JBookTrader

User Guide

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1. Summary

JBookTrader is a fully automated trading system (ATS) that can trade various types of market securities during the trading day without user monitoring. All aspects of trading, such as obtaining prices, analyzing price patterns, making trading decisions, placing orders, monitoring order executions, and controlling the risk are automated according to the user preferences. The central idea behind JBookTrader is to completely remove the emotions from trading, so that the trading system can systematically and consistently follow a predefined set of trading and risk management rules.

The features include strategy back testing, strategy optimization, intraday data retrieval, and real time trading via the Interactive Brokers API.

JBookTrader is intended for software developers. It is not an "off-the-shelf" product that can be installed and run. Instead, JBookTrader provides a framework for developing automated trading systems and requires a certain amount of programming knowledge and experience. The users can modify any part of the source code, implement their own trading strategies, and customize the system in any way. If you are not a software developer or if you don't have much experience programming in Java, JBookTrader is probably not for you.

2. System Requirements

To use JBookTrader, you need the following:

- A universal brokerage account with Interactive Brokers
- Trader's Workstation (TWS) version 895.3 or higher
- An Interactive Brokers market data subscription to the securities of interest (such as stocks or futures)
- Virtually any operating system (such as Windows, Mac OS, or Linux)
- Java Development Kit (JDK) version 1.6 or higher
- Java Integrated Development Environment (such as Eclipse, IntelliJIdea, NetBeans, or JBuilder)

3. Installation

JBookTrader is distributed in a singe archive file (JBookTrader.zip). The latest version is available at http://code.google.com/p/jbooktrader/downloads/list. Unzip the contents of the JBookTrader.zip file to any destination directory on you machine, such as C:\JBookTrader.

To setup JBookTrader in a Java IDE (such as Eclipse, A Java IDE), follow the steps in the document JBookTrader.Eclipse.doc located in the /docs directory of the distribution.

4. Running JBookTrader

- Start TWS normally and log in to your account (use simulated account until you get comfortable with JBookTrader). Make sure that the "Enable ActiveX and Socket Clients" and the "Bypass Order Precautions for API Orders" options are checked:
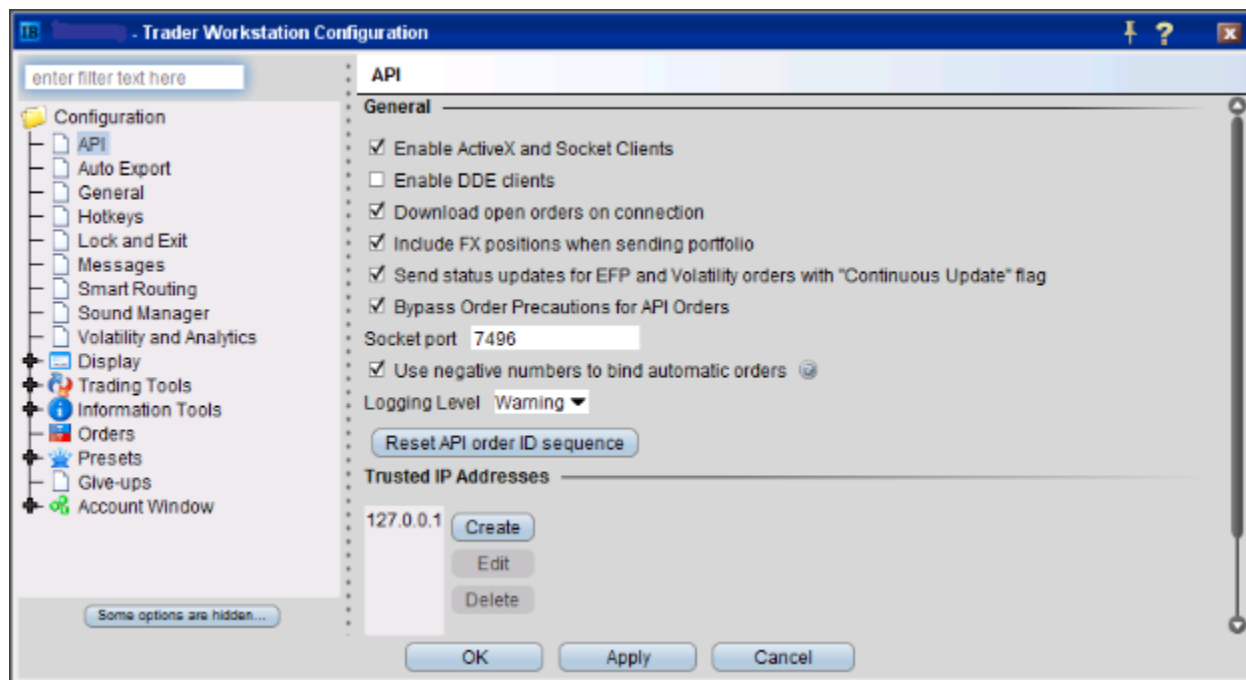
- Start JBookTrader:

- Verify that JBookTrader can connect to TWS: right-click (control-click on Mac) on any strategy row and select **Forward Test**:

If the connection is successful and the security specified by the strategy is currently trading, you'll see market information:
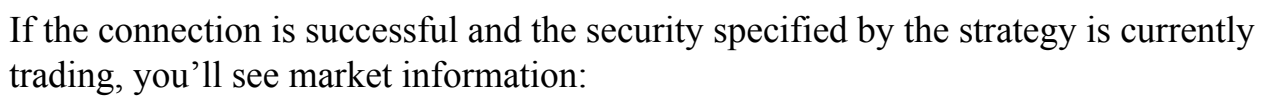
5. JBookTrader Operations

Once started with the trading strategies specified, JBookTrader does not require any user actions and monitoring, or even user presence. During the trading day, JBookTrader will continuously monitor the price action for the specified securities, determine if the predefined trade entry/exit conditions have been met, place the trades, monitor their execution status, and record all events in a report file.

Specifically, JBookTrader will continuously execute the following sequence for each running trading strategy:

- Detect when the market depth changes (any one of the 10 best bids or 10 best asks changes in either price or quantity). For the liquid securities (such as ES and YM), this may happen several times every second.
- Recalculate technical indicators based on the new market depth.
- Determine if the trading strategy calls for a new position based on the new information. If new position differs from the current position, JBookTrader will place an order. For example, let us suppose that the the strategy is currently long 5 contracts. If the market moves higher and strategy determines that the profit target is reached and that the new position should be flat (i.e. 0 contracts), JBookTrader will place an order to sell 5 contracts at the market.
- The strategy will wait until the order is fully filled.
- The transaction will be recorded in both event report and strategy report.

