later in this section.

Once the Trading Strategy Testing Engine is done evaluating the orders that were active through the second bar, TradeStation returns to the EasyLanguage instructions that compose the Strategy and generates the necessary orders for the close of the second bar and

places those for the third bar. This process, called backtesting, is repeated on every bar until the last bar on the chart is reached (the most recent bar). The results of each trade are stored and are presented in a variety of ways in the Strategy Performance Report.

The second part of the process is the automation of new orders. Backtesting takes a few seconds to complete, at which point, TradeStation begins to evaluate the new data as it is received. TradeStation also monitors any outstanding orders remaining from the backtesting process. When each new bar is completed, TradeStation evaluates the EasyLanguage instructions of the Strategy for this new bar, and places any orders for the close of the current bar and/or the next bar. This process is repeated on every new bar until the Strategy is deleted from the chart or the workspace is closed.

Automation and backtesting are discussed in detail next.

Automation

Automation is the process of monitoring new data for the symbol to which the Strategy is applied. The rules followed by the Trading Strategy Testing Engine to evaluate the Strategy orders are described next.

Price at Which Orders are Placed and Filled

The very first thing TradeStation does to any order it receives from a Strategy is verify that the order has a valid price for the instrument to which it is applied.

A valid price is any price that has a valid decimal value compared to the settings of the charted symbol. The settings are the *price scale* and the *minimum movement.*

If the price scale of a given symbol is 1/100, and the minimum movement is 10, then this symbol only trades in 10ths of a point; therefore, 100.1, 950.5 and 10,000.7 are valid prices whereas 95.125 is not.

If the order being processed is an *or higher* order, the price is rounded up to the nearest valid trading price. If it is an *or lower* order, the price is rounded down to the nearest price. Figure 3-3 describes how orders are interpreted by the Trading Strategy Testing Engine.

Trading Verb	*Stop*	*Limit*
`Buy`	or Higher	or Lower
`Sell`	or Lower	or Higher
`SellShort`	or Lower	or Higher
`BuyToCover`	or Higher	or Lower

Figure 3-3. Stop and Limit orders

To continue with the above example, in which the price scale is 1/100 and the minimum movement is 10, if an order to *Buy at 100.125 limit* is placed, this order will be placed in TradeStation as an order to *Buy at 100.1 or anything lower*. If an order is placed to *Buy at 100.125 stop*, this order will be placed as *Buy at 100.2 or higher*.

This rounding is essential because if an order is received to buy at 100.125 or higher, it means that you do not want to buy at 100.124, or at 100.120, or much less at 100.1 because the order stated '100.125 or higher'; therefore, the only alternative is to round up to the nearest valid trading price. The opposite is done for *or lower* orders for the same reason.

Determining Which Order to Fill

A Strategy can place multiple orders (Buy, Sel, SellShort, BuyToCover) for any single bar. Each order can use the same or a different execution method. When two or more orders are placed at the same time, the Trading Strategy Testing Engine determines which order to fill based on the execution method:

Rule 1: Orders on Close and Next Bar at Market

Orders that are placed to be filled *this bar on close* have the highest priority, once all these orders have been filled, the *next bar at market* orders are evaluated. If there is more than one order with the same execution method (e.g., three orders for "this bar on close"), then the order that was placed first in the Strategy takes priority and is filled first. This works bothfor multiple orders in one Strategy, or when multiple Strategies are applied to the same Chart Analysis window.

For example, assume your Strategy generates an order that will enter a long position *next bar at market* based on a moving average crossover, and a second order that will enter a short position *next bar at market* based on a candlestick pattern. If both conditions are met on the same bar, the Strategy will issue orders to enter both a short and long position. The order listed first is executed first, and the order listed second is executed immediately after.

If the *Buy* order is listed first, the Strategy will display a long entry and then a short entry, ending that bar with a short position open. However, if the *SellShort* order is listed first, the Strategy will enter short first, long second, and end the bar with a long position.

If in our example both entries were long entry orders, the first order listed would be filled and the second would not.

***Note**: It is possible to enable pyramiding for a Strategy, in which case multiple entries in the same direction can be filled. The rules used to process orders for Strategies that allow pyramiding are explained on page 110.*

When there are multiple Strategies applied to a Chart Analysis window that place the same type of order, then the orders from the Strategy that is listed first in the **Format Strategy** dialog box is given priority (Figure 3-4). You can rearrange Strategies using the **Move Up** and **Move Down** buttons.

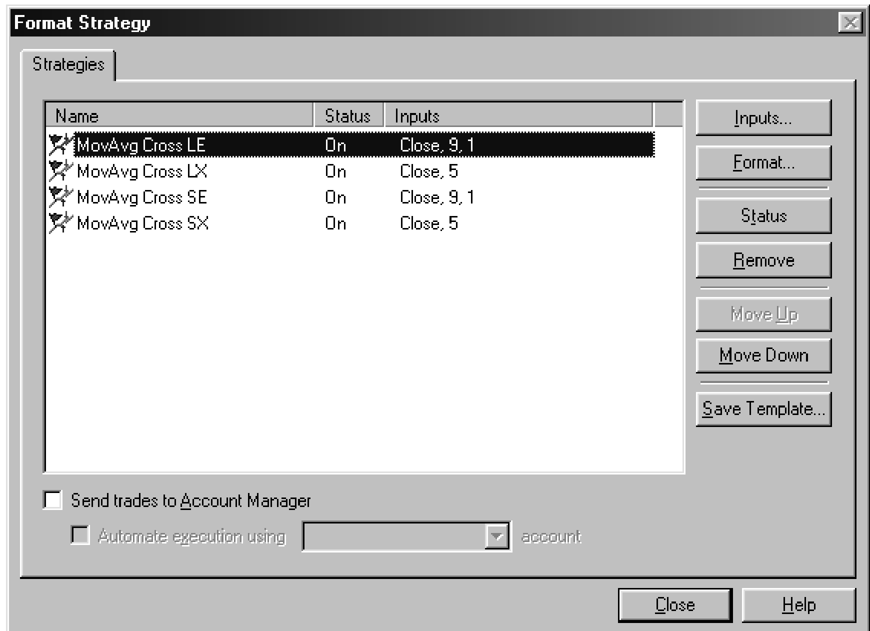


Figure 3-4. Strategies in the Format Strategy dialog. Strategies can be moved up or down to specify the order in which they are read by the engine.

To summarize this rule: *this bar on close* orders are evaluated first, then *next bar at market* orders. If there are multiple orders of the same type, the orders that appear first in the PowerEditor Strategy document are evaluated first, and the rest are ignored (unless pyramiding is allowed). Furthermore, if there is more than one Strategy applied to the Chart Analysis window, then the orders that come from the Strategy that is listed first in the **Format Strategy** dialog box have a higher priority.

As shown in Figure 3-5, if *Strategy A* is listed first in the **Format Strategy** dialog box then *Order A1* will be executed and the rest ignored; whereas if *Strategy B* is listed first, then *Order B1* will be filled.

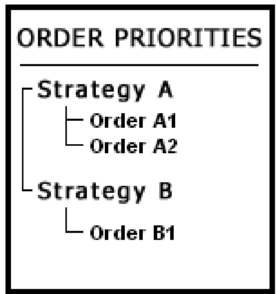


Figure 3-5. Order Priorities when using multiple Strategies

Rule 2: Stop and Limit Orders

Once all market orders are evaluated, the Trading Strategy Testing Engine analyzes stop and limit orders. If there are multiple stop or limit orders, the Trading Strategy Testing Engine gives a higher priority to the order that is closest to the market (closest to the current price).

This is done in order to simulate how stop and limit orders are actually filled. If a symbol is trading at 950, and there are two limit orders to buy—one at 949 and one at 948—as the market drops, the order to buy at 949 would be filled first, and the order to buy at 948 would be filled second. Therefore, the TradeStation Strategy Engine fills these orders in that way, producing results are as realistic as possible.

As another example, assume there are three (or more) different orders to buy at a limit price (e.g., buy 100 shares at 101 limit, buy 300 shares at 98 limit, and buy 500 shares at 95 limit). In this case, when pyramiding is disabled, TradeStation only displays the order to buy 100 shares at 101 limit, which is closest to the market. If pyramiding is enabled, then all three orders are shown, and the orders that are closest to the market are filled first.

To summarize this rule: if the stop or limit orders are an "or higher" order, TradeStation gives a higher priority when filling orders to the order with the lowest price target. If the stop or limit orders are "or lower," TradeStation gives a higher priority when filling orders to the highest price target.

Advanced Tips: 'Acceptable Orders'

Although many brokers will not accept buy stop or sellshort limit orders below the market or buy limit or sellshort stop orders above the market, TradeStation ***will*** *accept these orders and fill them on the next bar at the first available price, which will usually be the open of the bar. For example, if the market is trading at 950 and the Strategy places an order to buy at 1,000 limit, TradeStation will fill this order during the next bar at the first price under 1,000, which will probably be the open of the next bar.*

Determining the Number of Shares when Opening Positions

When formatting Strategies, under the **Trade size** section of the **General** tab (Figure 3-6) there is an option to specify the default number of shares (or contracts) that the Strategy will use when opening a position. This number is used unless the Strategy's entry or exit order specifies the number of shares/contracts to buy, sell short or close out (as discussed in the section, "Order Placement" on page 119). When the order

specifies the number of shares/contracts, it will override the setting under the **Trade size** section.

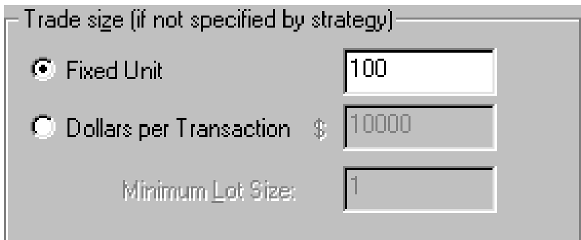


Figure 3-6. Trade size section of Format Strategy dialog box

Once it has determined the number of shares/contracts, the Trading Strategy Testing Engine will look at the setting under the **Position limits** section labeled **Maximum shares/contracts per position** (shown in Figure 3-7). If necessary, the number of contracts/shares of any orders are adjusted so that the total number of contracts/shares in an open position does not exceed the number specified in this option.

If there is no open position, and a Strategy places an order to buy 5,500 shares, and the number entered under the **Maximum shares/contracts per position** box is 5,000, the Trading Strategy Testing Engine will reduce the number of shares to 5,000.

Also, assuming the same maximum limit, if the Strategy allows for pyramiding, and there are 1,000 shares in the open position, and the Strategy places an order to buy 5,500 shares, the Trading Strategy Testing Engine will modify the order to 4,000 shares.

In summary, to determine how many contracts/shares the order will include, we need to find the lowest of the two numbers:

- Maximum contracts/shares per position (minus the current shares/contracts held) as specified in the **Position limits** section
- Number of contracts/shares requested by the order

The **Maximum shares/contracts per position** option enables you to set a global limit to the number of contracts/shares traded by a Strategy. This allows you to vary the limit depending on the symbol you are trading without having to modify the Strategies that are applied to the Chart Analysis window.

Limiting the Number of Open Entries per Position

When you enable pyramiding, it is possible for a Strategy to buy (or sell short) a number of consecutive times (increasing the size of the position). You can specify the maximum number of times the Strategy can buy (or sell short) without closing any of the open entries. You set this in the **Position limits** section of the **Format Strategy** dialog box, as shown in Figure 3-7.

The **Maximum open entries per position** option enables you to force the Strategy to ignore any new orders to add to the current position once the Strategy has already bought (or sold short) a specified number of consecutive times in a single position.

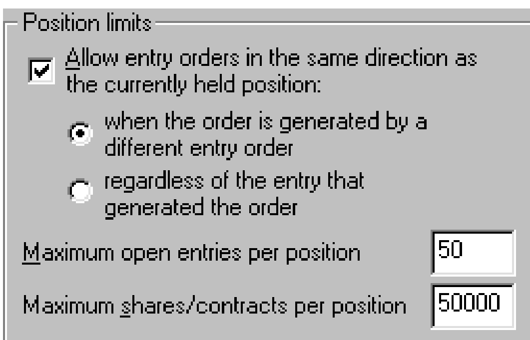


Figure 3-7. Format Strategy - General tab.

Stand-by Orders

Stand-by orders are orders that are generated by the Strategy that are not active. They remain on stand-by for the duration of the bar on which they were placed until either the bar is closed and the order is discarded, or conditions change during the bar such that the order is made active.

For example, assume you have applied a Strategy to a daily chart, the bar being evaluated is a Monday, and your current position is flat (neither long nor short). At this point, the Strategy places an order to exit a long position on the next bar at the low or anything lower. Since you are not currently in a long position, TradeStation generates this order and places it on stand-by. You are not informed that this order has been generated, it is invisible to you.

Now, assume that subsequently, an order to buy is placed for the next bar. During the next bar (the Tuesday bar), the entry order is filled (and now your position is long). At that point, the status of the exit order changes from stand by to active (and is listed on the **Strategy Orders** tab of the Account Manager window). Conditions changed such that the order was made active. However, if no long position had been established during the Tuesday bar, the exit order would have been discarded.

This stand-by feature enables you to place protective stops on the bar of entry; the order is placed on stand-by only until the close of the bar on which it is placed. Following is a list of scenarios under which orders are placed on stand-by:

General Scenarios:

- If the Strategy is not in a long position, all sell orders for long positions are placed in stand-by.
- If a sell order for a long position is tied to a specific entry, and the current long position was not initiated by the entry to which the exit is tied, the exit order is placed in stand-by.
- If the Strategy is not in a short position, all buy to cover orders for short positions

are placed in stand-by.

- If a buy to cover order for a short position is tied to a specific entry, and the current short position was not initiated by the entry to which the exit is tied, the buy to cover order is placed in stand-by.
- If there are multiple *or higher* exit (sell or buy to cover) orders, the Strategy traverses the orders, starting from the order with the lowest price, and adds the number of shares/contracts in each exit order. Any orders above and beyond the number of outstanding shares/contracts are placed in stand-by.
- If there are multiple *or lower* exit orders, the Strategy traverses the orders, starting from the order with the highest price, and adds the shares/contracts that each order is covering. Any orders above and beyond the number of outstanding shares/contracts are placed in stand-by.

No Pyramiding:

- All cases already described under 'General Scenarios'.
- If the Strategy is already in a long position, any additional stop or limit buy orders are placed on stand-by.
- If the Strategy is in a short position, any additional stop or limit sell short orders are placed on stand-by.
- If the Strategy is in a long or short position, and there is more than one *or higher* exit order, all exit orders except the one with the lowest target price are placed on stand-by.
- If the Strategy is in a long or short position, and there is more than one *or lower* exit order, all exit orders except the one with the highest target price will be placed on stand-by.
- If there are multiple *or higher* or *or lower* entry orders while the Strategy is not in a long or short position, all orders except the order that is closest to the market will be placed on stand-by.

Pyramiding - When the Order is Generated by a Different Entry Order:

- All cases already described under 'General Scenarios'.
- If a Strategy is in a long or short position, and a new order is generated by the same entry that opened the position, then the order is placed on stand-by.

Pyramiding - Regardless of the Entry that Generated the Order:

- All cases already described under 'General Scenarios'.
- If the Strategy has more than one *or higher* entry orders, it will consider the lower orders first, and if the combined orders reach the maximum number of shares/contracts allowed by the Strategy, then all additional higher entry orders will be placed on stand-by.
- If the Strategy has more than one *or lower* entry orders, it will consider the highest orders first, and if the combined orders reach the maximum number of shares/contracts allowed by the Strategy, then all additional higher entry orders will be placed on stand-by.

Canceling Orders

As a general rule, all stop and limit orders are canceled at the close of the bar. For example, if a trading strategy is applied to a daily price chart, and a buy limit order is placed on Monday, then the order is active throughout the Tuesday bar. This limit order

is canceled at the close of the session on Tuesday if the target price of the limit order is not met by the market. This applies to intra-day charts as well.

Note that we use the word *bar* instead of day. This implies that if you apply a trading strategy to a 30-minute bar, and the strategy places a buy limit order at 10am, the order is active from 10am to 10:30am (or the duration of the bar) and canceled if the order is not filled at the close of the bar.

There is one exception to this rule, and that is when a trading strategy places the exact same order for two or more consecutive bars. In this case, TradeStation will not cancel an order to replace it with an exact duplicate. Instead, it leaves the order active until it is filled, or the order is not placed (or it is changed in some way).

For example, let's assume that the trading strategy we apply to a daily chart places an order to buy 100 shares at 50 limit on Monday. This order remains active through Tuesday, and is canceled at the end of the trading session on Tuesday *unless* the strategy places another order to buy 100 shares at 50 limit during the Tuesday bar. If any element of the order changes, such as the number of shares, the price, etc., the order is canceled, and a new active order is placed.

When you work with intra-day charts, you can write day-only orders (orders that are canceled at the end of the day) by having the trading strategy place the exact same order repeatedly throughout the day once it finds its entry point.

Stop and limit orders are canceled at the close of the bar when:

- The order was not placed on this bar by the strategy
- The order was placed but either the number of shares or the target price changed from last bar
- A different entry/exit order generated the order in the current bar
- A different entry/exit order with a higher/lower target price was placed at a price closer to the market (then the order is placed in stand-by mode)

Backtesting

During backtesting, TradeStation reviews all the historical data and derives the historical results for the Strategy applied to the price chart.

Strategy Testing Data Resolution

The finer the data resolution that the strategy can analyze, the more accurate the Strategy results are when comparing real-time results to backtested results. In real time, stop and limit orders are monitored for possible fill prices on every tick received from your datafeed; therefore, when your Strategy includes stop and/or limit orders, setting a backtesting resolution will allow the most accurate simulation possible.

A bar has four prices: open, high, low, and close. By reading these four values, the only certain fact is that the first and last prices traded correspond to the values of the open and close, respectively. The order in which the market reached the high and low, and how much the market oscillated when building the bar cannot be inferred from these four

prices. Therefore, TradeStation must make assumptions about how the market moved ‘inside the bar.’

As shown in Figure 3-8, when formatting a Strategy, the **General** tab includes a section labeled **Backtesting** that contains the option **Backtesting resolution**. This option enables you to specify the data resolution to use when backtesting your Strategies. If you don’t specify an option, the data resolution of the price chart to which the Strategy is applied is used.

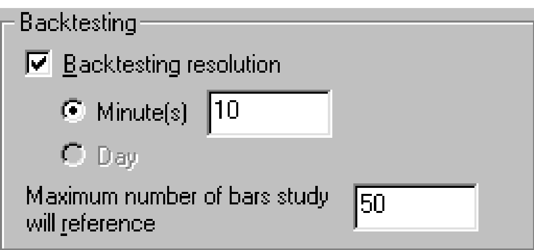


Figure 3-8. Format Strategy - General tab.

On an intraday chart, the most accurate Backtesting resolution available is one minute. On Daily, Weekly and Monthly charts, the most accurate testing is to an individual Day. TradeStation evaluates Strategies based on the selected Backtesting resolution, and uses bar assumptions to simulate the trading activity within each period.

Also, due to performance considerations (memory and speed), it may not be convenient or necessary to backtest to the most accurate data interval, but to backtest using simply a finer resolution than what the chart contains. For example, if a test is performed across 5,000 60-minute bars, the Strategy can look at 10-minute bars to find the fill prices instead of every minute, since 5,000 60-minute bars is an enormous amount of one minute bars to load and use on a price chart. In this case, TradeStation will apply the bar assumptions to each 10-minute bar, looking for fill prices for the stop and/or limit orders placed by the Strategy. This significantly improves the accuracy of the results (over using 60-minute bars) but reduces considerably the resource requirements when compared to testing the Strategy on a one minute resolution.

On the other hand, if a Strategy only places orders at the close of the current bar or on the next bar at market, it is not necessary to backtest using a fine resolution because these prices are always known.

Remember, from the four prices every bar has, we know at which price the bar opened and at which price the bar closed, so if a Trading Strategy includes an order to buy at the open of the next bar, this price will not be any different historically than in real time. Examining the “bars within a bar” reveals no additional information about the open or closing prices of the bar. Therefore, enabling the backtesting resolution setting for Strategies containing only these types of orders does not increase the backtesting accuracy of the Strategy.

Bar Assumptions

When tick data is not available, TradeStation makes certain assumptions about how each price bar was formed. These bar assumptions apply only when the Strategy uses stop and/ or limit orders; they do not apply when it includes only on close or at market orders, as described in the section above.

After extensive research, a few rules were established to describe the 'normal' behavior of bars. The Trading Strategy Testing Engine follows these rules in an attempt to simulate the market activity when there is not sufficient data available. However, these are market assumptions designed to improve the accuracy of the testing when there is not enough data available, and historical results will not always match real-time results. The assumptions are:

1. The market traded at every valid price throughout the range of the bar.
2. If the open price is nearer to the low than to the high (i.e., the open is in the bottom half of the bar), the intra-bar movement is assumed to be Open -> Low -> High -> Close, chronologically (see Figure 3-9).
3. If the open price is in the upper half of the bar (i.e., nearer to the high than the low), the intra-bar movement is assumed to be Open -> High -> Low -> Close, chronologically (see Figure 3-9).

The first assumption implies that the fill prices of stop and limit orders during backtesting may not be exactly the same as the results obtained while trading real time. Stop and limit orders are interpreted as the first price available over or under a certain level; if you place a buy stop order at 100, and the market trades at 99.875, and then the next trade jumps in price to 100.5, the real-time order is filled at 100.5, but if the backtest is performed and the tick data is not available to the Strategy, TradeStation will have no way of knowing that the market jumped in price, so the order is filled at 100.

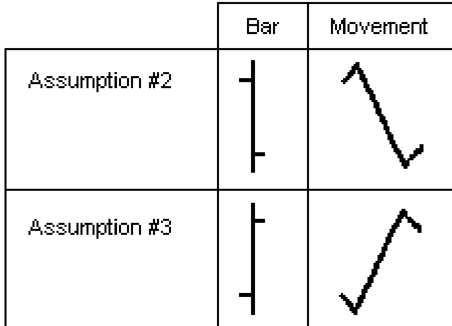


Figure 3-9. Intra-bar movement assumption

The second and third assumptions are important only when there are multiple active orders in one bar. If a Strategy places both a stop loss and a profit target order, and both prices are reached during one particular bar, the behavior of the market inside that bar determines if the trade is a winner or a loser.

For instance, if the market dropped, reached the low, and then rallied to the high, the stop loss was hit first and the trade lost money. However, if the high is reached first, the profit

target makes the trade a winner. Without the tick data available, there is no certain way to determine how the market moved during the bar. The assumptions may or may not be correct.

Keep in mind however, that by law of averages, if a backtest includes sufficient incidents of these scenarios, and they are resolved in a consistent fashion, the errors in favor and against tend to offset each other.

Bouncing Ticks

The markets do not move in straight lines, and they tend to oscillate even when in a strong trend. In fact, the market will rarely, if ever, move in the straight line as assumed by the second and third market assumptions explained in the previous section. Even within a bar, the market will usually oscillate as it reaches the highs and lows, and its movement will generally more closely resemble the illustration in Figure 3-10 than a straight line.

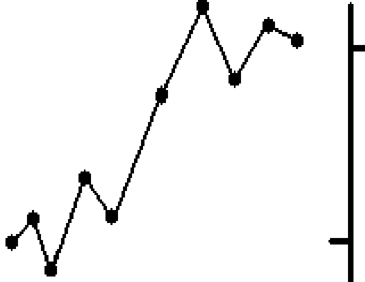


Figure 3-10. Normal intra-bar price movement

To simulate this behavior, the Trading Strategy Testing Engine uses a technique called ‘bouncing ticks’ that simulates market oscillations whenever stop or limit orders are filled. This method simulates market activity by *bouncing* the assumed price a certain percentage of the bar’s range (10% by default) in the opposite direction of any filled stop

or limit order. The Bouncing Ticks setting may be changed under the **Chart Analysis Preferences** dialog box (Figure 3-11).

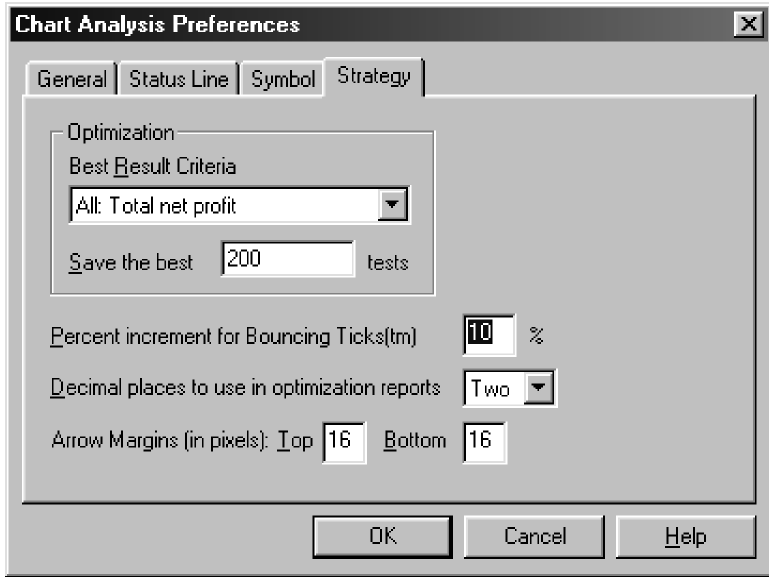


Figure 3-11. Percent increment for Bouncing Ticks

For example, if the range of the bar is 10 points, and a buy stop order is filled, TradeStation looks *down* the bar as far as 1 point under the entry price of the buy stop order looking for other orders to fill before continuing with the bar assumptions (Figure 3-12). If the stop or limit order filled is read as an *or higher* order, the Trading Strategy Testing Engine bounces the tick down, if the order is read as an *or lower* order, it bounces the tick up.

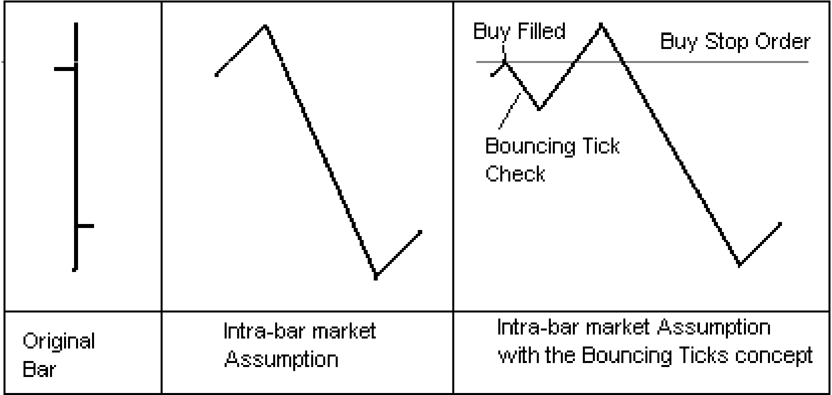


Figure 3-12. Bouncing tick

Bouncing ticks affect Strategy results in a very minor way, and only when the Strategy includes multiple stop and limit orders that are placed very close to each other.

Let’s look at an example of how bouncing ticks can affect your Strategy results.

Suppose there are three orders active for a particular bar: a *Buy* stop order at 100, a *Sell Short* stop order at 99.125, and an *Sell* limit order at 103. The market opens at 99.5, goes up to 105, falls to 90, and finally closes at 92. What trades took place, and what is the your market position at the close of the bar?

If bouncing ticks is not enabled (set to 0%), the *Buy* stop order is filled first, followed by the *Sell* limit order, resulting in a profit, and then the *Sell Short* order is filled, leaving you in a short position at the close of the bar.

If bouncing ticks is set to 10%, the *Buy* stop order is filled, then TradeStation bounces the price 10% lower, hitting the *Sell Short* stop (this exits you from the long position with a loss and establishes a short position), and bounces the price again, this time upwards. At this point, since there are no valid orders left (the *Sell* order is ignored since you are in a short position), TradeStation finishes traversing the bar normally, and leaves you in a short position. This example is illustrated in Figure 3-13.

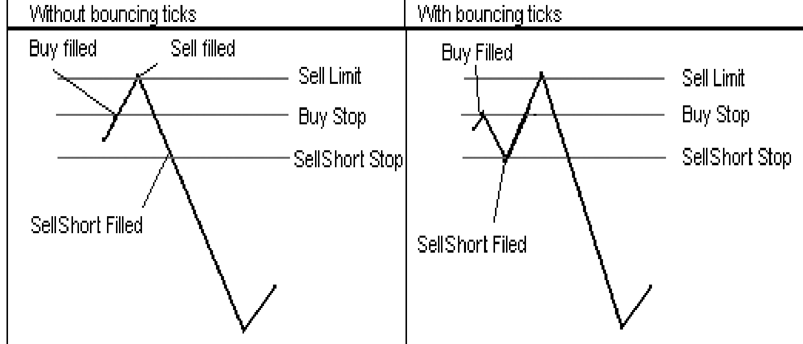


Figure 3-13. Bouncing tick example

With this technique, TradeStation introduces several oscillations into the intra-bar movement without having the underlying tick data. This particular example showed how the bouncing tick technique can turn a winning trade to a losing trade; however, it can just as easily turn a losing trade into a winning trade. Again, if a backtest includes sufficient incidents of these scenarios, and they are resolved in a consistent fashion, the errors in favor and against tend to offset each other.

It is very important to remember that this technique is designed to simulate market activity, but it is only a simulation. Actual market movement may differ significantly from this simulation, and produce differences in the Strategy Performance Report results.

Order Placement

Using the four trading verbs, you can simulate a wide variety of trading ideas and order types. This section describes the four trading verbs—*Buy*, *SellShort*, *Sell,* and *BuyToCover*—in detail.

Buy

This trading verb is used to open a long position (it covers your short positions and opens a long position). The specifics of the order are defined by the optional parameters used in the statement (i.e., number of shares, at what price, etc.).

Syntax:

```
Buy [("Order Name")] [Number of Shares] Execution Method;
```

Only the word *Buy* and the *Execution Method* are required to open a long position. The following is a complete EasyLanguage statement:

```
Buy This Bar on Close ;
```

If no other parameters are specified, the default value for the *Order Name* is "*Buy*", and the number of contracts entered is then determined by the amound specified in the **Trade size** section of the **Format Strategies** dialog box.

Each portion of the statement, *Order Name*, *Number of Shares*, and *Execution Method* is described next.

Order Name

When using multiple long entries within a Strategy, it is helpful to label each entry order with a different name. By naming entry orders, you can easily identify all positions, both on the chart and in the Strategy Performance Report. Also, naming the entry orders allows you to tie an exit to a particular entry order (For information on doing this, refer to the discussion of the trading verb "Sell" on page 124).

To name a long entry order, include a descriptive name in quotation marks and within parenthesis after the trading verb *Buy*. For example:

```
Buy ("My Entry") This Bar on Close ;
```

This instruction initiates a long position named *My Entry*. Again, when a Strategy that contains this statement is applied to a price chart, the order name is displayed on the chart and in the Strategy Performance Report under the **Trades** tab (Figure 3-14).

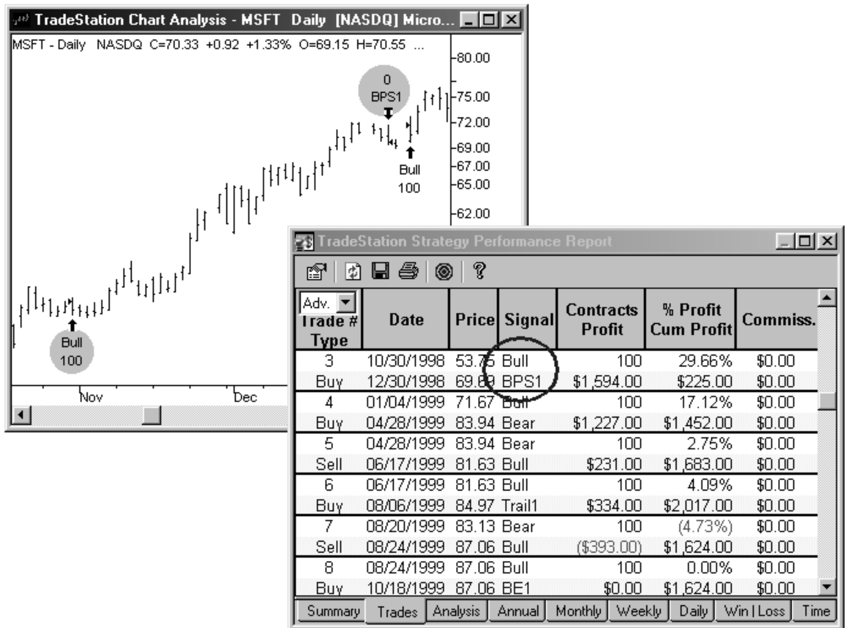


Figure 3-14. Naming Trading Orders

Number of Shares/Contracts

To specify how many shares (or contracts) to open the long position with, place a numeric expression followed by the words *shares* (or *contracts*) after the trading verb *Buy* (and entry order name if used). Some examples:

```
Buy ("My Entry") 100 Shares Next Bar at Market ;

Buy 5 Contracts This Bar on Close ;

Buy Value1 Shares Next Bar at Market ;
```

Note*: The words* shares *and* contracts *are synonymous.*

If the number of shares/contracts is not specified, the value entered under the **Trade size** section of the **Format Strategy** dialog box is used. The **Trade size** section controls the default trade amount; this can be set to either a fixed unit or dollars per transaction. Whatever is specified in this section is used by the Trading Strategy Testing Engine only if the *Buy* statement does not specify the number of shares/contracts with which to open the position.

Execution Method

You can use four different execution methods with the *Buy* trading verb:

```
... this bar on close

... next bar at market

... next bar at price Stop

... next bar at price Limit
```

The execution method *this bar on close* is provided for backtesting purposes only; it enables you to backtest ‘market at close’ orders, which you cannot automate using TradeStation. Given that all orders are evaluated and executed at the end of each bar, TradeStation reads and issues the *this bar on close* order once the bar has closed (e.g., once the daily trading session has ended). TradeStation fills the order using the close of the current bar, but you must place an order at market for execution on the next bar. This invariably introduces slippage.

The execution method *next bar at price Limit* instructs TradeStation to buy at the first opportunity at the specified *price* or lower. The execution method *next bar at price Stop* instructs TradeStation to buy at the first opportunity at the specified *price* or higher.

It is possible for stop and limit orders not to be filled (i.e., price never met); in this case, the orders are canceled at the close of the bar.

Examples

The following statement buys 100 contracts/shares at the closing price of the bar:

```
Buy 100 Shares This Bar on Close;
```

This statement buys the number of contracts/shares specified in the **Trade size** section of the **Format Strategy** dialog box at the open of the next bar, and is named *Entry#1:*

```
Buy ("Entry#1") Next Bar at Market;
```

The next statement places an order to buy 5 contracts at the high of the current bar plus the range of the current bar, or any price higher. Note that *Range* is a function that returns the high minus the low. This order remains active throughout the next bar (until filled or canceled):

```
Buy 5 Contracts Next Bar at High + Range Stop;
```

The next statement places an order to buy 100 shares at the lowest low of the last 10 bars, or any price lower. This order remains active throughout the next bar (until filled or canceled), and the order is named *LowBuy:*

```
Buy ("LowBuy") 100 Shares Next Bar at Lowest(Low, 10) Limit ;
```

SellShort

This trading verb is used to open a short position. A short position is created by covering all open long positions (if any) and opening a short position. The specifics of the order are defined by the optional parameters used in the statement (i.e., number of shares, at what price, etc.).

Syntax:

```
SellShort [("Order Name")] [Number of Shares] Execution Method ;
```

Only the word *SellShort* and the *Execution Method* are required to open a short position. The following is a complete EasyLanguage statement:

```
SellShort This Bar on Close ;
```

If no other parameters are specified, the default value for the *Order Name* is "*Short*", and the number of contracts entered is then determined by the amount specified in the **Trade size** section of the **Format Strategy** dialog box, **General** tab.

Each portion of the statement, *Order Name*, *Number of Shares*, and *Execution Method* is described next.

Order Name

When using multiple short entries within a Strategy, it is helpful to label each entry order with a different name. By naming entry orders, you can easily identify all positions both on the chart and in the Strategy Performance Report. Also, naming the entry orders allows you to tie an exit to a particular entry order (for information on doing this, refer to the discussion of the trading verb "BuyToCover" on page 128).

To name a short entry order, include a descriptive name in quotation marks and within parenthesis after the trading verb *SellShort*. For example:

```
SellShort ("My Entry") This Bar on Close ;
```

This instruction initiates a short position named *My Entry*. Again, when a Strategy that contains this statement is applied to a price chart, the order name is displayed on the chart and in the Strategy Performance Report under the **Trades** tab (see Figure 3-14, "Naming Trading Orders," on page 120).

Number of Shares/Contracts

To specify how many shares (or contracts) to open the short position with, place a numeric expression followed by the words *shares* (or *contracts*) after the trading verb *SellShort* (and entry order name if used). Some examples:

```
SellShort ("My Entry") 100 Shares This Bar on Close ;

SellShort 5 Contracts Next Bar at Market ;

SellShort Value1 Shares Next Bar at Market ;
```

***Note**: The words* shares *and* contracts *are synonymous.*

If the number of shares/contracts is not specified, the value entered under the **Trade size** section of the **Format Strategy** dialog box is used. The **Trade size** section controls the default trade amount; this can be set to either a fixed unit or dollars per transaction. Whatever is specified in this dialog box is used by the Trading Strategy Testing Engine only if the *SellShort* statement does not specify the number of shares/contracts with which to open the position.

Execution Method

You can use four different execution methods with the trading verb *SellShort*:

```
... this bar on close;

... next bar at market;

... next bar at price Stop;

... next bar at price Limit;
```

The execution method *this bar on close* is provided for backtesting purposes only; it enables you to backtest 'market at close' orders, which you cannot automate using TradeStation. Given that all orders are evaluated and executed at the end of each bar, TradeStation reads and issues the *this bar on close* order once the bar has closed (e.g., once the daily trading session has ended). TradeStation fills the order using the close of the current bar, but you have to place an order at market to be executed on the next bar. This invariably introduces slippage.

An order to *SellShort next bar at price Limit* instructs TradeStation to sell short at the first opportunity at the specified price or higher. A *SellShort next bar at price Stop* order instructs TradeStation to sell short at the first opportunity at the specified price or lower.

It is possible for stop and limit orders not to be filled (i.e., price never met); in this case, the orders are canceled at the close of the bar.

Examples

The following statement sells short 100 contracts/shares at the closing price of the current bar:

```
SellShort 100 Shares This Bar on Close;
```

This statement sells short the number of contracts/shares specified in the **Trade size** section of the **Format Strategy** dialog box at the open of the next bar, and is named *Entry#2:*

```
SellShort ("Entry#2") Next Bar at Market;
```

The next statement places an order to sell 5 contracts at the low of the current bar minus the range of the current bar, or any price lower. Note that *Range* is an EasyLanguage function that returns the high minus the low of the current bar. This order remains active throughout the next bar (until filled or canceled).

```
SellShort 5 Contracts Next Bar at Low - Range Stop;
```

The following statement places an order to sell 100 shares at the highest high of the last 10 bars, or any price higher. This order remains active throughout the next bar (until filled or canceled) and is named *HighSell:*

```
SellShort ("HighSell") 100 Shares Next Bar at Highest(High,10)
    Limit;
```

Sell

This trading verb is used to close a long position. The specifics of the order are defined by the optional components used in the statement (i.e., how many shares/contracts, at what price, etc.).