6. Market Data Display

The market depth change at any point of time is reflected in the strategies table. The **Market Depth** column shows cumulative bid and the ask size. The **Price** column in JBookTrader is the midpoint between the current highest bid price and the current lowest ask price. At all times, the market data in JBookTrader is identical to that in TWS, and both applications reflect the changes almost simultaneously. Here is the TWS market depth window superimposed on JBookTrader for comparison:
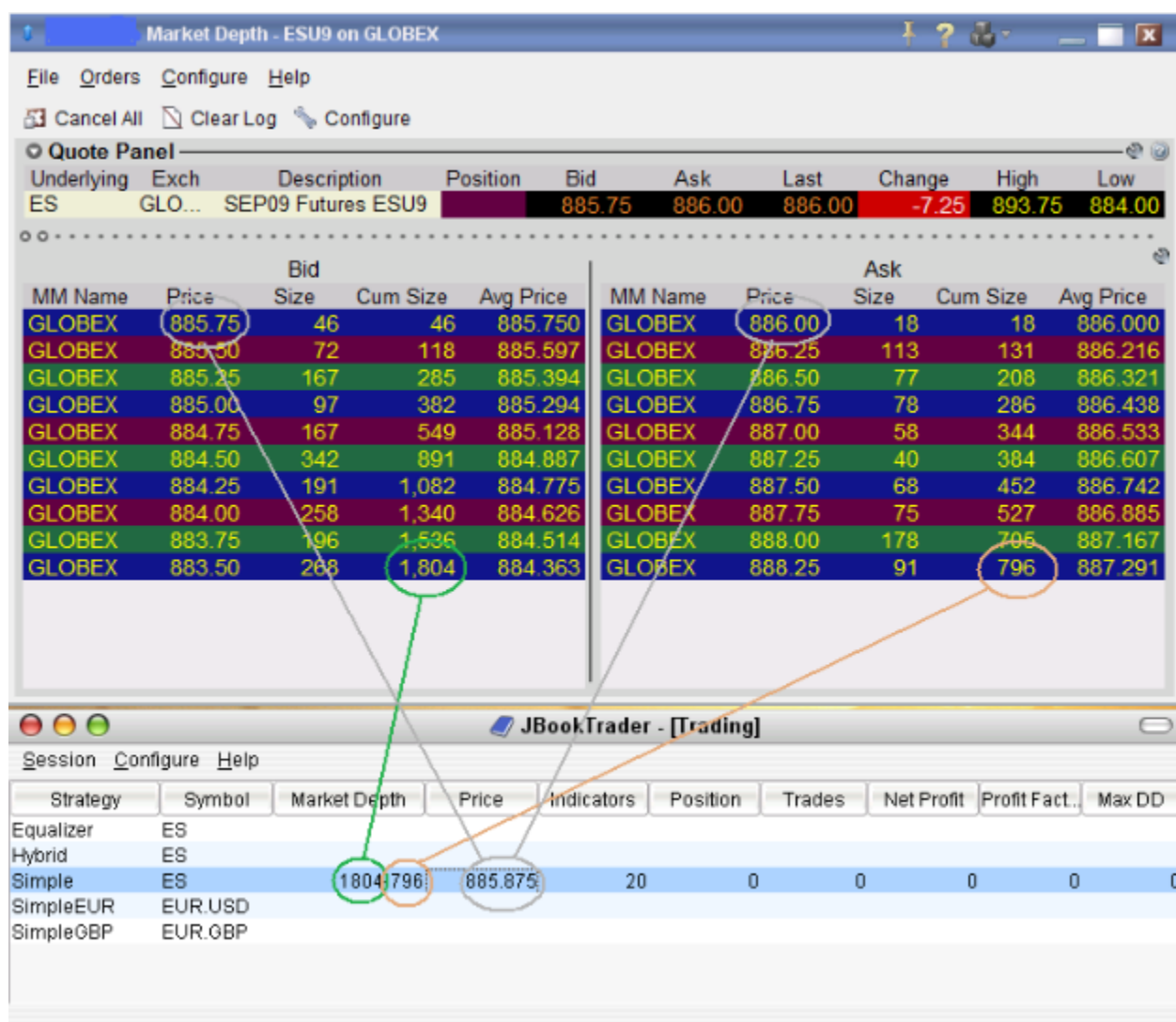
7. Strategy Running Modes

JBookTrader can run any trading strategy in the following four running modes: back testing, forward testing, optimization, and trading. No changes to the strategy are required to run it in any of the running modes. Furthermore, the back testing, forward testing, and optimization modes are *result-consistent*. That is, if you run a strategy in the forward test mode, and then back test and optimize the same strategy over the same time period, the performance results (net profit, number of trades, profit factor, etc.) will be identical. The trading mode is *approximately result-consistent* with the forward testing and the back testing modes. That is because in real trading, the bid/ask spreads and the quality of executions may vary beyond the boundaries assumed by the back testing, forward testing, and optimization modes.

The trading modes and their characteristics are summarized in the table below:

Running Mode	Purpose	TWS Connection and live market data	Historical Data File	Order placement and execution
Back Testing	Evaluation of historical strategy performance	Not used	Required	Simulated
Forward Testing	Evaluation of real time strategy performance	Required	Not used	Simulated
Optimization	Discovery and calibration of strategy parameters	Not used	Required	Simulated
Trading	Live strategy trading	Required	Not used	Real

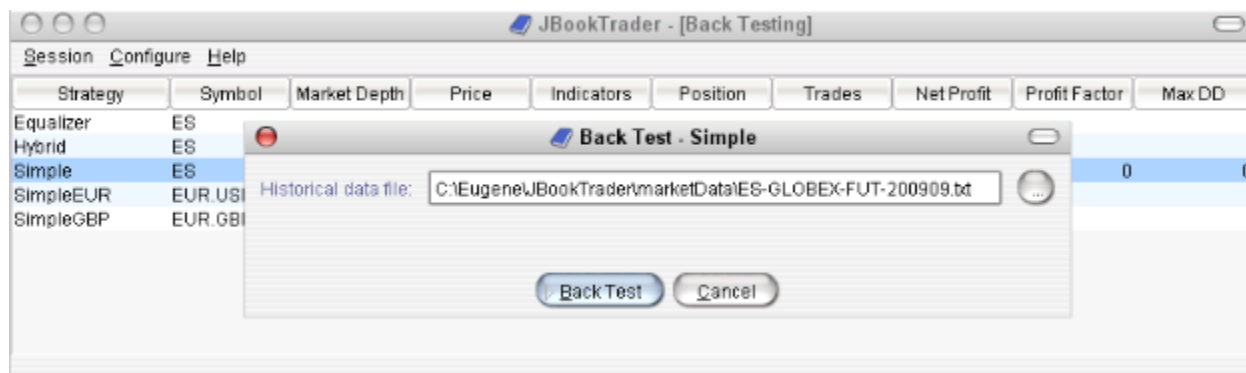All four trading modes are described in detail in the sections below.

8. Back Testing

Back testing is evaluating your trading strategy performance using historical market depth data. Historical data sets can be downloaded from the [Project Downloads Page](#).

To run a back test, right click on the strategy and select **Back Test**:
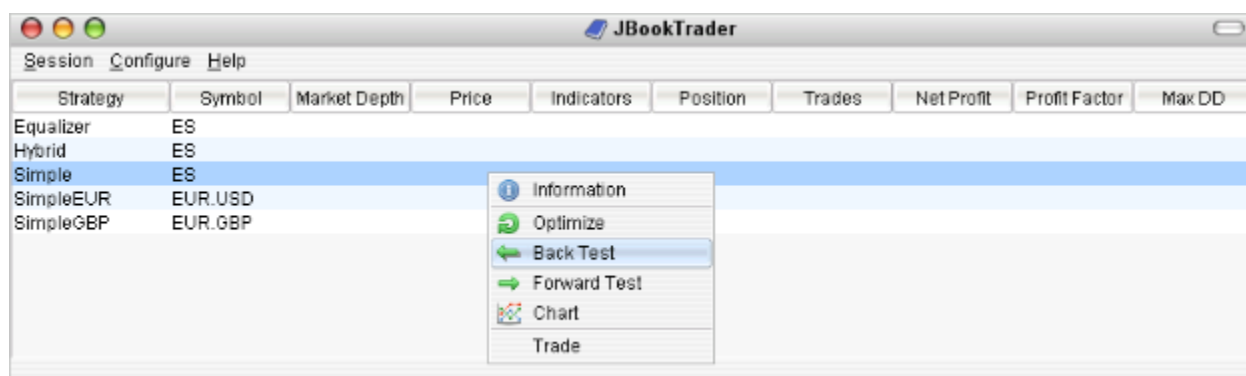
JBookTrader will pop up a file dialog. Select a historical data file:

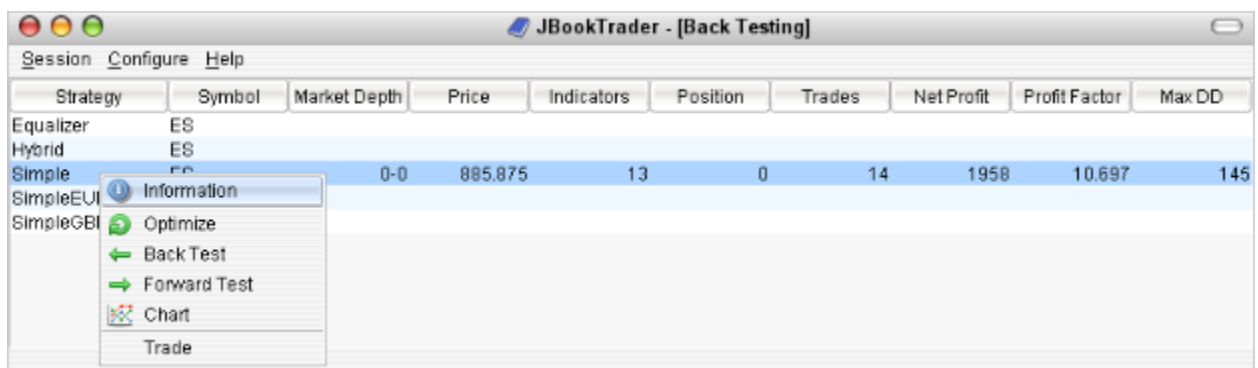After the historical data file is loaded, JBookTrader will run the test and display the results:

To see the extended back testing results, right click on the strategy and select **Information**:

Extended back testing results will be displayed:

9. Forward Testing

Forward testing is evaluating your trading strategy performance using live market data. In the forward testing mode, JBookTrader will connect to TWS and run the strategy, but no actual trade orders will be submitted. This makes it possible to run JBookTrader against real TWS account without making any trades. Although a paper trading account can also be used, the data feed from that type of account is unreliable.

To start a forward test, right click on the strategy and select **Forward Test**:
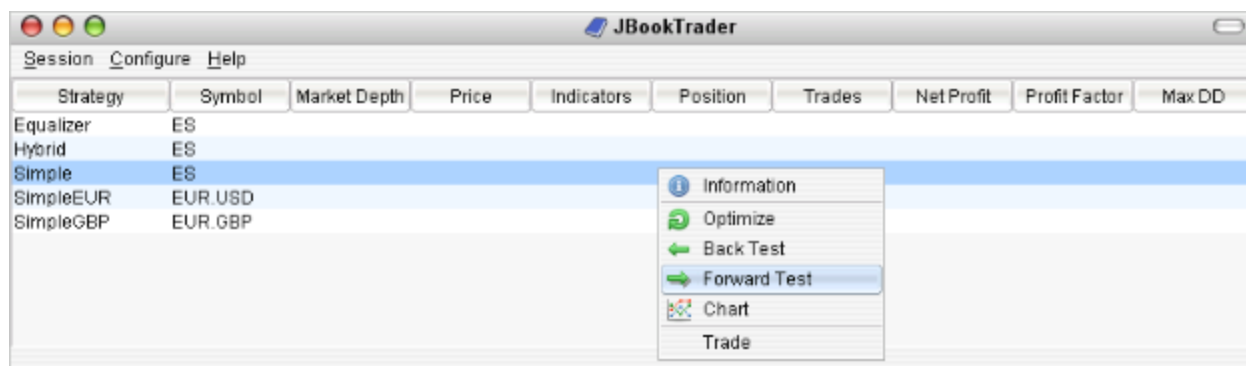
If the security specified by the strategy is trading, the strategy line will be updated with live market data:

10. Using simulated TWS Account

Unfortunately, the "market depth" (and similarly "market book") functionality in simulated IB account is flawed. You can frequently see crossed market (bid higher than ask), missing rows of data, and downright wrong information. The best way to see it is to start two instances of TWS, and log in to your real account in one TWS instance, and log in to your simulated account in the other TWS instance. Then bring up the "market depth" window in each one, for the same security, and compare the two windows side by side. As market depth changes, you'll see that very frequently, the data is not the same in the two windows.

Here is how it may look like (notice the "crossed market" and other inconsistencies in the market depth for the simulated TWS account):

Quote Panel

Underlyi..	Excha..	Description	Positi...	Bid	Ask	Last	Change	High	Low
ES	GLO...	MAR08 Futures...		1381....	1382.00	1381.75	-1.00	1383...	1381...

Buttons

[Close Position] [View Account]

Bid				Ask			
Price	Size	Cum Size	Avg Price	Price	Size	Cum Size	Avg Price
1381.75	109	109	1381.750	1382.00	2	2	1382.000
1381.50	48	157	1381.674	1382.25	137	139	1382.246
1381.25	122	279	1381.488	1382.50	86	225	1382.343
1381.00	328	607	1381.224	1382.75	117	342	1382.482
1380.75	228	835	1381.095	1383.00	49	391	1382.547

Simulated Trading - Market Depth - ESH8 on GLOBEX

File Orders Configure Help

Cancel All Clear Log Configure

Quote Panel

Underlyi..	Exch...	Description	Posit...	Bid	Ask	Last	Chan...	High	Low
ES	GL...	MAR08 Futures E...	0	1381.75	1382.00	1381...	-1.00	1383...	1381...

Buttons

[Close Position] [View Account]

Bid				Ask			
Price	Size	Cum Size	Avg Price	Price	Size	Cum Size	Avg Price
1382.00	109	109	1382.000	1381.75	137	137	1381.750
1381.75	48	157	1381.924	1382.25	137	274	1382.000
1381.50	122	279	1381.738	1382.50	86	360	1382.119
1381.25	328	607	1381.474	1382.75	117	477	1382.274
1380.75	228	835	1381.277	1383.00	49	526	1382.342

Since market depth data is critical to JBookTrader, simulated account simply doesn't cut it.

The solution is to use the "Forward Test" in JBookTrader with the real TWS account. In the "Forward Test" mode, everything that happens is exactly the same as if you were actually trading, except for one thing: no orders will be transmitted to TWS. For the performance evaluation, the executions will be simulated in a manner consistent with the real executions: all buy orders will be simulated to fill at the current ask, and all sell orders will be simulated to fill at the current bid.

The "Forward Test" mode should also be used if your intent is to record market depth.

11. Strategy Optimization

Strategy optimization is a search for a set of strategy parameters that results in the best strategy performance. JBookTrader uses multiple measures of performance. You can select a particular measure to be used in the search.

To start a strategy optimization, right click on the strategy and select **Optimize**:
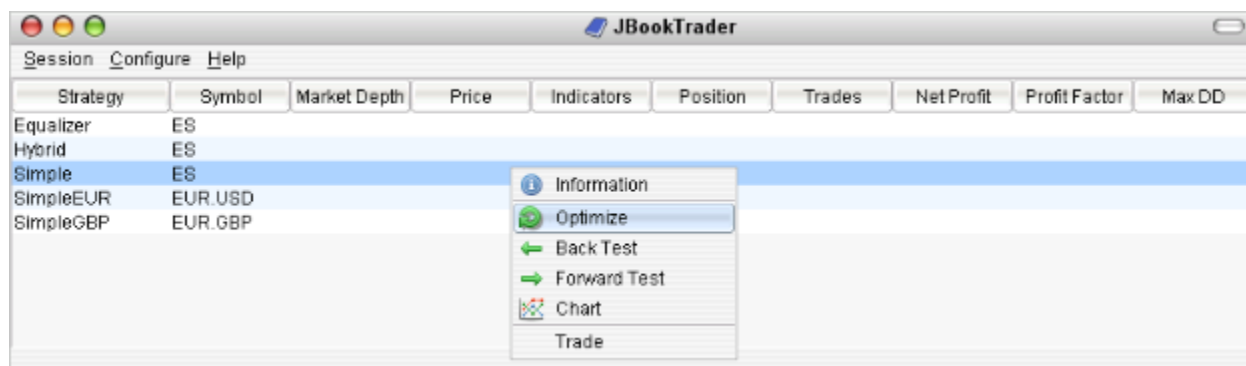
In the strategy optimizer dialog, select optimization options and click **Optimize** button:

After completion, optimization results will be shown:

Strategy Optimizer - Simple

Strategy parameters

Historical data file: `C:\Eugene\JBookTrader\marketData\ES-GLOBEX-FUT-200909.txt`

Parameter	Min Value	Max Value
Period	100	2000
Entry	5	20

Optimization options

Search method: Divide & Conquer
Selection criteria: PI
Minimum trades: 8

Optimization Results

Period	Entry	Trades	Net Profit	Max DD	Profit Factor	Kelly	PI
1,026	11	14	2008	132	10.71	71	7.73
830	12	14	1945	132	11.27	78	7.72
831	12	14	1945	132	11.27	78	7.72
1,028	11	14	1995	132	10.65	71	7.71
1,034	11	14	1995	132	10.65	71	7.71
1,030	11	14	1995	132	10.65	71	7.71
1,027	11	14	1995	132	10.65	71	7.71
1,032	11	14	1995	132	10.65	71	7.71
827	12	14	1933	132	11.2	78	7.71
826	12	14	1933	132	11.2	78	7.71
1,023	11	14	1983	132	10.59	71	7.7
1,014	11	14	1983	132	10.59	71	7.7
1,022	11	14	1983	132	10.59	71	7.7
1,015	11	14	1983	132	10.59	71	7.7
1,013	11	14	1983	132	10.59	71	7.7

Optimize   Optimization Map   Cancel   Close

Optimization Options

The optimization window offers a number of configurations. These are shown here:
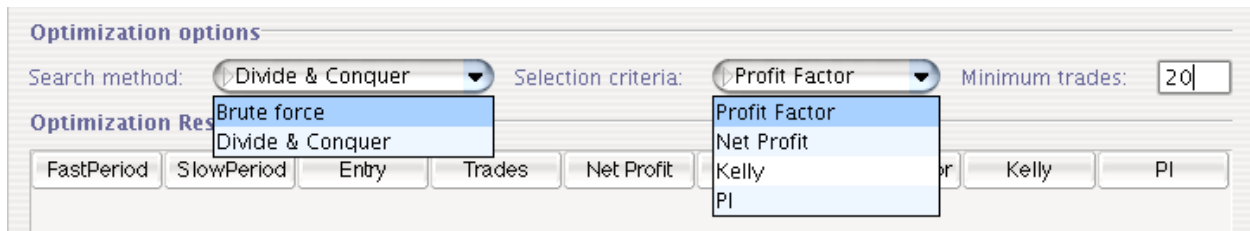
Search Method

There are currently two choices for the search method; "Brute Force" and "Divide & Conquer". The simplest is Brute Force. This method will systematically backtest every possible combination of parameters to locate the highest scoring configuration based on your selection criteria and minimum number of trades. Depending on the number of combinations of parameters, the size of the backtesting data and the computing power of your computer, this method may require minutes, hours, days or even weeks to complete.

Divide & Conquer takes a speedier approach by dividing the whole set of parameters combinations into a relatively small number of groups. The method then scores a sample of combinations from each group. Divide and Conquer will then divide the highest scoring group into a new set of sub-groups and sample these, recursively, until it can no longer sub-divide the highest scoring group. While this method is very quick, it isn't as thorough as the brute force method.

Selection Criteria

There are currently four options for the selection criteria; Profit Factor, Net Profit, Kelly (Kelly Criterion) and PI (Performance Index). Each of these choices is described in the 12. Strategy performance evaluation section of this document.

The selection here determines how the search method scores the best combination of parameters.

Minimum Trades

The statistical relevance of the selection criteria depends greatly on the number of trades that occur over the optimization search. The Minimum Trades field allows you to omit optimization results that produced a number of trades lower than this setting.

Optimization Maps

Once an optimization has completed, it may be helpful to visualize a heat map of the parameter combinations showing the relative performance of each combination.
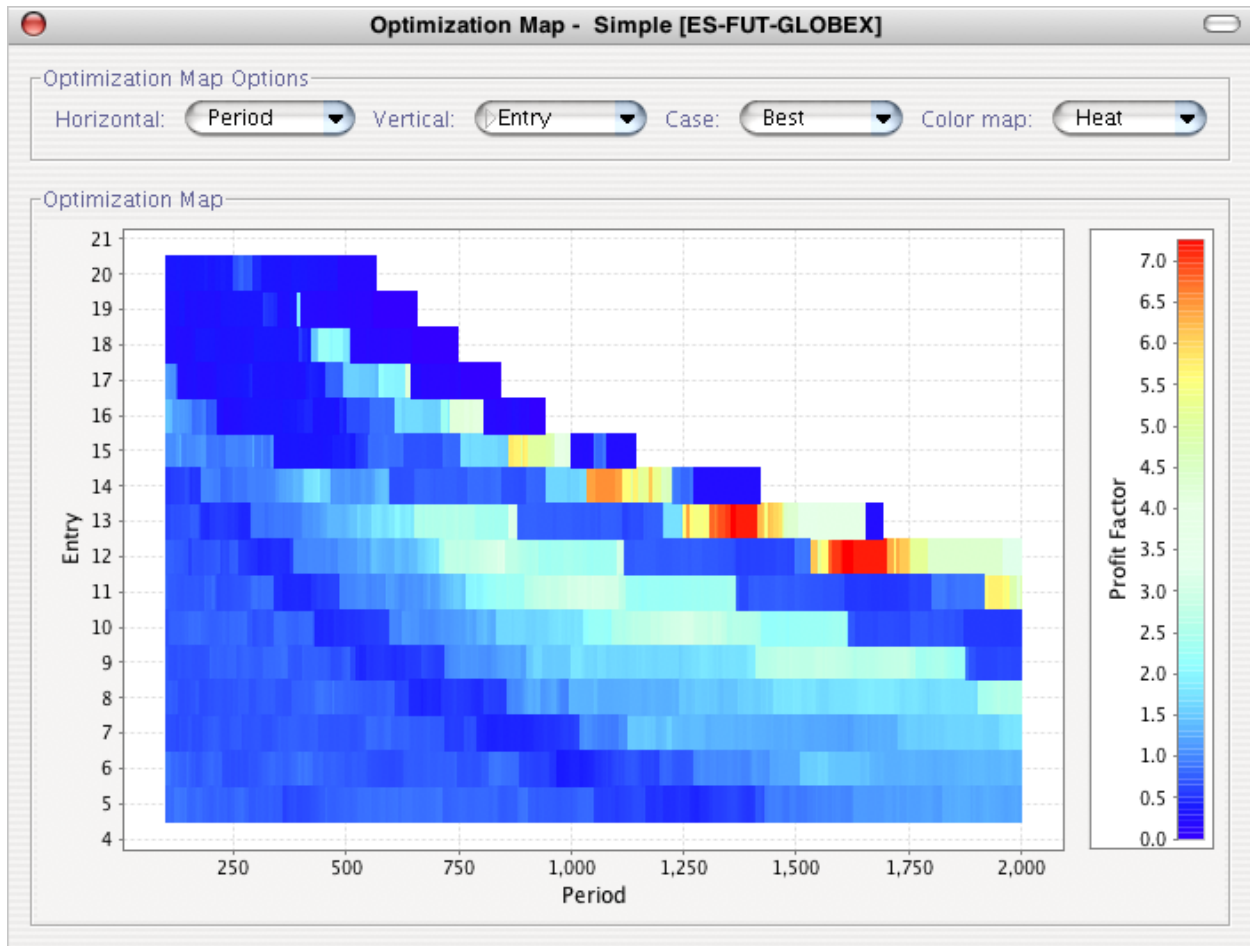

Each point in the map shows the relative performance of the combination of parameter values at that point. In the case of the map shown above, each point represents a value combination for the Entry and Period parameters for this optimization run. The color value represents the value of the selection criteria selected for the optimization run.

As shown in the legend along the right edge of the window, the red areas in the map have the highest profit factor and the areas in the dark blue have the lowest profit factor.