Exit orders do not pyramid. Once the exit criteria is met and the exit order filled, the order is ignored for that position until the position is modified (i.e., more shares/ contracts are bought or a new long position is established).

***Syntax*:**

```
Sell [("Order Name")] [from entry ("Entry Name")] [ Number of
    Shares [Total]] Execution Method;
```

Only the word *Sell* and the *Execution Method* are required to exit a long position. For example:

```
Sell This Bar on Close ;
```

If no other parameters are specified, the default value for the Order Name is "*Sell*", and all long contracts will be exited from the position.

Each portion of the statement, *Order Name*, *Number of Shares*, and *Execution Method* are described next.

Order Name

When using multiple exits within a Strategy, it is helpful to label each exit order with a different name. As shown in Figure 3-14, this enables you to identify these exit orders in both the price chart and the Strategy Performance Report.

To assign an exit order a name, specify a name in quotation marks and within parentheses immediately after the word *Sell*. For example:

```
Sell ("My Exit") This Bar on Close ;
```

This instruction closes the entire long position, and the order is labeled *My Exit*.

Tying an Exit to an Entry

It is possible to tie an exit instruction to a specific entry. This can be achieved only if you named the long entry, and the long entry is in the same Strategy as the exit order. Consider the following Strategy:

```
Buy ("MyBuy") 10 Shares Next Bar at Market;
```

```
Buy 20 Shares Next Bar at High + 1 Point Stop ;

Sell From Entry ("MyBuy") Next Bar at High + 3 Points Stop;
```

In the above example, the Strategy may buy 30 shares total; your long position is 30 shares. However, the *Sell* instruction only closes out the 10 shares bought using the *MyBuy* entry order. It ignores any other order, and does not close out the other 20 shares. Therefore, this exit order leaves you long 20 shares.

You can also close part of an entry order. For example, if your entry, which you named "*MyBuy*" buys 10 shares, you can specify that you want to exit from entry "*MyBuy*" but only close out 5 shares, not the entire 10:

```
Sell From Entry ("MyBuy") 5 Shares Next Bar at High + 3
    Points Stop;
```

Important*: The entry name is case sensitive. Be sure to use consistent capitalization. Also, it is important to remember that exit orders do not pyramid; therefore, if an exit does not close out a position, you will need another exit order (or reversal order) in order to close out the position.*

Number of Shares/Contracts

To specify how many shares (or contracts) to close, place a numeric expression followed by the word *shares* or *contracts* after the trading verb *Sell*. Some examples:

```
Sell 100 Shares This Bar on Close ;

Sell From Entry ("MovAvg") 10 Shares Next Bar at High + 1
    Point Stop ;
```

Note*: The words* shares *and* contracts *are synonymous.*

If you do not specify the number of shares or contracts in the *Sell* instruction, the exit order closes out the entire long position, rendering your position flat.

When you specify the number of shares/contracts, the *Sell* instruction exits the specified number of shares/contracts from every open entry.

Therefore, if the Strategy allows for pyramiding, and has bought 500 shares twice (for a total of 1,000 shares), and an order to *Sell 100 shares* is placed by the Strategy, the instruction will exit a total of 200 shares: 100 shares from each of the two entries. Figure 3-15 illustrates this example. After buying a total of 1,000 shares (500 at two different entry points), the order based on the instruction *Sell 100 shares next bar at market* exits a total of 200 shares, 100 from each entry, leaving you in a long position consisting of

800 shares. The onscreen cues in Figure 3-15 show you how many shares you hold in your current position.

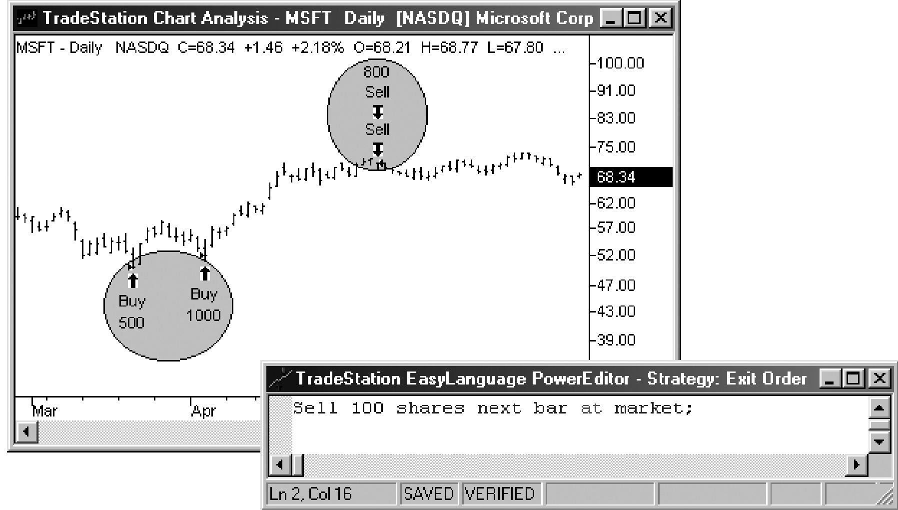


Figure 3-15. The instruction 'Sell 100 shares next bar at market' exits 100 shares out of each open entry.

However, if you want to exit a total of 100 shares, you can use the word *Total* in the *Sell* instruction. Using the word *Total* instructs the Strategy to exit 100 shares from the first open entry (first in, first out). This example is illustrated in Figure 3-16.

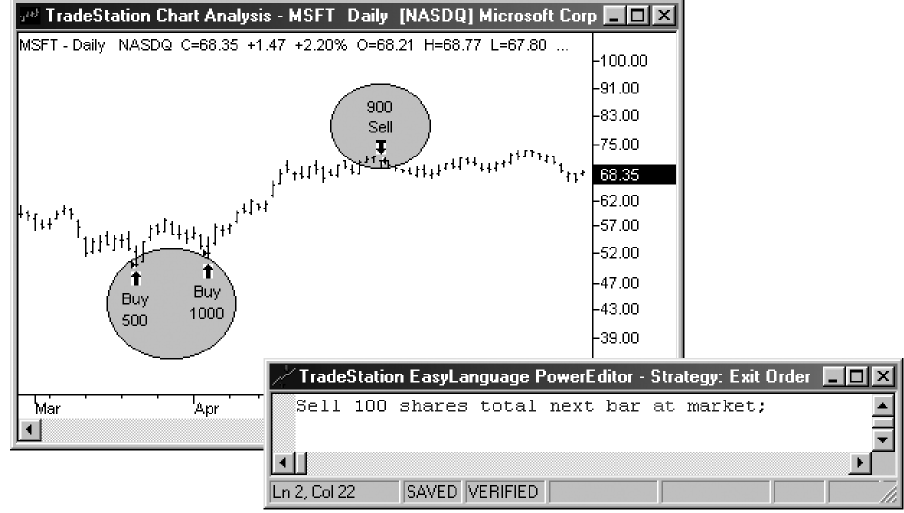


Figure 3-16. The instruction 'Sell 100 shares total next bar at market' exits 100 shares out of the oldest open entr(ies).

Execution Method

You can use four different execution methods with the trading verb *Sell*:

```
... this bar on close

... next bar at market

... next bar at price Stop

... next bar at price Limit
```

The execution method *this bar on close* is provided for backtesting purposes only; it enables you to backtest 'market at close' orders, which you use with TradeStation when trading real-time. Given that all orders are evaluated and executed at the end of each bar, TradeStation reads and issues the *this bar on close* order once the bar has closed (e.g., once the daily trading session has ended). TradeStation fills the order using the close of the current bar, but you have to place an order at market to be executed on the next bar. This invariably introduces slippage.

An order to *Sell at price Limit* instructs TradeStation to exit a long position at the first opportunity at the specified price or higher. A *Sell at price Stop* instructs TradeStation to exit a long position at the first opportunity at the specified price or lower.

It is possible for stop and limit orders not to be filled (i.e., price never reached); in this case, the orders are canceled at the close of the bar.

Tying the Exit Price to the Order Bar

When specifying the execution method, you can vary stop and limit orders by using 'At$' instead of 'at'. Using At$ forces the exit order to refer to the value the numerical expression *Price* had on the entry order bar (the bar that *generated* the entry order). Consider the following statement:

```
Sell From Entry ("MyBuy") Next Bar At$ Low - 1 Point Stop;
```

The above statement places an order to exit the long position at one point lower than the low of the entry order bar (e.g., if an order to *Buy next bar...* is generated today, the prices referenced will be today's, not tomorrow's. Even though the order was placed and filled tomorrow, it was generated today, and that is the bar referenced).

To use the At$ reserved word, you must name the entry order, and the *Sell* instruction must refer to the specific entry order.

As another example, if the maximum risk you will tolerate for a position is 5 points under the closing price of the entry order bar, you can use the following statement:

```
Sell From Entry ("MyBuy") Next Bar At$ Close - 5 Points
    Stop;
```

This is a valuable technique that allows you to refer easily to the prices of the bar on which the entry order was generated.

Examples

This statement exits all contracts/shares of your open long position at the close of the current bar. Your position will be flat.

```
Sell This Bar on Close;
```

The next instruction exits all contracts/shares of your positions opened by the entry order *Entry#1* at the open of the next bar, and the exit order is named *LongExit.*

```
Sell ("LongExit") From Entry ("Entry#1") Next Bar at Market;
```

The following statement places an order to close 5 contracts/shares in total at the low of the current bar minus 1 point or anything lower. This order is active throughout the next bar (until filled or canceled):

```
Sell 5 Contracts Total Next Bar at Low - 1 Point Stop;
```

The next instruction places an order to exit 100 shares from every entry at the high plus the range of the current bar or anything higher. This order is active throughout the next bar (until filled or canceled) and will be named *HighExit.*

```
Sell ("HighExit") 100 Shares Next Bar at High + Range Limit;
```

The following statement allows you to monitor your risk by placing an exit order 5 points below the closing price of the bar that generated the long entry order:

```
Sell From Entry ("MyBuy") Next Bar At$ Close - 5 Points
    Stop;
```

BuyToCover

This trading verb is used to cover a short position. The specifics of the order are defined by the optional components used in the statement (i.e., how many shares/contracts, at what price, etc.).

Exit orders do not pyramid. Once the exit criteria is met and the exit order filled, the order is ignored for that position until the position is modified (i.e., more shares/ contracts are sold or a new short position is established).

Syntax:

```
BuyToCover [("Order Name")] [from entry ("Entry Name")] [Number of
    Shares [Total]] Execution Method ;
```

Only the word *BuyToCover* and the *Execution Method* are required to exit a short position. The following is a complete EasyLanguage statement:

```
BuyToCover This Bar on Close ;
```

If no other parameters are specified, the default value for the *Order Name* is "*Cover*", and all short contracts will be exited from the position.

Each portion of the statement, *Order Name*, *Entry Name*, *Number of Shares*, and *Execution Method* are described next.

Order Name

When using multiple exits within a Strategy, it is helpful to label each one with a different name. As shown in Figure 3-14, this helps to identify these exit orders in both the price chart and the Strategy Performance Report.

To assign an exit order a name, specify a name in quotation marks and parentheses after the trading verb *BuyToCover*. For example:

```
BuyToCover ("My Exit") This Bar on Close ;
```

This statement exits the short position in its entirety, and the order is named *My Exit*.

Tying an Exit to an Entry

It is possible to tie an exit instruction to a specific entry. This can be done only if you name the short entry, and if the short entry is in the same Strategy as the exit. For example:

```
SellShort ("MyShort") Next Bar at Market ;
BuyToCover from Entry ("MyShort") This Bar on Close ;
```

In the above example, the Strategy may short 30 shares total; your short position is 30 shares. However, the *BuyToCover* statement only closes out the 10 shares shorted using the *MyShort* entry order. It ignores any other order, and does not close out the other 20 shares. Therefore, this exit order leaves you short 20 shares.

You can also close out part of an entry order, For example, if your entry "*MyShort*" sells short 10 shares, you can specify that you want to exit from entry "*MyShort*" but only close out 5 shares, not the entire 10:

```
BuyToCover from Entry ("MyShort") 5 Shares Next Bar at Low - 3
    Points Stop ;
```

Important*: The entry name is case sensitive. Be sure to use consistent capitalization. Also, it is important to remember that exit orders do not pyramid; therefore, if an exit does not close out a position, you will need another exit order (or reversal order) in order to close out the position.*

Number of Shares/Contracts

To specify how many shares/contracts to close out, use a numeric expression followed by the word *shares* after the trading verb *BuyToCover*. For example:

```
BuyToCover 100 Shares This Bar on Close ;
```

or

```
BuyToCover 5 Contracts Next Bar at Market ;
```

***Note**: The words* shares *and* contracts *are synonymous.*

If you do not specify the number of shares/contracts in the *BuyToCover* instruction, the order exits all shares/contracts, rendering your position flat.

If you do specify the number of shares/contracts, the *BuyToCover* instruction exits the determined number of shares/contracts out of every open entry. For example, if the Strategy allows for pyramiding, and has shorted 500 shares three times (for a total of 1,500 shares), and an order to *BuyToCover 100 shares* is placed, the exit order will exit a total of 300 shares: 100 shares from each one of the three entries. Refer to the discussion on the trading verb "Sell" on page 124 for an additional examples and charts illustrating this feature.

However, if the purpose of the *BuyToCover* statement is to exit a total of 100 shares, you can use the reserved word *Total* in the *BuyToCover* statement. Using the word *Total* causes the Strategy to exit 100 shares from the oldest open entry (first in, first out). For example:

```
BuyToCover 100 Shares Total This Bar on Close;

BuyToCover From Entry ("MovAvg") 10 Shares Total Next Bar at
    Low - 1 Point Stop;
```

Execution Method

You can use four different execution methods with the trading verb *BuyToCover*:

```
... this bar on close;

... next bar at market;

... next bar at price Stop;

... next bar at price Limit;
```

The execution method *this bar on close* is provided for backtesting purposes only; it enables you to backtest 'market at close' orders, which you use with TradeStation when trading real-time. Given that all orders are evaluated and executed at the end of each bar, TradeStation reads and issues the *this bar on close* order once the bar has closed (e.g., once the daily trading session has ended). TradeStation fills the order using the close of the current bar, but you must place an order at market to be executed on the next bar. This invariably introduces slippage.

An order to *BuyToCover at price Limit* causes TradeStation to close a short position at the first opportunity at the specified price or lower. An *BuyToCover at price stop* order causes TradeStation to close at the first opportunity at the specified price or higher.

It is possible for stop and limit orders not to be filled (i.e., price never reached); in this case, the orders are canceled at the close of the bar.

Tying the Exit Price to the Order Bar

When specifying the execution method, you can vary the stop and limit orders by using 'At$' instead of 'at'. Using At$ forces the exit order to refer to the value the numerical expression *Price* had on the entry order bar (the bar that generated the entry order). Consider the following statement:

```
BuyToCover From Entry ("MyBuy") Next Bar At$ High + 1 Point
    Stop;
```

The statement places an order to exit the short position at one point higher than the high of the entry order bar. For example, if an order to *SellShort next bar* is generated today, the prices referenced will be today's, not tomorrow's. Even though the order was placed and filled tomorrow, it was generated today and that is the bar referenced.

To use the reserved word At$, you must name the entry order, and the *BuyToCover* instruction must refer to the name of the specific entry order.

As another example, if the maximum risk you will tolerate for a position is 5 points over the closing price of the entry order bar, you can use the following expression:

```
BuyToCover From Entry ("MySell") Next Bar At$ Close + 5 Points
   Stop;
```

This is a valuable technique that allows you to refer easily to the prices of the bar on which the entry order was generated.

Examples

The next statement exits all contracts/shares of all open short entries at the close of the current bar:

```
BuyToCover This Bar on Close;
```

The following instruction exits all contracts/shares of any short entries opened by the entry order *Entry#1* at the open of the next bar, and this order is named *ShortExit.*

```
BuyToCover ("ShortExit") From Entry ("Entry#1") Next Bar at
   Market;
```

The next instruction places an order to close 5 contracts in total at the high of the current bar plus 1 point or higher. This order is active during the next bar (until filled or canceled):

```
BuyToCover 5 Contracts Total Next Bar at High + 1 Point Stop;
```

The next instruction places an order to exit 100 shares out of every open entry at the low minus the range of the current bar or anything lower. This order is active throughout the next bar (until filled or canceled), and is named *MyExit*.

```
BuyToCover ("MyExit") 100 Shares Next Bar at Low - Range Limit;
```

The following statement enables you to monitor your risk by placing an exit order 5 points over the closing price of the bar on which you generated the short entry order:

```
BuyToCover From Entry ("MySell") Next Bar At$ Close + 5 Points
   Stop;
```

Understanding Built-in Stops

Stops are exit orders that are not market driven; they exit you from the market based on your risk tolerance or desired profit. TradeStation provides six built-in stops in the form of Strategies that are written using specific reserved words. The built-in stops are unique because the reserved words they use are recalculated on every tick instead of at the completion of a bar. In other words, they are active on the bar of entry and updated for every bar of a position on a tick-by-tick basis. All other EasyLanguage instructions you write are calculated at the completion of a bar only.

This unique behavior is especially important to remember when using the trailing stop. Once a built-in stop order is placed, the value of the trailing stop is recalculated on every tick, and if necessary, the stop order is canceled and a new stop order is placed before the completion of a bar. This means that a built-in stop order can be generated, placed, and filled on the same bar using the prices from that bar.

For example, assume you apply a trading strategy that contains a built in trailing stop to a daily chart. The price at which the order is placed is recalculated every tick. If the price for the order differs from the last calculation (e.g., because the market made a new high), then the open order is canceled and a new order is placed on the current bar, regardless of the status of the bar.

The drawback to using the built-in stops (or your own Strategies written with the specific reserved words) is that since they are updated on every tick, the given stop price may not be realistically attainable because of the tick by tick updating of the stop price. In addition, the results of these stops (like any entry/exit orders) can be affected by bar assumptions.

You can combine the six built-in stops with other trading strategies, or you can use the specific reserved words as orders in your own Strategies. The eight specific reserved words are listed next, along with a description of the corresponding trading strategy.

SetBreakEven

This reserved word is used to place an order to exit the position or contract/share at the breakeven point once the specified amount of profit is reached.

Syntax:
```
SetBreakEven(FloorAmnt)
```

Parameters:
FloorAmnt is the amount of profit to be reached before the exit order is placed.

Notes:
Use with *SetStopContract* or *SetStopPosition*.

Strategy:
Breakeven StopFloor — When the profit (for the position or per contract/share) exceeds the breakeven floor, an exit order is generated. The exit order is a stop order placed at the entry price (average entry price if multiple entries) plus the commission specified in the **Trade costs** section of the **General** tab when formatting the strategy.

The profit on a position basis is calculated by subtracting any commissions specified in the **Trade costs** section from the overall position profit. The profit on a contract/ share basis is calculated by dividing the overall position profit by the number of contracts/shares and then subtracting the commissions from the resulting value.

The *Breakeven StopFloor* strategy only takes effect once a certain amount of profit is reached, so in a given position, it may never take effect.

SetExitOnClose

This reserved word is used to place an order to exit the position or contract/share on the close of the last bar of the trading session.

Syntax:
```
SetExitOnClose
```

Parameters:
None

Strategy:
Close at End of Day — The *Close at End of Day* strategy has no inputs. It will exit all open positions at the close of the trading session. It is particularly useful for day traders who do not want to hold any positions overnight.

SetDollarTrailing

This reserved word is used to specify the amount, based on the maximum open position profit, you are willing to lose (in dollars). The position or contract/share is closed out when the specified amount is lost.

Syntax:
```
SetDollarTrailing(DollarValue)
```

Parameters:
DollarValue is the amount of the maximum open profit that you are willing to lose.

Notes:
Use with *SetStopContract* or *SetStopPosition*.

Strategy:
Dollar Risk Trailing — The *Dollar Risk Trailing* strategy allows you to indicate the maximum amount of money you are willing to risk on a position, based on the maximum open position profit. The maximum profit is calculated from the point of entry using the highest high when long, or the lowest low when short. The dollar amount of profit per contract or per position you are willing to risk is then subtracted, and the trailing stop is placed at that point.

For example, assume that a dollar risk trailing stop is placed for $500. A protective stop would be placed for the maximum profit minus $500. If the amount you are willing to risk is greater than the maximum open position profit, this trailing stop does not take effect.

Consequently, the *Dollar Risk Trailing* strategy only locks in profits; it does not exit a position if you have a loss on the trade. Therefore, you should not use it to limit losses.

SetPercentTrailing

This reserved word is used to specify the amount of the maximum open position profit you are willing to lose (as a percent) as well as the profit level that must be reached in order for the stop to take effect. The position or contract/share is closed out when the specified percentage of the maximum profit is lost.

Syntax:
```
SetPercentTrailing(FloorAmnt, Amount)
```

Parameters:
FloorAmnt is the amount of profit to be reached before the stop takes effect. *Amount* is the percent of the profit you are willing to lose.

Notes:
Use with *SetStopContract* or *SetStopPosition*.

Strategy:
PercentRisk Trailing — The *PercentRisk Trailing* strategy enables you to indicate what percent of the maximum position profit you are willing to give back before the position is automatically closed out. It also requires that you provide a minimum profit level that must be reached by the position before the stop will take effect.

The maximum profit is calculated from the point of entry using the highest high when long or the lowest low when short. The percent of this amount per contract that you are willing to risk is then subtracted, and the trailing stop is placed at that point.

For example, assume that a *PercentRisk Trailing* Stop is placed at 20% with a floor of $500. Once profits exceed the floor value of $500, the stop will become active. The stop is then placed for the maximum profit to date minus 20%.

If the maximum open position profit for the trade does not exceed the floor level, this trailing stop does not take effect. Consequently, this stop only locks in profits, it does not limit losses.

SetProfitTarget

This reserved word is used to specify the amount of profit you want to reach in order to close out the position or per contract/share.

Syntax:
```
SetProfitTarget(DollarValue)
```

Parameters:
DollarValue is the amount of profit to reach in order to close the position (or exit from the contracts/shares).

Notes:
Use with *SetStopContract* or *SetStopPosition*.

Strategy:
Profit Target — The *Profit Target* strategy enables you to set a profit target (in dollars per contract/share or per position) at which your position is automatically closed out. If that profit level is never reached, the stop will not take effect. This stop locks in profits, it does not limit losses.

SetStopLoss

This reserved word is used to specify the amount you are willing to lose per position or per contract/share.

Syntax:
```
SetStopLoss(DollarValue)
```

Parameters:
DollarValue is the amount you are willing to lose per position or per contract/share.

Notes:
Use with *SetStopContract* or *SetStopPosition*.

Strategy:
Stop Loss

The *Stop Loss* Strategy enables you to specify the maximum amount of money you are willing to risk on any position, or on any one contract/share.

For example, if you specify a per position stop loss of $500 on your S&P 500 Futures contracts, TradeStation automatically exits the entire position when losses on the position reach $500. If on S&P 500 Futures, you specify a per contract stop loss of $500, TradeStation automatically exits the position when losses for any contract reach $500.

A *Stop Loss* Strategy should never be used as the only exit your trading strategy as using it requires the position to lose money in order to exit the trade.

For example, if the market goes in your favor, and you achieve a great deal of profit, you would have to lose all of that profit, plus the amount you specify as the stop loss value before the strategy would issue an order liquidating the contract/share or position.

SetStopContract

This reserved word forces an evaluation per contract/share of the stop that is being used. If neither *SetStopContract* or *SetStopPosition* is used, the stop is evaluated on a position basis.

SetStopPosition

This reserved word forces an evaluation on a position basis of the stop that is being used. If neither *SetStopContract* or *SetStopPosition* is used, the stop is evaluated on a position basis.

Writing Indicators and Studies

Indicators and studies display information on a price chart. The most common definition of an indicator is a mathematical formula that returns a number for every bar on a chart, with its resulting value displayed as a line, histogram, or series of points.

Studies are much like indicators, except that they have specific formatting built-in. The studies available to you in TradeStation are ShowMe, PaintBar, ProbabilityMap, and ActivityBar.

This section discusses how to write indicators, and is followed by sections describing how to write studies.

Writing Indicators

When you apply an indicator to a price chart, you can format the indicator to display its values in different ways; for example, as shown in Figure 3-17, you can format the indicator to display as a line on the chart, as a histogram underneath the price data, or as a series of dots, etc.

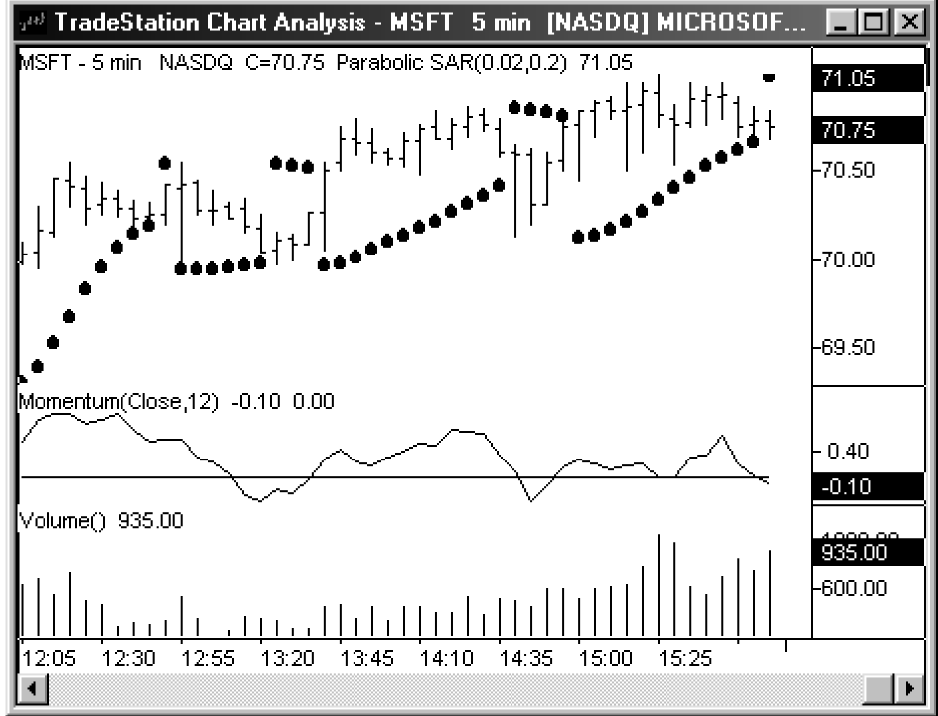


Figure 3-17. Different formatting styles of indicators

You can even format the properties of an indicator to display as a bar chart. For example, in the case of an indicator with three or four plots, such as the *Custom 4-Lines* Indicator, you can format the indicator and set one plot to *bar high*, another to *bar low,*

one to *left tick* and another to *right tick.* The *Custom 4 Lines* indicator displayed as a bar chart is shown in Figure 3-18.

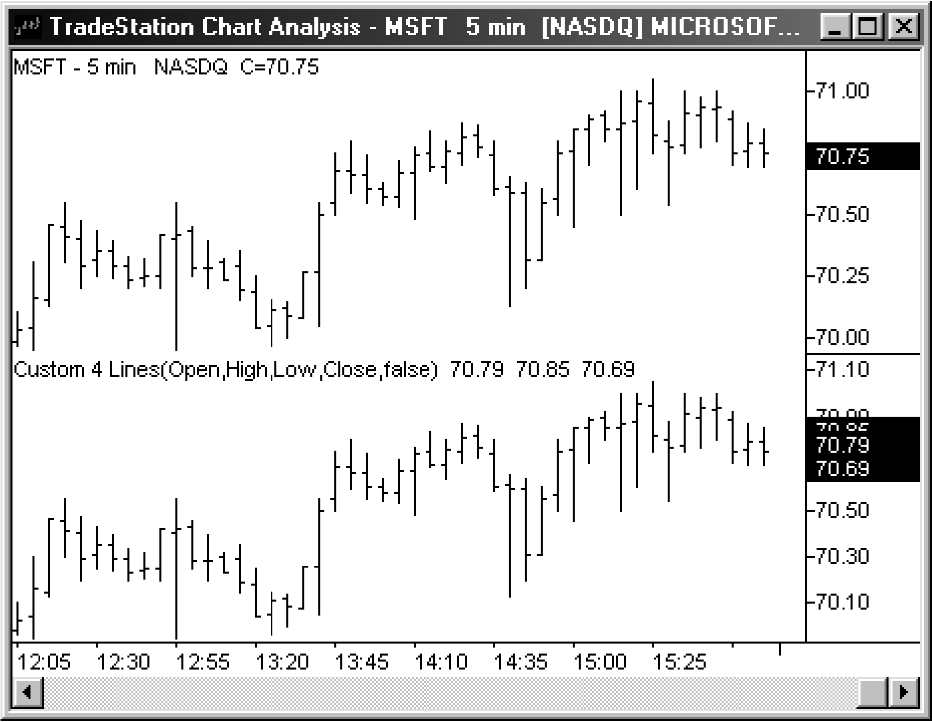


Figure 3-18. Indicator formatted to display as a bar chart

For more information on formatting indicators, please refer to the TradeStation WebHelp.

Also, make sure you understand the concept of scaling with respect to price charts and indicators. Using different scaling can dramatically alter the display of your indicators. For information on scaling, search the TradeStation WebHelp for *Indicator Formatting*.

The Plot statements used to write indicators for price charts are discussed next.

Plot*N(Expression, "<PlotName>", ForeColor, Default, Width)*

Displays values, resulting from a calculation or an expression, in a price chart. For price charts, the values displayed can only be numeric.

Syntax:
```
PlotN(Expression[,"<PlotName>"[,ForeColor[,Default,[,Width]]]]);
```

Parameters:
N is a number between 1 and 4, representing one of the four available plots. *Expression* is the numeric value plotted, and *<PlotName>* is the name of the plot. *ForeColor* is an Easy-

Language color used for the plot (also referred to as *PlotColor*), *Default* is reserved for future use, and *Width* is a numeric value representing the width of the plot. The parameters *<PlotName>, ForeColor, Default,* and *Width* are optional.

For a list of the available colors and widths, refer to Appendix B of this book.

Notes:
The parameter *Default* currently has no effect. However, a value for the parameter is required in order to specify a width, as discussed in the example.

Example:
Any one or more of the optional parameters can be omitted, as long as there are no other parameters to the right. For example, the *Default* and *Width* parameters can be excluded from a statement as follows:

```
Plot1( Volume, "V", Red);
```

But the plot name cannot be omitted if you want to specify the plot color and width. For instance, the following example generates a syntax error because the name of the plot statement is expected:

Incorrect:

```
Plot1( Volume, Black, Default, 2);
```

Correct:

```
Plot1( Volume, "V", Black, Default, 2);
```

The only required parameter for a valid Plot statement is the value to be plotted. So the following statement is valid:

```
Plot1(Volume);
```

When no plot name is specified, EasyLanguage uses Plot1, Plot2, Plot3, or Plot4 as the plot names for each plot. The first plot is named Plot1, the second Plot2, and so on.

Whenever referring to the plot color or width, you can use the word *Default* in place of the parameter(s) to have the Plot statement use the default color and/or width selected in the **Style** and/or **Color** tabs of the **Format Indicator** dialog box.

For example, the following statement will display the volume in the default color but specifies a specific width:

```
Plot1( Volume, "V", Default, Default, 3);
```

Again, you can use the word *Default* for the color parameters or the width parameter.

Also, the same plot (i.e., Plot1, Plot2) can be used more than once in an analysis technique; the only requirement is that you use the same plot name in both instances of the Plot statement. If no name is assigned, then the default plot name is used (i.e., Plot1, Plot2).

For example, if you want to plot the net change using red when it is negative and green when it is positive, you can use the same plot number (in this case Plot1) twice, as long a the name of the plot is the same:

```
Value1 = Close - Close[1];
```

```
If Value1 > 0 Then
   Plot1( Value1, "NetChg", Green )
Else
   Plot1( Value1, "NetChg", Red );
```

In this example, the plot name "NetChg" must be the same in both instances of the Plot statement.

***Note**: Once you have defined a plot using the* Plot*N* *reserved word, you can reference the value of the plot simply by using the reserved word,* Plot*N. In the example below, the reserved word* Plot1 *is used to plot the accumulation distribution of the volume. The value of the plot is referenced in the next statement, in order to write the alert criteria:*

```
Plot1(AccumDist(Volume), "AccumDist") ;

If Plot1 > Highest(Plot1, 20) then Alert ;
```

SetPlotColor*(Number, Color)*

This reserved word is used to change the color of a particular plot in a price chart window.

Syntax:
`SetPlotColor(Number, Color);`

Parameters:
Number is a number from 1 to 4 representing the number of the plot to modify. *Color* is the EasyLanguage color to be used for the plot.

For a list of the available colors, refer to Appendix B of this book.

Example:
The following EasyLanguage statements color the plot red when the RSI Indicator is over 75, and green when it is under 25:

```
Plot1(RSI(Close, 9), "RSI");

SetPlotColor(1, Default);

If Plot1 > 75 Then
    SetPlotColor(1, Red);

If Plot1 < 25 Then
    SetPlotColor(1, Green);
```

In this example, the *RSI* Indicator has three possible colors: red when it is over 75, green when it is below 25, and the default color when it is between 25 and 75. If you only set two colors, one for over 75 and one for under 25, it would remain one of the two colors (which ever it was set to last) when it is between 25 and 75.

What you need to do is reset the plot color to a default color every bar so that it is only red when above 75 and green when below 25. The rest of the time it is the default color.

In this example, we used the *SetPlotColor* reserved word to reset the plot to the default color.

You can also set the default color of the plot using the *Plot*N reserved word. If you set the default color in the *Plot*N statement, then you don't have to use the first *SetPlotColor* statement; instead your instructions would be as follows:

```
Plot1(RSI(Close, 9), "RSI", Default) ;

If Plot1 > 75 Then
   SetPlotColor(1, Red) ;

If Plot1 < 25 Then
   SetPlotColor(1, Green) ;
```

SetPlotWidth(*Number, Width)*

This reserved word sets the width of the specified plot.

Syntax:
`SetPlotWidth(Number, Width);`

Parameters:
Number is a number from 1 to 4 representing the number of the plot to modify. *Width* is the EasyLanguage width to be used for the plot.

For a list of the available widths, refer to Appendix B of this book.

Example:
The following EasyLanguage statements change the width of the plot to a thicker line when the Momentum Indicator is over 0, and to a thinner line when it is under 0:

```
Plot1(Momentum(Close, 10), "Momentum") ;

If Plot1 > 0 Then
   SetPlotWidth(1, 4);

If Plot1 < 0 Then
   SetPlotWidth(1, 1);
```

In this example, the *Momentum* Indicator has two possible widths: thicker when it is over 0, and thinner when it is below 0. However, in some cases you will want the indicator to have three or more possible widths. Please refer to the example for the previous reserved word, *SetPlotColor* for a variation on the usage of the *SetPlotWidth* reserved word.

Writing ShowMe and PaintBar Studies

ShowMe and PaintBar studies are somewhat similar to one another, in that both look for a bar that meets a specific condition and marks the bar if the condition is met. Their difference lies in the way each study marks the bar: the PaintBar study colors the entire bar, while the ShowMe studies typically place a mark above or below the bar.

A ShowMe study is best used when the objective of the analysis is to find a criteria that normally happens once every certain number of bars. A mark (usually a round dot) is

placed above or below these bars. The intention of the ShowMe study is to save you the work of scrolling through the chart looking for bars that meet a certain criteria.

A PaintBar study is best used to highlight when a market enters a certain mode or trend. In other words, it is best used in order to highlight an event that happens for a number of consecutive bars. For example, in Figure 3-19, we see how a ShowMe study is used to find all Bullish Key Reversal bars, and a PaintBar study is used to find whenever the momentum of the symbol is positive.

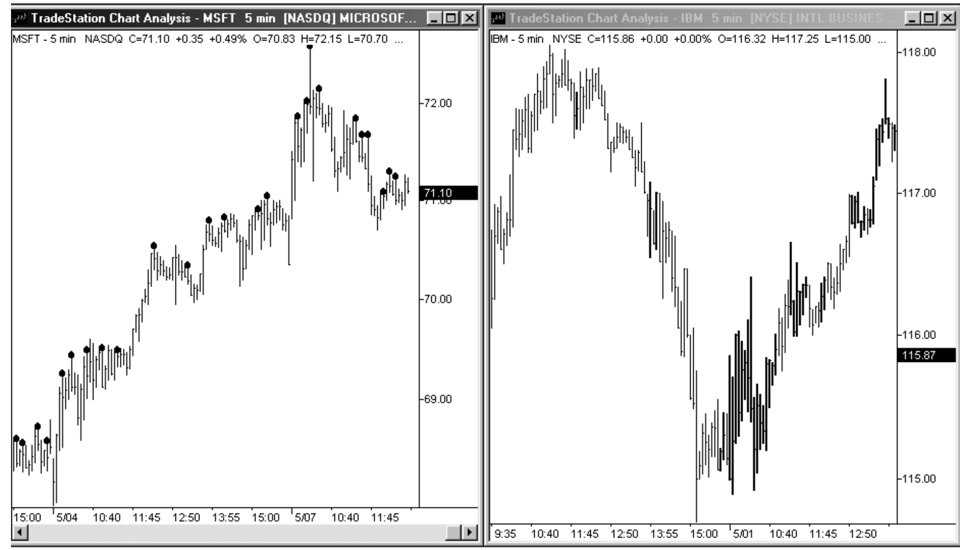


Figure 3-19. ShowMe and Paintbar studies

ShowMe Studies

To write ShowMe studies, you use the *Plot*N reserved word described on page 137 but instead of plotting a value for every tick or bar, you specify the conditions under which you want the Plot statement to be executed using an IF-THEN statement. Also, instead of specifying the value to plot, you specify the value on the bar at which to place the mark when the conditions are met (for example, the high, low, open, close, or any other numeric value).

Below is an example from the *Outside Bar* ShowMe study, which places a mark at the high of the bar when the high is higher than the previous high and the low is lower than the previous low:

```
If High > High[1] AND Low < Low[1] Then
   Plot1(High, "Outside Bar") ;
```

In the above example, we specified only the value at which to place the mark, in this case, the high price of the bar, and we named the plot *Outside Bar*. We could also specify the color of the mark and the width, or thickness, of the mark, as described in the discussion of the reserved word *Plot*N.

When working with ShowMe studies, you have an additional reserved word available to you, *NoPlot*.

NoPlot(*Num*)

This reserved word removes the specified plot from the current bar in the price chart.

Syntax:
```
NoPlot(Num)
```

Parameters:
Num is a numeric expression representing the number of the plot to remove.

Notes:
This reserved word is useful when collecting data and you have the **Update on every tick** check box selected for the ShowMe study. If the ShowMe study condition becomes true during the bar, but is not true at the end of the bar, the mark is removed. If you do not use this reserved word, the mark would be placed on the bar when the condition became true and left there even when the condition was no longer true.

Example:
The following ShowMe study marks the low of a gap down bar, but removes the mark if the condition is no longer true for the bar:

```
If High < Low of 1 Bar Ago Then
    Plot1(Low, "GapDown")
Else
    NoPlot(1) ;
```

PaintBar Studies

To write PaintBar studies, you use the reserved words described next.

PlotPaintBar(*BarHigh, BarLow , "PlotName", ForeColor, Default, Width*)

This reserved word is used only within a PaintBar study, and enables you to paint the entire bar a specified color or paint the bar between two specified values.

Syntax:
```
PlotPaintBar( BarHigh, BarLow [, BarOpen [, BarClose
    [, "<PlotName>"[, ForeColor[, Default [, Width]]]]]] );
```

Parameters:
BarHigh, *BarLow*, *BarOpen* and *BarClose* are numeric expressions representing the high, low, open and closing prices for the bar to be drawn by the PaintBar study, and *<PlotName>* is the name of the plot. *ForeColor* is an EasyLanguage color that will be used to paint the bar, *Default* is currently not used, and *Width* is a numeric value representing the width of the plot.

Notes:
You can also specify only two of the bar parameters instead of the four: *BarHigh*, *BarLow*. However, you must specify either two or all four of the bar parameters.

The parameter *Default* currently has no effect on a chart; however, you do need to include it in the statement when you want to specify *Width*.

You can abbreviate the *PlotPaintBar* reserved word to *PlotPB*. Also, you can use the *PlotN* reserved word described previously to write a PaintBar study; however, we recommend you use the *PlotPaintBar* reserved word.

For a list of the available colors and widths, refer to Appendix B of this book.

Example:
For example, the following instructions can be used in order to paint red the bars with twice the 10-bar average of the volume:

```
If Volume > 2 * Average(Volume, 10) Then
   PlotPB(High, Low, Open, Close, "AvgVol", Red );
```

The following instructions paint the area between the two plots of the Bollinger Bands Indicator when the 14-bar ADX value is lower than 25:

```
Variables: Top(0), Bottom(0);

Top = BollingerBand(Close, 14, 2);
Bottom = BollingerBand(Close, 14, -2);

If ADX(14) < 25 Then
   PlotPaintBar(Top, Bottom, "Area", Blue);
```

In this last example, notice that although we omitted the *BarOpen* and *BarClose* parameters, we are still able to specify the name and color of the plot. We applied this PaintBar study to a chart and formatted it to use a dotted line. The result is shown in Figure 3-20.

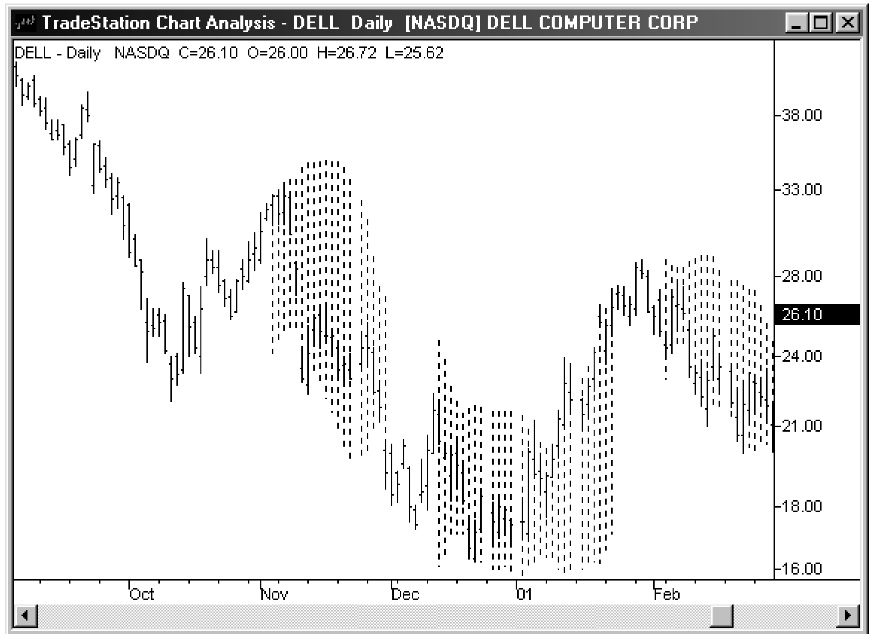


Figure 3-20. Use of a PaintBar study to shade an area of the chart

NoPlot(*Num*)

This reserved word removes the specified plot from the current bar in the price chart.

Syntax:
`NoPlot(Num)`

Parameters:
Num is a numeric expression representing the number of the plot to remove.

Notes:
This reserved word is useful when collecting data and you have the **Update on every tick** check box selected for the PaintBar study. If the PaintBar study condition becomes true during the bar, but is not true at the end of the bar, the plot is removed from that bar. If you do not use this reserved word, the bar is painted when the condition becomes true and remains painted even when the condition is no longer true.

Example:
The following PaintBar study paints the bars while the close is less than the 10-bar average of the close, but removes the plot from the current bar if the condition is no longer true:

```
If Close < Average(Close, 10) Then
    PlotPaintBar(High, Low, "Price<BarAvg")
Else
    NoPlot(1) ;
```

A PaintBar study uses one plot for two parameters; therefore, to remove the above plot, you need to use one *NoPlot* statement, as shown above. If you use four price parameters with the *PlotPaintBar* reserved word, then you use two *NoPlot* statements to remove the plot, *NoPlot(1)* and *NoPlot(2)*.

Writing ProbabilityMap Studies

ProbabilityMap studies create a 'drawing area' to the right of any bar clicked in a Chart Analysis window. They are most commonly used to show the most probable path, or area where the symbol will move to in the future. An example of this is show in Figure 3-21.

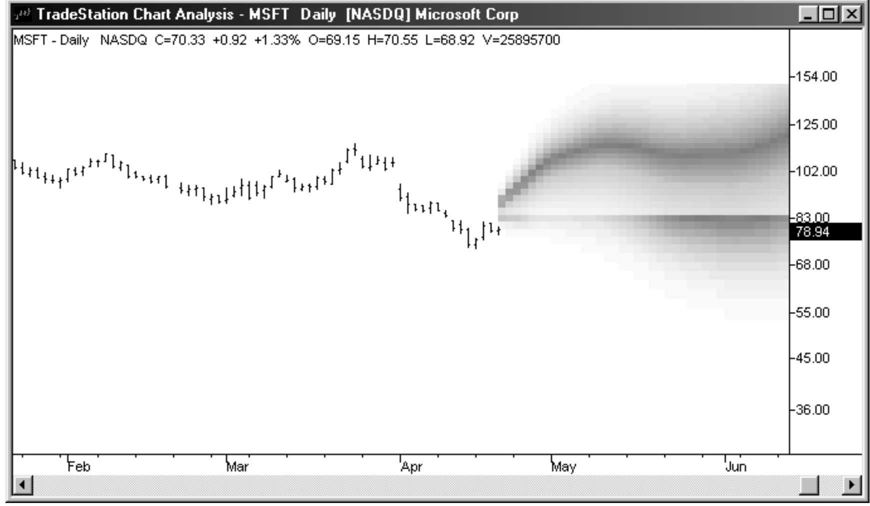


Figure 3-21. A ProbabilityMap study attempting to forecast future market activity.

You can also base ProbabilityMap studies on other analysis techniques, thereby providing a forecast of values based on the analysis technique.

However, this is not the only use for ProbabilityMap studies, as the analysis technique provides a canvas on which you can draw any pattern or figure.

As mentioned above, when creating a new ProbabilityMap study, your first task is to define the drawing area. This area is rectangular and divided into a grid with rows and columns. As illustrated in Figure 3-22, the number of rows is defined by a top and bottom price, and a row height, and the number of columns defined as a number of bars. You set these values using reserved words.

When the grid is initially created, it contains zeros (0) in all cells. Therefore, after you define the drawing area, you should assign a number between 0 and 100 to each one of the

cells in the grid. This number reflects the probability that the price (or value) will reach that particular cell.

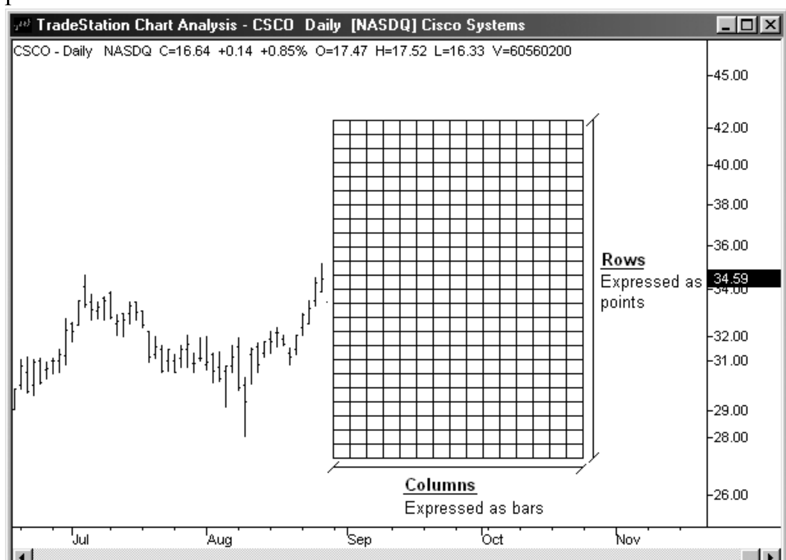


Figure 3-22. ProbabilityMap Study drawing area

As explained above, when creating a ProbabilityMap study, a rectangular area is created and divided into a grid with a specified number of rows and columns. Each one of the cells in this grid is assigned a value from 0 to 100, representing the probability that the price will reach that cell. When the ProbabilityMap study is applied to price chart, a color is assigned to each cell of the drawing area, thereby creating the ProbabilityMap graph.

As shown in Figure 3-23, there are three available patterns: fire, smoke, and fade. You specify the pattern using the **Style** tab in the **Format ProbabilityMap** dialog box.

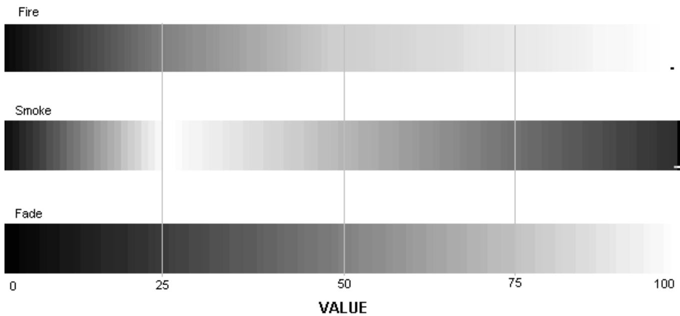


Figure 3-23. ProbabilityMaps color patterns

When creating ProbabilityMap studies, it is important to know that they are evaluated the same way as other analysis techniques (and as is explained in Chapter 2, “The Basic Elements of EasyLanguage”); however, they do not take into account all the bars on the price

chart, as do other analysis techniques. They take into account only however many bars are specified by the *MaxBarsBack* setting.

For instance, if 50 bars are specified in the *MaxBarsBack* setting, and we place our ProbabilityMap pointer on the 53rd bar of the price chart, the ProbabilityMap study begins calculating on the 50th bar of the chart, and so on until the 53rd bar until it displays the drawing area. However, if we place our pointer on the 100th bar of the price chart, the ProbabilityMap study will begin calculating on the 51st bar of the chart and so on until the most recent bar, at which point it will display the drawing area (the drawing area is actually created for each of the 50 bars, however, it is displayed for one bar at a time, that is why it is visible only on the selected bar).

This is illustrated in Figure 3-24.

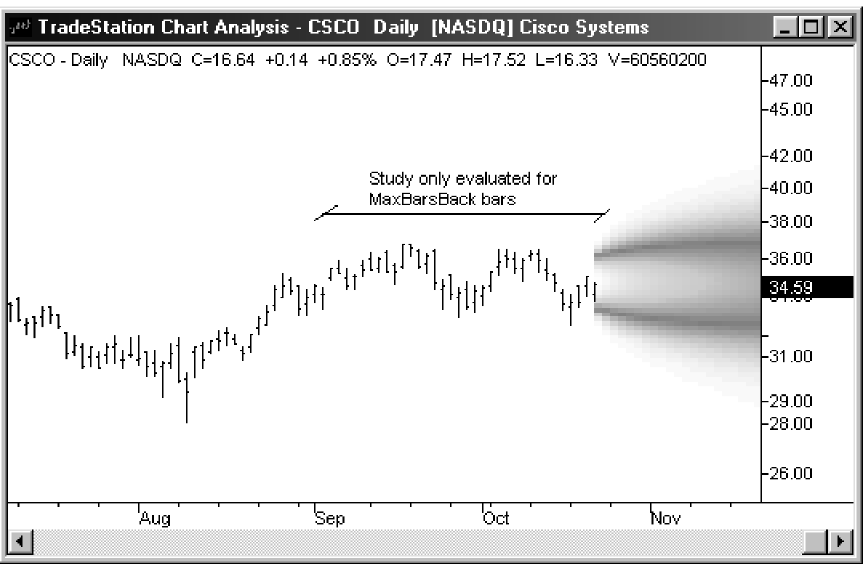


Figure 3-24. ProbabilityMap studies calculate only on the last *MaxBarsBack* of the chart

As with any trading strategy or analysis technique, you must specify the number of bars to use in the **Maximum Number of Bars study will reference** box (MaxBarsBack).

The reserved words available for the use of ProbabilityMap studies are divided into two groups: Set reserved words and Get reserved words. The Set reserved words are used to define the properties of the ProbabilityMap studies and to draw the graph itself. The Get reserved words, on the other hand, are used to read the values of an existing ProbabilityMap study or other analysis techniques applied to the price chart.

Set Reserved Words

To create a ProbabilityMap, you will use all the ProbabilityMap Set reserved words. These words define the size and properties of the ProbabilityMap study drawing area.

PM_SetHigh(*Num*)

This reserved word specifies the upper boundary of the ProbabilityMap area. The ProbabilityMap is not drawn above the value specified.

Syntax:
`PM_SetHigh(Num)`

Parameters:
Num is a numeric expression representing the upper boundary of the ProbabilityMap study.

Example:
The following statement sets the upper boundary of the ProbabilityMap study to a value of the close plus three times the range of the current bar:

```
PM_SetHigh(Close + (Range * 3));
```

PM_SetLow(*Num*)

This reserved word specifies the lower boundary of the ProbabilityMap area. The ProbabilityMap is not drawn below the value specified.

Syntax:
`PM_SetLow(Num)`

Parameters:
Num is a numeric expression representing the lower boundary of the ProbabilityMap.

Example:
The following statement sets the lower boundary of the ProbabilityMap study to the a value equal to the lowest low of the last 20 bars:

```
PM_SetLow(Lowest(Low,20));
```

PM_SetNumColumns(*Num*)

This reserved word is used to determine the number of columns inside the ProbabilityMap drawing area. The ProbabilityMap is not drawn past the number of columns (bars) specified.

Syntax:
`PM_SetNumColumns(Num)`

Parameters:
Num is a numeric expression representing the maximum number of bars to the right of the current bar that the ProbabilityMap is to be drawn.

Example:
The following statement defines the ProbabilityMap study drawing area to 50 bars:

```
PM_SetNumColumns(50);
```

You can use the following expression to set the ProbabilityMap drawing area to have as many columns as bars to the right available in the chart:

```
PM_SetNumColumns(MaxBarsForward);
```

PM_SetRowHeight(*Num*)

This reserved word is used to specify (in points) the height of each row of the ProbabilityMap drawing area.

Syntax:
`PM_SetRowHeight(Num)`

Parameters:
Num is a numeric expression representing the row height.

Notes:
The row height of the drawing area is usually specified as:

(ProbabilityMap Upper Boundary - ProbabilityMap Lower Boundary) / Number of Rows

So, for instance, if the difference between the upper and lower boundaries of the ProbabilityMap is 50, and you want 100 rows, the row height must be 0.5. The more rows there are in the ProbabilityMap, the better 'resolution'; in other words, the grid cells are smaller and the resulting graph appears smother and more detailed. However, it takes more time to draw, as there are more cells to calculate and for which to draw ProbabilityMap values.

Example:
If you want to have 50 rows in the ProbabilityMap, the following instructions specify the appropriate row height:

```
PM_SetRowHeight((PM_High - PM_Low) / 50 );
```

PM_SetCellValue(*Column, Price, Value*)

This reserved word is used to set the value of an individual cell in the ProbabilityMap drawing area.

Syntax:
`PM_SetCellValue(Column, Price, Value)`

Parameters:
Column, Price, and *Value* are numeric expressions. *Column* and *Price* are the column and the row of the drawing area, respectively, and *Value* is a numeric expression between 0 and 100 that colors that particular cell according to the color patterns shown in Figure 3-23.

Example:
The following statement sets the cell in the column corresponding to the close of the last bar on the chart (the first bar in the ProbabilityMap drawing area) to a value of 100:

```
PM_SetCellValue(1, Close, 100);
```

Get Reserved Words

The Get reserved words enable trading strategies, analysis techniques, and functions to read information from the ProbabilityMap study.

PM_Low

This reserved word returns a numeric value representing the lower boundary of the ProbabilityMap study drawing area. This value is important to ensure that you don’t query values outside of the ProbabilityMap study drawing area.

Syntax:
`PM_Low`

Parameters:
None

Example:
The following statement checks whether or not a particular value is inside the upper and lower boundaries of the ProbabilityMap study drawing area before assigning a color value to a cell:

```
If Value1 >= PM_Low AND Value1 <= PM_High Then
    PM_SetCellValue(1, Value1, 100);
```

PM_High

This reserved word returns a numeric value representing the upper boundary of the ProbabilityMap study drawing area. This value is important to ensure that you don’t query the values outside of the ProbabilityMap study drawing area.

Syntax:
`PM_High`

Parameters:
None

Example:
The following statement checks whether or not a particular value is inside the upper and lower boundaries of the ProbabilityMap study drawing area before assigning a color value to a cell:

```
If Value1 >= PM_Low AND Value1 <= PM_High Then
    PM_SetCellValue(1, Value1, 100);
```

PM_GetRowHeight

This reserved word returns numeric value representing the height (in points) of the cells of the ProbabilityMap study drawing area.

Syntax:
`PM_GetRowHeight`

Parameters:
None. To obtain the value returned by this reserved word, you can assign the value to a numeric variable, for example, *Value1*.

Notes:
This value should be used as an increment when traversing the ProbabilityMap study drawing area.

Example:
The following loop traverses the first column of the ProbabilityMap study drawing area:

```
Value1 = PM_Low;

While Value1 < PM_High Begin
    { EasyLanguage instructions }
    Value1 = Value1 + PM_GetRowHeight;
End;
```

PM_GetNumColumns

This reserved word returns a numeric value representing the number of columns of the ProbabilityMap study drawing area.

Syntax:
`Value1 = PM_GetNumColumns`

Parameters:
None. To obtain the value returned by this reserved word, you can assign the value to a numeric variable, for example, *Value1*.

Example:
The following loop traverses a row of the ProbabilityMap study drawing area from the first to the last column:

```
For Value1 = 1 To PM_GetNumColumns Begin
    { EasyLanguage instruction(s) }
End;
```

PM_GetCellValue(*Column, Price*)

This reserved word returns the number corresponding to the value of the specified cell of the ProbabilityMap study drawing area. The number returned by this reserved word is between 0 and 100, corresponding to the color patterns shown in Figure 3-23.

Syntax:
```
Value1 = PM_GetCellValue(Column, Price)
```

Parameters:
Column and *Price* are numeric expressions representing the cell in the ProbabilityMap study drawing area for which you want to obtain the value. To obtain the value returned by this reserved word, you can assign the value to a numeric variable, for example, *Value1*.

Example:
The following statement obtains the value of the cell in the lower left corner of the ProbabilityMap study drawing area:

```
Value1 = PM_GetCellValue(1, PM_Low);
```

ProbabilityMap Related Functions

When creating ProbabilityMaps, the following functions will be useful.

ProbAbove(*PriceTarget, CurrentPrice, VltyVal, BarsToGo*)

This function returns the probability that price will rise or remain above a price target, given the current price, volatility and time remaining in bars. *ProbAbove* is a simple function.

Syntax:
```
ProbAbove(PriceTarget, CurrentPrice, VltyVal, BarsToGo)
```

Parameters:
PriceTarget is a numeric expression representing the supposed future value that *ProbAbove* is testing. *CurrentPrice* is the current market price of the symbol being tested and *VltyVol* is the annualized volatility calculated for that symbol. *BarsToGo* is the time (number of bars) into the future that is desired to determine the *ProbAbove*.

Example:
The following statement calculates that chance that the symbol, which is currently trading at 100, will be trading at 110 or higher 30 bars into the future:

```
Value1 = ProbAbove(110, 100, .50, 30);
```

ProbBelow(*PriceTarget, CurrentPrice, VltyVal, BarsToGo*)

This function returns the probability that price will fall or remain below a price target, given the current price, volatility and time remaining in bars. *ProbBelow* is a simple function.

Syntax:
`Value1 = ProbBelow(PriceTarget, CurrentPrice, VltyVal, BarsToGo)`

Parameters:
PriceTarget is a numeric expression representing the supposed future value that *ProbBelow* is testing. *CurrentPrice* is the current market price of the symbol being tested and *VltyVol* is the annualized volatility calculated for that symbol. *BarsToGo* is the time (number of bars) into the future that is desired to determine the *ProbBelow*.

Example:
The following statement calculates that chance that the symbol, which is currently trading at 110, will be trading at 100 or lower 30 bars into the future:

```
Value1 = ProbBelow(100, 110, .50, 30);
```

ProbBetween(*LowTarget, HighTarget, CurrentPrice, VltyVal, BarsToGo*)

This function returns the probability that price will remain or fluctuate with a price range specified, given the current price, volatility and time remaining in bars. *ProbBetween* is a simple function.

Syntax:
`ProbAbove(LowTarget, HighTarget, CurrentPrice, VltyVal, BarsToGo)`

Parameters:
LowTarget and *HighTarget* are numeric expressions representing the low- and high-end values that *ProbBetween* is testing. *CurrentPrice* is the current market price of the symbol being tested and *VltyVol* is the annualized volatility calculated for that symbol. *BarsToGo* is the time (number of bars) into the future that is desired to determine the *ProbBetween*.

Example:
The following statement calculates that chance that the symbol, which is currently trading at 105, will be trading between 100 and 110 in exactly 30 bars into the future:

```
Value1 = ProbBetween(100, 110, 105, .50, 30);
```

Writing ActivityBar Studies

ActivityBar studies provide you with the ability to show trading patterns that occur within a range of bars on a chart. Unlike other indicators or studies, which consist of lines drawn between price points or that plot symbols above or below a bar, ActivityBar studies produce a series of cells to the right or left of a bar that show additional information about the trading activity *within* each bar.

ActivityBar studies break down each bar into smaller bars by adding cells to the right or left of the bar following the EasyLanguage instructions provided in the ActivityBar study. When writing new ActivityBar studies in the PowerEditor, it is helpful to think of the studies as multi-data analysis techniques, where the two data streams are for the same symbol, but one data stream has a finer resolution (smaller data interval) than the other and is placed in a hidden subgraph.

All the EasyLanguage instructions are evaluated on the hidden data stream, referred to as the *ActivityData* data stream, and the resulting cells are added to the visible bars.

When creating an ActivityBar study, only two instructions are necessary. The first is the instruction that defines the height of the cells, which is determined on a bar-by-bar basis. The other is the instruction or criteria that determines whether or not a cell is added.

You can also define and draw a zone around the ActivityBar study cells. You can draw this zone to the left, right, or on both sides of the bar. The EasyLanguage instructions define the upper and lower boundaries for the left and right zone separately, the width is automatically determined by the longest row of cells. For example, if the longest row has 35 cells, the zone is drawn wide enough to include all 35 cells.

You can also draw an arrow or pointer to highlight a specific price of the bar. You can draw this arrow on the left or right side of the bar (or both). By default, these pointers are drawn on the open and closing prices of the bar.

The ActivityBar study reserved words can be divided into three groups: 1) Set keywords used to set the properties of the ActivityBar study, 2) Get keywords used to obtain information on an existing ActivityBar study, and 3) other reserved words that are not necessary to when creating ActivityBar studies, but are helpful when working with them. Reserved words in the first two groups, Set and Get, are described next. For information on reserved words in the third group, refer to the Reserved Word Library in the TradeStation WebHelp.

Set Reserved Words

There are many ActivityBar study reserved words, but only two are required to write an ActivityBar study: *AB_AddCell* and *AB_SetRowHeight*. These and the other Set reserved words for ActivityBar studies are discussed next.

AB_AddCell(*Price, Side, Str_Char, Color, Value*)

This reserved word is used to add a cell to the current bar of the chart. You can only add cells to the bar currently being analyzed (e.g., *AB_AddCell(...)[1]* is not allowed). This reserved word must be included in an ActivityBar study.

Syntax:

```
AB_AddCell(Price, Side, Str_Char, Color, Value)
```

Parameters:

Price is a numeric expression representing the price value at which the cell is added. It can be any value inside or outside the range of the bar.

Side specifies the side of the bar on which the cell is placed, and it accepts one of two reserved words, *LeftSide* or *RightSide*.

Str_Char is the text string expression representing the text stored in the cell being added. The expression is limited to one character. If the text string expression is longer than one character, only the first character is used (e.g., if you use the text string expression “High” the letter “H” is placed in the cell).

Color is the EasyLanguage color or its numeric equivalent representing the color in which the cell is drawn. For a list of the available colors, see Appendix B.

Value is a numeric expression stored in the cell. This value is required; however, it does not affect the calculation of the ActivityBar study, and is solely for your use. You can refer to the value later from the ActivityBar study itself or from other analysis techniques that reference the ActivityBar study. Use zero (0) for this parameter if you do not want to specify a meaningful value.

Notes:
When writing an ActivityBar study, you must also specify the cell height. To do so, use the reserved word *AB_SetRowHeight*, described next.

Example:
The following statement adds a green cell to the right side of the bar for every tick. Each cell contains the letter A, and stores the trade volume for the tick in each cell:

```
AB_AddCell(Close of ActivityData, RightSide, "A", Green,
   Volume of ActivityData);
```

AB_SetRowHeight(*Value*)

This reserved word is used to define the height of each cell (row) on a bar-by-bar basis; it is required when writing an ActivityBar study.

Syntax:
`AB_SetRowHeight(Value)`

Parameters:
Value is a numeric expression representing the row height.

Notes:
You want the row height to be dynamic because symbols vary greatly in price from one symbol to another. For example, a row height of 0.25 will work nicely if the instrument is trading at $50, but it will be an enormous row height for a penny stock trading at $1 per share. Also, the trading range for a symbol can change significantly during a span of several years (e.g., a stock adjusted for several stock splits), and an appropriate row height for today may not work well in the past or the future. The built-in ActivityBar studies use the reserved word *AB_RowHeightCalc* as the parameter for this reserved word to calculate a dynamic row height.

When writing an ActivityBar study, you must also use the *AB_AddCell* reserved word (discussed previously) to add cells.

Example:
The following statement sets the row height to 1/20th of the average range of the last 10 bars. The result is approximately 20 rows of cells per bar:

```
AB_SetRowHeight(Average(Range, 10) / 20 );
```

AB_SetZone(*HighVal, LowVal, Side*)

This reserved word defines the properties of the ActivityBar study zone.

Syntax:
`AB_SetZone(HighVal, LowVal, Side)`

Parameters:
HighVal and *LowVal* are numeric expressions representing the upper and lower boundaries of the ActivityBar study zone, respectively. *Side* is one of two reserved words *LeftSide* or *RightSide*, which specifies the side of the bar on which the zone is drawn.

Notes:
The zone is drawn on every bar using the same drawing properties (color and thickness) of the bars, and is wide enough to fit the widest row of cells of that bar. The ActivityBar study zone is not drawn if there are no cells for a bar.

Example:
The following statements draw the ActivityBar study zone to the left of each bar at one standard deviation above and below the median price of the ActivityBar cells:

```
Value1 = AB_Median(RightSide);
Value2 = AB_StdDev(1, RightSide);
AB_SetZone(Value1 + Value2, Value1 - Value2, RightSide);
```

The above example uses the reserved words *AB_Median* and *AB_StdDev*. These reserved words are described in Appendix C, “Reserved Words Quick Reference,” as well as in TradeStation WebHelp.

AB_SetActiveCell(*Price, Side*)

ActivityBar studies display price markers on each bar on the chart. By default, these markers are drawn at the open (left side) and closing prices (right side). This reserved word overrides the default placement of these markers, allowing you to place them at any location on the bar.

Syntax:
`AB_SetActiveCell(Price, Side)`

Parameters:
Price is a numeric expression representing the price at which you want to place the marker, and *Side* defines the marker to move (left or right). *Side* only accepts one of two reserved words, *LeftSide* or *RightSide*.

Example:
The following statements place the right side marker at the modal cell of the ActivityBar study:

```
Value1 = AB_Mode(RightSide);
AB_SetActiveCell(Value1, RightSide);
```

AB_RemoveCell(*Price, Offset, Side*)

This reserved word is used to remove a cell from the current bar of an ActivityBar study.

Syntax:
`AB_RemoveCell(Price, Offset, Side)`

Parameters:
Price is a numeric expression representing the price of the row from which the cell is to be removed. *Offset* is the column number of the cell to be removed (where column 1 is the closest to the bar), and *Side* specifies the side of the bar on which the cell is located (you must use one of two reserved words, *LeftSide* or *RightSide*, to specify the side).

Notes:
If the specified cell does not exist, the ActivityBar study generates a run time error with the message "ActivityBar tried to reference an empty row."

Example:
The following statement removes the last cell on the right side of the bar, from the row corresponding to the close of the bar:

```
Value1 = AB_GetNumCells(Close of Data1, RightSide);

AB_RemoveCell(Close of Data1, Value1, RightSide);
```

This example uses the reserved word *AB_GetNumCells* to obtain the number of cells on the right side of the ActivityBar, and then uses the value obtained as the *Offset* parameter for *AB_RemoveCell*.

Get Reserved Words

Using the reserved words described in this section, you can reference information on existing ActivityBar study cells from any other analysis technique, trading strategy, or function.

AB_GetCellChar(*Price, Side, Offset*)

This reserved word returns the text string expression held by the specified cell.

Syntax:
```
AB_GetCellChar(Price, Side, Offset)
```

Parameters:
Price is a numeric expression representing the price of the cell referenced. *Side* specifies the side of the bar on which the cell is located (you must use one of two reserved words, *LeftSide* or *RightSide*, to specify the side), and *Offset* is the column number of the cell referenced (where column 1 is the closest to the bar).

Notes:
You can use this reserved word in an ActivityBar study as well as any other analysis technique, trading strategy, or function. To store the text string expression returned by the reserved word, you can assign this reserved word to a text string variable. If you reference a cell that does not exist, a runtime error will occur.

Example:
The following statements retrieve the text string expression held in the first cell of the row corresponding to the closing price of the current bar:

```
Variable: Str(" ");

Str = AB_GetCellChar(Close of data1, LeftSide, 1);
```

AB_GetCellColor(*Price, Side, Offset*)

This reserved word returns a number representing the color used to draw the specified cell.

Syntax:
```
AB_GetCellColor(Price, Side, Offset)
```

Parameters:
Price is a numeric expression representing the price of the cell referenced. *Side* specifies the side of the bar on which the cell is located (you must use one of two reserved words, *LeftSide* or *RightSide*, to specify the side), and *Offset* is the column number of the cell referenced (where column 1 is the closest to the bar).

Notes:
To store the number returned by the reserved word, you can assign this reserved word to a numeric variable. The numeric value returned is the EasyLanguage numeric equivalent used to specify colors. For a list of the available colors, refer to Appendix B of this book. You can use this reserved word in an ActivityBar study as well as any other analysis technique, trading strategy, or function. If you reference a cell that does not exist, a runtime error will occur.

Example:
The following statement retrieves the color of the first cell on the right side located at the opening price of the bar. The color is assigned to the variable *Value1*:

```
Value1 = AB_GetCellColor(Open of Data1, RightSide, 1);
```

AB_GetCellDate(*Price, Side, Offset*)

Each time a cell is added to a bar, the date and time of when it was added is stored with the cell. This reserved word returns the EasyLanguage date corresponding to the date the cell was added to the bar.

Syntax:
```
AB_GetCellDate(Price, Side, Offset)
```

Parameters:
Price is a numeric expression representing the price of the cell being referenced. *Side* specifies the side of the bar on which the cell is located (you must use one of two reserved words, *LeftSide* or *RightSide*, to specify the side), and *Offset* is the column number of the cell referenced (where column 1 is the closest to the bar).

Notes:
To store the date returned by the reserved word, you can assign this reserved word to a numeric variable. You can use this reserved word in an ActivityBar study as well as any other analysis technique, trading strategy, or function. If you reference a cell that does not exist, a runtime error will occur.

Example:
The following statement retrieves the date of the first cell on the right side at the opening price of the bar, and assign this date to the numeric variable *Value1*:

```
Value1 = AB_GetCellDate(Open of Data1, RightSide, 1);
```

AB_GetCellTime(*Price, Side, Offset*)

Each time a cell is added to a bar, the date and time of when it was added is stored with the cell. This reserved word returns the time that the cell was added to the bar.

Syntax:
`AB_GetCellTime(Price, Side, Offset)`

Parameters:
Price is a numeric expression representing the price of the cell being referenced. *Side* specifies the side of the bar on which the cell is located (you must use one of two reserved words, *LeftSide* or *RightSide*, to specify the side), and *Offset* is the column number of the cell referenced (where column 1 is the closest to the bar).

Notes:
To store the time returned by the reserved word, you can assign this reserved word to a numeric variable. You can use this reserved word in an ActivityBar study as well as any other analysis technique, trading strategy, or function. If you reference a cell that does not exist, a runtime error will occur.

Example:
The following statement retrieves the time of the first cell on the right side at the opening price of the bar, and assigns this date to the numeric variable *Value1*:

```
Value1 = AB_GetCellDate(Open of Data1, RightSide, 1);
```

AB_GetCellValue(*Price, Side, Offset*)

When you add a cell to a bar using the *AB_AddCell* reserved word, you can store a value in the cell. You use the *AB_GetCellValue* reserved word to obtain the value.

Syntax:
`AB_GetCellValue(Price, Side, Offset)`

Parameters:
Price is a numeric expression representing the price of the cell being referenced. *Side* specifies the side of the bar on which the cell is located (you must use one of two reserved words, *LeftSide* or *RightSide*, to specify the side), and *Offset* is the column number of the cell referenced (where column 1 is the closest to the bar).

Notes:
To store the value returned by the reserved word, you can assign this reserved word to a numeric variable. You can use this reserved word in an ActivityBar study as well as any other analysis technique, trading strategy, or function. If you reference a cell that does not exist, a runtime error will occur.

Example:
The following statement retrieves the value stored in the first cell on the right side at the opening price of the bar, and assigns this value to the numeric variable *Value1*:

```
Value1 = AB_GetCellValue(Open of Data1, RightSide, 1);
```

AB_GetNumCells(*Price, Side*)

This reserved word returns the number of cells in a specified row.

Syntax:
`AB_GetNumCells(Price, Side)`

Parameters:
Price is a numeric expression representing the price of the row being referenced, and *Side* specifies the side of the bar (*Side* accepts one of two reserved words, *LeftSide* or *RightSide)*.

Notes:
If you reference any attribute of a non-existent cell, a run time error is generated by the ActivityBar study when applied to a chart. For example, if at price 100 there are 5 cells to the right of the bar, and the study attempts to obtain the color of cell number 6, an error is generated and the study is turned off. You can avoid these errors by using the *AB_GetNumCells* reserved word to determine the number of available cells before attempting to reference any of them.

To store the resulting value, you can assign this reserved word to a numeric variable. You can use this reserved word in an ActivityBar study as well as any other analysis technique, trading strategy, or function.

Example:
The following statements obtain the text string expression stored in the last cell in the row corresponding to the open of the bar. Notice that we first obtain the total number of cells in the desired row, and store this number in the variable *Value1*. We then use the resulting number (*Value1*) to obtain the text string expression:

```
Variable: Str(" ");

Value1 = AB_GetNumCells(Open of Data1, RightSide);

Str = AB_GetCellChar(Open of Data1, Value1, RightSide);
```

AB_GetZoneHigh(*Side*)

This reserved word returns a numeric value representing the upper boundary of the ActivityBar study zone.

Syntax:
`AB_GetZoneHigh(Side)`

Parameters:
Side specifies the side for which to obtain the value. *Side* accepts one of two reserved words, *LeftSide* or *RightSide*.

Notes:
To store the resulting value, you can assign this reserved word to a numeric variable. You can use this reserved word in an ActivityBar study as well as any other analysis technique, trading strategy, or function.

Example:
The following statement assigns the high price of the ActivityBar zone to the numeric variable *Value1*:

```
Value1 = AB_GetZoneHigh(RightSide);
```

AB_GetZoneLow(*Side*)

This reserved word returns a numeric value representing the lower boundary of the ActivityBar study zone.

Syntax:
`AB_GetZoneLow(Side)`

Parameters:
Side specifies the side for which to obtain the value. *Side* accepts one of two reserved words, *LeftSide* or *RightSide*.

Notes:
To store the resulting value, you can assign this reserved word to a numeric variable. You can use this reserved word in an ActivityBar study as well as any other analysis technique, trading strategy, or function.

Example:
The following statement assigns the low price of the ActivityBar zone to the numeric variable *Value1*:

```
Value1 = AB_GetZoneLow(RightSide);
```

AB_High

This reserved word returns a numeric value representing the highest price on the bar at which a cell is drawn.

Syntax:
`AB_High`

Parameters:
None.

Notes:
If no cells are drawn, a value of zero (0) is returned. To store the resulting value, you can assign this reserved word to a numeric variable. You can use this reserved word in an ActivityBar study as well as any other analysis technique, trading strategy, or function.

Example:
The following statements use a While loop to traverse all the possible cells:

```
Value1 = AB_High;

While Value1 > AB_Low Begin
    { EasyLanguage Instruction(s) }
    Value1 = Value1 - AB_GetRowHeight;
End;
```

First, we use *AB_High* to obtain the highest price at which a cell is drawn, and we assign this value to *Value1*. In each iteration of the While loop, we subtract the value equal to one row (which we obtain using *AB_GetRowHeight*). The loop continues as long as *Value1* is greater than the lowest price on the bar at which a cell is drawn.

AB_Low

This reserved word returns a numeric value representing the lower of two values: the lowest price of the bar on which the ActivityBar study is applied, or the lowest price on the bar at which a cell is drawn.

Syntax:
`AB_Low`

Parameters:
None.

Notes:
If no cells are drawn, a value of zero (0) is returned. To store the resulting value, you can assign this reserved word to a numeric variable. You can use this reserved word in an ActivityBar study as well as any other analysis technique, trading strategy, or function.