Areas in white have no result because these combinations of parameter values produced a number of trades below the Minimum trade threshold set for the optimization run, or in the case of a Divide & Conquer optimization run, because the optimizer did not test them at all.

The map shown above represents a Brute Force optimization run. A Divide and Conquer run of the same strategy and other settings would appear like this:
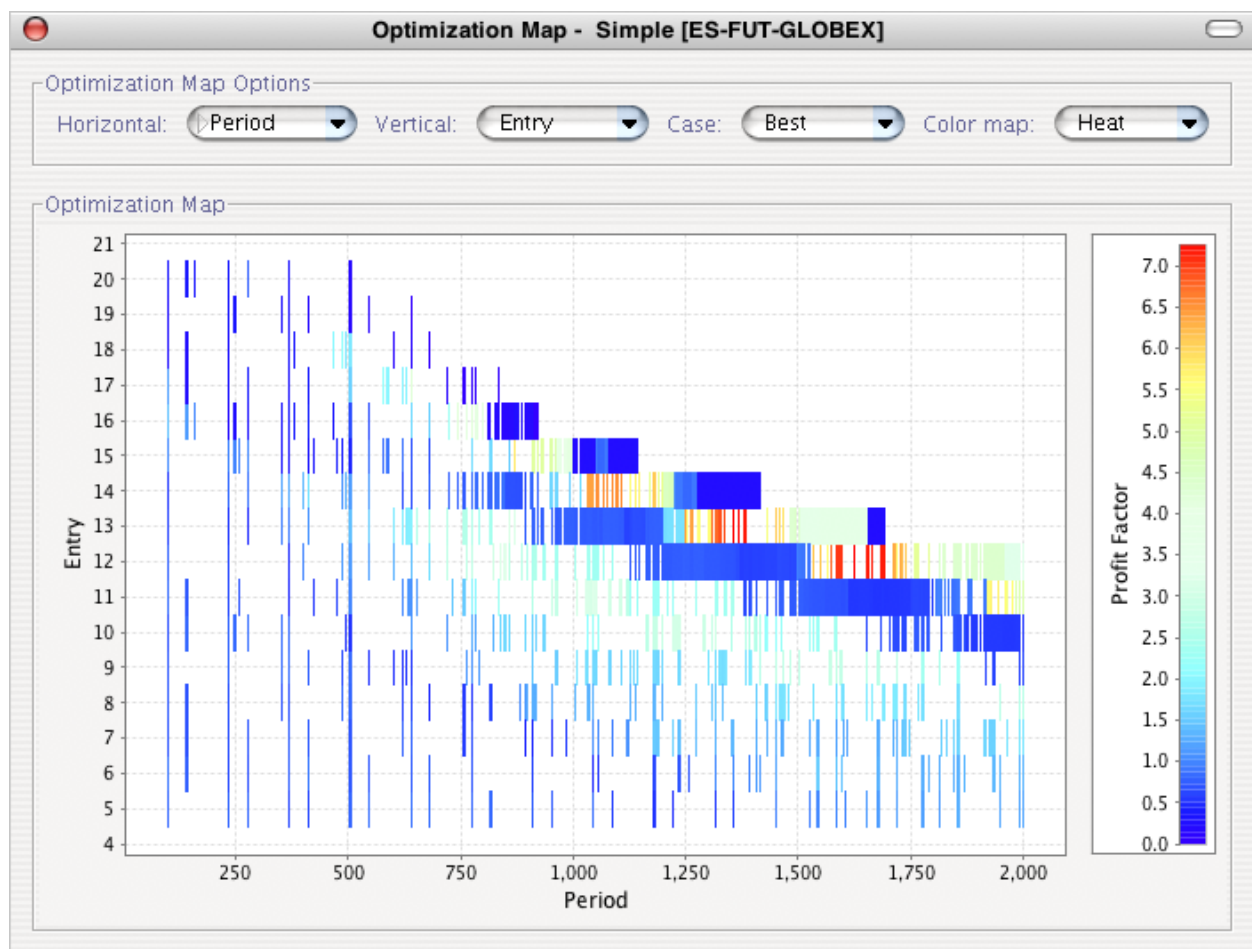
Here it is easy to see how the Divide and Conquer search method samples areas of the combination space then focuses on areas with the best relative performance. In this case, the optimizer very sparsely tested the map except in the areas where Entry is between 10 and 16 and Period is between about 800 and 1,750.

If desired a user may "zoom-in" to a part of the optimization map by dragging a box with his mouse around the area of interest.

There are a number of options for the optimization map; Horizontal, Vertical, Case and Color Map.

Horizontal

The Horizontal drop-down menu allows the selection of which parameter to map to the horizontal axis of the map. This is more important when there are more than two parameters as the map can only show two at a time.

Vertical

The Vertical drop-down menu allows the selection of which parameter to map to the horizontal axis of the map. This is more important when there are more than two parameters as the map can only show two at a time.

Case

The optimizer map can only show two parameters at a time. So, when an optimized strategy uses 3 or more parameters, the resulting P&L that is mapped may vary depending on the hidden parameters. Selecting Best will color the map with the best P&L for the shown parameters and selecting Worst will show the worst P&L for those parameters.

For example, suppose that a strategy with 3 parameters is optimized. Let us further suppose that the P&L for some of the parameter combinations is as follows:

(10, 20, 1) : -$1,000.00
(10, 20, 2) : $12,000.00
(10, 20, 3) : -$5,000.00

If the optimization map is only displaying the first 2 parameters in the map, the color of the map for these parameters will be determined by the Case setting. If set to Best, the map will be set to the color corresponding to $12,000.00, if Case is set to Worst, then the map will be set to the color corresponding to -$5,000.00.

Color Map

The color map drop-down menu contains the choices; Heat and Gray. Heat uses color to denote performance and Gray uses shades of grey to denote performance. This might be useful if the viewer has trouble distinguishing colors or if the the map will be printed on a monotone printer or other medium.

12. Strategy Performance Chart

In discretionary (manual) trading, charts are used *before* a trading decision is made. Since JBookTrader is a fully automated trading system, there is no one to actually look at the chart. The system makes all decisions. However, the charts are still very useful for strategy evaluation *after* the period of trading.

To display a strategy performance chart, run any strategy in one of the three modes: **Back Test**, **Forward Test**, or **Trade**. Next, right-click (control-click on Mac) on the strategy and select **Chart**:
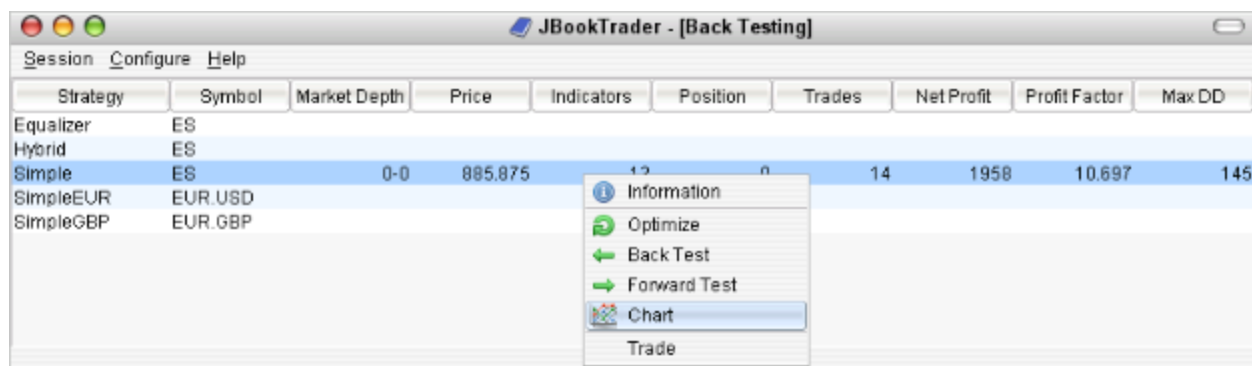
The strategy performance chart will be displayed:

The performance chart contains the information about the market and the strategy, since it has started. The green circles mark the times and the prices when the strategy took long positions, the red circles mark the times and the prices when the strategy took short positions, and the yellow circles mark the times and the prices when the strategy took flat positions. The number in the circle indicates the number of contracts/shares held by the strategy.