Example:
The following statements use a While loop to traverse all the possible cells:

```
Value1 = AB_Low;

While Value1 < AB_High Begin
    { EasyLanguage Instruction(s) }
    Value1 = Value1 + AB_GetRowHeight;
End;
```

First, we use *AB_Low* to obtain the lowest price at which a cell is drawn, and we assign this value to *Value1*. In each iteration of the While loop, we add the value equal to one row (which we obtain using *AB_GetRowHeight*). The loop continues as long as *Value1* is less than the highest price on the bar at which a cell is drawn.

Other Reserved Words Related to ActivityBar Studies

The following is a list of reserved words you can use when writing ActivityBar studies.

ActivityData

This reserved word is a data alias used to reference the hidden data stream used by the ActivityBar study. When you want to refer to the ActivityBar data stream, and the reserved word that you are using is not an ActivityBar-related reserved word (thereby referencing the ActivityBar study data stream by default), you must use this data alias.

Syntax:
```
... of ActivityData
```

Parameters:
None.

Notes:
The reserved word *Of* is used with *ActivityData* to make it easier to read.

Example:
The following statement calculates the average of the last 10 closing prices of the ActivityBar study data stream. For instance, assume the ActivityBar study uses a data interval of 30 minutes and is applied to a daily chart. In this case, the statement calculates the average of the last ten 30-minute bars:

```
Value1 = Average(Close, 10) of ActivityData;
```

BarStatus(*DataNum*)

It can be very useful to know when the ActivityBar study is being called for the last trade of a particular bar, or when the ActivityBar study is being read for a trade ‘inside the bar’. This reserved word obtains this information.

Syntax:
```
BarStatus(DataNum)
```

Parameters:
DataNum is a numeric expression representing the data stream that is being evaluated, and can be between 1 and 50, inclusive.

Notes:
This reserved word will return one of four possible values:

- 2 = the closing tick of a bar
- 1 = a tick within a bar
- 0 = the opening tick of a bar
- -1 = an error occurred while executing the reserved word

Example:
The following statements reset the numeric variable *Value1* to 0 when the bar to which the ActivityBar study is applied is closed:

```
If BarStatus(1) = 2 Then
    Value1 = 0
Else
    Value1 = Value1 + 1;
```

LeftSide

This reserved word is used with the other ActivityBar reserved words to specify the side of the ActivityBar you want to reference. It specifies that you are referencing the left side of the bar.

Syntax:
`LeftSide`

Parameters:
None.

Example:
The following statement obtains the number of cells on the left side of a bar, for the row corresponding to the closing price:

```
Value1 = AB_GetNumCells(Close of Data1, LeftSide);
```

RightSide

This reserved word is used with the other ActivityBar reserved words to specify the side of the ActivityBar you want to reference. It specifies that you are referencing the right side of the bar.

Syntax:
`RightSide`

Parameters:
None.

Example:
The following statement obtains the number of cells on the right side of a bar, for the row corresponding to the open price:

```
Value1 = AB_GetNumCells(Open of Data1, RightSide);
```

ActivityBar Related Functions

When creating ActivityBars, the following functions will be useful.

AB_AddCellRange(*HighValue, LowValue, Side, String, Color, AB_Value*)

This function adds cells to a price range of the current bar starting at *LowValue* going to *HighValue*.

Syntax:
```
AB_AddCellRange(HighValue, LowValue, Side, String, Color, AB_Value)
```

Parameters:
HighValue and *LowValue* are numeric expressions that determine the High and Low value, respectively, of the column of cells. *Side* is an integer that represents which side of the price bar to add the cells. *String* is the single character to place within the cells, *Color* is an integer or EasyLanguage color for the cells and *ABValue* is the value assigned to each new cell.

Example:
The following statement will add a number of blue cells with a "+", from the high to the low. The assigned value of the cells will be 0:

```
AB_AddCellRange(High, Low, RightSide, "+", Blue, 0);
```

This function will return -1 if the *LowValue* and/or *HighValue* are invalid, and 1 if the drawing of cells was successful. For the *Side* input, *RightSide* or *LeftSide* can be used, or the integer values 1 or -1, respectively.

AB_NextColor(*MinuteInterval*)

This function specifies the color of ActivityBar cells based on a user-defined interval.

Syntax:
```
AB_NextColor(MinuteInterval)
```

Parameters:
BStatus is a numeric expression used to determine if an ActivityBar is complete. *MinuteInterval* is the number of minutes that make up each cell color interval, and *ABInterval* is the type of bar interval on which the ActivityBar is based.

Example:
The following statement will change the EasyLanguage numeric equivalent of a color every 10 minutes for the cells that are added to the ActivityBar during that period:

```
Value1 = AB_NextColor(10);
```

The *MinuteInterval* input must be equal to or less than the *BarInterval* of the ActivityData. If the *MinuteInterval* input exceeds the *BarInterval* of the ActivityBar, only a single color will be displayed.

If the total number of intervals for a given ActivityBar exceeds 16 (the number of available colors), the colors will repeat the same rotation.

AB_NextLabel(*MinuteInterval*)

This function specifies the letter that is placed within the cells of an ActivityBar, based on a user-defined interval.

Syntax:
`AB_NextLabel(MinuteInterval)`

Parameters:
MinuteInterval is the number of minutes that make up each cell letter interval.

Example:

The following statement will change the letter contained in each cell every 10 minutes, for the cells that are added to the ActivityBar during that period:

```
Value1 = AB_NextLabel(10);
```

The *MinuteInterval* input must be equal to or less than the *BarInterval* of the ActivityData. If the *MinuteInterval* input exceeds the *BarInterval* of the ActivityBar, the same character will be displayed in all cells. This function does not affect the color of the cells, only the string contents.

If the total number of intervals for a given ActivityBar exceeds 36 (the number of letters A-Z, plus numeric characters 0-9), the characters will repeat the same rotation.

AB_Mode(*Side, Type, oModeCount*, *oModePriceValue*)

This function returns the price at which the Mode row occurred in the current bar.

Syntax:
`AB_ModePrice(Side, Type, oModeCount, oModePriceValue)`

Parameters:

Side determines the side of the ActivityBar on which the Mode will be calculated. *Type d*etermines either the largest or smallest mode to indicate (>= 0 for largest, < 0 for smallest). oModeCountValue passed by reference that reflects the mode Count. oModePriceValue passed by reference that reflects the mode Price.

Example:
The following statement will assign to Value1 the price at which there were more cells on both sides of the bar:

```
Value1 = AB_Mode(2, 1, oModeCountValue, oModePriceValue);
```

The *Side* input can be replaced by either *RightSide* (or 1), *LeftSide* (or -1) or 2 (representing both sides).

AB_RowHeightCalc(*ApproxNumRows, RangeAvgLength*)

This function calculates and returns the row height to be used for an ActivityBar.

Syntax:
`AB_RowHeightCalc(ApproxNumRows, RangeAvgLength)`

Parameters:
ApproxNumRows represents the approximate number of cell rows that are desired for an ActivityBar. *RangeAvgLength* is the number of bars used in the calculation of the average range.

Example:
The following statement approximates that there will be 10 rows for each ActivityBar, based on the average range of the last three bars:

```
Value1 = AB_RowHeigthCalc(10, 3);
```

AB_RowHeigthCalc uses a calculation of the average range divided by the *Proximity* input to determine what the row height should be set to. As a result of this calculation, the number of rows on each ActivityBar will be likely to vary. If the result of the *AB_RowHeigthCalc* function is smaller than the minimum movement of the symbol, the minimum movement value is returned.

If either `ApproxNumRows` or `RangeAvgLength` is set to zero, the function will return .125.

AB_StdDev(*Multiplier, Side*)

This function returns the standard deviation of the ActivityBar cells.

Syntax:
`AB_StdDev(Multiplier, Side)`

Parameters:
Multiplier is a numeric expression representing the number of standard deviations to calculate. *Side* determines the side of the ActivityBar on which to calculate.

Example:
The following statement will assign to Value1 two standard deviations of the cells drawn on the left side of the bar:

```
Value1 = AB_StdDev(2, LeftSide);
```

The *Side* input can be replaced by either *RightSide* (or 1), *LeftSide* (or -1) or 2 (representing both sides).

CHAPTER 4

EasyLanguage and Custom DLLs

EasyLanguage enables you to use functions residing in dynamic-link libraries (written in C or C++) in your trading strategies, analysis techniques, and functions. This means that in addition to all the EasyLanguage reserved words and functions, you also have at your disposal any function in a DLL that is written in C or C++.

TradeStation Technologies, Inc. provides an EasyLanguage DLL Extension Kit, which consists of four files and detailed documentation. This chapter introduces you to the kit and discusses the use of DLL functions with EasyLanguage.

This is an advanced topic and this chapter assumes you know C or C++ as well as how to create a Windows DLL file.

In This Chapter

- Defining a DLL Function..................... 170
- Using Functions from DLLs 173
- Keeping Track of Analysis Techniques 174
- More About the EasyLanguage DLL Extension Kit....................................... 177

Defining a DLL Function

Before you can call a DLL function from EasyLanguage, you must declare the DLL using a DLL Function Declaration statement.

Syntax:

```
DefineDLLFunc: "DLLNAME.DLL", Return Type, "FunctionName",
   Parameters ;
```

DLLNAME.DLL is the name of the DLL where the function resides, *Return Type* is the type of expression the function will return, *FunctionName* is the name of the function as defined in the DLL, and *Parameters* is the list of parameters expected by the function (each parameter separated by a comma).

It is very important to remember that 32-bit DLLs use case-sensitive exported functions declared using _cdecl, _ _stdcall , or fastcall. For DLLs to be compatible with EasyLanguage, exported functions should be created using all uppercase letters and be declared as _stdcall. These exported functions must be listed within the EXPORTS section of the DLL's .DEF file. Using "_declspec (dllexport)" from the function's prototype is not sufficient for EasyLanguage to locate a DLL's exported functions.

For example, the following statement declares a function called *MessageBeep* which resides in the DLL called USER32.DLL. It returns a boolean (true/false) value, and it expects one parameter, *int*.

Example:

```
// C/C++ function prototype
Bool __stdcall MESSAGEBEEP(int nValue);

{Corresponding Definition in EasyLanguage code...}
DefineDLLFunc: "USER32.DLL", bool, "MessageBeep", int;
```

Data Types

EasyLanguage supports a number of valid data types that may be used to send and receive information to functions contained in DLLs. Following is a list of the data types supported by EasyLanguage:

Fundamental Data Types:

BYTE	1 byte integer data type.
char	1 byte integer data type.
int	4 byte signed integer data type.
WORD	2 byte unsigned integer data type.
long	4 byte signed integer data type.
DWORD	4 byte unsigned integer data type.

float	4 byte floating point data type.
double	8 byte floating point data type.
BOOL	4 byte boolean data type.

Variants:

UNSIGNED LONG	Same as **DWORD**.
VOID	Means “No returned value”.

Pointer Types:

LPBYTE	Pointer to a BYTE.
LPINT	Pointer to an int.
LPWORD	Pointer to a WORD.
LPLONG	Pointer to a LONG.
LPDWORD	Pointer to a DWORD.
LPFLOAT	Pointer to a float (in C++ float FAR).
LPDOUBLE	Pointer to a double (in C++ double FAR).
LPSTR	Pointer to a char.

All pointers are **32-bit** pointers and EasyLanguage treats each of them in the same manner.

Also, it is very important to remember that all values in EasyLanguage are floats, except for the Open, High, Low and Close values, which are integers. To manipulate these prices, you will want to send to the function the price scale of the symbol being plotted.

For example, if a stock has a price scale of 1/1000 and the last price was 105.125, this price will be sent to a DLL as 105125. For the DLL to know how to read this price, you need to send the value in the reserved word *PriceScale,* which in this case, returns a value of 1000.

Using Pointer Data Types

Pointer data types are designed to pass the memory addresses of and data point to a DLL function. All pointers used in EasyLanguage are treated as **32-bit** pointers. To obtain the pointer of any data element in EasyLanguage, the user must precede the data element with an ampersand (&).

For example, in order to refer to the address of the open, high of one bar ago and the value of variable *value1* of two bars ago you would use the following expressions:

&Open	Address of the open price of the current bar.
&High[1]	Address of the high price of the previous bar.
&Value1[2]	Address of the Value1 variable of two bars ago.

EasyLanguage currently supports addresses for the following data objects:

- All *Date, Time, Open, High, Low, Close, Volume,* and *OpenInt* values.
- All true/false and numeric variables including predefined variables.
- All true/false and numeric arrays.

Text strings are passed by address as a default when the LPSTR parameter type is used. Do not change the size of the passed string within your DLL, as this can cause unpredictable results.

The following example uses the correct syntax for including a pointer data type as one of the parameters sent to a function from a DLL in a statement.

```
DefineDLLFunc: "C:\UserDLL\MyLib.DLL",int,"MyFunc",LPLONG;

If MyFunc(&Close) > 0 Then
   Buy next bar at market;
```

It is very important to remember that pointers cannot be correctly assigned to a variable or an array element. Because neither a variable nor an array element has the necessary accuracy to hold a pointer, you should not try to store a pointer for later use.

Important: *The following example is prohibited in the current version of EasyLanguage as it produces an unpredictable result when* Value1 *is referenced at a later time.*

```
Value1 = &Open;
```

Also, do not assume that there is any relationship between two memory addresses. For example, do not assume **&Open[1]** is equal to **&Open[0]** plus 4. You should always use the provided ELKIT32 Functions to perform pointer calculations. See "EasyLanguage Tool Kit Library" on page 263.

Before accessing the values of EasyLanguage user defined variables passed by address, you must pass the address to a pointer variable using the *FindAddress_Var* function before you can access the value contained in that address.

You do not have direct access to the value contained in the address when you simply pass the pointer to a DLL function. You must use *FindAddress_Var* first before you can access and manipulate the variable's value. For example:

```
// Correct way to access EasyLanguage var values passed
by address...

// Sample C code:

float __stdCall MYVAR (LPFLOAT lpVar, int nOfs, DWORD
dwStartAddr, DWORD dwVarSaze) {

float fTmp;
```

```
fTmp = *lpMyFloat;

// At this point, fTmp mya be calculated before return-
ing...

fTmp += 1; // Add one to fTmp....

return fTmp;

}


{Sample EasyLanguage Code}

DefineDLLFunc: "C:\UserDLL\MyLib.DLL", float, "MYVAR",
LPFLOAT, int, DWORD, DWORD;

Var: MyTestVar(0), MyStart(0), MySize(0);

MyStart = VarStartAddr(MyTestVar);

MySize = VarSize(MyTestVar);

If CurrentBar = 1 then begin

   print("MyTestVar before passing = ", MyTestVar:0:0);

   MyTestVar = MYVAR((LPFLOAT)&MyTestVar,(int) 0,
(DWORD)MyStart, (DWORD)MySize);

   print("MyTestVar after passing = ", MyTestVar:0:0);

   { You will notice that 1 was added to MyTestVar...}

end;
```

Using Functions from DLLs

Once it is defined using a *DefineDLLFunc* statement, a DLL function can be called from EasyLanguage in much the same way as any other EasyLanguage function is used. A DLL function can be called within an expression or as a distinct statement if the return value is not used. To call a DLL function, the user must specify the function name and enclose all parameters within parenthesis. If multiple parameters are used, they must be separated by commas.

For example, in order to use a function called *MessageBeep*, which is included in USER32.DLL the following statements can be used:

```
DefineDLLFunc: "USER32.DLL",bool,"MessageBeep",int;

If Open > Close Then
   MessageBeep(0);
```

A second example follows:

```
DefineDLLFunc: "MYLIB.DLL",int,"MyAverageFunc", multiple;

Value1 = MyAverageFunc("Open = ",(LONG)Open);
```

The return value of the function *MyAverageFunc* is assigned to *Value1*. Notice the data type specifier (*LONG*) is included before the second parameter's value. This specifier is necessary because *MyAverageFunc* declares multiple parameter fields. In this instance, a data type specifier must precede each parameter. The exception to this rule is when a text string is used as a parameter of a DLL function as in the second example. With this exception in mind, we know that the data type must be *LPSTR*. Therefore, no data type specifier is needed, even when *MULTIPLE* is used. This is why there is no data type specifier before the string "*Open* =".

Keeping Track of Analysis Techniques

We have introduced a mechanism by which a custom DLL can keep track of all analysis techniques making calls to that DLL. This allows custom DLLs to know when they are added or removed from a calculation-stream. This feature is especially useful to those developers needing to allocate storage for each study using the DLL, and to free the DLL when the study is turned off or deleted from a chart.

Implementation of this mechanism is very simple for the DLL author. You can keep track of your DLL by exporting three additional functions. You can choose to export one, two, three, or none of the functions, however, you cannot use this feature without adding at least one of the functions to your DLL.

The three function-prototypes are:

```
void __stdcall Dll_Add(DWORD dwIdentifier);

void __stdcall Dll_Context(DWORD dwIdentifier);

void __stdcall Dll_Free(DWORD dwIdentifier);
```

Each function contains a unique dwIdentifier across a study loaded in memory for a single chart.

***Note**: You must export these functions via the EXPORTS section of your DLL's ".def file". If you do not follow this procedure, you will not be able to track your analysis*

techniques. Also, these functions are case-sensitive: Dll_Add is not the same as DLL_ADD.

Example:

1. Create a PaintBar called *TestPB* calling a UserFunction *FuncDll*.
2. *TestPB* calls a function in your DLL called *Bar*.
3. *FuncDll* calls a function in your DLL called *Foo*.
4. Add *TestPB* to two chart windows.
5. Add *TestPB* to the first chart window again.
6. You will have a unique dwIdentifier values for each analysis technique (3 in total).
7. The dwIdentifier is the same value within the context of the UserFunction called from the PaintBar because the UserFunction and PaintBar share the same unique identifier.

Dll_Add

Dll_Add is called when the user adds an indicator to the chart or turns the status to "on" in the **Format Analysis Technique** dialog box. *Dll_Add* can use the passed identifier to keep a list of analysis techniques calling it. *Dll_Add* can provide added functionality such as memory allocation as well as initiate values for a new study.

Syntax:

```
void __stdcall Dll_Add(DWORD dwIdentifier);
```

Parameters:
dwIdentifier is a unique identifier provided by EasyLanguage.

Notes:
In general, *Dll_Add* and *Dll_Free* are called once for every call to a different function in each analysis technique. However, EasyLanguage only assigns one *dwIdentifier* per analysis technique. This means that *Dll_Add* and *Dll_Free* may be called multiple times with the same *dwIdentifier*.

Example:

1. Create a Study S and 2 User Functions: F1, F2.
2. You have 2 functions within your DLL: DF1, DF2.
3. F1 calls DF1 twice.
4. F2 calls DF1 and DF2 (once each).
5. S calls DF1, F1, and F2.
6. Apply S to a chart.

Dll_Add will be called 4 times with the same *dwIdentifier*.

1 (S contains DF1) + 1 (F1 contains DF1 (twice)) + 2 (F2 contains DF1 and DF2) = 4

Upon deletion of S from chart, *Dll_Free* will also be called 4 times (again, same *dwIdentifier*).

Dll_Context

Dll_Context is immediately called prior to any of your DLL's other functions being called in an EasyLanguage study. *Dll_Context* allows you to set a Global identifier in your DLL so that all DLL functions know the context (unique identifier) it is currently executing. This allows you to use the correct memory block possibly allocated during your *Dll_Add* function. If you plan to do nothing during the *Dll_Context* phase, we recommend not exporting *Dll_Context* as it would be called immediately before each DLL function exported with your DLL causing a slight increase in processing time.

Syntax:

```
void __stdcall Dll_Context(DWORD dwIdentifier);
```

Parameters:
dwIdentifier is a unique identifier provided by EasyLanguage.

Dll_Free

Dll_Free is called when the status of an analysis technique using the DLL is turned off. This can due to the user turning the analysis technique off, deleting the analysis technique from the chart, closing the chart window, or a runtime error caused by the analysis technique. *Dll_Free* should free any memory allocated to the same unique identifier. *Dll_Free* can also decrement the reference-count keeping track of the number of studies simultaneously using the DLL.

Syntax:

```
void __stdcall Dll_Free(DWORD dwIdentifier);
```

Parameters:
dwIdentifier is a unique identifier provided by EasyLanguage.

Notes:
In general, *Dll_Add* and *Dll_Free* are called once for every call to a different function in each analysis technique. However, EasyLanguage only assigns one dwIdentifier per analysis technique. This means that *Dll_Add* and *Dll_Free* may be called multiple times with the same *dwIdentifier*.

Example:

1. Create a Study S and 2 User Functions: F1, F2.
2. You have 2 functions within your DLL: DF1, DF2.
3. F1 calls DF1 twice.
4. F2 calls DF1 and DF2 (once each).

5. S calls DF1, F1, and F2.
6. Apply S to a chart.

Dll_Add will be called 4 times with the same *dwIdentifier*.

1 (S contains DF1) + 1 (F1 contains DF1 (twice)) + 2 (F2 contains DF1 and DF2) = 4

Upon deletion of S from chart, *Dll_Free* will also be called 4 times (again, same *dwIdentifier*).

More About the EasyLanguage DLL Extension Kit

The EasyLanguage DLL Extension Kit consists of four files:

- ELKIT32.DLL
- ELKIT32.H
- ELKITVC.LIB (for use with VC++ only)
- ELKITBOR.LIB (for use with Borland C++ Builder only)

These files are located in the \TradeStation\Program directory.

The EasyLanguage Toolkit Library (ELKIT32.DLL) is a dynamic-link library that provides useful functions that can be called from any user DLL. It is commonly used to find the address of an offset of an EasyLanguage data object from within a user DLL.

APPENDIX A

EasyLanguage Syntax Errors

Syntax errors are produced when verifying an EasyLanguage statement that is not understood or expected by the PowerEditor. Following is a list of all syntax errors and their description, listed by error number. Each entry includes the description of the error, probable causes of the error, and examples of the correct and incorrect syntax for the offending statement or instruction (where applicable).

61 "Word not recognized by EasyLanguage."

This error is displayed whenever a word is not recognized by the PowerEditor. For example, if it is not an EasyLanguage reserved word; EasyLanguage function, or a declared user defined variable, array, or input name.

62 "Invalid number."

The PowerEditor displays this message whenever it finds a typographical error in a number. For example, if a letter is inserted by mistake in a number, the number will be highlighted and this error will be displayed. An example of an invalid number is *100.b4.*

63 "Number out of range."

The PowerEditor displays this error whenever it finds a number that is outside the supported range (a number which is too big). The following statement will produce this error:

```
Value1 = 9999999999999999999;
```

65 "Invalid variable name."

The PowerEditor displays this error whenever it finds an invalid name in an variable declaration statement. Variable names cannot start with a number nor any special character other than the underline (_).

For example, this error will be generated when the following statement is verified:

```
Variable: $MyVariable(0);
```

66 "Invalid input name."

The PowerEditor will display this error whenever it finds an invalid name in a input declaration statement. Input names cannot start with a number nor any special character other than the underline (_).

For example, this error will be generated when the following statement is verified:

```
Input: $MyInput(0);
```

70 "Array size cannot exceed 2 billion elements."

Arrays can have up to 2 billion elements. The number of elements is calculated by multiplying all the dimensions of the array. For example, an array declared using the following statement will have 66 elements:

```
Array: MyArray[10,5](0);
```

This arrays will have rows 0 through 10 and columns 0 though 5; in other words, 11 rows and 6 columns. The resulting number from multiplying the dimensions of the array can't exceed 2 billion.

74 "Invalid array name."

The PowerEditor displays this error whenever it finds an invalid name in an array declaration statement. Array names cannot start with a number nor any special character other than the underline (_).

For example, this error will be generated when the following statement is verified:

```
Array: $MyArray[10](0);
```

90 "The first jump command must be a begin: (\\hb,\\pb,\\wb)"

This error is displayed when the PowerEditor finds an end *jump command* without a begin *jump command* in a text string. The end jump commands are:

```
\he
\pe
\we
```

Before these commands, a begin *jump command* must be used.

***Note**: when specifying a file name for the Print() or FileAppend() words, files that start with any of the jump commands will produce this error. So a file name "c:\hello.txt" will produce this error as part of the name \he.*

91 "You cannot nest jump commands within other jump commands."

Jump commands are used in commentary-related text string expressions to highlight words, and create links to the on line help. *Jump commands* cannot be nested; that is, there cannot be multiple starting *jump commands* without having matching end *jump commands*.

92 "You must terminate all jump commands with ends (\\he,\\pe,\\we)"

This error is displayed when the PowerEditor finds a begin *jump command* without a end *jump command* in a text string. The begin *jump commands* are:

```
\hb
\pb
\wb
```

After these commands, an end *jump command* must be used.

***Note**: when specifying a file name for the Print() or FileAppend() words, files that start with any of the jump commands will produce this error. So a file name "c:\hello.txt" will produce this error as part of the name is \he.*

151 "This word has already been defined."

User defined words (such as variables, arrays, and inputs) need to have unique names. This error is generated when a user defined word is defined more than once, such as in the following example:

```
Input: vac(10);
Variable: vac(0);
```

154 "=, <>, >, >=, <, <= expected here."

This error is displayed when the PowerEditor evaluates complex true/false expressions and it finds an error within the expression.

```
Condition1 = Condition2 = Close;
```

The intention of this statement was to assign a complex true-false value to the variable *Condition1*, by using *Condition2* and a comparison that involves the *Close*. A corrected version would look like this:

```
Condition1 = Condition2 AND Open = Close;
```

155 " '(' expected here."

The left parenthesis was expected before the highlighted word; for example, if you are using a function that requires parameters, and no parameters are listed.

```
Value1 = Average + 10;
```

In this example, the highlight signifies that a parenthesis was expected before the '+' sign.

156 " ')' expected here"

The right parenthesis was expected after the highlighted word; for example, if you are using a function that requires parameters, you must enclose them in parentheses.

```
Value1 = Average(Close, 10;
```

Here, the highlight signifies that a closing parenthesis was expected before the';'

157 "Arithmetic (numeric) expression expected here."

This error is displayed whenever the PowerEditor is expecting a number or a numeric expression and it finds a true-false expression, string value, or any other keyword that does not return a numeric expression. For example, the *Average()* function expects two numeric expressions, so the following:

```
Value1 = Average(Condition1, 10);
```

generates an error since *Condition1* is a true-false expression.

158 "An equal sign '=' expected here."

This error is displayed if the equal sign is omitted when assigning a value to a variable, array, or function (writing an assignment statement).

For example, the following statement will cause an error:

```
Value1 10;
```

and would be corrected by adding an equal sign, as in:

```
Value1 = 10;
```

159 "This word cannot start a statement."

Not all words can be used to start a statement. For example, the data word *Close* cannot be used to start a statement. Usually, reserved words that generate some action are used to start statements such as *Buy*, *Plot1*, or *If-Then*.

160 "Semicolon (;) expected here."

All EasyLanguage statements must end with a semicolon. Whenever the PowerEditor finds a word or expression that can be interpreted as a new line, it will place the cursor before this expression and show this error. For example, the following statements will produce this error:

```
Value1 = Close + Open|
Buy Next Bar at Value1 Stop;
```

Given that the word *Buy* is always used at the beginning of a statement to place a trading order, a semicolon is required after the *Open*.

161 "The word THEN must follow an If condition."

This error is displayed whenever the word *Then* is omitted from a *If-Then* statement. The word *Then* must always follow the condition of the *If-Then* statement. The correct syntax for an If-Then statement is:

```
If Condition1 Then {any operation}
```

162 "STOP, LIMIT, CONTRACTS, SHARES expected here."

This error is displayed by the PowerEditor if it finds a numeric expression following a trading verb without including one of the words listed above. A numeric expression can be used in a trading order to determine the number of shares (or contracts) and/or to specify the price of the stop or limit order. For example:

```
Buy Next Bar at Low - Range;
```

is incorrect because it does not include a trading verb after the price **Range**. To be correct, you could add the word Stop or Limit, as in:

```
Buy Next Bar at Low - Range Stop;
```

163 "The word TO or DOWNTO was expected here."

This error is displayed whenever writing a *For* loop and the word *to* or *downto* is omitted. The correct syntax for a *For* loop is:

```
For Value1 = 1 To 10 Begin
   {statements}
End;
```

165 "The word BAR or BARS expected here."

This error is displayed whenever referencing to a value of a previous bar where the word *Bar* is omitted. For example, the following statement will cause this error:

```
Value1 = Close of 10 Ago;
```

The correct syntax is:

```
Value1 = Close of 10 Bars Ago;
```

166 "The word AGO expected here."

This error is displayed when the PowerEditor finds a reference to any expression for a number of bars ago without using the phrase *Bars Ago*. For example:

```
Value1 = Close of 10 Bars;
```

produces this error because the word *Ago* is missing. The correct syntax for this expression is:

```
Value1 = Close of 10 Bars Ago;
```

167 " '}' was expected before end of file."

In order to add comments to your EasyLanguage, it is necessary to enclose the commentary text in the curly braces '{' and '}'. An error message is displayed when a left curly brace is found without a matching right curly brace.

```
{ this was written by Trader Joe
If Close > Highest(High, 10)[1] Then
   Buy Next Bar at Market;|
```

Above, the right curly brace was omitted somewhere before the vertical cursor. In this example a right curly brace should have been placed after the word 'Joe'.

168 " '[' was expected here."

When declaring, assigning, or referencing array values you are required to use the squared braces to specify the array element(s). This error is displayed if the left squared brace is not used when working with an array.

```
Array: MyArray(10);
```

For example, here the highlight shows that a squared brace, corresponding to the declared number of array element, is expected before the parenthesis.

169 "']' was expected here."

When working with bar offsets or arrays, the bar or array index must be enclosed in squared braces. This message is displayed if the right squared brace is missing.

```
Value1 = Close[10 * 1.05;
```

In this example, the highlight indicates that a squared bracket should be placed somewhere before the semicolon. Note that since the PowerEditor is expecting a numeric value in the squared braces, it places the highlight after the last character in a numeric expression. However, in this case, the right bracket was probably intended to be placed after the number 10.

170 "Assignment to a function not allowed."

This error is displayed when you attempt to assign a value to a function. By definition, a function is an EasyLanguage procedure that returns a value, so it is not possible to assign a different value to a function (except when returning a value from within a function).

```
Average = 100.1245;
```

In this example, the highlighted function name indicates that you cannot assign it a value.

171 "A value was never assigned to user function."

By definition, a function is a set of statements that return a value. This error will be displayed when editing or creating a function and the PowerEditor finds that no value has been assigned to the function. A statement similar to the following must be included in every function:

```
MyFunction = Value;
```

where *MyFunction* is the name of the function and *Value* is the expression to be returned when the function is referenced.

172 "Either NUMERIC, TRUEFALSE, STRING, NUMERICSIMPLE, NUMERICSERIES, TRUEFALSESIMPLE, TRUEFALSESERIES, STRINGSIMPLE, or STRINGSERIES expected."

When declaring the inputs in a function it is necessary to specify the type of each input. This error is generated when any word or value, other than a valid input type, is used when declaring function inputs.

174 *"Function not verified."*

In order for an analysis technique to verify, all functions used by the analysis technique must be verified as well. This error is displayed if there is a function that is not verified and you attempt to verify the analysis technique.

In order to solve this, open the function and verify it, or run "Verify All" from the PowerEditor menu.

175 " ',' or ')' expected here."

This error is displayed when listing a number of elements in parentheses and a semicolon is read before the list is finished.

```
Value1 = Average(Close, 10;
```

In this case, the highlight indicates that either more parameters (separated by a comma) or a right parenthesis were expected before the semicolon.

176 "More inputs expected here."

This error is displayed whenever referencing a function or an included strategy without specifying enough inputs. For example:

```
Value1 = Average(Close);
```

displays an error because only one input is specified while the *Average* function requires two inputs: 1) the price to be averaged and 2) the number of bars.

177 "Too many inputs supplied."

The PowerEditor displays this error when too many inputs are supplied for a function. For example, the *Average* function requires only two inputs, so the following statement will produce this error:

```
Value1 = Average(Close, 10, 5);
```

The correct syntax would be

```
Value1 = Average(Close, 10);
```

180 "The word #END was expected before end of file."

The compiler directive #END must be used to indicate the end of a group of statements included in the alert or commentary only section of an analysis technique. The alert and commentary compiler directives will allow certain instructions to be executed only when the alert or commentary is enabled.

181 "There can only be 10 dimensions in an array."

Arrays can have up to 10 dimensions. The correct syntax for creating a multi-dimensional array is:

```
Array: MyArray[10,10,10](0);
```

where this statement creates a three dimensional array of 11x11x11

183 "More than 100 errors. Verify termination."

When the PowerEditor is verifying a document for correctness, it will continue to evaluate expressions until it finds 100 errors. These errors will be found in the error log once the verification process is finished. If the PowerEditor finds more than 100 errors it will stop the process and will display this message.

185 "Either HIGHER or LOWER expected here."

When specifying the execution instructions for an order in a strategy, it is possible to use the words *or Higher* and *or Lower* as synonyms to stop and limit. This error occurs when the word *or* is found in an order without the words *Higher* or *Lower*. The following is the proper syntax for this statement:

```
Buy Next Bar at Low - Range or Lower;
```

186 "Input name too long."

Input names in any PowerEditor analysis technique can be up to 20 characters long. This error is displayed by the PowerEditor whenever an input has a name that has more than 20 characters.

187 "Variable name too long."

Variable names can have up to twenty characters. This error is displayed whenever a variable is declared with a name that contains more than twenty characters.

188 "The word BEGIN expected here."

This error is generated whenever the PowerEditor is expecting a block statement. For example, all loops require *Begin* and *End* block statements, so writing the following will generate this error:

```
For Value1 = 1 To 10
   Value10 = Value10 + Volume[Value1];
```

The correct syntax is:

```
For Value1 = 1 To 10 Begin
   Value10 = Value10 + Volume[Value1];
End;
```

189 "This word not allowed in a strategy."

The word highlighted by the PowerEditor is not allowed in a Strategy.

190 "This word not allowed in a function."

The word highlighted by the PowerEditor is not allowed in a function. Words like *Plot1*, *Buy*, *SellShort*, etc., are not allowed in functions.

191 "This word not allowed in a study."

The word highlighted by the PowerEditor is not allowed in a study. Words like *Plot1*, *Buy, SellShort*, etc., are not allowed in studies.

192 "This word not allowed in an ActivityBar."

The word highlighted by the PowerEditor is not allowed in an ActivityBar study. Words like *Plot1*, *Buy*, *SellShort*, etc., are not allowed in ActivityBar studies.

193 "Comma (,) expected here."

Commas are used to separate elements in a list; for example when declaring multiple inputs or variables, or when listing the parameters of a function.

This error will be generated whenever the PowerEditor finds two words, that seem to be part of the list, which are not separated by a comma. For example, in the following:

```
Inputs: Price(Close) | Length(10);
```

the comma after the first input is missing. The PowerEditor places the vertical cursor at the location where it was expecting a comma.

195 "Matching quote is missing."

All text string expressions need to be within double quotes. This error will be displayed whenever there are not matching quotes around a text string expression. For example, the following statement will produce this error:

```
Variable: Txt(" ");
Txt = "This is an example;
```

because there is a missing quote to the right of the text expression. The correct syntax for this expression is:

```
Variable: Txt(" ");
Txt = "This is an example";
```

197 "Strategy not verified."

In order for a trading strategy to verify, any strategies referenced by the trading strategy through the use of the *IncludeSignal* reserved word must be verified as well. This error is displayed if you attempt to verify a trading strategy that references an unverified strategy.

In order to solve this, open the referenced strategy and verify it, or run "Verify All" from the PowerEditor menu.

200 "Error found in function."

This error is displayed whenever verifying an analysis technique that refers to an unverified function. The only solution is to open the function, verify the function, and then return to the analysis technique.

201 "User function cannot refer to current cell of itself."

A simple function cannot refer to the same value of a function within its calculations. However, if defined as a series function, it can refer to a previous value of itself. For example, the following simple function gives an error:

```
MyFunction = MyFunction + Volume;
```

because the calculation refers to the current value of the function. By setting the function **Parameter** to "Series", the following becomes a valid expression that uses a function's previous value to accumulate the volume of the chart:

```
MyFunction = MyFunction[1] + Volume;
```

204 "Orders cannot be inside a loop."

EasyLanguage does not allow trading orders to be placed inside a *For* or *While* loop. If the intention of placing an order inside a loop is to increase the number of shares or contracts that the strategy will handle, this can still be done by placing the calculation of the number of shares or contracts inside a loop and then using the resulting value in the order instruction after the loop is finished. For example,

```
While Condition1 Begin
   Value1 = <calculation of number of shares>;
End;
Buy Value1 Shares Next Bar at Market;
```

205 "Statement does not return a value."

This error is displayed when attempting to return a value from statements not designed to return a value, such as those that set or change a value. For example:

```
Value1 = AB_SetZone(High, Low, RightSide);
```

To correct this error, do not assign the expression to a variable:

```
AB_SetZone(High, Low, RightSide);
```

208 "CONTRACTS, SHARES expected here."

When writing an EasyLanguage statement to place an order, it is possible to specify how many contracts or shares the strategy should use to open (or exit) the position. This error will be generated by the PowerEditor whenever it finds a numeric expression after the trading verb that is not followed by the words *Stop, Limit, or Higher,* or *or Lower*. For example:

```
Buy 100;
```

generates an error because it is not clear if '100' is a part of the instructions to specify the number of shares or the execution instruction (the price at which the order should be placed). A correct statement might read:

```
Buy 100 Shares;
```

209 "Strategy name expected within quotes."

When specifying the name of an order, it must be enclosed within parentheses and double quotes. This error is displayed if the name is missing or not correctly provided. For example, the following statement will cause this error:

```
Sell From Entry () Next Bar at Market;
```

211 "Strategy cannot call itself."

A strategy cannot reference itself when using the *IncludeSignal* reserved word.

213 "Error found in strategy."

This error is displayed whenever verifying a strategy that contains the *IncludeSignal* reserved word which references a strategy that is not verified. The only solution is to open the unverified strategy, verify it, and then return to the original strategy.

214 "Colon (:) expected here."

EasyLanguage expects a colon to be used when declaring certain elements of the language like inputs, variables, arrays, and DLLs. In order to declare a new input, the word input should be followed by a colon, and then the list of input names. This error will be displayed whenever the colon is missing from this expression, for example:

```
Input MyValue(10);
```

Since there is no colon after the word 'Input', the word *MyValue* is highlighted and this error message is displayed. To correct the error, simply add a colon after 'Input':

```
Input: MyValue(10);
```

215 "Cannot use next bar's price and close order in the same strategy."

EasyLanguage does not support using information from the next bar (the *Date*, *Time*, or *Open*) and placing an order at the close of the current bar in the same strategy. If the instructions are not related, they should be written as different strategies and merged using TradeStation StrategyBuilder.

The following produces an error because it includes a reference to the *Open of Next Bar* with a *Close* order for *This Bar* (current bar):

```
If Open of Next Bar > Price Then Buy This Bar on Close;
```

217 "Function circular reference found."

A circular reference is defined as two formulas that refer to each other in their respective calculations. This type of formula cannot be solved by EasyLanguage, so whenever a circular reference is found this error is displayed.