The performance chart is zoom-able. To zoom in, left-click on the chart area and drag to the right. To zoom out, left-click on the chart area and drag to the left:

There are numerous chart display options which you can adjust. To get to the options, right-click (control-click on Mac) on the chart and choose **Properties**:

Strategy Performance Chart - Simple [ES-FUT-GLOBEX]

Chart Options

Chart Type: Candle   Timeline: Trading Hours   Time Zone: Exchange   ☒ Show trades   ☒ Show net profit

Performance Chart

Properties...
Copy
Save as...
Print...
Zoom In ▶
Zoom Out ▶
Auto Range ▶

13. Strategy Performance Evaluation

Trades

This is the total number of trades that executed during the strategy's run. The greater the number of trades (and the longer the historical data period is), the more statistically significant the performance results will be.

Percent Profitable

Percent of profitable trades.

Average Trade

This is the total net profit divided by the number of trades.

Net Profit

This is the total profit or loss of the strategy's run.

Max DD

The Maximum Drawdown indicates the largest decline from the highest peak during the course of the strategy's run.

Profit Factor

Profit Factor is a measure of a strategy's performance and is measured as the ratio:

$$pf = \frac{Gross\ Profits}{Gross\ Losses}$$

Kelly

Kelly provides an indication of the *maximum* amount of trading capital that should be applied to the given strategy. The result is in the range 0 - 100 and indicates the *maximum* percentage that should be allocated. The Kelly Criterion is calculated with the formula:

$$f = \frac{bp - q}{b}$$

Where:

f is the maximum fraction of the total capital to invest
b is the win-loss ratio
p is the probability of a winning trade
q is the probability of a losing trade

For more information see http://en.wikipedia.org/wiki/Kelly_criterion.

In the trading systems domain, Kelly can be used for position sizing. It can also be used to directly compare the "goodness" of multiple strategies side by side. Let's suppose that system *A* has Kelly of 5% while system *B* has Kelly of 50%. Clearly, system *B is* superior to system *A,* because its distribution of winning and losing trades allows a much greater proportion of capital to risk on every trade.

Performance Index

The Performance Index is another measure of the Strategy's performance. It is calculated as 10 times the average profit per trade divided by the standard deviation of trades:

Performance Index = 10 * AverageProfitPerTrade / Standard Deviation of Trades

The higher the performance index is, the more "quality" the strategy has. Performance Index is closely related to System Quality Number, introduced by Van K. Tharp in his "Definitive Guide to Position Sizing".

References:

http://www.ninjatrader-support2.com/vb/showthread.php?t=4320
http://www.iitm.com/Definitive-Guide-to-Position-Sizing.htm
http://groups.google.com/group/jbooktrader/browse_thread/thread/f35707d6d1e5163f

14. Recording Market Data

When a strategy runs in either **Forward Test** or **Trade** mode, it accumulates market depth data and saves it in a file in the */marketData* directory.

Open one of the saved files in a text editor. The market depth history is saved as a sequence of lines.
Each line represents a 1-second snapshot of the market and contains 4 columns:

      Column 1: date in the MMddyy format
      Column 2: time in the HHmmss format
      Column 3: book balance
      Column 4: price

Here is how it may look:

```
…
062409,081232,-11,894.375
062409,081233,-11,894.375
062409,081234,-11,894.375
062409,081235,-11,894.375
062409,081236,-11,894.375
062409,081237,-12,894.375
062409,081238,-13,894.375
062409,081239,-6,894.125
062409,081240,1,894.125
062409,081241,2,894.125
062409,081242,2,894.125
062409,081243,1,894.125
062409,081244,1,894.125
…
```
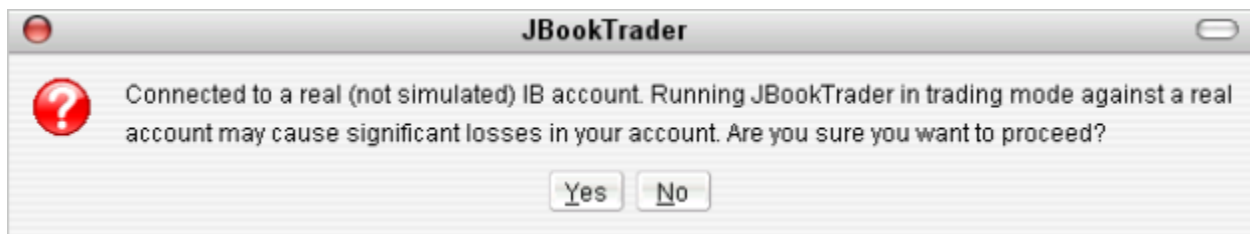
The saved book may subsequently be used by any strategy for back testing and optimization purposes.

15. Trading

To begin live trading of your strategy, right-click (control-click on Mac) and choose Trade from the contextual menu.
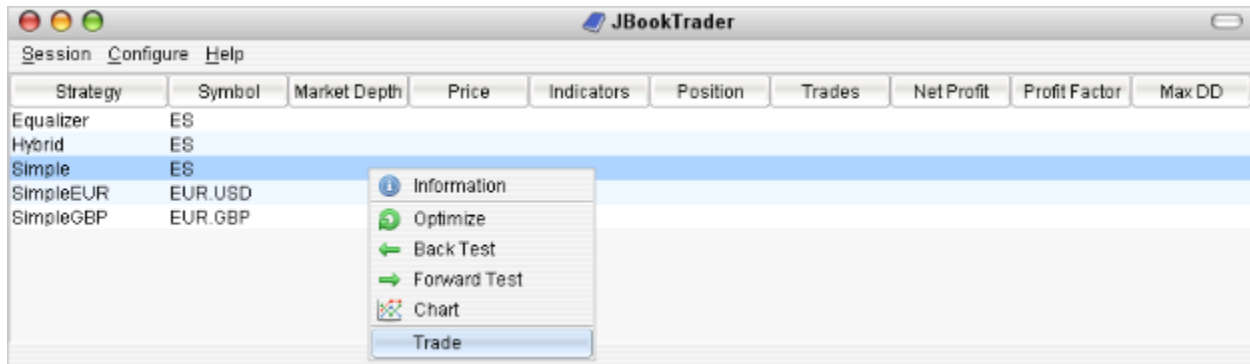

If JBookTrader detects that you connected to a real TWS account, it will ask for a confirmation:

16. Reporting

All major activities that JBookTrader performs during the trading day are logged into a dedicated log file in HTML format (EventLog.htm). The event report can be used at the end of the trading day to diagnose and debug any potential problems that occurred during the day.

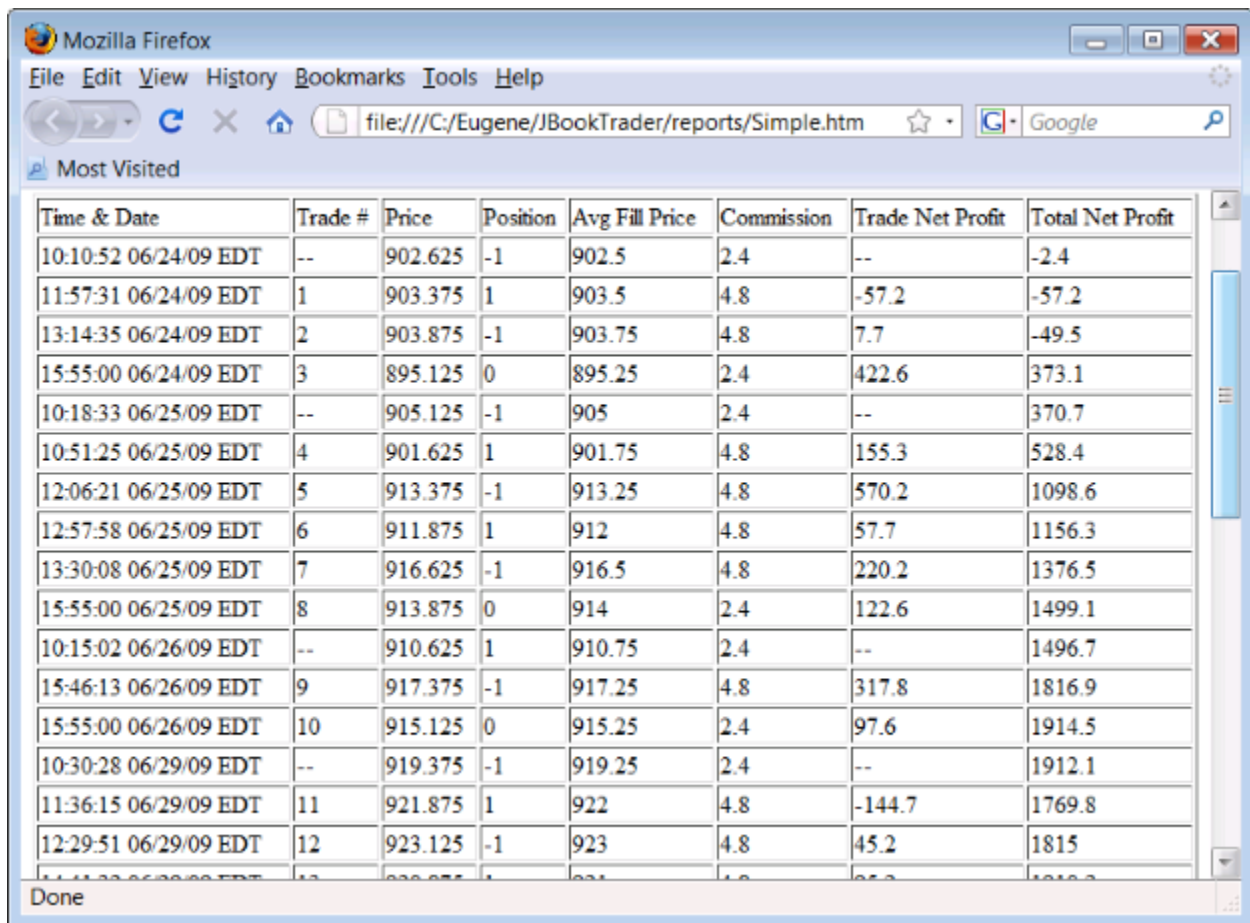The event report typically looks like this:
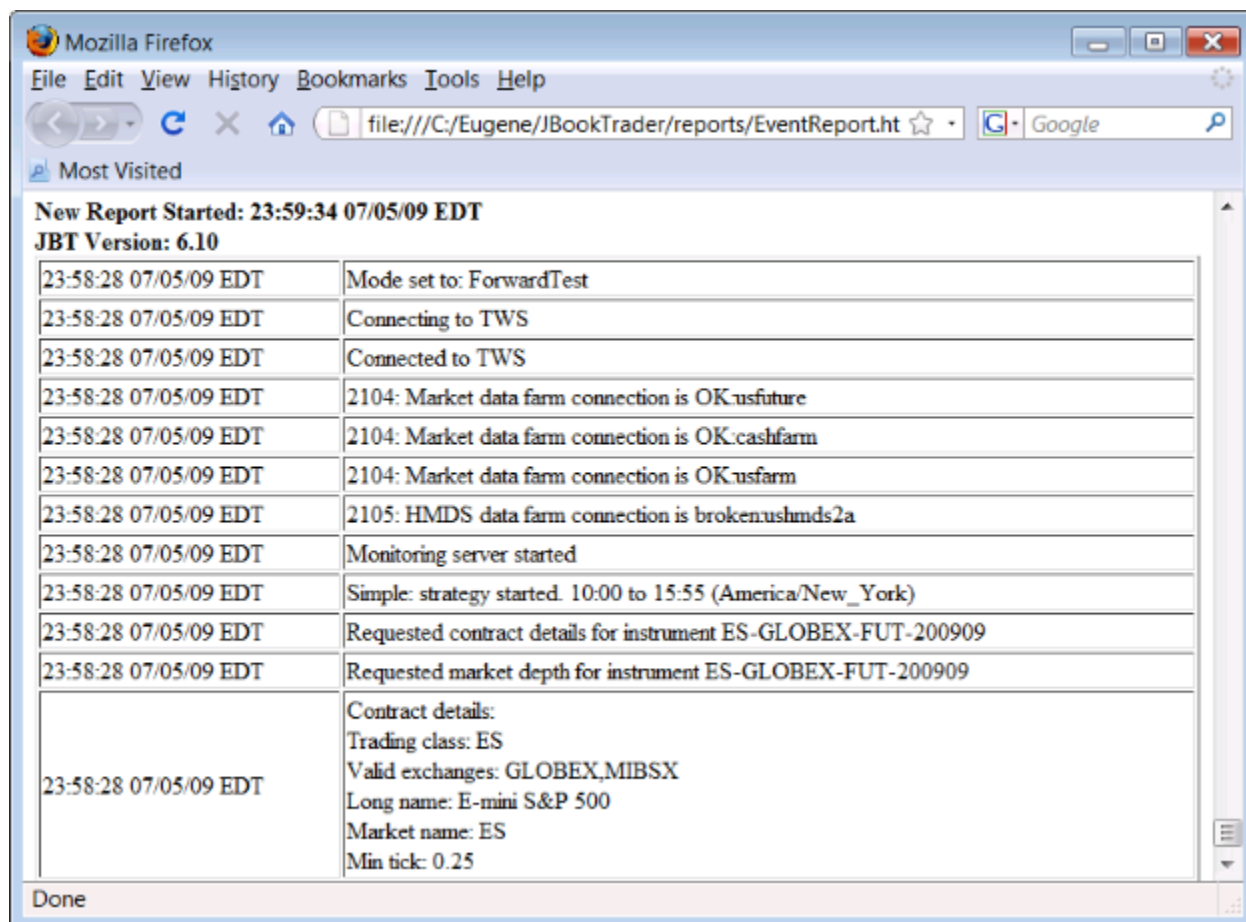
The event report will contain informational messages from TWS and execution reports. If you see anything else (such as error messages from TWS or other errors), that would indicate a problem that needs to be addressed.

Additionally, every strategy creates its own log file, which is named after the class where this strategy is implemented. For example, if the strategy is defined in a class MyStrategy.java, the corresponding strategy report will be named

MyStrategy.htm. The strategy log can be used to evaluate the strategy performance. Although the log is in HTML format for easy viewing, you can also import it into a spreadsheet (such as MS Excel) to analyze the strategy performance during the day and to construct the charts, if needed.

A typical example of a strategy log:

Mozilla Firefox

File Edit View History Bookmarks Tools Help

file:///C:/Eugene/JBookTrader/reports/Simple.htm · Google

Most Visited

| Time & Date	Trade #	Price	Position	Avg Fill Price	Commission	Trade Net Profit	Total Net Profit
10:10:52 06/24/09 EDT	--	902.625	-1	902.5	2.4	--	-2.4
11:57:31 06/24/09 EDT	1	903.375	1	903.5	4.8	-57.2	-57.2
13:14:35 06/24/09 EDT	2	903.875	-1	903.75	4.8	7.7	-49.5
15:55:00 06/24/09 EDT	3	895.125	0	895.25	2.4	422.6	373.1
10:18:33 06/25/09 EDT	--	905.125	-1	905	2.4	--	370.7
10:51:25 06/25/09 EDT	4	901.625	1	901.75	4.8	155.3	528.4
12:06:21 06/25/09 EDT	5	913.375	-1	913.25	4.8	570.2	1098.6
12:57:58 06/25/09 EDT	6	911.875	1	912	4.8	57.7	1156.3
13:30:08 06/25/09 EDT	7	916.625	-1	916.5	4.8	220.2	1376.5
15:55:00 06/25/09 EDT	8	913.875	0	914	2.4	122.6	1499.1
10:15:02 06/26/09 EDT	--	910.625	1	910.75	2.4	--	1496.7
15:46:13 06/26/09 EDT	9	917.375	-1	917.25	4.8	317.8	1816.9
15:55:00 06/26/09 EDT	10	915.125	0	915.25	2.4	97.6	1914.5
10:30:28 06/29/09 EDT	--	919.375	-1	919.25	2.4	--	1912.1
11:36:15 06/29/09 EDT	11	921.875	1	922	4.8	-144.7	1769.8
12:29:51 06/29/09 EDT	12	923.125	-1	923	4.8	45.2	1815

Done

The type of information logged in either event report and, like everything else in JBookTrader, the strategy report can be customized by the user.