For example, a circular reference can happen if you have a function *A,* which is defined as the value of the current bar of a function *B* plus 1, and the definition of the function *B* is the value of the current bar of *A* plus 1. In order to calculate the value of function *A*, the value of *B* is needed, but in order to calculate *B*, the value of *A* is needed. Therefore, it is not possible to obtain the values of these functions and this error occurs.

220 "Cannot anchor a global exit."

The price date of the bar where an entry order was placed can be accessed from an exit by using *At$*. This is only allowed when the entry order has a label and if the exit is tied to the entry. An error will be generated if the entry is not labeled or if the exit does not specify what entry it is attempting to close. For example, the following exit will cause this error:

```
If Condition1 Then
   Buy ("MyEntry") This Bar on Close;
Sell At$ Low - 1 Stop;
```

since the exit does not specify the name of a matching entry. The correct syntax is:

```
If Condition1 Then
   Buy ("MyEntry") This Bar on Close;
Sell From Entry ("MyEntry") At$ Low - 1 Stop;
```

223 "A simple function cannot call itself."

Historical values of simple functions are not available to EasyLanguage, so referring to previous values of itself in its calculations is not allowed. If this is necessary, change the function to a series.

```
MyFunction = MyFunction[1] + Volume;
```

For example, if *MyFunction* is a simple function, the above reference to the value of *MyFunction* of one bar ago is not allowed in this calculation.

224 "Strategy name already used."

The PowerEditor does not allow the reuse of a name in two different orders. It is mandatory that all orders have a different name. The following *SellShort* statement produces this error:

```
If Condition1 Then
   Buy ("MyStrategy") Next Bar at Market;

If Condition2 Then
   SellShort ("MyStrategy") Next Bar at Market;
```

because both orders cannot have the same name.

226 "Next bar's prices can only be used in a strategy."

The *Open, Date* and *Time* of the next bar can only be referenced from a strategy; no other analysis has access to this information.

227 "Default expected here."

When declaring an input in any analysis technique, you need to enclose the default value in parentheses. This error will be shown whenever there is no default value specified (the parentheses are empty). For example, the following is the correct syntax for declaring an input with the default value of 15:

```
Input: MyInput(15);
```

229 "Invalid initial value."

An initial value needs to be specified when declaring a variable or array. This initial value needs to be enclosed by parentheses and is used to 1) determine the type of the variable or array (numeric, true-false, or text string), and 2) assign the initial value of the variable or array on the first bar.

The correct syntax when declaring a variable is:

```
Variable: MyVariable(10);
```

where the initial value assigned to this variable is *10,* which is a numeric value.

230 "Initial value expected here."

An initial value needs to be specified when declaring a variable or array. This initial value needs to be enclosed by parentheses and is used to 1) determine the type of the variable or array (numeric, true-false, or text string), and 2) assign the initial value of the variable or array on the first bar.

The correct syntax when declaring a variable is:

```
Variable: MyVariable(10);
```

where the initial value assigned to this variable is *10,* which is a numeric value.

231 "Function has no inputs. Parenthesis not needed."

This error is shown by the PowerEditor when parentheses are used for a function which has no inputs. For example, the EasyLanguage function *Range* has no inputs, so the following statement:

```
Value1 = Range(10);
```

displays the error message and highlights the first parenthesis before the parameter.

232 "Matching left comment brace '{' is missing."

The PowerEditor displays this error whenever it finds a right comment brace “}” without a matching left comment brace. In order to fix this, find the beginning of the comment text and place a left comment brace before it. If there is no comment in your analysis technique, then remove the right comment brace.

233 "Extra right parenthesis."

When writing any type of expression or statement that requires parentheses, it is necessary to have matching left and right parentheses. This error is displayed if there are extra right parentheses in the expression being evaluated. For example:

```
Value1 = (Close + Open))/2
```

234 "END found without matching BEGIN."

This error is displayed whenever a block statement does not contain a matching *End* for every *Begin*.

237 "Position Information function not allowed in a study."

Strategy position information words can only be used in strategies and functions. This error will be generated if any one of these words are found in anything other than a strategy or function.

238 "Performance Information function not allowed in a study."

Strategy performance information words can only be used in strategies and functions. This error will be generated if any one of these words are found in anything other than a strategy or function.

239 "Array name too long."

Array names can have up to 20 characters. An error message will be displayed if the array name used in the declaration statement has more than 20 characters.

240 "This strategy name does not exist."

This error is displayed whenever tying an exit to a non-existent entry name. For example, the following strategy produces this error:

```
Buy ("Break") Next Bar at Highest(High, 10) Stop;

Sell From Entry ("BreakOut") Next Bar at Low Stop;
```

because the exit incorrectly refers to an entry labeled “BreakOut” which does not exist in this strategy. Changing the entry name to “Break” will correct this error.

241 "Cannot exit from an exit strategy."

This error is displayed when an exit strategy is mistakenly tied to another exit strategy. Exit strategies can only be tied to an entry through the use of the instruction *from Entry (“entry name”)*. For example, the following statements will generate this error:

```
If Condition1 Then
   Buy (“MyEntry”) This Bar at Close;

If Condition2 Then
   Sell (“MyExit”) This Bar at Close;

Sell from Entry (“MyExit”) Next Bar at Lowest(Low,10) Stop;
```

Instead, the following statements are correct:

```
If Condition1 Then
   Buy (“MyEntry”) This Bar at Close;

If Condition2 Then
   Sell (“MyExit”) This Bar at Close;

Sell From Entry (“MyEntry”) Next Bar at Lowest(Low,10) Stop;
```

242 "Cannot BuyToCover from a buy strategy."

This error will be displayed when a short exit strategy is tied mistakenly to a long entry strategy. Short exit strategies can be tied only to a short entry through the use of the instruction *from Entry (“entry name”).* For example, the following statements will generate this error:

```
If Condition1 Then
   Buy (“MyEntry”) This Bar at Close;
BuyToCover From Entry (“MyEntry”) Next Bar at Lowest(Low,10)
Stop;
```

In this case, the error can be corrected by using the appropriate exit instruction, *Sell*:

```
If Condition1 Then
   Buy (“MyEntry”) This Bar at Close;
Sell From Entry (“MyEntry”) Next Bar at Lowest(Low,10) Stop;
```

243 "Cannot Sell from a SellShort strategy."

This error will be displayed when an long exit strategy is tied mistakenly to a short entry strategy. Long exit strategies can be tied only to a long entry through the use of the instruction *from Entry ("entry name").* For example, the following statements will generate this error:

```
If Condition1 Then
   SellShort ("MyEntry") This Bar at Close;

Sell from Entry ("MyEntry") Next Bar at Low Stop;
```

In this case, the error can be corrected by using the appropriate exit instruction, *BuyToCover*:

```
If Condition1 Then
   SellShort ("MyEntry") This Bar at Close;

BuyToCover from Entry ("MyEntry") Next Bar at Low Stop;
```

244 "At$ cannot be used after the word TOTAL."

EasyLanguage does not allow the reserved word *Total* to be tied to reference information from the bar of entry by using the *AT$* instruction. For example, the following statement will generate this error:

```
Sell 20 Shares Total From Entry ("MyEntry") At$ Low Stop;
```

247 "References to previous values are not allowed in simple functions."

Prior values of simple functions, simple variables, or simple expressions cannot be referenced from within simple functions. If this is necessary for the calculation of a function then the function must be set as series, not simple. This incorrect example:

```
MyFunction = MyFunction[1] + Close;
```

creates an error if *MyFunction* is a simple function with a reference to previous values of itself. Setting the function **Properties** to "Series" will correct this error.

250 "Cannot reference a previous value of a simple input."

Historical values of simple inputs in functions are not stored by EasyLanguage, so referring to previous values of them is not allowed. For example, in the following:

```
Input: MyVal(NumericSimple);
MyFunction = MyVal[5];
```

the value *MyVal[5] is* not allowed in this function since it includes a reference to the value of the input of five bars ago but is declared as a *NumericSimple* input. If the reference to a previous value is necessary, change the input type to series.

251 "Variables and arrays not allowed here."

In previous product versions this error is displayed when attempting to pass variables or arrays to series functions.

```
Value2 = Average(Close, Value1);
```

253 "Cannot reference a previous value of this input."

Historical values of simple inputs in functions are not stored by EasyLanguage, so referring to previous values of them is not allowed. For example, in the following:

```
Input: MyVal(NumericSimple);
MyFunction = MyVal[5];
```

the value *MyVal[5] is* not allowed in this function since it includes a reference to the value of the input of five bars ago but was declared as a *NumericSimple* input. If the reference to a previous value is necessary, change the input type to series.

258 "Variables, arrays and inputs not allowed here."

This error is displayed when a variable, array, or input is used as the initializer for an input value, such as:

```
Vars: MyVar(3);
Input: MyInput(MyVar);
```

259 "This number is too big."

The PowerEditor displays this error whenever it finds a number that is outside the supported range (a number which is too big). The following statement produces this error:

```
Value1 = 99999999999999999999;
```

260 " 'Next Bar' can only be applied to 'OPEN', 'DATE' and 'TIME'."

The only prices available from the next bar that can be read from a strategy are *Open, Date,* and *Time.* All other prices from the next bar can't be accessed.

261 "The word 'BAR' expected here."

This error is shown whenever writing an order in a strategy where the word *Bar* is left out of the expression. For example, the following:

```
Buy Next on the Close;
```

generates an error because *Bar* is missing. The correct syntax is:

```
Buy Next Bar on the Close;
```

262 "At market order can only be placed for the next bar."

All analysis techniques are read and executed at the end of each bar. Because of this, market orders can only be placed for the next bar. An error will be generated whenever a market order is placed to be filled on this bar, such as:

```
Buy This Bar at Market;
```

263 "Stop and limit orders can only be placed for the next bar."

This error is displayed when trying to write a stop or limit order for the current bar. For example:

```
Buy This Bar at Low - Range Limit;
```

is not correct because a *Limit* order cannot be placed on *This Bar*. To be correct, the *Limit* order must be on the *Next Bar*:

```
Buy Next Bar at Low - Range Limit;
```

264 "On close order must be placed for this bar."

Given that all instructions are read at the close of each bar, the only types of orders that can be placed on the current bar are at the close. Whenever *This Bar* is included as part of an order it may only refer to the *at Close* price. The correct syntax for *This Bar* orders is:

```
Buy This Bar at Close;
```

265 "Cannot mix next bar prices with data streams other than data1."

EasyLanguage prohibits the reference of secondary data streams in the same strategy where references to the *Date*, *Time*, or *Open* of the next price are also made. If the references to a secondary data stream and the next bar prices are not directly related, it is recommended that you write two strategies, one that uses next bar prices and a second that references other data streams.

For example, the following statements included in one strategy are not allowed because they reference two different data streams (*Data1* by default is the first and *Data2* in the second):

```
If Open Next Bar > High Then
   SellShort Next Bar at Open Next Bar + Range Limit;

If Average(Close, 4) of Data2 < Average(Close, 7) of Data2 Then
   BuyToCover Next Bar at Close;
```

Instead, writing two different strategies, one containing the first IF-THEN statement and another containing the second IF-THEN statement is necessary. Later these strategies can both be included as part of the same Trading Strategy by adding them to the same Chart Analysis window.

266 "Library name within double quotes expected here."

The PowerEditor displays this error when defining an external DLL function and the name of the DLL is missing or incorrect. The first element of the list of parameters in the *DefineDLLFunc* statement should be the name of the DLL library within double quotes. The following statement will generate this error:

```
DefineDLLFunc: int, “MyFunc”, int;
```

The correct syntax for this statement is:

```
DefineDLLFunc: “MyDLL”, int, “MyFunc”, int;
```

267 "DLL function name within double quotes expected here."

When defining a function from a DLL, the name of the DLL must be enclosed in double quotes. For example, the following is a proper example of such a function definition because it includes the function name “user.dll” followed by DLL’s return type and parameters:

```
DefineDLLFunc: “user.dll”, int, “beep”;
```

274 "Return type of this DLL function must be specified."

When declaring a DLL function, the return type of the function must be the second parameter listed. Following is a correct DLL function declaration statement with the DLL’s type **int** following the DLL name:

```
DefineDLLFunc: “MyDLL.DLL”, int, “MyFunction”, int;
```

276 "DLL name cannot be longer than 60 characters."

The name of the DLL used to define any function through the *DefineDLLFunc* statement cannot exceed 60 characters.

277 "DLL function name cannot be longer than 65 characters."

The name of a function defined using the *DefineDLLFunc* statement cannot exceed 65 characters.

278 "A variable expected here."

Whenever the PowerEditor expects a variable and finds another reserved or user defined word, it will highlight the unexpected word and give this message. An example is when a function is expecting a variable as one of the parameters (because it is expecting to receive the variable by reference).

279 "An array expected here."

Functions can now receive arrays as parameters. If a function is expecting an array and instead the PowerEditor finds a variable, input, or other reserved word (different than an array), it will display this error. In the following example the function *Average_a()* calculates the average of a particular array, so the following will generate the syntax error:

```
Variable: MyVar(0);

Value1 = Average_a(MyVar, 10);
```

To correct this problem, you need declare *MyVar* as an array instead of an integer. It should be written:

```
Array: MyArray[20](0);
Value1 = Average_a(MyArray, 10);
```

280 "TrueFalse expression expected here."

This error is displayed when the PowerEditor expects a true/false expression and finds a numeric or text string expression instead. For example:

```
Condition1 = High ;
```

281 "Mixing data types (NUMERIC, TrueFalse, String) not allowed."

This error appears when incompatible data types are combined in a single expression.

In this example:

```
Value1 = 100 + “12” ;
```

the text string “12” cannot be directly combined with a numeric value. To resolve such a problem, use the appropriate EasyLanguage reserved word to convert the data to a compatible type.

For example, use the function *StrToNum* to convert the text string to a numeric value:

```
Value1 = 100 + StrToNum(“12”) ;
```

283 "Strategy has no inputs. Comma not needed."

When including a strategy through the *IncludeSignal* keyword, the list of the inputs must be supplied and each input must be separated by a comma. This error is displayed if the strategy has no inputs, and an input is mistakenly included in the statement.

Following is the correct syntax of an *IncludeSignal* statement of a strategy with no inputs:

```
IncludeSignal: “My Trailing LX”;
```

284 "There is no such strategy."

This error is displayed by the PowerEditor whenever the strategy name referenced by an *IncludeSignal* statement does not exist in the strategy library.

285 "Strategy circular reference found."

A circular reference is defined as two formulas that refer to each other's current bar value in their respective calculations. This type of formula cannot be solved by EasyLanguage, so whenever a circular reference is found this error is displayed.

286 "Cannot divide by zero."

This error will be displayed when dividing any numerical expression by the literal number 0. So when the following is written:

```
Value1 = Close / 0;
```

the PowerEditor will generate a syntax error because dividing by zero is a mathematical indetermination and cannot be solved.

287 "File name expected here."

This error is displayed when using the *Print* statement to send information to the printer, and an invalid file name is used for the file name. The file name should be specified as text between double quotes. Note that a text string expression will not be accepted as a file name in the *Print* statement. For example, the PowerEditor will display this error when evaluating the following statement:

```
Print(File(Value1), Date, Time, Close);
```

The file name needs to be text included in double quotes; for example:

```
Print(File("c:\tradestation\test.txt"), Date, Time, Close);
```

288 "A file or directory name must be <260 characters and may not contain "/ : * ? < > |"."

Certain instructions like the *Print()* and *FileAppend()* statements require a file name. The file name needs to be less than 260 characters long and cannot have any of the characters listed in the error label. For example, this error will be displayed when writing:

```
Print(File("c:\data?.txt", Date, Time, Close);
```

since the '?' character is not a valid character and cannot be used as part of a file name.

291 "The word 'OVER' or 'UNDER' expected here."

This error is displayed whenever using the word *Cross* without *Over* or *Under* when writing a true-false expression. For example, the following expression will produce this error:

```
Condition1 = Close Crosses Open;
```

The correct syntax would be:

```
Condition1 = Close Crosses Over Open;
```

292 "Two constants cannot cross over each other."

The PowerEditor displays this error whenever using the logical operators *Crosses Over* or *Crosses Under* compares two constants. Since they are constants, they will never cross each other and the statement will display an error, as in:

```
Condition1 = 10 Crosses Over 15;
```

293 "This plot has been defined using a different name."

The value of a plot can be assigned more than once within an analysis technique but it must always be referenced using the same name (or the name can be left out). For example, the following statement will cause this error:

```
Plot1( Volume, "Vol" );

If Volume > 1000000 Then
   Plot1(Volume, "V", Red);
```

because the plot has been assigned a second name "V". The correct way of writing this statement is:

```
Plot1( Volume, "Vol" );

If Volume > 1000000 Then
   Plot1(Volume, "Vol", Red);
```

295 "This plot name has never been defined."

This error is displayed whenever referencing a *Plot* with a different name than it was defined with, or a plot that doesn't exist. For example, the following statements will cause this error:

```
Plot1(High, "H");

Value1 = Plot1 + Plot2 ;
```

since Plot2 has not been defined. The PowerEditor highlights the second instance of the *Plot* command to indicate where the error occurred.

296 "This plot has never been assigned a value."

This error is generated when referring to the value of a plot that has not been previously defined in the analysis technique. For example, the following statements will produce this error:

```
Plot1( Average(Close,10) );

If Plot1 Crosses Over Plot2 Then
   Alert;
```

because Plot2 has not been defined.

297 "Server field name too long; cannot be more than 30 characters."

Server Quote fields can be up to 30 characters long. This error will be generated whenever a server field with a name that has more than 30 characters is used.

298 "Strategy Information (for plots) function not allowed in a strategy."

None of the "Strategy Information for plots" words can be used within a strategy. These words are designed to be used in other analysis techniques to refer to overall performance of the strategy. However, there are strategy-specific words that can be used from the strategy to refer to these figures.

These words are:

```
I_AvgEntryPrice

I_ClosedEquity

I_CurrentContracts

I_MarketPosition

I_OpenEquity
```

299 "Strategy Information function not allowed in a study."

Strategy information words (other than the strategy information for plots) can only be used in trading strategies and functions. These words, which are listed in the EasyLanguage Dictionary under the categories *Strategy Performance* and *Strategy Position*, can only be used when writing trading strategies and functions.

300 "This plot has been defined with a different type."

The value of a plot can be assigned more than once but it must always be of the same type. Plot statements can display numeric, true-false, and string expressions, but they cannot change types within an analysis technique. For example, the following pair of *Plot* statements are not allowed in an analysis technique because they include different data types, where the first plot is a text string and the second a true-false value:

```
Plot1( "This is a text string");

If Condition1 Then
   Plot1(Condition1);
```

302 "Different number of dimensions specified in the array than the parameter."

This error is shown when an array is passed into a function with the wrong number of dimensions. For example, this error will be generated if a function is expecting a single dimension array but is sent an array with two dimensions instead.

303 "Extraneous text is not allowed after the array-type parameter"

When passing an array into a function, only the array name should be used. This error is displayed whenever any text, words, or braces are added after the array name that is passed to a function. For example:

```
Array: MyArray[10](0);

Value1 = Average_a(MyArray[0], 10);
```

the *[* will be highlighted because an array index appears after the array name. The correct syntax would be:

```
Array: MyArray[10](0);
Value1 = Average_a(MyArray, 10);
```

304 "Numeric-Array Parameter expected here."

Functions can receive arrays as parameters. If a function is expecting an array, any other type of parameter (variable, input, or reserved word) will display this error. In the following example:

```
Variable: MyVar(0);

Value1 = Average_a(MyVar, 10);
```

the function *Average_a()* requires an array on which to calculate an average and displays this error because *MyVar* is not an array.

Instead, you can write:

```
Array: MyArray[20](0);
Value1 = Average_a(MyArray, 10);
```

305 "TrueFalse-Array Parameter expected here."

Functions can now receive arrays as parameters. If a function is expecting a true-false array and, instead, the PowerEditor finds a variable, input, or other reserved word (different than a true-false array), it will display this error. For example, a function *MyTrueFalse_a()* that correctly uses true-false arrays would be written as follows:

```
Array: MyArray[20](False);
Variable: MyTF(False);

MyTF = MyTruefalse_a(MyArray, 10);
```

306 "String Array Parameter expected here."

Functions can now receive arrays as parameters. If a function is expecting an array of text strings and, instead, the PowerEditor finds a variable, input, or other reserved word (different than an array of text strings) it will display this error. For example, a function *Average_a(),* which combines all the text strings that are in an array into one, should be used as follows:

```
Array: MyArray[20](" ");
Variable: MyText(" ");
MyText = Average_a(MyArray, 10);
```

307 "The word 'Cancel' must be followed by 'Alert'."

Whenever canceling a previously enabled alert, the statement *Cancel Alert* needs to be used. This error is displayed whenever using the word *Cancel* without the word *Alert.*

314 "This word is only allowed in ActivityBar studies."

The words that are used to set the properties and draw ActivityBars are only allowed from ActivityBars and are not allowed in any other study or strategy.

323 "'Value-type inputs' may not be passed into 'reference-type inputs'."

Functions can receive array and variable parameters by reference or by value. However, if a function receives a variable or array by value, it is not possible to pass the parameter to a second function by reference. If an input of a function needs to be passed by reference to another function, it must also be declared as a reference input.

325 "Only an array, variable, or reference-input is allowed here"

Functions can receive arrays as parameters. If a function is expecting an array, any other type of parameter (variable, input, or reserved word) will display this error. In the following example:

```
Variable: MyVar(0);

Value1 = Average_a(MyVar, 10);
```

the function *Average_a()* requires an array on which to calculate an average and displays this error because *MyVar* is not an array.

Instead, you can write:

```
Array: MyArray[20](0);
Value1 = Average_a(MyArray, 10);
```

340 "This word is only allowed when defining array-type inputs."

This error is displayed when creating a function input using any input-type (such as *NumericArray*, *NumericArrayref*) without fully qualifying the input with braces. For example, this creates an error:

```
Input: MyInput(StringArrayRef );
```

because it does not include the array length parameter in brackets after the array name. The correct syntax would be:

```
Input: MyInput[n](StringArrayRef);
```

341 "An array input word (NUMERICARRAY, STRINGARRAY, TRUEFALSEARRAY, NUMERICARRAYREF, STRINGARRAYREF, TRUEFALSEARRAYREF) was expected here."

When declaring inputs that are meant to receive an array, one of the above words are expected as the input type. For example, this error will be displayed when declaring an input for a function using the following statement:

```
Input: MyArray[M,N](Numeric);
```

since the reserved word *Numeric* is not valid for declaring arrays. However, the following will verify successfully:

```
Input: MyArray[M,N](NumericArray);
```

342 "This word can only be used in a PaintBar study."

This error occurs when you use the reserved word *PlotPaintBar* when writing anything other than a PaintBar study.

396 "This statement cannot specify an odd number of plots."

This error is displayed when using the *PlotPaintBar* statement and specifying an odd number of plots. There are two possible uses for this statement, either specifying only a high and low value, or specifying high, low, open, and close markers. The correct syntax for the *PlotPaintBar* statement follows:

```
PlotPaintBar(High, Low, “PB”);
```

or

```
PlotPaintBar(High, Low, Open, Close, “PB”);
```

403 "Cannot implicitly convert String to Numerical"

Whenever the PowerEditor expects a numerical expression, and, instead, finds a text string expression, it will highlight the text string expression and display this message.

For example, the following statement will produce this error:

```
Variable: MyNumber("55");
Value1 = Close + MyNumber;
```

Instead, the following expression accomplishes the expected result because it first uses the keyword *StrToNum()* to convert a text string expression to a numeric value:

```
Variable: MyNumber("55");
Value1 = Close + StrToNum(MyNumber);
```

404 "Cannot implicitly convert String to TrueFalse"

Whenever the PowerEditor expects a true-false expression and, instead, finds a text string expression, it will highlight the text string expression and will display this message.

For example, the following statement will produce the error:

```
Input: Text1("Yes"), Text2("No");
Condition1 = Text1;
```

because the input "Text1" was declared as a text value and cannot be assigned the true-false variable *Condition1*. Instead, the following statement is correct:

```
Input: Text1("Yes"), Text2("No");
Condition1 = (Text1 = Text2);
```

Notice that while both *Text1* and *Text2* are string values, the result of the comparison is a true-false value which is properly assigned to a true-false variable.

405 "Cannot implicitly convert TrueFalse to String"

Whenever the PowerEditor expects a text string expression and, instead, finds a true-false expression, it will highlight the true-false expression and display this message. In this example, *Condition1* is a true-false variable and cannot be directly combined with a string:

```
FileAppend("Output.txt", "This is a text string" + Condition1);
```

Instead, the following expression corrects the problem by creating a string value based on whether *Condition1* is true or false:

```
Variable: txt(" ");

If Condition1 Then
   txt = "true"
Else
   txt = "false";
FileAppend("Output.txt", "This is a text string" + txt);
```

406 "Cannot implicitly convert Numerical to String"

Whenever the PowerEditor expects a text string expression and, instead, finds a numerical expression, it will highlight the numerical expression and will display this message.

For example:

```
FileAppend("Output.txt", "This is text" + Value1);
```

displays an error when a numeric expression is found. Instead, the following expression will accomplish the expected results because it uses the keyword *NumToString()* to convert a numerical expression to a string:

```
FileAppend("Output.txt", "This is text" + NumToStr(Value1, 2));
```

407 "Cannot implicitly convert TrueFalse to Numerical"

Whenever the PowerEditor expects a numerical value and, instead, finds a true-false expression, it will highlight the expression and will display this message.

For example, the following statement will produce this error because the *Condition1* value is a true-false variable and cannot be assigned to the numeric variable *Value1*:

```
Value1 = Condition1;
```

408 "Cannot implicitly convert Numerical to TrueFalse"

Whenever the PowerEditor expects a true/false expression and, instead, finds a numerical expression, it will highlight the numerical expression and will display this message. For example, the following statement produces an error because the reserved word *Open* is a numeric value and not a true/false expression:

```
Condition1 = Open;
```

Instead, assign the numeric value *Open* to the numeric variable *Value1*:

```
Value1 = Open ;
```

Or, change the statement such that it is a comparison. For example:

```
Condition1 = Open > Close;
```

Notice that while both *Open* and *Close* are numerical values, the result of the comparison is a true/false value, which is properly assigned to a true/false variable.

409 "String expression expected here"

This error is displayed whenever the PowerEditor is expecting a string expression and, instead, it finds a numeric or true-false expression. For example, this error will be displayed when writing information to a file with a *FileAppend* statement:

```
FileAppend("file.txt", Value1);
```

that includes the numeric expression *Value1* instead of a text string. Numeric expressions can be converted to strings by using the *NumToStr()* keyword. For example:

```
FileAppend("file.txt", NumToStr(Value1,2));
```

569 "Buy or SellShort name within double quotes expected here."

When specifying the name of a trading strategy, only a text string literal can be used, and it can't be substituted by a variable or an input. The following statements will generate this error:

```
Variable: txt("MyStrategy");

Buy (txt) Next Bar at Market;
```

while the correct way of assigning a name to a strategy is to use a literal string, such as:

```
Buy ("Strategy Name") Next Bar at Market;
```

APPENDIX B

EasyLanguage Colors, Widths & Codes

Colors

When working with analysis techniques or drawing objects using colors, you can specify any of the 17 colors listed below (including -1), using the name, EasyLanguage word, or numeric equivalent:

Color Name	Reserved Word	Numeric Equivalent
Use the color specified in **Color** tab of **Format** dialog box	Default	-1
Black	Tool_Black	1
Blue	Tool_Blue	2
Cyan	Tool_Cyan	3
Green	Tool_Green	4
Magenta	Tool_Magenta	5
Red	Tool_Red	6
Yellow	Tool_Yellow	7
White	Tool_White	8
DarkBlue	Tool_DarkBlue	9
DarkCyan	Tool_DarkCyan	10
DarkGreen	Tool_DarkGreen	11
DarkMagenta	Tool_DarkMagenta	12
DarkRed	Tool_DarkRed	13
DarkBrown	Tool_DarkBrown	14
DarkGray	Tool_DarkGray	15
LightGray	Tool_LightGray	16

Widths

You can specify the width of a plot in EasyLanguage by using a numerical value from 0 - 6, where 0 represents the thinnest width and 6 the thickest. Also, you can use -1 to have the analysis technique use the width specified in the **Style** tab of the **Format** dialog box.

Trendline and Text Object Error Codes

Value	**Explanation**
-2	*The identification number used was invalid (i.e., there is no object on the chart with this ID number).*
-3	*The data number (Data2, Data3, etc.) passed to the function was invalid. There is no symbol (or data stream) on the chart with this data number.*
-4	*The value passed to a SET function was invalid (for example, an invalid color or line thickness was used).*
-5	*The beginning and ending points were the same (only when working with trendlines). Can occur when you relocate a trendline or change the begin/end points.*
-6	*The function was unable to load the default values for the tool.*
-7	*Unable to add the object. Possibly due to an out of memory condition. Your system resources have been taxed and it cannot process the request.*
-8	*Invalid pointer.Your system resources have been taxed and it cannot process the request.*
-9	*Previous failure.Once an object returns an error code, no additional objects can be created by the trading strategy, analysis technique, or function that generated the error.*
-10	*Too many trendline objects on the chart.*
-11	*Too many text objects on the chart.*

When the text or trendline operation was successful, zero (0) is returned.

APPENDIX C

Reserved Words Quick Reference (alphabetical)

#BEGINALERT

A compiler directive that executes instructions between **#BeginAlert** and **#End** only when the **Enable Alert** check box is selected.

Usage:
```
#BeginAlert
       Alert("ADX Alert");
#End;
```

#BEGINCMTRY

A compiler directive that executes instructions between **#BeginCmtry** and **#End** only when using the **Analysis Commentary** tool to select a bar on a chart or a cell on a grid.

Usage:
```
#BeginCmtry
       Commentary("The value is " + NumtoStr(Plot1, 0));
#End;
```

#BEGINCMTRYORALERT

A compiler directive that executes instructions between **#BeginCmtryOrAlert** and **#End** when either the Alert or Commentary conditions exist.

Usage:
```
#BeginCmtryorAlert
       Alert("ADX Alert");
       Commentary("The value is " + NumtoStr(Plot1, 0));
#End;
```

#END

A compiler directive used to terminate an alert or commentary block statement.

A

Skip word ignored during execution.

Usage: **If** a **Close** is > 100 **Then** *{any operation} ;*

AB_AddCell

Adds a cell to an ActivityBar row.

Syntax: **AB_AddCell**(*Price*, *Side*, *Str_Char*, *Color*, *Value);*

Price: a numeric expression representing the price of a bar (e.g.,Open,Close)
Side: **LeftSide**,**RightSide**
Str_Char: a character that is displayed in the ActivityBar cell (e.g.,"A","N")
Color: an EasyLanguage color value (e.g.,Red, Black)
Value: a numeric expression representing the value of the cell

Usage: `AB_AddCell(Open, Leftside, "A", Red, 1) ;`

AB_AddCellRange

Adds cells to a price range of the current bar starting at LowValue to HighValue.

Syntax: **AB_AddCellRange**(*RangeHi*, *RangeLo*, *Side*, *Label*, *Color*, *Value*)

RangeHi: a numeric expression representing the highest *price* for a column
RangeLo: a numeric expression representing the lowest *price* for a column
Side: **LeftSide**,**RightSide**
Label: a character that will be placed in the ActivityBar cell (e.g.,"A","N")
Color: an EasyLanguage color value (e.g.,Red, Black)
Value: a numeric expression representing the value of each cell to be added

Usage:
```
Value1 = AB_AddCellRange(High of ActivityData, Low of
ActivityData, RightSide, “U”, Green, 0);
```

AB_AverageCells

Returns the average number of ActivityBar cells per row for the current bar.

Syntax: **AB_AverageCells**(*Side*)

Side: **LeftSide**,**RightSide**

Usage: `Value2 = AB_AverageCells(RightSide);`

AB_AveragePrice

Returns the average price of the ActivityBar cells on one or both sides.

Syntax: **AB_AveragePrice**(*Side*)

Side: **LeftSide**,**RightSide**

Usage: `Value2 = AB_AveragePrice(LeftSide);`

AB_CellCount

Counts and returns the number of cells on one or both sides of an ActivityBar.

Syntax: **AB_CellCount**(*Side*)

Side: **LeftSide**,**RightSide**

Usage: `Value2 = AB_CellCount(LeftSide);`

AB_GetCellChar

Returns the text string expression stored in the specified cell.

Syntax: **AB_GetCellChar**(*Price*,*Side*,*Column*)

Price: price value of the row containing the character

Side: **LeftSide**,**RightSide**

Column: number of the cell column containing the character on the side specified

Usage: `Str = AB_GetCellChar(Close, RightSide, 3) ;`

AB_GetCellColor

Returns the color of the character stored in the specified cell.

Syntax: **AB_GetCellColor**(*Price*,*Side*,*Column*)

Same parametersparameters as AB_GetCellChar above.

Usage: `Value1 = AB_GetCellChar(Open, LeftSide, 2) ;`

AB_GetCellDate

Returns the corresponding date of the specified cell.

Syntax: **AB_GetCellDate**(*Price*,*Side*,*Column*)

Same parameters as AB_GetCellChar above.

Usage: `Value2 = AB_GetCellDate(High,RightSide, 5) ;`

AB_GetCellTime

Returns the corresponding time of the specified cell.

Syntax: **AB_GetCellTime**(*Price*,*Side*,*Column*)

Same parameters as AB_GetCellChar above.

Usage: `Value1 = AB_GetCellTime(Low,LeftSide, 4) ;`

AB_GetCellValue

Returns the extra value stored in the specified cell.

Syntax: **AB_GetCellValue**(*Price*,*Side*,*Column*)

Same parameters as AB_GetCellChar above.

Usage: `Value2 = AB_GetCellValue(High,RightSide, 1) ;`

AB_GetNumCells

Returns how many cells exist at a specified price on the right or left side.

Syntax: **AB_GetNumCells**(*Price*,*Side*)

Price: price value of the row

Side: **LeftSide**,**RightSide**

Usage: `Value1 = AB_GetNumCells(Close,LeftSide) ;`

AB_GetZoneHigh

Returns the value of the top (high) of the ActivityBar zone.

Syntax: **AB_GetZoneHigh**(*Side*)

Side: **LeftSide**,**RightSide**

Usage: `Value1 = AB_GetZoneHigh(LeftSide) ;`

AB_GetZoneLow

Returns the value of the bottom (low) of the ActivityBar zone.

Syntax: **AB_GetZoneLow**(*Side*)

Side: **LeftSide**,**RightSide**

Usage: `Value2 = AB_GetZoneLow(RightSide) ;`

AB_High

Returns the high of the current ActivityBar.

Usage: `Value1 = AB_High ;`

AB_Low

Returns the low of the current ActivityBar.

Usage: `Value1 = AB_Low ;`

AB_Median

Returns the median price value of the cells for the current ActivityBar.

Syntax: **AB_Median**(*Side*)

Side: **LeftSide**,**RightSide**

Usage: `Value2 = AB_Median(RightSide) ;`

AB_Mode

Returns the cell count of the row with the most cells (the Mode row) and the price of the Mode row.

Syntax: **AB_Mode**(*Side*, *Type*, *oModeCount*, *oModePrice*)

Side: **LeftSide**,**RightSide**

Type: >= 0 for Largest mode, < 0 for smallest mode

oModeCount: Variable or array element that takes the number of cells (passed by reference)

oModePrice: Variable or array element that takes the Mode price (passed by reference)

Usage: `Value1 = AB_Mode(LeftSide) ;`

AB_NextColor

Specifies the color of ActivityBar cells based on a user-defined interval.

Syntax: **AB_NextColor**(*MinuteInterval*)

MinuteInterval: number of minutes that make up each cell color interval

Usage: `Value1 = AB_NextColor(10);`

AB_NextLabel

Returns an letter/number to use in an ActivityBar cell based on a user-defined interval.

Syntax: **AB_NextLabel**(*MinuteInterval*)

MinuteInterval: number of minutes that make up each cell label interval

Usage: `Value1 = AB_NextLabel(10);`

AB_RemoveCell

Removes a cell from an ActivityBar row.

Syntax: **AB_RemoveCell**(*Price*,*Column*,*Side*)

Price: price value of the cell to remove

Column: number of the column containing the cell on the side specified

Side: **LeftSide**,**RightSide**

Usage: `Value1 = AB_RemoveCell(Close,3,RightSide) ;`

AB_RowHeightCalc

Calculates and returns the row height to use for an ActivityBar.

Syntax: **AB_RowHeightCalc**(*ApproxNumRows*,*RangeAvgLength*)

ApproxNumRows: the approximate number of rows desired (usually between 5 and 25)

RangeAvgLength: number of bars back used to determine the average price rage

Usage: `Value2 = AB_RowHeightCalc(10, 5) ;`

AB_RowHeight

Returns the row (cell) height for an ActivityBar. Often used with **AB_SetRowHeight**.

Usage: `Value1 = AB_RowHeight ;`

AB_SetActiveCell

Changes the placement of the ActivityBar marker to the specified location on the bar.

Syntax: **AB_SetActiveCell**(*Price*,*Side*)

Price: price value of the cell row

Side: **LeftSide**,**RightSide**

Usage: `AB_SetActiveCell(Open,RightSide) ;`

AB_SetRowHeight

Changes the current ActivityBar's row-increment value.

Syntax: **AB_SetRowHeight**(*RowHeight*)

RowHeight: value representing the row spacing for cells. Generally use AB_RowHeightCalc as the parameter.

Usage: `AB_SetRowHeight(AB_RowHeightCalc(10,5)) ;`

AB_SetZone

Sets a zone range box for an ActivityBar side.

Syntax: **AB_SetZone**(*HighPrice*,*LowPrice*, *Side*)

HighPrice: a numeric expression representing the high *price* of the zone range box

LowPrice: a numeric expression representing the low *price* of the zone range box

Side: **LeftSide**,**RightSide**

Usage: `AB_SetZone(Average(High, 5), Average(Low, 5), RightSide);`

AB_StdDev

Returns the standard deviation of the ActivityBar cells for the specified side.

Syntax: **AB_StdDev**(*Multiplier*, *Side*)

Multiplier: represents the number of standard deviations to calculate

*Side: **LeftSide**,**RightSide**,**Both***

Usage:
```
Value2 = AB_StdDev(2, LeftSide);
```

Above

Used only with **Crosses** to detect a value crossing above, or over, another value.

Usage:
```
If Plot11 Crosses Above Plot2 Then {Any Operation} ;
```

AbsValue

Absolute value of num.

Syntax: **AbsValue**(*Num*)

Num: a numeric value or expression

Usage:
```
Value1 = AbsValue(-1.45);    {returns a value of 1.45}
```

ActivityData

References any bar data element (Open, upticks, etc.) of the ActivityBar.

Usage:
```
Value2 = AB_AddCellRange(High of ActivityData,Low of
ActivityData,Rightside,3,2);
```

AddToMovieChain

Appends movie file *MFile* to end of movie chain *MChain*.

Syntax: **AddToMovieChain**(*MFile,MChain*)

MFile: a numeric expression representing a movie chain ID

MChain: a string expression representing the path and name of the *.avi file to be added to the specified movie chain

Ago

References a specified number of bars back already analyzed by EasyLanguage.

Usage:
```
Value1 = Close of 1 Bar Ago;    {returns Close of the previous bar}
```

Alert

When *True*, triggers an alert for an indicator or study. The alert description is optional.

Usage:
```
If {Your Alert Criteria} Then Alert("MyAlert");
```

AlertEnabled

Returns *True* if the **Enable Alert** check box is selected.

Usage:
```
If AlertEnabled Then Begin
        {Your Code Here}
End ;
```

All

Specifies all shares/contracts are to be sold/covered when exiting a position.

Usage:
```
If Condition1 Then Sell All Shares Next Bar at Market;
```

An

Skip word used to improve readability. Ignored during execution.

Usage: `If an Open is > 100 Then` *{any operation}*

AND

Links 2 true/false expressions together. *True* if both expressions are true.

Usage: `If Plot1 Crosses Above Plot2 AND Plot2 > 5 Then`
{any operation};

Arctangent

Returns the inverse tangent (arctangent) value of num, where num is the slope (rise/run);

Usage: Value1 = **Arctangent**(*num*); {returns 45.0 when *num* is 1}

Array

Used to declare an array type of variable.

Syntax: **Array:** AnyName[Elements](InitialValue)

Elements: the number of indexed values that this array can store

InitialValue: a numeric expression used to set the initial value of each element

Usage: `Array: AnyName[4](0);` {declares a 4 element array with '0' for initial values}

Arrays

Used to declare an array type of variable.

See **Array**.

ARRAYSIZE

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

ARRAYSTARTADDR

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

At

Skip word used to improve readability. Ignored during execution.

Usage: `Buy 100 Contracts on Next Bar at Market;`

At$

Anchors exit prices to the bar where the named entry order was placed.

Usage: `Sell from Entry("MA Cross") At$ Low - 1 Point Stop;`

AtCommentaryBar

Returns *True* if the current bar was selected with the Analysis Commentary Tool.

Usage: `If AtCommentaryBar Then` *{your commentary} ;*

AvgBarsLosTrade

The average number of bars that elapsed during losing trades for all closed trades.

Usage: `Value1 = AvgBarsLosTrade;` {**Note**: returns the integer portion of the average}

AvgBarsWinTrade

The average number of bars that elapsed during winning trades for all closed trades.

Usage: `Value2 = AvgBarsWinTrade;` {**Note**: returns the integer portion of the average}

AvgEntryPrice

Returns the average entry price of each open entry in a pyramided position.

Usage: `Value1 = AvgEntryPrice;` {returns 70 for open trades entered at 45, 75 and 90}

AvgList

Returns the average of the listed values.

Usage: `Value2 = AvgList(18, 67, 98, 24, 65, 19);` {returns a value of 48.5}

Bar

References values for a specific bar based on the data interval.

Usage: `Buy Next Bar at Open ;`

BarInterval

Returns the data interval (in minutes) for bars on a minute-based chart.

Bars

References a bar occurring N bars ago based on the data interval.

Usage: `Value2 = Open of 5 Bars Ago ;`

BarsSinceEntry

Bars since initial entry of position, num position(s) ago.

Syntax: **BarsSinceEntry**(*Num*)

Num: number of positions ago, 0 for current position

BarsSinceExit

Bars since position closed-out, num position(s) ago.

Syntax: **BarsSinceExit**(*Num*)

Num: number of positions ago, 0 for current position

BarStatus

Determines if a trade (tick) opened the bar, closed the bar, or is ‘inside the bar.’

Syntax: **BarsStatus**(*DataSeries*)

DataSeries: specifies which data series to use

Returns: 0 for opening tick, 1 for inside tick, 2 for closing tick, -1 on an error

Usage: `Value2 = BarStatus(2) ;`

BarType

The compression setting of the price data for the applied analysis technique.

Returns: 0 forTick, 1 for Intraday, 2 for Daily, 3 for Weekly, 4 for Monthly, 5 for Point & Figure.

Usage: `If BarType = 2 Then {Any Operation}` {tests for daily bars}

Based

Skip word retained for backward compatibility.

Begin

Used to begin a block of EasyLanguage instructions within a conditional statement.

Usage:
```
If Condition1 = True Then Begin
    {Your Code Line1}
    {Your Code Line2, etc.}
  End;
```

Below

Used only with **Crosses** to detect a value crossing below, or under, another value

Usage:
```
If Value1 Crosses Below Value2 Then {Any Operation} ;
```

Beta

Returns the Beta value of a stock compared to the S&P 500 index.

BigPointValue

Dollar amount of 1 full point move.

Usage:
```
Value1 = BigPointValue * Close;
```

Black

Specifies color Black (numeric value = 1) for plots and backgrounds.

BlockNumber

Returns the unique Security Block number attached to this computer.

Blue

Specifies the color Blue (numeric value = 2) for plots and backgrounds.

Usage:
```
Plot1(Value1, "Test", Blue);
```

BOOL

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

BoxSize

Refers to minimum price change needed to add an X or O to a Point & Figure chart.

BreakEvenStopFloor

Reserved for backward compatibility with previous versions of the product. Replaced by the reserved word **SetBreakEven**.

Buy

Initiates a long position. Covers any short positions & reverses an existing position.

Syntax: **Buy** [("Order Name")] [*num* of **shares**] execution instruction;
execution instructions: **this bar** on **close**, **next bar** at **market**,
next bar at *price* **stop**, **next bar** at *price* **limit**

Usage:
```
Buy Next Bar at Market;
Buy("Buy Close") 20 Shares This Bar on Close;
Buy 5 Contracts Next Bar at High + Range Stop;
Buy("BuyLimit") Next Bar at Price Limit;
```

BuyToCover

A trading strategy order to partially or completely cover short positions.

Syntax: **BuyToCover** [from entry ("MyTrade")] [*num* of **shares**] execution instruction;
execution instructions: **this bar** on **close**, **next bar** at **market**,
next bar at *price* **stop**, **next bar** at *price* **limit**

Usage:
```
BuyToCover Next Bar at Market;
BuyToCover From Entry ("BuyClose") Next Bar at 75 Stop
BuyToCover 5 Contracts Next Bar at Low + Range Stop;
BuyToCover From Entry ("BuyLimit") Next Bar at Price Limit;
```

By

Skip word ignored during execution.

Usage: Value1 = (**High-Close**) / by 2;

BYTE

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

C

Abbreviation for Close. Returns the closing price of a referenced bar.

Usage:
```
If Price > Close of 1 Bar Ago Then Buy on Close;
```

Cancel

Used in conjunction with Alert to cancel a previously triggered alert.

Usage:
```
If {Any Condition} Then Cancel Alert;
```

Category

Category of symbol: 0=Future, 1=Future Option, 2=Stock, 3=Stock Option, etc.

Usage: `Value1 = Category` {returns a value of 3 for MSQ option of MSFT}

Ceiling

Returns the lowest integer greater than num.

Syntax: **Ceiling**(*Num*);
Num: a numeric value or expression

Usage: `Value1 = Ceiling(4.5)` {returns a value of 5}

CHAR

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

CheckAlert

Returns *True* for the last bar when **Enable Alert** check box is selected.

Usage:
```
If CheckAlert Then {Any Operation};
```

CheckCommentary

Returns *True* when the Analysis Commentary Tool is applied to the current bar.

Usage:
```
If CheckCommentary Then {Any Operation};
```

ClearDebug

Clears the contents of the Print Log tab of the EasyLanguage Output Bar.

Close

Returns the closing price of the bar being referenced.

Usage:
```
Value1 = Close of 1 Bar Ago ;
If Close > Close[1] Then Plot1(High,"ClosedUp");
```

Commentary

Sends EasyLanguage expression(s) to the Analysis Commentary window.

Usage:
```
Commentary("This is analysis commentary");
```

CommentaryCL

Sends EasyLanguage expression(s) to Analysis Commentary with a carriage return.

Usage:
```
CommentaryCL("This is a single line of commentary");
```

CommentaryEnabled

Returns *True* on any bar when the Analysis Commentary window is open.

Commission

Returns the commission setting from the current strategy's **Costs** tab.

CommodityNumber

Unique number representing a particular symbol in the Symbol Dictionary (optional).

Usage:
```
If CommodityNumber = 149 Then {Any Operation};
```

Contract

Specifies the number of units (contracts/shares) to trade within a trading strategy.

Usage:
```
Sell 1 Contract Next Bar at Market;
```

Contracts

Specifies the number of units (contracts/shares) to trade within a trading strategy.

Same as **Contract**.

Cosine

Returns the cosine value of *num* degrees.

Usage: `Value1 = Cosine(72);` {returns 0.3090 when *num* is 72 degrees}

Cost

Returns the value of the cost of establishing a leg or position.

Usage: `Plot1(Cost of Leg(1), "Cost");`

Cotangent

Returns the cotangent value of *num* degrees.

Usage: `Value1 = Cotangent(45);` {returns 1.0 when *num* is 45 degrees}

Cross

Used to detect when values have crossed over/under or above/below another value.

Usage: `If Plot1 does Cross Above Plot2 Then {Any Operation};`

Crosses

Used to detect when values have crossed over/under or above/below another value.

Usage: `If Value1 Crosses Below Value2 Then {Any Operation};`

Current

Reserved for future use.

CurrentBar

Returns the number of the bar currently being evaluated. Since CurrentBar is based on MaxBarsBack, if there are 500 bars in a chart, with a MaxBarsBack setting of 10, the next bar after the 9th bar on the chart moving left to right, will be CurrentBar = 1. The last bar on the chart (most recent) will be CurrentBar = 491.

CurrentContracts

The number of contracts in the current position.

CurrentDate

Returns the current date in the format YYMMDD or YYYMMDD.

Usage: Value1 = **CurrentDate**; {returns a value of 1011220 on December 20, 2001}

CurrentEntries

Number of entries currently open within a position.

Usage: Value2 = `CurrentEntries`

CurrentTime

Returns the current time as HHMM using a 24-hour format.

Usage: `Value2 = CurrentTime` {returns a value of 1718 at 5:18 pm}

CustomerID

Returns the User ID number of the person to whom the software is registered.

Cyan

Specifies color Cyan (numeric value = 3) for plots and backgrounds.

D

Returns the closing date of the bar referenced. (Abbreviation for **Date**).

DailyLimit

Number of stocks/contracts allowed traded in 1 day.

DarkBlue

Specifies color Dark Blue (numeric value = 9) for plots and backgrounds.

DarkBrown

Specifies color Dark Brown (numeric value = 14) for plots and backgrounds.

DarkCyan

Specifies color Dark Cyan (numeric value = 10) for plots and backgrounds.

DarkGray

Specifies color Dark Gray (numeric value = 15) for plots and backgrounds.

DarkGreen

Specifies color Dark Green (numeric value = 11) for plots and backgrounds.

DarkMagenta

Specifies color Dark Magenta (numeric value = 12) for plots and backgrounds.

DarkRed

Specifies color Dark Red (numeric value = 13) for plots and backgrounds.

Data*N*

Used to reference information from a specified data stream.

Usage: `Value1 = Low of Data10` {returns the Low for the current bar from data stream 10}

DataCompression

The compression setting of the price data for the applied analysis technique.

Returns: 0 forTick, 1 for Intraday, 2 for Daily, 3 for Weekly, 4 for Monthly, 5 for Point & Figure.

Usage: `If DataCompression=2 Then {Any Operation}` {tests for daily bars}

DataInUnion

Reserved for future use.

Date

Returns the closing date of the bar referenced in YYYMMDD format.

Usage: `If Date < 990101 Then Buy This Bar on Close;`

DateToJulian

Converts calendar date to Julian date.

Syntax: **DateToJulian**(*cDate*);
cDate: numeric expression for the date in YYMMDD or YYYMMDD format.

Usage: `Value2 = DateToJulian(991024)` {returns Julian value of 36457)

Day

Reserved for backward compatibility. Replaced by **Bar**.

DayOfMonth

Returns the day of month (DD) portion of the specified calendar date.

Syntax: **DayOfMonth**(*cDate*);
cDate: numeric expression for the date in YYMMDD or YYYMMDD format.

Usage: `Value1 = DayOfMonth(991004)` {returns day value of 4)

DayOfWeek

Returns the day of week (0 for Sun., 1 for Mon., ..., 6 for Sat.) for a calendar date.

Syntax: **DayOfWeek**(*cDate*);
cDate: numeric expression for the date in YYMMDD or YYYMMDD format

Usage: `Value1 = DayOfWeek(1011024)` {returns 3 because Oct 24, 2001 is a Wednesday)

Days

Reserved for backward compatibility. Replaced by **Bars**.

Default

Used in plot statements to set a style to its default value.

Usage: `Plot1(Value1, "Plot1", Default, Default, 5);`

DefineCustField

Reserved for future use.

DEFINEDLLFUNC

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

DeliveryMonth

Used for contracts that expire. Returns the month of expiration (1...12).

DeliveryYear

Used for contracts that expire. Returns the 3-digit year of expiration.

Description

Returns a string containing the description of the symbol if it is available.

Usage: `TextString= Description;` {symbol decription - blank if none available}

Dividend

Returns the Dividend paid any number of periods ago.

Usage: `Value1 = Dividend(2);` {the last dividend amount paid 2 periods ago}

Dividend_Yield

Most recent cash dividend paid (or declared) times the dividend payment frequency.

Does

Skip word ignored during execution.

Usage:
```
If Plot1 Does Cross Over Plot2 Then {Any Operation}
```

DOUBLE

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

DownTicks

Number of ticks on a bar whose value is lower than the tick immediately preceding it (or an unchanged tick that follows a downtick).

DownTo

Instructs a loop's counter to decrement and exit the loop at a specified value.

Usage:
```
For Value5 = Length DownTo 0 Begin
     {Any Operations}
End;
```

DWORD

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

EasyLanguageVersion

Returns the EasyLanguage version currently installed (i.e., EL 2000i is version 5.1).

Usage:
```
If EasyLanguageVersion >= 5.0 Then {Any Operation}
```

EL_DateStr

Returns an 8 character YYYYMMDD string based on month, day, and year values.

Syntax: **EL_DateStr**(Month,Day,Year);

(Month) is a numeric expression representing a month (e.g., January = 01).

(Day) is a numeric expression representing the day of the month.

(Year) is a numeric expression representing a four-digit year.

Usage:
```
Value1 = EL_DateStr(09,05,1999){returns the string 19990905)
```

Else

Used to execute instructions when the specified ‘If’ condition returns *False*.

Usage:
```
If Condition1 Then
     {Operation done if condition is true}
Else
   {Operations done if condition is false} ;
```

End

Used with **Begin** to execute multiple statements based on a condition. See **Begin**.

Entry

An optional Exit parameter used to reference a specific, named entry.

Usage: `Sell from Entry ("MyTrade") Next Bar at Market;`

EntryDate

Returns the entry date for the specified period in the format YYYMMDD.

Usage: `Value1 = EntryDate(2)` {the date of the entry 2 periods ago}

EntryPrice

Returns the entry price for the specified period.

Usage: `Value2 = EntryPrice(1)` {the price of the entry 1 period ago}

EntryTime

Returns the entry time for the specified period in the 24-hour format HHMM.

Usage: `Value1 = EntryTime(3)` {the time of the entry 3 periods ago}

EPS

Returns the reported earnings-per-share value for the specified period.

Usage: `Value2 = EPS(5)` {the Earnings-Per-Share 5 periods ago}

ExitDate

Returns the exit date for the specified position in the format YYYMMDD.

Usage: `Value2 = ExitDate(4)` {the exit date 4 positions ago}

ExitPrice

Returns the exit price for the specified position

Usage: `Value1 = ExitPrice(2)` {the exit price 2 positions ago}

ExitTime

Returns the exit time for the specified position in 24-hour HHMM format.

Usage: `Value1 = ExitTime(1)` {the exit time 1 position ago}

ExpValue

Returns the exponential value of the specified number.

Usage: `Value2 = ExpValue(4.5)` {returns a value of 90.0171}

False

Represents the logical value *False* when evaluating an expression or setting an input.

Usage: `Input:MyValue(False);` {initializes MyValue to False}

File

Sends information to a specified file from a print statement.

Syntax: **File**(*strFilename*);

strFileName: name of file to receive 'print' output

Usage: `Print(File("c:\data\mydata.txt"), Date, Time, Close);`

FileAppend

Appends a text string to the end of a specified file.

Syntax: **FileAppend**(*strFilename*,*strText*);

strFileName: name of file to which text will be appended

strText: text string containing information that will be added to the specified text file

Usage:
```
FileAppend("d:\myfile.txt","Add this text to the file");
```

FileDelete

Deletes the specified file.

Syntax: **FileDelete**(*strFilename*);

strFileName: path name of file

Usage:
```
FileDelete("e:\path\anyfile.txt");
```

FirstNoticeDate

Returns the first notice date of a futures contract, in YYYMMDD format.

FLOAT

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

Floor

Returns the highest integer less than the specified number.

Usage:
```
Floor(6.5)                {returns a value of 6}
```

For

Executes a block of instructions a specified number of times within a loop.

Usage:
```
For N = 1 To 10 Begin
    Total = Total + Price[N];
End ;                     {adds Price(N) to Total 10 times}
```

FracPortion

Returns the fractional portion of a number while retaining the sign.

Usage:
```
FracPortion(-1.72)        {returns a value of -0.72}
```

Friday

Specifies day of the week Friday (numeric value = 5).

From

Used with **Entry** to specify the name of a Long or Short entry in an Exit statement.

Usage:
```
Sell From Entry("MyTrade") Next Bar at 75 Stop ;
```

GetBackgroundColor

Returns the current chart background color (see Appendix B for color values).

Usage:
```
Value1 = GetBackgroundColor;
```

GetCDRomDrive

Returns the drive letter of first CD-ROM found.

Usage:
```
Variable: Drive("D");
Drive = GetCDRomDrive;
```

GetExchangeName

Returns the name of the Exchange for a symbol.

Usage: `Value1 = GetExchangeName;` {i.e. ,'NYSE' for the New York Stock Exchange}

GetPlotBGColor

Returns the background color of a cell on a grid.

Syntax: **GetPlotBGColor**(*PlotNum*);

PlotNum: value or expression representing the plot number

Usage: `Value2 = GetPlotBGColor(1);`

GetPlotColor

Returns the numeric color value of a chart's plot line or grid's foreground color.

Syntax: **GetPlotColor**(*PlotNum*);

PlotNum: value or expression representing the plot number

Usage: `Value1 = GetPlotColor(2);`

GetPlotWidth

Returns the width value of a plot line in a chart.

Syntax: **GetPlotWidth***PlotNum*);

PlotNum: value or expression representing the plot number

Usage: `Value2 = GetPlotWidth(1);`

GetStrategyName

Reserved for backward compatibility.

GetSymbolName

Returns a string with the symbol name to which the analysis technique is applied.

GetSystemName

Reserved for backward compatibility. See **GetStrategyName**.

Gr_Rate_P_EPS

Returns the Earnings Per Share Growth Rate for a stock.

Green

Specifies color Green (numeric value = 4) for plots and backgrounds.

GrossLoss

Cumulative dollar total of all closed-out losing trades.

Usage: `Value1 = GrossLoss;` {returns -1000 for three losing trades of -500,-200, and -300}

GrossProfit

Cumulative dollar total of all closed-out winning trades.

Usage: `Value2 = GrossProfit;` {returns 800 for three winning trades of 100, 300, and 400}

H

Returns the highest price of the bar referenced. (abbreviation for **High**)

Usage: `Value1 = H[2];` {returns the High of 2 bars ago}

High

Returns the highest price of the bar referenced.

Usage: `Value2 = High of 1 bar ago;` {returns the High of the previous bar}

Higher

Synonym for stop or limit orders depending on the context used within a strategy.

Usage1:
```
Buy Next Bar at MyEntryPrice or Higher;            {Buy... Stop}
BuyToCover Next Bar at MyExitPrice or Higher;      {BuyToCover... Stop}
```
Usage:2
```
SellShort Next Bar at MyEntryPrice or Higher;      {SellShort... Limit}
Sell Next Bar at MyEntryPrice or Higher;           {Sell...Limit}
```

HistFundExists

True if historical fundamental info (EPS, Dividends, and Splits) exists for symbol.

I

Number of contracts outstanding at the close of a bar (abbreviation for **OpenInt**).

Usage: `Value1 = I of 1 bar ago;` {returns the open interest of the previous bar}

I_AvgEntryPrice

Returns the average entry price of each open entry in a pyramided position. For use when writing indicators and studies.

Usage: `Value2 = I_AvgEntryPrice;` {returns150 for opens entries at 130, 145, and 175)

I_ClosedEquity

Returns the profit or loss realized when a position is closed. For use when writing indicators and studies.

I_CurrentContracts

Returns the number of contracts held in all open entries. For use when writing indicators and studies.

Usage: `Value2= I_CurrentContracts;` {returns 3 for 3 open enries of 1 contract each)

I_MarketPosition

A strategy's current market position: 1 = long, -1 = short, 0 = flat. For use when writing indicators and studies.

Usage: `Value1 = I_MarketPosition;` {returns 1 if currently held position is Long)

I_OpenEquity

Returns the current gain or loss while a position is open.

If

Specifies condition(s) that must be met to execute a set of instructions.

Usage:
```
If Condition1 Then Begin
    {Operations done if condition is true}
End ;
```

IncludeSignal

Reserved for backward compatibility.

IncludeSystem

Reserved for backward compatibility. Replaced by IncludeSignal.

InitialMargin

Returns the Initial Margin Requirement of a position.

Usage: `If InitialMargin of Position > 500 Then {Any Operation}`

Input

Used to declare an input name that accepts a user value when applying a technique.

Usage: `Input: Length(10);` {declares input 'Length' with an initial value of 10}

Inputs

Declares multiple inputs separated by commas. See Input.

Usage: `Inputs: Price(5.25), Length(8), Status(True);`

InStr

Returns the location of String2 within String1.

Syntax: **InStr**(String1,String2);

String1: Text string to be searched

String2: Word or phrase to be found in String1

Returns: Character position of the start of String2, if found. Zero if not found.

Usage: `Value1 = InStr("Net Profit Margin", "Profit");` {returns a 5}

INT

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

IntPortion

Returns the integer portion of the specified decimal number.

Syntax: **IntPortion**(*Num*);

Num: A numeric value or expression

Usage: `Value1 = IntPortion(4.125);` {returns a 4}

Is

Skip word ignored during execution.

Usage: **If** a **Close** is > 100 **Then** *{any operation} ;*

JulianToDate

Returns the calendar date YYYMMDD for the specified Julian date.

Syntax: **JulianToDate**(*jDate*);

jDate: numeric expression for the date in Julian format.

Usage: `Value2 = JulianToDate(36457);` {returns Date value of 991024}

L

Returns the lowest price of the bar referenced. (abbreviation for **Low**)

Usage: `Value1 = L[4];` {returns the Low of 4 bars ago}

LargestLosTrade

Returns the dollar value of the largest closed-out losing trade.

LargestWinTrade

Returns the dollar value of the largest closed-out winning trade.

LastCalcJDate

Returns the Julian date of last completed bar.

LastCalcMMTime

Returns the time of last completed bar, in minutes since midnight.

Usage: `Value1 = LastCalcMMTime;` {returns a value of 540 if last bar was at 9:00 am}

LastTradingDate

Refers to the last day an option, future, position leg, or asset may be traded.

LeftSide

Used with ActivityBars to refer to actions on the left side of a bar.

Usage: `Value2 = GetCellChar(Close, Leftside, 3);`

LeftStr

Returns the leftmost (starting) portion of a text string.

Syntax: **LeftStr**(*String,Length*);

String: A text string to evaluate. Must be enclosed in quotation marks.

Length: The number of characters to return from the start of *String*.

Usage: `Value1 = LeftStr("Net Profit", 3);` {returns the word "Net"}

LightGray

Specifies color Light Gray (numeric value = 16) for plots and backgrounds.

Limit

In an entry or exit order, means 'or higher' or 'or lower', depending on the context.

Usage:

```
Buy Next Bar at 75 Limit; {enters a long position at a price of 75 or lower}
SellShort Next Bar at 75 Limit; {enters a short position at 75 or higher}
```

Log

Returns the natural logarithm of a number.

Usage: `Value1 = Log(172);` {returns a log value of 5.1475}

LONG

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

Low

Returns the lowest price of the bar referenced.

Usage: `Value2 = Low of 1 bar ago;` {returns the Low of the previous bar}

Lower

Synonym for stop or limit orders depending on the context used within a strategy.

Usage1:
```
Buy Next Bar at MyEntryPrice or Lower;            {Buy... Limit}
BuyToCover Next Bar at MyExitPrice or Lower;{BuyToCover... Limit}
```
Usage2:
```
SellShort Next Bar at MyEntryPrice or Lower;{SellShort... Stop}
Sell Next Bar at MyEntryPrice or Lower;           {Sell...Stop}
```

LowerStr

Used to convert a string expression to lowercase letters.

Usage1: `Value1 = LowerStr("My TextString") ;` {returns "my textstring"}

LPBOOL

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

LPBYTE

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

LPDOUBLE

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

LPDWORD

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

LPFLOAT

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

LPINT

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

LPLONG

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

LPSTR

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

LPWORD

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

Magenta

Specifies color Magenta (numeric value = 5) for plots and backgrounds.

MakeNewMovieRef

Creates new movie reference number.

Usage: `Print(MakeNewMovieRef = 1);`

Margin

Returns the margin setting from the **Trade costs** section of the strategy's **General** tab

Market

Order type referring to the opening price of the next bar.

Usage: `Buy Next Bar at Market;`

MarketPosition

The market position (1 = long, -1 = short, 0 = flat) of the specified position.

Syntax: **MarketPosition**(*Num*)

Num: number of positions ago

Usage: Value1 = **MarketPosition**(2) ; {returns1 if long 2 posittions ago was long}

MaxBarsBack

MaxBarsBack is the minimum number of referenced historical bars required, at the beginning of a chart, to begin calculating a trading strategies, analysis techniques, and functions. For example, a 10-bar moving average would require a MaxBarsBack setting of 10 to calculate, which is 9 historical bars and the current bar.

MaxBarsForward

Represents the number of bars to the right of the last bar on the chart.

MaxConsecLosers

Represents the longest chain of consecutive closed-out losing trades.

MaxConsecWinners

Represents the longest chain of consecutive closed-out winning trades.

MaxContracts

The maximum number of contracts held during the specified position.

Syntax: **MaxContracts**(*Num*)

Num: number of positions ago.

Usage: Value1 = **MaxContracts**(2) ; {returns number of contracts held 2 posittions ago}

MaxContractsHeld

Maximum number of contracts held at any one time.

MaxEntries

The maximum number of entry strategies for the specified position.

Syntax: **MaxEntries**(*Num*)

Num: number of positions ago.

MaxIDDrawDown

The largest drop in equity (in dollars) throughout the entire trading period.

MaxList

Returns the highest value of the listed inputs.

Syntax: **MaxList**(*Num1[,NumN...]*)

Num1 the first value or expression to compare

NumN additional values to compare separated by commas

Usage: `Value1 = MaxList(45, 72, 86, 125, 47);` {returns a value of 125}

MaxList2

Returns the second highest value of the listed inputs. See **MaxList** for syntax.

Usage: `Value2 = MaxList2(18, 67, 98, 24, 65, 19);` {returns a value of 67}

MaxPositionLoss

Dollar amount of largest loss for the specified position.

Syntax: **MaxPositionLoss**(*Num*)

Num: number of positions ago.

MaxPositionProfit

Dollar amount of largest gain for the specified position.

Syntax: **MaxPositionProfit**(*Num*)

Num: number of positions ago.

MessageLog

Reserved for backward compatibility.

MidStr

Returns the middle portion of a text string.

Syntax: **MidStr** (*String*,*Location*,*Size*) ;

String: text expression to evaluate

Location: starting character position of the text string to be returned

Size: length of the text string to be returned

Usage: `Value1 = MidStr("Net Profit Value", 5, 6)` {returns the word 'Profit'}

MinList

Returns the lowest value of the listed inputs.

Syntax: **MinList**(*Num1[,NumN...]*)

Num1 the first value or expression to compare

NumN additional values to compare separated by commas

Usage: `Value1 = MinList(45, 72, 86, 125, 47);` {returns a value of 45}

MinList2

Returns the second lowest value of the listed inputs. See **MinList** for syntax.

Usage: `Value2 = MinList2(18, 67, 98, 24, 65, 19)` {returns a value of 19}

MinMove

Minimum tick movement of stock/future symbol.

Usage: `Value1 = MinMove * PriceScale` {returns the smallest price increment}

Moc

Reserved for future use.

Mod

Divides two numbers and returns the remainder.

Syntax: **Mod**(*Num,Divisor*)

Num: any value or expression

Divisor: any numeric expression representing the divisor.

Usage: `Value1 = Mod(17, 5);` {divides 17 by 5 and returns 2 as the remainder}

Monday

Specifies day of the week Monday (numeric value = 1).

MoneyMgtStopAmt

Reserved for backward compatibility with previous versions of the product. Replaced by the reserved word **SetStopLoss**.

Month

Returns the month (MM) portion of the specified calendar date, from 1 to 12.

Syntax: **Month**(c*Date*);

cDate: numeric expression for the date in YYMMDD or YYYMMDD format.

Usage: `Value1 = Month(991004)` {returns day value of 10}

MULTIPLE

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

Neg

Returns the absolute negative value of a number.

Usage:

```
Value1 = Neg(17);     {returns a value of -17}
Value2 = Neg(-9);     {returns a value of -9}
```

NetProfit

Cumulative dollar total of all closed-out trades, both winning and losing.

Usage: `Value1 = NetProfit` {returns 1000 for three closed trades of -500, 1200 and 300}

NewLine

Adds carriage return/linefeed in FileAppend and commentary/file output strings.

Usage:

```
FileAppend("c:\my.txt", "Text Line1" + NewLine + "Line2");
```

Next

Used in conjunction with **Bar** to reference the next bar in a trading strategy.

Usage:

```
Buy Next Bar at Market;
```

NoPlot

Removes a plot from the current bar in a chart or cell in a grid.

Usage:
```
If Close > Close[1] Then
        Plot1(High, "CloseUp")                    {plots 'CloseUp' on the bar}
Else
        NoPlot(1);                       {removes a previous plot from the bar}
```

Not

Reserved for future use.

NthMaxList

Returns the Nth highest value of the listed inputs.

Syntax: **NthMaxList**(*N*,*Num1[,NumN...]*)

N: an integer representing the rank in the list (1st, 2nd, 3rd, etc.)

Num1: the first value or expression to compare

NumN: additional values to compare separated by commas

Usage:
```
Value1 = NthMaxList(2, 45, 72, 86, 125, 47);   {returns a value of 86}
```

NthMinList

Returns the Nth lowest value of the listed inputs. See syntax as **NthMaxList**.

Usage:
```
Value1 = NthMaxList(2, 45, 72, 86, 125, 47);   {returns a value of 47}
```

Numeric

Defines an input that expects a number passed by value.

Usage:
```
Input: Price(Numeric);                {accepts a numeric value for Price}
```

NumericArray

Defines an input that expects a number passed by value for each array element.

Usage:
```
Input: MyArray[n](NumericArray)           {accepts numeric inputs by value}
```

NumericArrayRef

Defines an input that expects a numeric variable passed by reference for each array element.

Usage:
```
Input: MyArray[n](NumericArrayRef)  {accepts numeric inputs by reference}
```

NumericRef

Defines an input that expects a numeric variable passed by reference.

Usage:
```
Input: Price(NumericRef);    {accepts a numeric variable reference for Price}
```

NumericSeries

Defines an input as a numeric series expression with price history.

Usage:
```
Input: Price(NumericSeries);  {a numeric input allowing previous bar history}
```

NumericSimple

Defines an input as a numeric simple expression.

Usage:
```
Input: Price(NumericSimple);       {a numeric input not allowing bar history}
```

NumFutures

Returns the total number of futures contracts associated with a future symbol root.

Usage: `Value1 = NumFutures of Asset;`

NumLosTrades

Returns the total count of closed-out losing trades.

NumToStr

Converts the specified numeric expression to a string expression.

Syntax: **NumToStr**(*Num*,*Dec*);

Num: a numeric expression to be converted to a string

Dec: the number of decimal places for the string version of the value

Usage: `Value1 = NumToStr(1170.5, 2) ;` {returns the text string '1170.50'}

NumWinTrades

Total count of closed-out winning trades.

O

Abbreviation for Open. Returns the opening price of a referenced bar.

Usage: `If Price < O of 1 Bar Ago Then SellShort at Market;`

Of

Skip word ignored during execution.

Usage: `If Close of Data1 = Highest(High, 14) Then {any operation} ;`

On

Skip word ignored during execution.

Usage: `Buy 100 Contracts on Next Bar Open;`

Open

Returns the opening price of the bar referenced.

Usage: `Value1 = Open of 2 Bars Ago;`

OpenInt

The open interest, or number of contracts outstanding, at the close of a specific bar.

Usage: `Value2 = Average(OpenInt, 10);` {returns the average OpenInt over 10 bars}

OpenPositionProfit

Returns the gain or loss of current open position (only used with strategies).

Or

Links 2 true/false expressions together. *True* if either expression is true.

Usage:

```
If Plot1 Crosses Above Plot2 Or Plot2 > 5 Then Begin
  {any operations}                        {done if either condition is true}
End;
```

Over

Used only with **Crosses** to detect a value crossing over, or above, another value.

Usage: `If Plot1 Crosses Over Plot2 Then {Any Operation} ;`

Pager_DefaultName

Returns the string containing of the default Message Recipient as specified in the **Messaging** tab under the **File - Desktop Options** menu.

Usage:
```
Name = Pager_DefaultName;
Pager_Send(Name, "Buy 200 AMD at Market");
```

Pager_Send

Sends a text message to a specified pager recipient (if pager module enabled).

Syntax: **Pager_Send**(*sTo*,*sMessage*);

sTo: text string containing the name of the message recipient

sMessage: text string containing the message contents

Usage: `Pager_Send("Joe Trader", "Buy 200 AMD at Market");`

PercentProfit

Percentage of all closed-out winning trades.

Usage: Value1 = **PercentProfit**; {returns 80 if 8 of 10 trades were winners}

Place

Retained for backward compatibility. Skip word.

PlayMovieChain

Queues and plays the movie chain with the specified reference number.

Usage: `Condition1 = PlayMovieChain(1);` {plays the movie chain with ref number 1}

PlaySound

Plays the specified sound file (.wav file).

Usage: `Condition1 = PlaySound("c:\sounds\thatsabuy.wav");`

Plot

References the value of a specified plot.

Syntax: **Plot**(*n*);

n: plot number ranging from 1-4

Usage: `If Plot(Value1) < Close Then Buy Next Bar on Open;`

Plot1

Displays an expression (numeric or text) in a price chart or grid.

Syntax: **Plot1**(*Value[,sName[,fgColor,[bgColor[,Width]]]]*);

Value: a numeric or text string expression or value to display on a chart or grid

sName: text string containing the name of the plot (optional)

fgColor: color number (or Default) of the plotted object or text (optional)

bgColor: color number (or Default) of the cell background in a grid (optional, ignored for charts)

Width: the thickness of a line to be plotted on a chart (optional, ignored for grids)

Usage:
```
Plot1(Value) ;
```
or
```
Plot1(Value, "My Plot Name", Red, Default, 0) ;
```

Plot2

Displays an expression in a price chart or grid. See **Plot1** for syntax and usage.

Plot3

Displays an expression in a price chart or grid. See **Plot1** for syntax and usage.

Plot4

Displays an expression in a price chart or grid. See **Plot1** for syntax and usage.

PlotPaintBar

For use with PaintBar studies, enables you to paint the entire bar, or part of the bar, with a single instruction.

Syntax: **PlotPaintBar**(*High, Low[, Open, Close[, "PlotName"[,fgColor, [bgColor, Width]]]]*);

High: the upper price limit to paint

Low: the lower price limit to paint

Open: (optional) paints the opening tick mark

Close: (optional) paints the closing tick mark

PlotName: (optional) name used when referencing the plot

fgColor: (optional) color number (or Default) of the paint color

bgColor: (optional) color number (or Default) of the background (currently ignored with charts)

Width: (optional) the thickness of the lines to be plotted

Usage1:
```
PlotPaintBar(High,Low,Open,Close,"My Plot Name");
```
or

Usage2:
```
PlotPaintBar(High,Low);
```

PlotPB

Abbreviated version of **PlotPaintBar** (see PlotPaintBar).

PM_GetCellValue

Returns the intensity value of a cell at the specified column and price location.

Syntax: **PM_GetCellValue**(*ColNum,Price*);

ColNum: the ProbabilityMap column number where the cell is located

Price: the price location of the cell

Usage:
```
Value1 = PM_GetCellValue(12,High) ;
```

PM_GetNumColumns

Returns the number of columns in a ProbabilityMap array.

Usage: `Value1 = PM_GetNumColumns;`

PM_GetRowHeight

Returns the height or increment of the rows in a ProbabilityMap study.

PM_High

Returns the value of the upper range of a ProbabilityMap grid.

PM_Low

Returns the value of the lower range of a ProbabilityMap grid.

PM_SetCellValue

Sets the location and intensity of ProbabilityMap cells.

Syntax: **PM_SetCellValue**(*ColNum,Price,Value*) ;

ColNum: the ProbabilityMap column of the cell to be set

Price: the price location of the cell within the column

Value: a numeric expression representing the intensity of the cell

Usage: `PM_SetCellValue(5,80,10) ;` {sets intensity of cell to 10}

PM_SetHigh

Sets the upper range value of a ProbabilityMap.

Syntax: **PM_SetHigh**(*Price*)

Price: a numeric expression or value for a price

Usage: `PM_SetHigh(Highest(High,50));` {sets the PM top to the Highest High}

PM_SetLow

Sets the lower range value of a ProbabilityMap.

Syntax: **PM_SetLow**(*Price*)

Price: a numeric expression or value for a price

Usage: `PM_SetLow(14.5) ;` {sets the PM bottom to a price of 14.50}

PM_SetNumColumns

Sets the number of columns in a probability map array.

Syntax: **PM_SetNumColumns**(*Num*);

Num: a numeric expression or value representing the desired number of columns

Usage: `PM_SetNumColumns(PM_BarColumns) ;`

PM_SetRowHeight

Sets the height of the rows for a ProbabilityMap grid.

Syntax: **PM_SetRowHeight**(*RowHeight);*

RowHeight: a numeric expression or value for the height of each PB row

Usage: `PM_SetRowHeight(.125) ;` {sets the PM row height to a price of .125}

Pob

Retained for backward compatibility. Replaced by **Limit**.

Point

The minimal fractional value a symbol can move (one increment in the Price Scale).

Usage:
```
Sell This Bar at EntryPrice - 1 Point Stop;
```

POINTER

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

Points

Represents multiple 'Point' increments of the Price Scale. See **Point**.

Usage:
```
Buy This Bar at Close - 3 Points Stop;
```

PointValue

The dollar value per share of one increment on the price scale. Calculated as Big Point Value divided by the Price Scale using the values specified in the symbol dictionary.

Usage:
```
Value1 = PointValue;                {returns 2.5 for S&P Futures}
```

Pos

Returns the absolute positive value of a number.

Usage:
```
Value1 = Pos(17);                   {returns a value of 17}
Value2 = Pos(-9);                   {returns a value of 9}
```

PositionProfit

Returns the current gain (positive) or loss (negative) of the specified position.

Usage:
```
Value1 = PositionProfit;     {returns -1.00 if the position had a loss of 1.00}
```

Power

Returns the number raised to the specified power.

Syntax: **Power**(*Num,Exponent*);

Num: a numeric expression or value

Exponent: the power by which to raise the number

Usage:
```
Value1 = Pow(2,3);                  {returns 8 based on 2^3}
```

PriceScale

Price scale of stock/future symbol (inverted).

Usage:
```
Value2 = PriceScale      {returns 100 for the S&P 500 Futures representing 1/100}
```

Print

Sends information to the Output Bar in the EasyLanguage PowerEditor or, if specified, to an alternate output location (a file or the default printer).

Syntax: **Print** (*Item1[,ItemN...]*) ;

Item1: a string or numeric expression

ItemN: additional strings or expressions separated by commas

Usage: `Print(Date, Time, Close);` {prints the 3 values to the Print Log} window}

Usage1: `Print(Printer, D, T, C);` {prints the same 3 values to the default printer}

Usage2: `Print("c:\myfile.txt", D, T, C);` {prints the 3 values to the specified file}

Printer

Sends information to the default printer from a Print statement.

Usage: `Print(Printer,"Today is: ", Date);` {sends output to the default printer}

Product

Number representing the TradeStation Technologies application currently being used.

Product Name	Product Number
TradeStation	0

Usage: `If Product = 0 Then Plot1(Value1, "TS Indicator");`

Profit

Reserved for future use.

ProfitTargetStop

Retained for backward compatibility with previous versions of the product. Replaced by the reserved word **SetProfitTarget**.

Protective

Reserved for future use.

Quick_Ratio

Calculated as (cash + short term investment + accounts receivable) / current liabilities.

Random

Returns a pseudo-random number between 0 and *num*.

Syntax: **Random**(*num*) ;

Num: value that determines the range of possible numbers, starting with 0 and ending with *Num*

Usage: `Value1 = Random(37);` {randomly returns any value between 0 and 37}

Red

Specifies color Red (numeric value = 6) for plots and backgrounds.

Repeat

Reserved for future use.

RevSize

Reversal size of a Point & Figure chart. Set on the **Settings** tab under **Format Symbol**.

RightSide

Used with ActivityBars to refer to actions on the right side of a bar.

Usage:
```
AB_AddCell(Open, Rightside, "A", 7, 1);
```

RightStr

Returns the rightmost (ending) portion of a text string.

Syntax: **RightStr**(*String,Length*);

String: A text string to evaluate. Must be enclosed in quotation marks.

Length: The number of characters to return from the end of *String*.

Usage:
```
Value1 = RightStr("Net Profit", 6);
```
{returns the word "Profit"}

Round

Returns a number rounded to nearest precision.

Divides two numbers and returns the remainder.

Syntax: **Round**(*Num,Precision*)

Num: any value or expression

Precision: the number of decimal places to keep

Usage:
```
Value1 = Round(9.5687, 3);
```
{returns a value of 9.569}

Saturday

Specifies day of the week Saturday (numeric value = 6).

Screen

Reserved for future use.

Sell

A trading strategy order to partially or completely liquidate a long position.

Syntax: **Sell** [from entry ("MyTrade")] [*num* of **shares**] [execution instruction];

execution instructions: **this bar** on **close**, **next bar** at **market**,
next bar at *price* **stop**, **next bar** at *price* **limit**

Usage:
```
Sell Next Bar at Market;
Sell From Entry ("BuyClose") Next Bar at 75 Stop
Sell 5 Contracts Next Bar at Low + Range Stop;
Sell From Entry ("BuyLimit") Next Bar at Price Limit;
```

SellShort

Initiates a short position. Closes any open positions & reverses an existing position.

Syntax: **SellShort** [("Order Name")] [*num* of **shares**] [execution instruction]*;*
execution instructions: **this bar** on **close**, **next bar** at **market**,
next bar at *price* **stop**, **next bar** at *price* **limit**

Usage:
```
SellShort Next Bar at Market;
SellShort("Buy Close") 20 Shares This Bar on Close;
SellShort 5 Contracts Next Bar at Low + Range Stop;
SellShort("BuyLimit") Next Bar at Price Limit;
```

Sess1EndTime

Ending time of the first trading session for the security in 24-hour format.

Usage: `Value2 = Sess1EndTime;` {returns 1615 for IBM trading on the NYSE}

Sess1FirstBarTime

Completion time of the first bar in the first session in 24-hour format.

sage: `Value2 = Sess1FirstBarTime;` {returns 1000 for IBM using 30 min bars}

Sess1StartTime

Starting time of the first trading session for the security in 24-hour format.

Usage: `Value1 = Sess1StartTime;` {returns 0930 for IBM trading on the NYSE}

Sess2EndTime

Ending time of the second trading session for the security in 24-hour format.

Usage: `Value2 = Sess2EndTime;` {returns 0745 for US Treasury Bonds on CBOE}

Sess2FirstBarTime

Completion time of the first bar in the second session in 24-hour format.

Usage: `Value1 = Sess2FirstBarTime;` {returns 1715 for S&P 500 Futures on 30 min bars}

Sess2StartTime

Starting time of the second trading session for the security in 24-hour format.

Usage: `Value1 = Sess2StartTime;` {returns 1530 for US Treasury Bonds on CBOE}

Sessions

Returns a numeric expression representing the number of sessions.

SetBreakEven

Sets a breakeven stop; specifies the profit required before placing the stop. Used by the trading strategy **BreakEven StopFloor**.

Syntax: **SetBreakEven**(*Price*)
Price: the floor, or minimum equity, needed for the stop to become active

Usage:
```
SetStopPosition;          {can also use SetStopContract}
SetBreakEven(250);        {places a breakeven stop after a $250 position profit}
```

SetDollarTrailing

Sets a dollar risk trailing stop; specifies the maximum tolerated loss amount (in dollars) of the maximum open position profit. Used by the trading strategy **Dollar Risk Trailing**.

Syntax: **SetDollarTrailing**(*Amount*)

Amount: the dollar amount you are willing to risk per position or per contract/share

Usage: `SetStopPosition;` {can also use SetStopContract}
`SetDollarTrailing(500);` {sets dollar risk trailing stop at $500 for entire position}

SetExitOnClose

Sets a stop to exit the position on the last bar of the day (for intraday charts). Used by the trading strategy **Close at End of Day**.

Usage: `SetExitOnClose;` {exits positions at end of day}

SetPercentTrailing

Sets a percent risk trailing stop; specifies the profit that must be reached to activate stop and the maximum tolerated loss amount (as a percentage) of the maximum open position profit. Used by the trading strategy **PercentRisk Trailing**.

Syntax: **SetPercentTrailing**(*Amount,Percent*)

Amount: the dollar amount representing the minimum needed to activate the stop

Percent: the percentage of the maximum equity needed to be lost to close the trade

Usage: `SetStopPosition;` {can also use SetStopContract}
`SetPercentTrailing(500,15);` {exits after returnof 15% over $500 earned}

SetPlotBGColor

Assigns a specified background color to grid cells for an indicator.

Syntax: **SetPlotBGColor**(*Num,Color*)

Num: plot number to set

Color: EasyLanguage color word (e.g., red, black,white) or color number

Usage: `SetPlotBGColor(1, Green);` {sets background color of Plot1 cells to Green}

SetPlotColor

Sets the color value of a chart's plot line or grid's foreground text color.

Syntax: **SetPlotColor**(*Num,Color*);

Num: plot number to set

Color: EasyLanguage color word (e.g. red, black,white) or color number

Usage: `SetPlotColor(2, Blue);` {sets foreground color of Plot2 text to Blue}

SetPlotWidth

Modifies the width value (thickness) of a plot line in a chart.

Syntax: **SetPlotWidth**(*Num,Width*);

Num: plot number to set

Width: Numeric expression representing the plot's width

Usage: `SetPlotWidth(1, 5);` {sets the line width of Plot1 to 5}

SetProfitTarget

Sets a profit target stop; this reserved word specifies the profit required in order to exit the position. Used by the trading strategy **Profit Target**.

Syntax: **SetProfitTarget**(*Amount*)

Amount: the dollar value of the profit target

Usage:
```
SetStopContract;
SetProfitTarget(400);        {exits a position once it has returned $400}
```

SetStopContract

Instructs TradeStation to evaluate all stop values of a strategy on a per contract (entry) basis. Use **SetStopPosition** to evaluate stop values on a per position basis.

Usage:
```
SetStopContract;             {sets a stop for individual contract (entry)}
SetStopLoss(50) ;
```

SetStopLoss

Sets a stop loss order (money management stop); specifies the amount (in dollars) you are willing to lose on the position/contract before it is liquidated. Used by the trading strategy *Stop Loss*.

Syntax: **SetStopLoss**(*Amount*)

Amount: the dollar amount that must be incurred before position/contract is liquidated

Usage:
```
SetStopContract;             {can also use SetStopContract}
SetStopLoss(2);              {exits long position when down $2 per contract}
```

SetStopPosition

Instructs TradeStation to evaluate all stop values of a strategy on a per position basis. To evaluate all stop values on a per contract (entry) basis, use **SetStopContract**.

Usage:
```
SetStopPosition;
SetStopLoss(1200);           {places a stop loss order of $1200 for entire position}
```

SGA_Exp_By_NetSales

Annualized growth rate percentage of sales (calculated from the total revenue divided by the number of outstanding shares).

Share

Used to specify a contract/share for a particular Buy, SellShort, or exit order.

Usage:
```
Buy 1 Share Next Bar at Market;
```

Shares

Used to specify the number of contracts/shares for a particular Buy, SellShort, or exit order.

Usage:
```
Sell 5 Shares Next Bar at Open;
```

Sign

Returns 1 for a positive num, -1 for a negative num, and 0 for a num of zero.

Syntax: **Sign**(*Num*)

Num: a numeric value or expression.

Usage: `Value1 = Sign(-9.5687)` {returns a value of -1}

Sine

Returns the sine value of *num* degrees.

Usage: `Value1 = Sine(72);` {returns 0.9511 when *num* is 72 degrees}

Skip

Reserved for future use.

Slippage

Returns the slippage per contract from **Trade costs** section of the strategy's **General** tab.

SnapFundExists

True if snapshot fundamental data exists in the data stream; False otherwise.

Spaces

Specifies the number of blank spaces to add to a text or commentary string.

Usage: `Print("Close" + Spaces(5) + NumToStr(Close, 3));`

Square

Returns the square (2nd power) of the specified number.

Syntax: **Square**(*Num*)

Num: a numeric value or expression

Usage: `Value1 = Square(6.23)` {returns a value of 38.8219}

SquareRoot

Returns the square root of the specified number.

Syntax: **SquareRoot**(*Num*)

Num: a numeric value or expression

Usage: `Value1 = SquareRoot(5);` {returns a value of 2.2361}

StartDate

Reserved for future use.

StockSplit

Ratio of the stock split reported during a certain period.

Usage: `Value2 = StockSplit(2);` {returns the split ratio reported 2 periods ago}

StockSplitCount

The number of stock splits that have been reported in a given time frame.

StockSplitDate

The date on which a stock split was reported during a certain period.

Usage: `Value1 = StockSplitDate(3);` {date of a stock split reported 3 periods ago}

StockSplitTime

The time at which a stock split occurred during a certain period.

Usage: `Value2 = StockSplitTime;` {time of the last reported stock split}

Stop

In an entry or exit order, means 'or higher' or 'or lower', depending on the context.

Usage: `Buy Next Bar at 65 Stop;` {enters a long position at a price of 65 or higher}
`Sell Next Bar at 65 Stop;` {exits a long position at a price of 65 or lower}

String

Defines a function input that accepts a string expression value.

Usage: `Input: MyMessage(String);` {accepts a text string value}

StringArray

Defines a function input array that accepts multiple string expressions.

Usage: `Input: Messages[n](StringArray);` {array that accepts text strings}

StringArrayRef

Defines a function input array that accepts multiple string references.

Usage: `Input: Note[n](StringArrayRef);` {array that accepts strings by reference}

StringRef

Defines a function input that accepts a string expression by reference.

Usage: `Input: SomeText(StringRef);` {accepts a text string by reference}

StringSeries

Defines a function input that accepts string expressions that include history.

Usage: `Input: SomeText(StringSeries);` {accepts text strings with history}

StringSimple

Defines a function input that accepts simple string expressions without history.

Usage: `Input: SomeText(StringSimple);` {accepts text strings without history}

StrLen

The number of characters that make up a text string.

Syntax: **StrLen**(*String*)

String: a text string expression (a variable or text contained within quote marks).

Usage: `Value1 = StrLen("Net Profit");` {returns a count of 10 characters}

StrToNum

Returns the numerical value of a text string, zero if the string not numeric.

Syntax: **StrToNum***(String)*

String: a text string expression (a variable or text contained within quote marks).

Usage: `Value2 = StrToNum("1170.50");` {returns the numeric value 1117.5}

SumList

Returns the sum of all listed inputs.

Syntax: **SumList**(*Num1[,NumN...]*)

Num1: the first value or expression

NumN: additional values to add separated by commas

Usage: `Value1 = SumList(45, 72, 86, 125, 47);` {returns a value of 375}

Sunday

Specifies day of the week Sunday (numeric value = 0).

SymbolName

Returns a string expression representing the symbol name. See also **GetSymbolName**.

SymbolNumber

Number representing the GlobalServer symbol. See **CommodityNumber** and **Cusip**.

SymbolRoot

Returns a text string representing the root of the symbol (for futures and options only).

T

Abbreviation for Time. Returns the closing time of a referenced bar in 24-hour format.

Usage:

```
If T of 1 Bar Ago >= 1100 Then
     Buy at Market;
```

{buys at or after 11 AM}

Tangent

Returns the tangent value of *num* degrees.

Usage: `Value1 = Tangent(num);` {returns 1 when *num* is 45 degrees}

Target

Reserved for future use.

TargetType

Reserved for future use.

Text

Retained for backward compatibility.

Text_Delete

Deletes the specified text object.

Syntax: **Text_Delete**(*TX_Ref*)

TX_Ref: a numeric expression representing the object identification number

Returns: status code indicating whether or not operation was successful

Usage1: `Text_Delete(3);` {deletes text object number 3}

Usage2: `Value1 = Text_Delete(2);` {returns status code after deleting text object 2}

Text_GetColor

Returns the color value of the specified text object. (see **Text_Delete** for syntax)

Usage: `Value1 = Text_GetColor(4);` {returns the color of text object 4}

Text_GetDate

Returns the date of the left edge of the specified text object.

Syntax: **Text_Delete**(*TX_Ref*)

TX_Ref: a numeric expression representing the object identification number

Usage: `Value1 = Text_GetDate(2);` {returns the date of text object 2}

Text_GetFirst

Returns the text object id number for the first object of a specified type.

Syntax: **Text_GetFirst**(*Type*)

Type: identifies the origin of the requested first text object

1 = text created by an analysis technique

2 = text created by the text drawing object only, and

3 = text created by either the text drawing object or an analysis technique

Returns: status code indicating whether or not operation is successful

Usage: `Value2 = Text_GetFirst(2);` {returns the id of first text drawing object}

Text_GetHStyle

Gets the horizontal placement style of the specified text object. (see **Text_Delete** for syntax)

Returns: 0 for left, 1 for right, 2 for center, or status code if operation not successful

Usage: `Value1 = Text_GetHStyle(5);` {returns horiz style of text object 5}

Text_GetNext

Returns the text object id for the next object of a specified type after specified object.

Syntax: **Text_GetNext**(*TX_Ref*, *Type*)

TX_Ref: a numeric expression representing the object identification number

Type: identifies the origin of the next text object

1 = text created by an analysis technique

2 = text created by the text drawing object only, and

3 = text created by either the text drawing object or an analysis technique

Returns: status code indicating whether or not operation is successful

Usage: *Value2 = **Text_GetNext**(2,1);* {returns the id of analysis text after id 2}

Text_GetString

Returns the text string of the specified text object. (see **Text_Delete** for syntax)

Usage: `TextValue1 = Text_GetString(3);` {returns text string of object number 3}

Text_GetTime

Returns the time of the left edge of the specified text object. (see **Text_Delete** for syntax)

Usage: `Value2 = Text_GetTime(4);` {returns the time of text object 4}

Text_GetValue

Returns the price (vertical axis) of the specified text object. (see **Text_Delete** for syntax)

Usage: `Value1 = Text_GetValue(2);` {returns the price of text object 2}

Text_GetVStyle

Gets the vertical placement style of the specified text object. (see **Text_Delete** for syntax)

Returns: 0 for top, 1 for bottom, 2 for center, or error code if operation not successful

Usage: `Value2 = Text_GetVStyle(5);` {returns vert style of text object 5}

Text_New

Creates and draws a new text object at a specified date, time, and price location.

Syntax: **Text_New**(*cDate,Time,Price,Text*)

cDate: date in YYYMMDD format

Time: time in HHMM 24-hour format

Price: value or numeric expression of the price

Text: text variable or text expression within quotes

Returns: object number if successful, or error code if operation not successful

---

***Note**: Drawing objects are numbered by type in the order they are created, from 0 to n. Therefore, 0 is the identification number of the first drawing object of that type created, and n is the last object of the same type created.*

Usage: `Value1 = Text_New(Date, Time, High + 1, "Stock Split");`

Text_SetColor

Changes the color of the specified text object.

Syntax: **Text_SetColor**(*TX_ref, Color*)

TX_Ref: a numeric expression representing the object identification number

Color: the color name or numeric value

Usage: `Text_SetColor(3,red);` {sets text object 3 to color *red*}

Text_SetLocation

Moves specified text object to a new date, time, and price location.

Syntax: **Text_SetLocation**(*TX_ref, cDate,Time,Price,Text*)

TX_Ref: a numeric expression representing the object identification number
cDate: date in YYYMMDD format
Time: time in HHMM 24-hour format
Price: value or numeric expression of the price
Text: text variable or text expression within quotes
Returns: 0 if successful, or error code if operation not successful

Usage:
```
Value1 = Text_SetLocation(2,990114,1500,24.5); {moves text obj 2}
```

Text_SetString

Changes the text of a specified text object.

Syntax: **Text_SetString**(*TX_ref, Text*)

TX_Ref: a numeric expression representing the object identification number
Text: text variable or text expression within quotes
Returns: 0 if successful, or error code if operation not successful

Usage:
```
Value2 = Text_SetString(1, "New String") ;   {changes text for obj 1}
```

Text_SetStyle

Changes the horizontal and vertical position style for the specified text object.

Syntax: **Text_SetStyle**(*TX_ref, Horiz,Vert*)

TX_Ref: a numeric expression representing the object identification number
Horiz: 0 for left, 1 for right, 2 for center
Vert: 0 for top, 1 for bottom, 2 for center
Returns: 0 if successful, or error code if operation not successful

Usage:
```
Value1 = Text_SetStyle(3,0,1) ;      {repositions obj 3 to the left-bottom}
```

Than

Skip word used to improve readability. Ignored during execution.

Usage:
```
If High > than the Highest(Close, 14) Then {any operation}
```

The

Skip word used to improve readability. Ignored during execution. *(see Than)*

Then

Precedes the operation(s) to be executed when the matching *If* condition is true.

Usage:
```
If Condition1 Then Begin
     {Operations done if condition is true}
End ;
```

This

Used to reference the current Bar.

Usage:
```
Buy This Bar on Close;
```

Thursday

Specifies day of the week Thursday (numeric value = 4).

Ticks

Reserved for backward compatibility. Replaced with Points.

TickType

The kind of tick that triggered an option core event: Asset, Option, Future, or Model.

Time

Closing time of the current bar in 24-hour HHMM format.

Usage: `Value1 = Time;` {returns 2130 if the bar time is 9:30pm}

TL_Delete

Deletes the specified trendline from the chart.

Syntax: **TL_Delete**(*TL_Ref*)

TL_Ref: a numeric expression representing the trendline identification number

Returns: 0 if operation is successful, or error code if not

Usage1: `TL_Delete(2);` {deletes trendline number 2}

Usage2: `Value1 = TL_Delete(3);` {returns status code after deleting trendline 3}

TL_GetAlert

Gets the alert status of the specified trendline object.

TL_Ref: a numeric expression representing the trendline identification number

Returns: 0 = no alert, 1 = Breakout Intrabar, 2 = Breakout on Close

Usage: `Value2 = TL_GetAlert(4);` {returns alert status for trendline number 4}

TL_GetBeginDate

The date of the starting point for the specified trendline. (see **TL_Delete** for syntax)

Usage: `Value1 = TL_GetBeginDate(2);` {returns the start date of trendline 2}

TL_GetBeginTime

The time of the starting point for the specified trendline. (see **TL_Delete** for syntax)

Usage: `Value2 = TL_GetBeginTime(3);` {returns the start time of trendline 3}

TL_GetBeginVal

The price (vertical axis) of a trendline's starting point. (see **TL_Delete** for syntax)

Usage: `Value1 = TL_GetBeginVal(4);` {returns the start price of trendline 4}

TL_GetColor

Returns the color value of the specified trendline. (see **TL_Delete** for syntax)

Usage: `Value1 = TL_GetColor(3);` {returns the color of trendline 3}

TL_GetEndDate

The date of the ending point for the specified trendline. (see **TL_Delete** for syntax)

Usage: `Value1 = TL_GetEndDate(2);` {returns the end date of trendline 2}

TL_GetEndTime

The date of the ending point for the specified trendline. (see **TL_Delete** for syntax)

Usage: `Value2 = TL_GetEndTime(4);` {returns the end time of trendline 4}

TL_GetEndVal

The price (vertical axis) of a trendline's ending point. (see **TL_Delete** for syntax)

Usage: `Value1 = TL_GetEndVal(3);` {returns the end price of trendline 3}

TL_GetExtLeft

True if the specified trendline is extended left, False otherwise. (see **TL_Delete** for syntax)

Usage: `Condition1 = TL_GetExtLeft(12) ;` {true if trendline 12 extends left}

TL_GetExtRight

True if the specified trendline is extended right, False otherwise. (see **TL_Delete** for syntax)

Usage: `Condition1 = TL_GetExtRight(5) ;` {true if trendline 5 extends right}

TL_GetFirst

Returns the ID number for the first trendline of a specified type.

Syntax: **TL_GetFirst**(*Type*)

Type: identifies the origin of the requested first trendline

1 = trendline created by the current analysis technique only

2 = trendline created by any analysis technique, and

3 = trendline created by any other means

Returns: ID if operation successful or error code if not

Usage: `Value2 = TL_GetFirst(2);` {returns id of first trendline of type}

TL_GetNext

Returns the text object ID for the next object of a specified type after specified object.

Syntax: **TL_GetNext**(*TL_Ref*, *Type*)

TL_Ref: a numeric expression representing the object identification number

Type: (see TL_GetFirst)

Returns: ID if operation successful or error code if not

Usage: `Value1 = TL_GetNext(2,1);` {returns id of trendline draw object after id 2}

TL_GetSize

The line thickness setting (weight) for the specified trendline. (see **TL_Delete** for syntax)

Usage: `Value2 = TL_GetSize(3);` {returns thickness of trendline 3}

TL_GetStyle

The line style for the specified trendline.

Syntax: **TL_GetStyle**(*TL_Ref*)

TL_Ref: a numeric expression representing the object identification number

Returns: Tool_Solid = 1 (solid)
Tool_Dashed = 2 (dashed)
Tool_Dotted= 3 (dotted)
Tool_Dashed2= 4 (dashed pattern)
Tool_Dashed3= 5 (dashed pattern)

Usage: `Value1 = TL_GetStyle(6);` {returns 3 if trendline 6 is dotted}

TL_GetValue

The price (vertical axis) of the specified trendline at date and time.

Syntax: **TL_GetStyle**(*TL_Ref,cDate,Time*)

TL_Ref: a numeric expression representing the object identification number

cDate: date in YYYMMDD format

Time: time in HHMM 24-hour format

Returns: price if operation successful or error code if not

Usage: `Value2 = TL_GetValue(2,991104,0930);` {returns the price of trendline 2}

TL_New

Creates a new trendline using specified start and end points.

Syntax: **TL_New**(*sDate,sTime,sPrice,eDate,eTime,ePrice*)

sDate: starting point date in YYYMMDD format

sTime: starting point time in HHMM 24-hour format

sPrice: starting point price

eDate: ending point date in YYYMMDD format

eTime: ending point time in HHMM 24-hour format

ePrice: ending point price

Returns: trendline ID if operation successful, error code if not

Usage: `Value1 = TL_New(990107, 0930, 45, 990125, 1600, 37.250);`

TL_SetAlert

Sets the alert status for a specified trendline.

Syntax: **TL_SetAlert**(*TL_Ref, Status*)

TL_Ref: a numeric expression representing the object identification number

Status: 0=no alert, 1=breakout intrabar alert, 2=breakout on close alert

Usage: `TL_SetAlert(3, 1);` {sets intrabar alert for trendline 3}

TL_SetBegin

Changes the starting point of a specified trendline.

Syntax: **TL_SetBegin**(*TL_Ref,sDate,sTime,sPrice*)

TL_Ref: a numeric expression representing the object identification number

(see **TL_New** for descriptions of *sDate,sTime,sPrice*)

Usage: `TL_SetBegin(4, 990221, 1015, 107.225);`

TL_SetColor

Changes the color of a specified trendline.

Syntax: **TL_SetColor**(*TL_Ref*, *Color*)

TL_Ref: a numeric expression representing the object identification number

Color: the color name or numeric value

Usage: `TL_SetColor(3, Blue);` {sets trendline 3 to color blue}

TL_SetEnd

Changes the ending point of a specified trendline.

Syntax: **TL_SetEnd**(*TL_Ref*, *eDate, eTime, ePrice*)

TL_Ref: a numeric expression representing the object identification number

(see **TL_New** for descriptions of *eDate,eTime,ePrice*)

Usage: `TL_SetEnd(2, 990221, 1515, 207.125);`

TL_SetExtLeft

Changes the leftward extension status of a specified trendline.

Syntax: **TL_SetExtLeft**(*TL_Ref*, *Status*)

TL_Ref: a numeric expression representing the object identification number

Status: True turns on leftward extension, False turns it off

Usage: `TL_SetExtLeft(2,True);` {turns on left extend for trendline 2}

TL_SetExtRight

Changes the rightward extension status of a specified trendline.

Syntax: **TL_SetExtRight**(*TL_Ref*, *Status*)

TL_Ref: a numeric expression representing the object identification number

Status: True turns on rightward extension, False turns it off

Usage: `TL_SetExtRight(3,False);` {turns off right extend for trendline 3}

TL_SetSize

Changes the line thickness setting (weight) for the specified trendline.

Syntax: **TL_SetSize**(*TL_Ref*, *Size*)

TL_Ref: a numeric expression representing the object identification number

Size: numeric value ranging from 0 (the thinnest) to 6 (the thickest).

Usage: `TL_SetSize(2,4);` {sets trendline 2 to thickness 4}

TL_SetStyle

Changes line style for the specified trendline.

Syntax: **TL_SetStyle**(*TL_Ref*,*Type*)

TL_Ref: a numeric expression representing the object identification number

Type: Tool_Solid = 1 (solid)
Tool_Dashed = 2 (dashed)
Tool_Dotted= 3 (dotted)
Tool_Dashed2= 4 (dashed pattern)
Tool_Dashed3= 5 (dashed pattern)

Usage:
```
TL_SetStyle(4,Tool_Dashed);                {sets trendline 4 to dashed}
```

To

Used in a For-Loop statement to separate the starting and ending counter values.

Usage:
```
For Value5 = Start To Start + 10 Begin
        {Any operations}
End ;
```

Today

Retained for backward compatibility. Replaced by **This Bar**.

Tomorrow

Retained for backward compatibility. Replaced by **Next Bar**.

Tool_Black

Retained for backward compatibility. Replaced by the color name **Black**.

Tool_Blue

Retained for backward compatibility. Replaced by the color name **Blue**.

Tool_Cyan

Retained for backward compatibility. Replaced by the color name **Cyan**.

Tool_DarkBlue

Retained for backward compatibility. Replaced by the color name **DarkBlue**.

Tool_DarkBrown

Retained for backward compatibility. Replaced by the color name **DarkBrown**.

Tool_DarkCyan

Retained for backward compatibility. Replaced by the color name **DarkCyan**.

Tool_DarkGray

Retained for backward compatibility. Replaced by the color name **DarkGray**.

Tool_DarkGreen

Retained for backward compatibility. Replaced by the color name **DarkGreen**.

Tool_DarkMagenta

Retained for backward compatibility. Replaced by the color name **DarkMagenta**.

Tool_DarkRed

Retained for backward compatibility. Replaced by the color name **DarkRed**.

Tool_DarkYellow

Retained for backward compatibility. Replaced by the color name **DarkYellow**.

Tool_Dashed

Represents a dashed line style (2) used with drawing objects.

Tool_Dashed2

Represents a dashed line style (4) used with drawing objects.

Tool_Dashed3

Represents a dashed line style (5) used with drawing objects.

Tool_Dotted

Represents a dotted line style (3) used with drawing objects.

Tool_Green

Retained for backward compatibility. Replaced by the color name **Green**.

Tool_LightGray

Retained for backward compatibility. Replaced by the color name **LightGray**.

Tool_Magenta

Retained for backward compatibility. Replaced by the color name **Magenta**.

Tool_Red

Retained for backward compatibility. Replaced by the color name **Red**.

Tool_Solid

Represents a solid line style (1) used with drawing objects.

Tool_White

Retained for backward compatibility. Replaced by the color name **White**.

Tool_Yellow

Retained for backward compatibility. Replaced by the color name **Yellow**.

Total

Specifies the number of shares/contracts to exit from a position created by pyramiding.

Usage:
```
Sell 5 Contracts Total Next Bar at Market;
```
{Exits five contracts/shares from the entire long position}

TotalBarsLosTrades

The total number of bars that elapsed during losing trades for all closed trades.

Usage: `Value2 = TotalBarsLosTrades ;`

TotalBarsWinTrades

The total number of bars that elapsed during winning trades for all closed trades.

Usage: `Value1 = TotalBarsWinTrades ;`

TotalTrades

The total number of closed trades in the current strategy.

TrailingStopAmt

Retained for backward compatibility with previous versions of the product. Replaced by the reserved word **SetDollarTrailing**.

TrailingStopFloor

Retained for backward compatibility with previous versions of the product. Replaced by the reserved word **SetPercentTrailing**.

TrailingStopPct

Retained for backward compatibility with previous versions of the product. Replaced by the reserved word **SetPercentTrailing**.

True

Represents a true, or correct, conditional expression.

TrueFalse

Defines an input that expects a true/false expression.

Usage: `Input: Switch(TrueFalse);` {accepts a true/false input for Switch}

TrueFalseArray

Defines an input that expects a true/false expression for each array element.

Usage: `Input: MyArray[n](TrueFalseArray)` {accepts t/f inputs by value}

TrueFalseArrayRef

Defines an input that expects a true/false variable reference for each array element.

Usage: `Input: MyArray[n](TrueFalseArrayRef)` {accepts t/f inputs by reference}

TrueFalseRef

Defines an input that expects a true/false variable reference.

Usage: `Input: Switch(TrueFalseRef)` {accepts a t/f input by reference}

TrueFalseSeries

Defines an input as a true/false series expression.

Usage: `Input: Flag(TrueFalseSeries);` {taccepts a t/f input with history}

TrueFalseSimple

Defines an input as a true/false simple expression.

Usage: `Input: Switch(TrueFalseSimple);` {accepts a t/f input without history}

TtlDbt_By_NetAssts

Returns the total debt (long + short term) divided by total assets.

Tuesday

Specifies day of the week Tuesday (numeric value = 2).

Under

Used only with **Crosses** to detect a value crossing under, or below, another value.

Usage: `If Value1 Crosses Under Value2 Then {Any Operation} ;`

UnionSess1EndTime

Latest session 1 end time of all data in a multi-data chart.

UnionSess1FirstBar

Earliest session 1 first bar time of all data in a multi-data chart.

UnionSess1StartTime

Earliest session 1 start time of all data in a multi-data chart.

UnionSess2EndTime

Latest session 2 end time of all data in a multi-data chart.

UnionSess2FirstBar

Earliest session 2 first bar time of all data in a multi-data chart.

UnionSess2StartTime

Earliest session 2 start time of all data in a multi-data chart.

Units

Retained for backward compatibility.

UNSIGNED

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

Until

Reserved for future use.

UpperStr

Used to convert a string expression to uppercase letters.

Usage1: `Value1 = UpperStr("My TextString");` {returns "MY TEXTSTRING"}

UpTicks

Number of ticks on a bar whose value is higher than the tick immediately preceding it.

V

Abbreviation for Volume. Returns the volume of shares/contracts of a referenced bar.

Usage: **If** *MyVol* > **V** of 1 **Bar Ago Then SellShort** at **Close**;

Var

Declares a variable name to use throughout your analysis technique. Shorthand form.

Usage: `Var: Count(10);` {declares the variable Count with an initial value of 10}

Variable

Declares a variable name to use throughout your analysis technique.

Usage: `Variable: Val(5);` {declares the variable Val with an initial value of 5}

Variables

Declares multiple variable names separated by commas.

Usage: `Variables: Countup(0),Countdown(10);` {declares and initializes variables}

Vars

Declares multiple variable names separated by commas. Shorthand form.

Usage: `Vars: MyVal(2), MyPrice(31);` {declares and initializes variables}

VARSIZE

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

VARSTARTADDR

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

VOID

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

Volume

Returns the number of shares/contracts traded for the referenced bar.

Usage: **If** *TestVol* > **Volume** of 3 **Bars Ago Then Buy** at **Market**;

Was

Skip word ignored during execution.

Usage: **If Close** was < than the **Lowest**(**Close**, 14) **Then** *{any operation}* ;

Wednesday

Specifies day of the week Wednesday (numeric value = 3).

While

Defines instructions that are executed until a true/false expression returns *False*.

Usage:
```
While Condition1 Begin
        {any operations};
End;
```
{continues to loop until the Condition is no longer true}

White

Specifies color White (numeric value = 8) for plots and backgrounds.

WORD

Reserved for use with custom DLLs designed for EasyLanguage and ELKIT32.DLL.

Year

Year on specified calendar date, in short form (last 2 or 3 digits of year)

Returns the year (YYY) portion of the specified calendar date.

Syntax: **Year**(c*Date*);

cDate: numeric expression for the date in YYMMDD or YYYMMDD format.

Usage: `Value1 = Year(1011004)` {returns the year 101 representing 2001}

Yellow

Specifies color Yellow (numeric value = 7) for plots and backgrounds.

Yesterday

Retained for backward compatibility. Refers to the previous bar.

APPENDIX D

EasyLanguage Tool Kit Library

Functionality

The EasyLanguage Tool Kit Library is implemented in the form of a dynamic-link library. It provides useful functions that can be called from any user DLL. It is commonly used to find the address of an offset of an EasyLanguage data object from within a user DLL.

Components

There are four components in the EasyLanguage Tool Kit Library: a header file (ELKIT32.H), two link-time library files (ELKITVC.LIB and ELKITBOR.LIB), and an executable DLL file (ELKIT32.DLL). 'ELKIT32.H' is a standard C header file. It contains the function headers for all the functions that are available in 'ELKIT32.DLL'. The '.LIB' files should be used when linking a user DLL that calls the ELKIT32.DLL functions. 'ELKITVC.LIB' should be used when working in the Microsoft Visual C++ environment while 'ELKITBOR.LIB' should be used in the C++ Builder environment.

FindAddress Functions

FindAddress_Array

Syntax:

```
LPFLOAT FindAddress_Array( LPFLOAT lpArray[ArrayPosi-
   tion], int nSpaceOfs, int nOfs, DWORD dwStartAddr,
   DWORD dwArraySize );
```

Parameters:
lpArray is a pointer to an array in EasyLanguage. *nSpaceOfs* specifies the offset of array elements, forward if *nSpaceOfs* is positive and backwards if *nSpaceOfs* is negative. *nOfs* specifies the bar offset, backwards if *nOfs* is positive or forward if *nOfs* is negative. *dwStartAddr* is the starting address of the buffer as determined by the EasyLanguage keyword *ArrayStartAddr*, and *dwArraySize* is the size of the buffer associated with the array as determined by the EasyLanguage keyword *ArraySize*.

Returns:
A pointer to the value of an Array element offset by *nOfs*.

Notes:
dwArraySize is the size of the buffer associated with the array. This value is obtained from EasyLanguage by calling the *ArraySize* function. *dwStartAddr* is the starting

address of the buffer. The *ArrayStartAddr* function should be called to obtain this value.

Example:

```
// Example of FindAddress_Var in MYLIB.DLL

float FindArray( LPFLOAT lpVar, int nSpaceOfs, int nOfs,
DWORD dwStartAddr, DWORD dwArraySize )

{

LPFLOAT lpNewAddr;

// starting at element 7, go back 3 elements and 2 bars

lpNewAddr = FindAddress_Array(lpArray, nSpaceOfs, nOfs,
dwStartAddr, dwArraySize);

return *lpNewAddr;

}

...

{ EasyLanguage Example }

DefineDLLFunc: "MYLIB.DLL",float,"FindArray",multiple;

Var: dwStartAddr(0),dwArraySize(0),Counter(0),Result(0);

Array: MyArray [10](0);

if CurrentBar = 11 then Begin

   For Counter = 0 to 10 Begin

      MyArray[Counter] = Close[Counter];

   End;

End;

dwStartAddr = ArrayStartAddr(MyArray);

dwArraySize = ArraySize(MyArray);

Result = FindArray((LPFLOAT)&MyArray[7],(int) -3,(int) 2,
(DWORD)dwStartAddr, (DWORD)dwArraySize );

Plot1(Result, "FindArray");
```

FindAddress_Close

Syntax:

```
LPLONG FindAddress_Close( LPLONG lpClose, int nOfs );
```

Parameters:
lpClose is a pointer to a Close array element in EasyLanguage, *nOfs* specifies the bar offset. The offset is backwards if *nOfs* is positive or forward if *nOfs* is negative.

Remarks:
A pointer to the value of a Close array element offset by nOfs.

Note:
The value contained at the pointer location returned by the *FindAddress_Close* function does not have the price scale applied. The values received must be divided by the EasyLanguage Data Information function *PriceScale* in order to obtain the proper Close value.

Example:

```
// Example of FindAddress_Close

long MyClose( LPLONG lpClose, int nOfs)

{

LPLONG lpNewAddr;

lpNewAddr = FindAddress_Close(lpClose,nOfs); // go back 3
bars

return *lpNewAddr;

}

...

{ EasyLanguage Example }

DefineDLLFunc: "MYLIB.DLL",long,"MyClose",multiple;

Var: Result(0);

Result = MyClose((LPLONG)&Close,(int) 3);

Plot1(Result, "MyClose");
```

FindAddress_Date

Syntax:

```
LPLONG FindAddress_Date( LPLONG lpDate, int nOfs );
```

Parameters:
lpDate is a pointer to a Date array element in EasyLanguage. *nOfs* specifies the bar offset. The offset is backwards if *nOfs* is positive or forward if *nOfs* is negative.

Returns:
A pointer to the value of a Date array element offset by nOfs.

Note:
All Date values are in Julian date format. If a 'YYMMDD' format is desired, you must call the tool kit function *JulianToDate*.

FindAddress_DownTicks

Syntax:

```
LPLONG FindAddress_DownTicks( LPLONG lpDownTicks, int
   nOfs );
```

Parameters:
lpDownTicks is a pointer to a DownTicks array element in EasyLanguage. *nOfs* specifies the bar offset. The offset is backwards if *nOfs* is positive or forward if *nOfs* is negative.

Returns:
A pointer to the value of a DownTicks array element offset by *nOfs*.

Example:

```
// Example of FindAddress_DownTicks

long MyDownTicks( LPLONG lpDownTicks, int nOfs )

{

LPLONG lpNewAddr;

lpNewAddr = FindAddress_DownTicks(lpDownTicks,nOfs); //
go back 3 bars

return *lpNewAddr;

}

...
```

```
{ EasyLanguage Example }

DefineDLLFunc: "MYLIB.DLL",long,"MyDownTicks",multiple;

Var: Result(0);

Result = MyDownTicks((LPLONG)&DownTicks,(int) 3);

Plot1(Result, "MyDownTicks");
```

FindAddress_High

Syntax:

```
LPLONG FindAddress_High( LPLONG lpHigh, int nOfs );
```

Parameters:
lpHigh is a pointer to a High array element in EasyLanguage. *nOfs* specifies the bar offset. The offset is backwards if *nOfs* is positive or forward if *nOfs* is negative.

Returns:
A pointer to the value of a High array element offset by *nOfs*.

Note:
The value contained at the pointer location returned by the *FindAddress_High* function does not have the price scale applied. The values received must be divided by the EasyLanguage Data Information function *PriceScale*.

Example:

```
// Example of FindAddress_High

long MyHigh( LPLONG lpHigh, int nOfs)

{

LPLONG lpNewAddr;

lpNewAddr = FindAddress_High(lpHigh,nOfs); // back 3 bars

return *lpNewAddr;

}
...
{ EasyLanguage Example }

DefineDLLFunc: "MYLIB.DLL",long,"MyHigh",multiple;

Var: Result(0);

Result = MyHigh((LPLONG)&High,(int) 3) / PriceScale;

Plot1(Result, "MyHigh");
```

FindAddress_Low

Syntax:

```
LPLONG FindAddress_Low( LPLONG lpLow, int nOfs );
```

Parameters:
lpLow is a pointer to a Low array element in EasyLanguage. *nOfs* specifies the bar offset. The offset is backwards if *nOfs* is positive or forward if *nOfs* is negative.

Returns:
A pointer to the value of a Low array element offset by nOfs.

Note:
The value contained at the pointer location returned by the *FindAddress_Low* function does not have the price scale applied. The values received must be divided by the EasyLanguage Data Information function *PriceScale*.

Example:

```
// Example of FindAddress_Open

long MyLow( LPLONG lpLow, int nOfs)

{

LPLONG lpNewAddr;

lpNewAddr = FindAddress_Low(lpLow,nOfs); // go back 3
bars

return *lpNewAddr;

}

...

{ EasyLanguage Example }

DefineDLLFunc: "MYLIB.DLL",long,"MyLow",multiple;

Var: Result(0);

Result = MyLow((LPLONG)&Low,(int) 3) / PriceScale;

Plot1(Result, "MyLow");
```

FindAddress_Open

Syntax:

```
LPLONG FindAddress_Open( LPLONG lpOpen, int nOfs );
```

Parameters:
lpOpen is a pointer to a Open array element in EasyLanguage. *nOfs* specifies the bar offset. The offset is backwards if *nOfs* is positive or forward if *nOfs* is negative.

Returns:
A pointer to the value of a Open array element offset by nOfs.

Note:
The value contained at the pointer location returned by the *FindAddress_Open* function does not have the price scale applied. The values received must be divided by the EasyLanguage Data Information function *PriceScale*.

Example:

```
// Example of FindAddress_Open

long MyOpen( LPLONG lpOpen, int nOfs)

{

LPLONG lpNewAddr;

lpNewAddr = FindAddress_Open(lpOpen,nOfs); // go back 3
bars

return *lpNewAddr;

}

...

{ EasyLanguage Example }

DefineDLLFunc: "MYLIB.DLL", long, "MyOpen", multiple;

Var: Result(0);

Result = MyOpen((LPLONG)&Open,(int) 3) / PriceScale;

Plot1(Result, "MyOpen");
```

FindAddress_OpenInt

Syntax:

```
LPLONG FindAddress_OpenInt( LPLONG lpOpenInt, int nOfs );
```

Parameters:
lpOpenInt is a pointer to a OpenInt array element in EasyLanguage. *nOfs* specifies the bar offset. The offset is backwards if *nOfs* is positive or forward if *nOfs* is negative.

Returns:
A pointer to the value of a OpenInt array element offset by *nOfs*.

Example:

```
// Example of FindAddress_OpenInt

long MyOpenInt( LPLONG lpOpenInt, int nOfs)

{

LPLONG lpNewAddr;

lpNewAddr = FindAddress_OpenInt(lpOpenInt,nOfs); // go
back 3 bars

return *lpNewAddr;

}

...

{ EasyLanguage Example }

DefineDLLFunc: "MYLIB.DLL",long,"MyOpenInt",multiple;

Var: Result(0);

Result = MyOpenInt((LPLONG)&OpenInt,(int) 3);

Plot1(Result, "MyOpenInt");
```

FindAddress_Time

Syntax:

```
LPINT FindAddress_Time( LPINT lpTime, int nOfs );
```

Parameters:
lpTime is a pointer to a Time array element in EasyLanguage. *nOfs* specifies the bar offset. The offset is backwards if *nOfs* is positive or forward if *nOfs* is negative.

Returns:
A pointer to the value of a Time array element offset by *nOfs*.

Note:
All time values are in minutes-since-midnight format. If an 'HHMM' format is desired, you must call the ELKIT32 function *MinuteToTime*.

FindAddress_Upticks

Syntax:

```
LPLONG FindAddress_UpTicks( LPLONG lpUpTicks, int nOfs );
```

Parameters:
lpUpTicks is a pointer to a UpTicks array element in EasyLanguage. *nOfs* specifies the bar offset. The offset is backwards if *nOfs* is positive or forward if *nOfs* is negative.

Returns:
A pointer to the value of a UpTicks array element offset by nOfs.

Example:

```
// Example of FindAddress_UpTicks

long MyUpTicks( LPLONG lpUpTicks, int nOfs )

{

LPLONG lpNewAddr;

lpNewAddr = FindAddress_UpTicks(lpUpTicks,nOfs); // go
back 3 bars

return *lpNewAddr;

}

...
```

```
{ EasyLanguage Example }

DefineDLLFunc: "MYLIB.DLL",long,"MyUpTicks",multiple;

Var: Result(0);

Result = MyUpTicks((LPLONG)&UpTicks,(int) 3);

Plot1(Result, "MyUpTicks");
```

FindAddress_Var

Syntax:

```
LPFLOAT FindAddress_Var( LPFLOAT lpVar, int nOfs, DWORD
   dwStartAddr, DWORD dwVarSize );
```

Parameters:
lpVar is a pointer to a Variable in EasyLanguage. *nOfs* specifies the bar offset. The offset is backwards if *nOfs* is positive or forward if *nOfs* is negative. *dwStartAddr* is the starting address of the buffer as determined by the EasyLanguage keyword VarStartAddr keyword, and *dwVarSize* is the size of the buffer associated with the variable as determined by the EasyLanguage keyword VarSize keyword.

Returns:
A pointer to the value of a Variable array element offset by *nOfs*.

Remarks:
dwVarSize is the size of the buffer associated with the variable. This value is obtained from EasyLanguage by calling the *VarSize* function. *dwStartAddr* is the starting address of the buffer. The *VarStartAddr* function should be called to obtain this value.

Example:

```
// Example of FindAddress_Var in MYLIB.DLL

float FindAVar( LPFLOAT lpVar, int nOfs, DWORD dwStar-
   tAddr, DWORD dwVarSize )

{

LPFLOAT lpNewAddr;

// returns the equivalent of MyVar[2] since nOfs == -1

lpNewAddr = FindAddress_Var(lpVar, nOfs, dwStartAddr,
   dwVarSize);

return *lpNewAddr;

}
```

```
...

{ EasyLanguage Example }

DefineDLLFunc: "MYLIB.DLL",float,"FindAVar",multiple;

Var: MyVar(0), dwStartAddr(0), dwVarSize(0), Result(0);

MyVar = Close;

dwStartAddr = VarStartAddr(MyVar);

dwVarSize = VarSize(MyVar);

Result = FindAVar((LPFLOAT)&MyVar,(int) 2, (DWORD)dwStar-
    tAddr, (DWORD)dwVarSize );

Plot1(Result, "FindAVar");
```

FindAddress_Volume

Syntax:

```
LPLONG FindAddress_Volume( LPLONG lpVolume, int nOfs );
```

Parameters:
lpVolume is a pointer to a Volume array element in EasyLanguage. *nOfs* specifies the bar offset. The offset is backwards if *nOfs* is positive or forward if *nOfs* is negative.

Returns:
A pointer to the value of a Volume array element offset by *nOfs*.

Example:

```
// Example of FindAddress_Volume

long MyVolume( LPLONG lpVolume, int nOfs)

{

LPLONG lpNewAddr;

lpNewAddr = FindAddress_Volume(lpVolume,nOfs); // go back
3 bars

return *lpNewAddr;

}

...
```

```
{ EasyLanguage Example }

DefineDLLFunc: "MYLIB.DLL",long,"MyVolume",multiple;

Var: Result(0);

Result = MyVolume((LPLONG)&Volume,(int) 3);

Plot1(Result, "MyVolume");
```

Conversion Functions

DateToJulian

Syntax:

```
WORD DateToJulian( DWORD dwDate );
```

Parameters:
dwDate is a date specified in "YYMMDD" format.

Returns:
The Julian date for the specified "YYMMDD" formatted date.

Notes:
This function converts a date value from its 'YYMMDD' format to the Julian calendar format.

Date Logic for dates after the 12/31/1999 will be calculated by counting the number of years since 1900; therefore, Jan. 1st, 2000 will be represented in EasyLanguage as 100/01/01, etc.

JulianToDate

Syntax:

```
DWORD JulianToDate(WORD wJulianDay);
```

Parameters:
wJulianDay is a date specified in "YYMMDD" format.

Returns:
The date converted to 'YYMMDD' format from a Julian date.

Note:
Date Logic for dates after the 12/31/1999 will be calculated by counting the number of years since 1900; therefore, Jan. 1st, 2000 will be represented in EasyLanguage as 100/01/01, etc.

MinuteToTime

Syntax:

```
int MinuteToTime( int nMinutes);
```

Parameters:
nMinutes is the number of minutes since midnight.

Returns:
Integer representations of Time in ‘HHMM’ format.

Note:
This function converts a time value from the minutes-since-midnight format to the 'HHMM' format.

TimeToMinute

Syntax:

```
int TimeToMinute( int nTime );
```

Parameters:
nTime is an integer representation of Time in 'HHMM' format.

Returns:
An integer representation of minutes since midnight.

Index

Symbols

#BEGINALERT 38, 211
#BEGINCMTRY 64, 211
#BEGINCMTRYORALERT 39, 65, 211
#END 211

A

A (skip word) 211
AB_AddCell 154, 212
AB_AddCellRange 212
AB_AverageCells 212
AB_AveragePrice 212
AB_CellCount 212
AB_GetCellChar 157, 213
AB_GetCellColor 158, 213
AB_GetCellDate 158, 213
AB_GetCellTime 159, 213
AB_GetCellValue 159, 213
AB_GetNumCells 160, 213
AB_GetZoneHigh 160, 213
AB_GetZoneLow 161, 214
AB_High 161, 214
AB_Low 162, 214
AB_Median 214
AB_Mode 214
AB_NextColor 214
AB_NextLabel 214
AB_RemoveCell 156, 215
AB_RowHeight 215
AB_RowHeightCalc 215
AB_SetActiveCell 156, 215
AB_SetRowHeight 155, 215
AB_SetZone 155, 215
AB_StdDev 216
Above 216
AbsValue 216
Accumulative Calculations
  generating orders for next bar, calculations for 52
  updating every tick, calculations for 52
ActivityBar Studies
  bar status, obtaining 163, 218
  cell color, obtaining 158, 213
  cell date, obtaining 158, 213
  cell time, obtaining 159, 213
  cell value, obtaining 159, 213
  cells
    adding 154, 212
    removing 156, 215
  highest cell price, obtaining 161, 214
  left side of bar, specifying 164, 231
  lowest cell price, obtaining 162, 214
  number of cells, obtaining 160, 213
  price markers, specifying placement 156, 215
  referencing ActivityBar data using data alias 163, 216
  right side of bar, specifying 164, 243
  row height, specifying 155, 215
  text string, obtaining 157, 213
  understanding 153

zone
height, obtaining 160, 213
low price, obtaining 161, 214
properties, specifying 155, 215
ActivityData 163, 216
Addition, performing 9
Additional EasyLanguage Resources 2
AddToMovieChain 101, 216
Advanced Tips
auto-detect loop, understanding 15
calculation time, speeding up 52
conditional expressions, writing 13
division by zero 10
series arrays, working with 44
series values, assigning to inputs 28
series variables, working with 24
Ago 216
Alert 35, 216
AlertEnabled 37, 216
Alerts
Alert Statement 35
compiler directives 38
historical data and 35
trendlines
obtaining alert status 84
setting alert status 94
Aliases, *see* Data Aliases
All 216
An (skip word) 217
Analysis Commentary 58
Analysis Commentary, pointer 61
AND 11, 217
Arctangent 217
Arguments, *see* Parameters
Array 217
Arrays
Array Declaration Statement 41
Array Element Assignment Statement 42
dimensions 40
DLLs referencing 44
errors, runtime 44
functions, referencing previous values of arrays in loops 57
populating arrays using loops 43
sorting arrays using loops 57
parameters, declaring arrays as 56
populating 43
series arrays, working with 44
sorting 57
understanding 40
values
assigning to elements 42
referencing 43
ARRAYSIZE 217
ARRAYSTARTADDR 217
At (skip word) 217
At$ 217
AtCommentaryBar 62, 217
Auto-detect Loop, understanding 15
Auto-Detect, MaxBarsBack 15
Automating a Trading Strategy, *see* Trading Strategy Testing Engine
AvgBarsLosTrade 217
AvgBarsWinTrade 218
AvgEntryPrice 218
AvgList 218
AVI Files, playing 100

B

Backtesting Trading Strategies, *see* Backtesting *under* Trading Strategy Testing Engine
Bar 218
BarInterval 218
Bars 218
Bars Ago, using 13
BarsSinceEntry 218
BarsSinceExit 218
BarStatus 163, 218
BarType 218
Based (skip word) 219
Begin 219
Below 219
Beta 219
BigPointValue 219
Black 219
Block IF-THEN Statement 30
BlockNumber 219
Blue 219
BOOL 219
Boolean Expressions 8
Bouncing Ticks 116
BoxSize 219
Brackets 7
Breakeven StopFloor 132
BreakEvenStopFloor 219
Built-in Stops, *see* Stops
Buy 119, 220
By (skip word) 220
BYTE 220

C

C 7, 220
C and C++, *see* DLL Functions
Calculation Time, decreasing 52
Cancel 36, 220
Canceling Orders 112

Category 220
Ceiling 220
CHAR 221
CheckAlert 36, 37, 221
CheckCommentary 221
ClearDebug 221
Close 7, 221
Close at End of Day 133
Close Orders 107
Colon, definition 7
Colors
  numeric equivalents 209
  plot foreground, changing
    TradeStation 137, 139
  text
    obtaining 72
    setting 78
  trendlines
    obtaining 87
    setting 95
Comma, definition 6
Commentary
  Commentary Statement 59
  compiler directives 64
  jump words 61
  working with 58
Commentary 59, 221
CommentaryCL 61, 221
CommentaryEnabled 63, 221
Commission 221
CommodityNumber 221
Comparing Expressions 11
Compiler Directives
  alerts 38
  commentary 64
Compression, *see* Compression *under* Data
Conditional Expressions 8, 13
Contract 221
Contracts 221
Contracts/Shares, number to use to open a position 120
Control
  expression 32
  structures 28
  variable 33
Conversion Functions 274
Cosine 222
Cost 222
Cotangent 222
Counters, using 21, 32, 49
Cross 222
Crosses 222
Crosses Over 11
Crosses Under 11
Curly Brackets, definition 7
Current 222
Current Bar, understanding 4, 15
CurrentBar 222
CurrentContracts 222
CurrentDate 222
CurrentEntries 222
CurrentTime 20, 222
CustomerID 222
Cyan 222

D

D 7, 223
DailyLimit 223
DarkBlue 223
DarkBrown 223
DarkCyan 223
DarkGray 223
DarkGreen 223
DarkMagenta 223
DarkRed 223
Data
  ActivityData 153, 163
  aliases, *see* Data Aliases
  appending to text files 66
  charts, evaluating data for 4
  compression
    strategy backtesting 114
  date format 15
  functions, using functions with data aliases 46
  historical data, testing with trading strategies 113
  MaxBarsBack setting, *see* MaxBarsBack
  outputting 58, 66
  pointer data types, *see* DLL Functions
  previous values, referencing 13
  printing 66
  real-time/delayed data, monitoring for trading strategies 106
  referencing for each bar 7
  streams, referencing 46
  time format 18
  trading strategies, evaluating data for 105
  types, *see* DLL Functions
Data Aliases
  data streams, referencing different 46
  functions
    parameters, using data aliases in function parameters 47
    using functions with data aliases 46
  no data alias specified 47
Data Streams, referencing 46
DataCompression 223
DataInUnion 223
DataN 223

Date 7, 16, 223
Dates, working with 15
DateToJulian 223, 274
Day 224
DayOfMonth 224
DayOfWeek 224
Days 224
Debug Window, using 66
Declaring
  arrays 41
  inputs 26
  parameters 55
  variables 22
Default 224
Define Feature, functions 45
DefineCustField 224
DEFINEDLLFUNC 224
DeliveryMonth 224
DeliveryYear 224
Description 224
Dividend 224
Dividend_Yield 224
Division by Zero 10
Division, performing 9
DLL Functions
  arrays, referencing 44
  data types 170
  defining 170
  extension kit 177
  pointer data types 171
  using 173
Dllr Risk Trailing 133
Does (skip word) 225
DOUBLE 225
DownTicks 7, 225
DownTo 225
Drawing
  text on price charts 69
  trendlines on price charts 81
DWORD 225
Dynamic Link Libraries (DLLs), *see* DLL Functions

E

EasyLanguage Dictionary, using 45
EasyLanguage DLL Extension Kit 169
EasyLanguage Resources and Support 2
EasyLanguage Support Center 2
EasyLanguage Tool Kit Library 263
  composition 177
  Conversion Functions 274
  FindAddress Functions 263
EasyLanguage Toolkit Library 177
EasyLanguage, defined 2
EasyLanguageVersion 225
EL_DateStr 225
ELDate 16
ELKIT32.DLL 177
ELKIT32.H 177
ELKITBOR.LIB 177
ELKITVC.LIB 177
Else 225
End 225
Entries
  execution method, specifying 121, 123
  exits, tying exits to an entry 125, 129
  limiting per position 110
  naming 122
  price, specifying 121, 123
  shares/contracts, specifying number of 120, 122
Entry 225
EntryDate 226
EntryPrice 226
EntryTime 226
EPS 226
Errors
  arrays, run time 44
  division by zero, avoiding 10
  EasyLanguage syntax errors 179
  text 69, 210
  trendlines 82, 210
Execution Method
  Buy 121
  ExitLong 127
  ExitShort 130
  Sell 123
  understanding 104
ExitDate 226
ExitLong 243
ExitPrice 226
Exits
  entries, tying exits to 125, 129
  execution method 127, 130
  price, tying to bar of entry 127, 131
  shares/contracts, specifying number of 125, 129
  stops, *see* Stops
ExitTime 226
Expert Commentary, *see* Commentary
Expressions
  comparing 11
  control 32
  numeric 8
  order of precedence 9
  previous values, referencing 13
  text string 8
  true/false (also conditional, logical, boolean) 8, 13
ExpValue 226

F

False ... 226
File ... 226
FileAppend ... 68, 227
FileDelete ... 227
Files, outputting to ... 66
Filling Orders, precedence of, *see* Fill precedence *under* Orders
Find Feature, functions ... 45
FindAddress Functions ... 263
FindAddress_Array ... 263
FindAddress_Close ... 265
FindAddress_Date ... 266
FindAddress_DownTicks ... 266
FindAddress_High ... 267
FindAddress_Low ... 267
FindAddress_Open ... 269
FindAddress_OpenInt ... 270
FindAddress_Time ... 271
FindAddress_Upticks ... 271
FindAddress_Var ... 272
FindAddress_Volume ... 273
FirstNoticeDate ... 227
FLOAT ... 227
Floor ... 227
For ... 227
For Loop ... 33
FracPortion ... 227
Friday ... 227
From (skip word) ... 227
Function Value Assignment Statement ... 48
Functions
  also see Reserved Words
  arrays as parameters in ... 56
  assigning values to ... 48
  counters, series functions as ... 49
  data aliases, using functions with ... 46
  Define feature ... 45
  DLL Functions, *see* DLL Functions
  EasyLanguage Dictionary, using ... 45
  Find feature ... 45
  Function Value Assignment Statement ... 48
  parameters, *see* Parameters
  referencing previous value of ... 46
  series ... 50
  simple ... 49
  understanding ... 44
  writing ... 48

G

Generate Orders for Next Bar Calculation ... 52
GetBackgroundColor ... 227
GetCDRomDrive ... 228
GetExchangeName ... 228
GetPlotBGColor ... 228
GetPlotColor ... 228
GetPlotWidth ... 228
GetStrategyName ... 228
GetSymbolName ... 228
GetSystemName ... 228
Gr_Rate_P_EPS ... 228
Green ... 228
GrossLoss ... 228
GrossProfit ... 229

H

H ... 7, 229
Hard Brackets, definition ... 7
Help System and Jump Words ... 61
HELP_KEY WinHelp API Call and Jump Words ... 61
High ... 7, 229
Higher ... 229
HistFundExists ... 229
Historical Testing, *see* Backtesting *under* Trading Strategy Testing Engine

I

I ... 229
I_AvgEntryPrice ... 229
I_ClosedEquity ... 229
I_CurrentContracts ... 229
I_MarketPosition ... 229
I_OpenEquity ... 229
If ... 230
IF-THEN Statement
  Block IF-THEN ... 30
  IF-THEN ... 28
  IF-THEN Else ... 30
  nesting ... 31
Ignoring Statements Using Compiler Directives
  alerts ... 38
  commentary ... 64
IncludeSystem ... 230
Indicators
  jump words, indicators as ... 61
  TradeStation
    adding ... 137
    bar chart, displaying as ... 136
    color, setting ... 137, 139
    formatting ... 136
    naming ... 137
    width, setting ... 137, 140
    writing for ... 136
Infinite Loops ... 32
InitialMargin ... 230
Input(s) ... 26, 230

Inputs (*also see* Parameters)
Input Declaration Statement 26, 55
series values, assigning to 28
types 25
using 25
values, referencing 26
Inside the Bar Technology, *see* ActivityBar Studies
InStr 230
INT 230
IntPortion 230
Is (skip word) 230

J

JulianToDate 17, 231, 274
Jump Words and Commentary 61

L

L 7, 231
LargestLosTrade 231
LargestWinTrade 231
LastCalcJDate 231
LastCalcMMTime 231
LastTradingDate 231
LeftSide 164, 231
LeftStr 231
LightGray 231
Limit 231
Limit Orders 109
Log 231
Logical
expressions 8
operators 11
LONG 232
Long Positions
closing 122, 124
opening 119
Loops
arrays
populating 43
sorting 57
control
expression 32
variables 33
For Loop 33
infinite 32
While Loop 31
Losses, limiting, *see* Stops
Low 7, 232
Lower 232
LowerStr 232
LPBOOL 232
LPBYTE 232
LPDOUBLE 232
LPDWORD 232
LPFLOAT 232
LPINT 232
LPLONG 232
LPSTR 232
LPWORD 232

M

Magenta 232
MakeNewMovieRef 101, 233
Margin 233
Market 233
Market If Touched (MIT)
Buy 121
ExitLong 127
ExitShort 130
Sell 123
Market Orders 107
MarketPosition 233
Mathematical Operators 9
MaxBarsBack
Auto Detect setting 15
definition 4, 14
ProbabilityMap studies 147
User-defined setting 15
MaxBarsBack 233
MaxBarsForward 233
MaxConsecLosers 233
MaxConsecWinners 233
MaxContracts 233
MaxContractsHeld 233
MaxEntries 233
MaxIDDrawDown 233
Maximum Number of Bars Study Will Reference Setting, *see* MaxBarsBack
MaxList 234
MaxList2 234
MaxPositionLoss 234
MaxPositionProfit 234
MessageLog 234
MidStr 234
MinList 234
MinList2 234
MinMove 235
MinutesToTime 19
MinuteToTime 275
MIT, *see* Market If Touched (MIT)
Moc 235
Mod 235
Monday 235
MoneyMgtStopAmt 235
Month 235
Movie Files, *see* Video Files

Multimedia Files
AVI files, playing 100
WAV files, playing 100
MULTIPLE 235
Multiplication, performing 9
Music Files, *see* Sound Files

N

Neg 235
Nesting IF-THEN Statements 31
NetProfit 235
NewLine 235
Next 235
NoPlot 142, 144, 236
Not 236
NthMaxList 236
NthMinList 236
Numeric 236
Numeric Expressions 8
Numeric Parameters 52
NumericArray 236
NumericArrayRef 236
NumericRef 236
NumericSeries 236
NumericSimple 236
NumFutures 237
NumLosTrades 237
NumToStr 237
NumWinTrades 237

O

O 7, 237
Of (skip word) 237
OI 7
On (skip word) 237
Online User Manual and Jump Words 61
Open 7, 237
OpenInt 7, 237
OpenPositionProfit 237
Operators
definition 6, 9
logical 11
mathematical 9
relational 10
string 9
OR 11, 237
Or Higher 104, 109, 111
Or Lower 104, 109, 111
Order of Precedence, controlling 9
Orders
acceptable orders 109
bouncing ticks 116
built-in stops, *see* Stops
canceling 112
execution methods, *see* Execution Method
exit price, tying to bar of entry 127, 131
exits to entries, tying 125, 129
fill precedence
close orders 107
limit orders 109
market orders 107
stop orders 109
fill prices 106
naming 122
open entries per position, limiting 110
pyramiding, effect on order placement 111
rules determining which to fill 107
shares, number to use to open position 109
shares/contracts, specifying number to use 120, 122, 125, 129
stand-by orders 111
stops, *see* Stops
trading verbs 119
trading verbs, *see* Trading Verbs
understanding 104
writing 104
Origin Type of Text Object 75
Output Methods
commentary 58
Debug window 66
file 66
printer 66
Over 237

P

Pager_DefaultName 238
Pager_Send 238
PaintBar Studies
adding 142
bar range to paint, specifying 142
color, setting 142
naming 142
removing 144
width, setting 142
writing 142
Parameters
arrays, using as parameters 56
data aliases in 46
declaring 55
Input Declaration Statement 55
numeric 52
offsetting values passed into functions as 46
reference 53
series 53
simple 53
text string 52

true/false ... 52
variables as ... 53
Parentheses
definition ... 6
precedence, order of ... 9
Percent Risk Trailing ... 134
PercentProfit ... 238
Place (skip word) ... 238
PlayMovieChain ... 102, 238
PlaySound ... 100, 238
Plot ... 238
Plot1 ... 239
Plot2 ... 239
Plot3 ... 239
Plot4 ... 239
PlotN ... 137
PlotPaintBar ... 142, 239
PlotPB ... 142, 239
PM_GetCellValue ... 152, 239
PM_GetNumColumns ... 151, 240
PM_GetRowHeight ... 151, 240
PM_High ... 150, 240
PM_Low ... 150, 240
PM_SetCellValue ... 149, 240
PM_SetHigh ... 148, 240
PM_SetLow ... 148, 240
PM_SetNumColumns ... 148, 240
PM_SetRowHeight ... 149, 240
Pob ... 241
Point ... 241
POINTER ... 241
Pointer Data Types, *see* DLL Functions
Points ... 241
PointValue ... 241
Pos ... 241
PositionProfit ... 241
Positions (Trading Strategy)
entries, limiting ... 110
opening positions, determining number of shares ... 109
Power ... 241
Previous Values, referencing ... 13, 46, 57
Price Data, *see* Data
PriceScale ... 241
Print ... 66, 242
Print Log, *see* Debug Window, using
Print Statement ... 66
Printer ... 242
Printer, outputting to ... 66
ProbabilityMap Studies
cell value
obtaining ... 152, 239
setting ... 149, 240
columns, number of
obtaining ... 151, 240
setting ... 148, 240
lower boundary
obtaining ... 150, 240
setting ... 148, 240
row height
obtaining ... 151, 240
specifying ... 149, 240
understanding ... 145
upper boundary
obtaining ... 150, 240
setting ... 148, 240
Product ... 242
Profit ... 242
Profit Target ... 135
Profits, taking, *see* Stops
ProfitTargetStop ... 242
Protective ... 242
Punctuation marks, definition ... 6
Pyramiding
order precedence ... 107, 111
stand-by orders ... 111

Q

Quick_Ratio ... 242
Quotation Marks, definition ... 7

R

Random ... 242
Red ... 242
Reference Parameters ... 53
Relational Operators ... 10
Removing a Plot ... 142, 144
Repeat ... 242
Reserved Words
also see Functions
definition ... 6
price data, referencing ... 7
quick reference ... 211
skip words ... 8
Resolution, *see* Compression *under* Data
Resources, EasyLanguage ... 2
RevSize ... 243
RightSide ... 164, 243
RightStr ... 243
Round ... 243
Runtime Errors, *see* Errors

S

Saturday ... 243
Screen ... 243
Sell ... 122, 244
Semicolon, definition ... 6

Series
- arrays 44
- functions 50
- inputs, assigning series values to 28
- parameters 53
- variables 24

Sess1EndTime 244
Sess1FirstBarTime 244
Sess1StartTime 244
Sess2EndTime 244
Sess2FirstBarTime 244
Sess2StartTime 244
Sessions 244
SetBreakEven 132, 244
SetDollarTrailing 133, 245
SetExitOnClose 133, 245
SetPercentTrailing 134, 245
SetPlotBGColor 245
SetPlotColor 139, 245
SetPlotWidth 140, 245
SetProfitTarget 134, 246
SetStopContract 135, 246
SetStopLoss 135, 246
SetStopPosition 135, 246
SGA_Exp_By_NetSales 246
Share 246
Shares 246
Shares/Contracts, number to use to open a position 120
Short Positions
- closing 119, 128
- opening 122

ShowMe Studies
- adding 137
- color, setting 137
- naming 137
- removing 142
- width, setting 137
- writing 141

Sign 247
Simple
- functions 50
- parameters 53
- variables 25

Sine 247
Skip 247
Skip Words 8
Slippage 247
SnapFundExists 247
Sorting Arrays 57
Sound Files, playing 100
Spaces 247
Square 247
Square Brackets, definition 7
SquareRoot 247
STAD Club 2
Stand-by Orders 111
StartDate 247
Statements, definition 6
StockSplit 247
StockSplitCount 247
StockSplitDate 248
StockSplitTime 248
Stop 248
Stop Loss 135
Stop Orders 109
Stops
- Breakeven StopFloor 132
- Close at End of Day 133
- contract basis 135
- Percent Risk Trailing 134
- position basis 135
- Profit Target 135
- Stop Loss 135
- understanding 132

Strategies, *see* Trading Strategies
Strategy Testing and Development Club 2
String 248
String Operators 9
StringArray 248
StringArrayRef 248
StringRef 248
StringSeries 248
StringSimple 248
StrLen 248
StrToNum 249
Studies
- ActivityBar studies, *see* ActivityBar Studies
- PaintBar studies, *see* PaintBar Studies
- ProbabilityMap studies, *see* ProbabilityMap Studies
- ShowMe studies, *see* ShowMe Studies

Subtraction, performing 9
SumList 249
Sunday 249
SymbolName 249
SymbolNumber 249
SymbolRoot 249
Syntax Errors 179

T

T 7, 249
Tangent 249
Target 249
TargetType 249
Testing Trading Strategies, *see* Trading Strategy Testing Engine
Text
- adding

price chart 70
alignment, setting 80
color
obtaining 72
setting 78
date, obtaining 73
deleting 71
error codes 69, 210
files, outputting to 66
first object, obtaining 73
horizontal alignment, obtaining 74
location, setting 79
next object, obtaining 75
origin type, number representing 75
price charts, drawing on 69
price value, obtaining 77
text string
obtaining 76
setting 79
time, obtaining 76
vertical alignment, obtaining 77
Text 249
Text String Expressions 8
Text String Parameters 52
Text_Delete 71, 250
Text_GetColor 72, 250
Text_GetDate 73, 250
Text_GetFirst 73, 250
Text_GetHStyle 74, 250
Text_GetNext 75, 250
Text_GetString 76, 251
Text_GetTime 76, 251
Text_GetValue 77, 251
Text_GetVStyle 77, 251
Text_New 70, 251
Text_SetColor 78, 251
Text_SetLocation 79, 252
Text_SetString 79, 252
Text_SetStyle 80, 252
Than (skip word) 252
The (skip word) 252
Then 252
This 252
Thursday 253
Ticks 7, 253
TickType 253
Time 7, 19, 253
Times, working with 18
TimeToMinute 275
TimeToMinutes 19
Tips, *see* Advanced Tips
TL_Delete 83, 253
TL_GetAlert 84, 253
TL_GetBeginDate 85, 253
TL_GetBeginTime 86, 253
TL_GetBeginVal 86, 253
TL_GetColor 87, 253
TL_GetEndDate 87, 253
TL_GetEndTime 88, 254
TL_GetEndVal 88, 254
TL_GetExtLeft 89, 254
TL_GetExtRight 89, 254
TL_GetFirst 90, 254
TL_GetNext 91, 254
TL_GetSize 92, 254
TL_GetStyle 92, 255
TL_GetValue 93, 255
TL_New 83, 255
TL_SetAlert 94, 255
TL_SetBegin 95, 255
TL_SetColor 95, 256
TL_SetEnd 96, 256
TL_SetExtLeft 97, 256
TL_SetExtRight 97, 256
TL_SetSize 98, 256
TL_SetStyle 99, 257
To 257
Today 257
Tomorrow 257
Tool_Black 257
Tool_Blue 257
Tool_Cyan 257
Tool_DarkBlue 257
Tool_DarkBrown 257
Tool_DarkCyan 257
Tool_DarkGray 257
Tool_DarkGreen 257
Tool_DarkMagenta 258
Tool_DarkRed 258
Tool_DarkYellow 258
Tool_Dashed 258
Tool_Dashed2 258
Tool_Dashed3 258
Tool_Dotted 258
Tool_Green 258
Tool_LightGray 258
Tool_Magenta 258
Tool_Red 258
Tool_Solid 258
Tool_White 258
Tool_Yellow 258
Total 258
TotalBarsLosTrades 259
TotalBarsWinTrades 259
TotalTrades 259
Trading Strategies
also see Orders
bouncing ticks 116

stops, *see* Stops
Strategy Testing Engine, *see* Trading Strategy Testing Engine
Trading Strategy Testing Engine
automation
canceling orders ... 112
contracts/shares, specifying number ... 109
open entries, limiting per position ... 110
orders, determining which to fill ... 107
price for placing and filling orders ... 106
stand-by orders ... 111
backtesting
bar assumptions ... 115
bouncing ticks ... 116
overview ... 105
Trading Verbs
Buy ... 119
or higher ... 105, 109, 111
or lower ... 105, 109, 111
orders ... 104
Sell ... 122
understanding ... 104
`TrailingStopAmt` ... 259
`TrailingStopFloor` ... 259
`TrailingStopPct` ... 259
Trendlines
adding to price charts ... 81, 83
alert status
obtaining ... 84
setting ... 94
color
obtaining ... 87
setting ... 95
deleting ... 83
ending point
obtaining date ... 87
obtaining price value ... 88
obtaining time ... 88
setting ... 96
error codes ... 82, 210
extending
left ... 97
obtaining status ... 89
right ... 97
first object, obtaining ... 90
next object, obtaining ... 91
starting point
obtaining date ... 85
obtaining price value ... 86
obtaining time ... 86
setting ... 95
style of line
obtaining ... 92
setting ... 99
thickness of line
obtaining ... 92
setting ... 98
value of line at specific bar, obtaining ... 93
Troubleshooting
EasyLanguage Support Center ... 2
syntax error list ... 179
`True` ... 259
True/False Expressions ... 8
True/False Parameters ... 52
`TrueFalse` ... 259
`TrueFalseArray` ... 259
`TrueFalseArrayRef` ... 259
`TrueFalseRef` ... 259
`TrueFalseSeries` ... 259
`TrueFalseSimple` ... 260
`TtlDbt_By_NetAssts` ... 260
`Tuesday` ... 260
TXT Files, outputting information to ... 66

U

`Under` ... 260
`UnionSess1EndTime` ... 260
`UnionSess1FirstBar` ... 260
`UnionSess1StartTime` ... 260
`UnionSess2EndTime` ... 260
`UnionSess2FirstBar` ... 260
`UnionSess2StartTime` ... 260
`Units` ... 260
`UNSIGNED` ... 260
`Until` ... 260
Update Every Tick Calculation ... 52, 142, 144
`UpperStr` ... 260
`UpTicks` ... 7, 260
User Defined, MaxBarsBack ... 15
User Functions, *see* Functions
USER32.DLL, *see* DLL Functions

V

`V` ... 7, 261
`Var` ... 22, 261
`Variable` ... 22, 261
Variables
arrays, *see* Arrays
assigning ... 23
benefit of ... 20
counters, variables used as ... 32, 33
declaring ... 22
generate orders for next bar calculations ... 52
loops and control variables ... 33
parameters, using variables as ... 53
series variables ... 24

simple variables 25
update every tick calculations 52
values, referencing 23
Variable Assignment Statement 23
Variable Declaration Statement 22
working with 20
Vars 261
VARSIZE 261
VARSTARTADDR 261
Video Files, playing 100
VOID 261
Volume 7, 261

W

Was (skip word) 261
WAV Files, playing 100
Wednesday 261
While 261
While Loop
infinite loops 32
understanding 31
White 262
Widths
EasyLanguage numeric values 209
plots, setting 137, 140, 142
WORD 262

Y

Year 262
Yellow 262
Yesterday 262

Z

Zero, division by 10