17. Preferences

JBookTrader user preferences are found by clicking the menu item Preferences in the Configure menu:
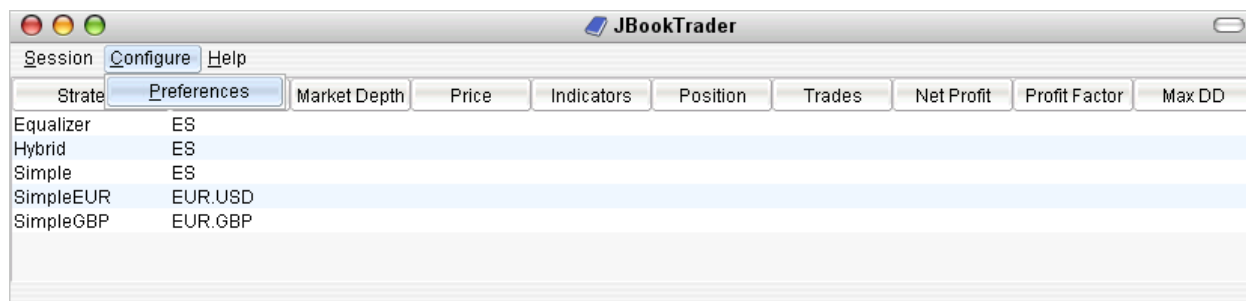

The preferences window will appear:
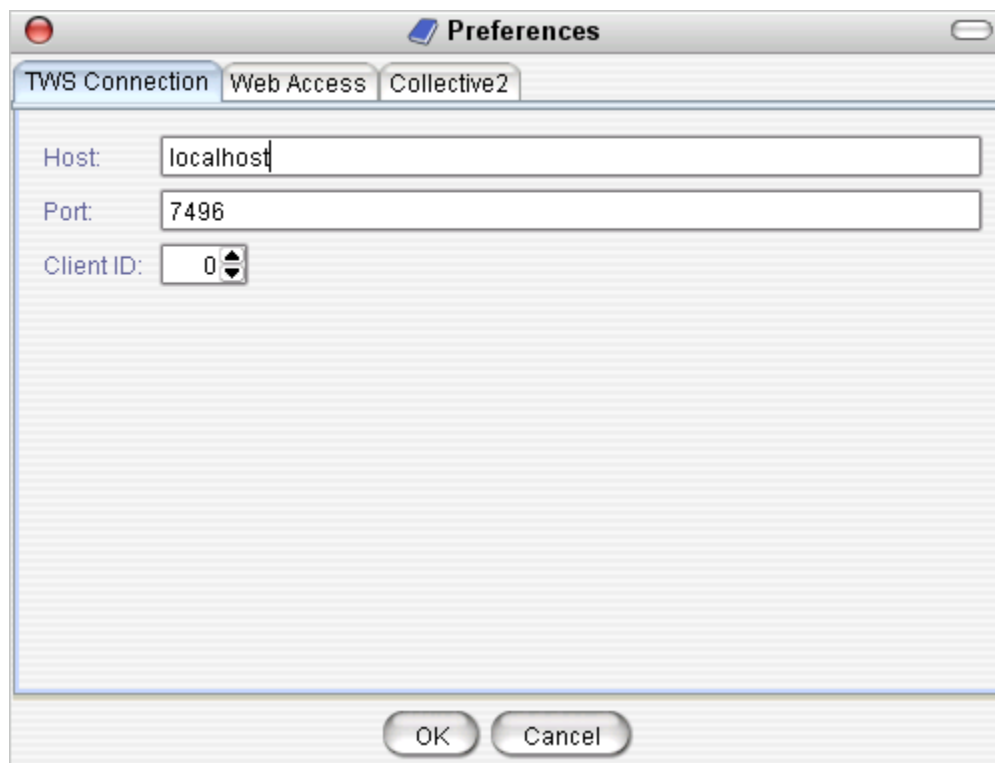
The Preferences window has three tabs:

- TWS Connection
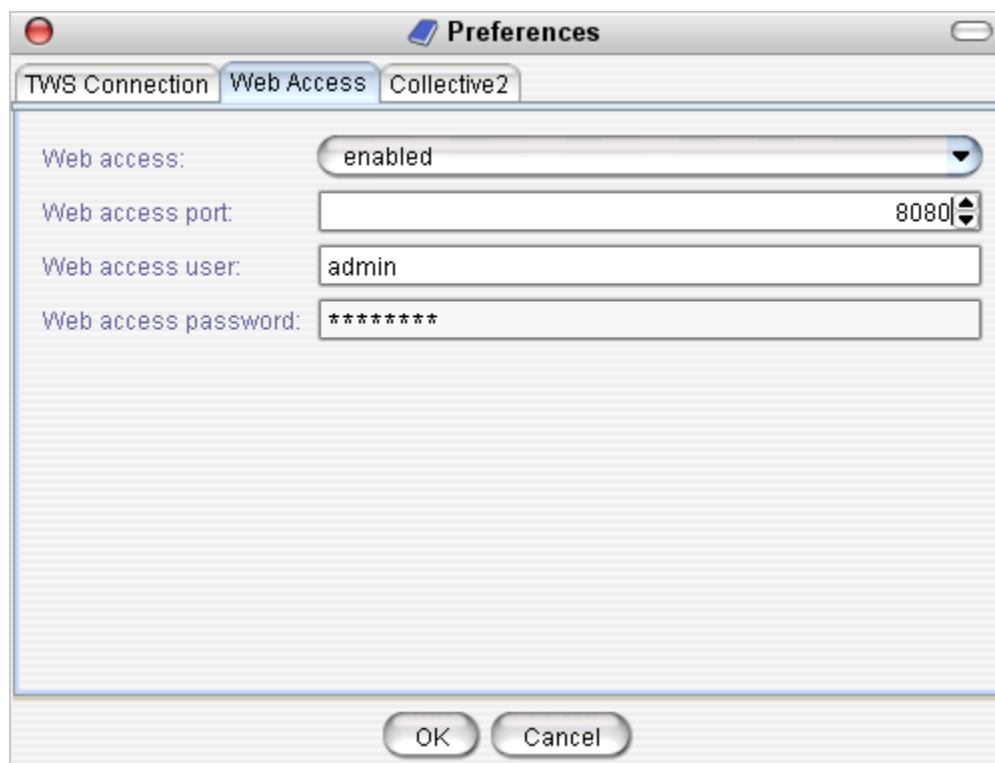- Web Access
- Collective2

TWS Connection

The TWS Connection tab allows configuration of the host, port and client ID that should be used when connecting to TWS. The Host preference should match the IP Address or host name of the computer running the TWS instance you which JBookTrader to connect to. Use localhost (the default) if TWS is running on the same machine as JBookTrader. The Port preference should match the value of the socket port as set in TWS under API in the Global Configuration (see Section 4, "Running JBookTrader"). The Client ID field should be used if you have multiple JBookTrader instances accessing the same TWS instance. Each should connect with a unique Client ID.
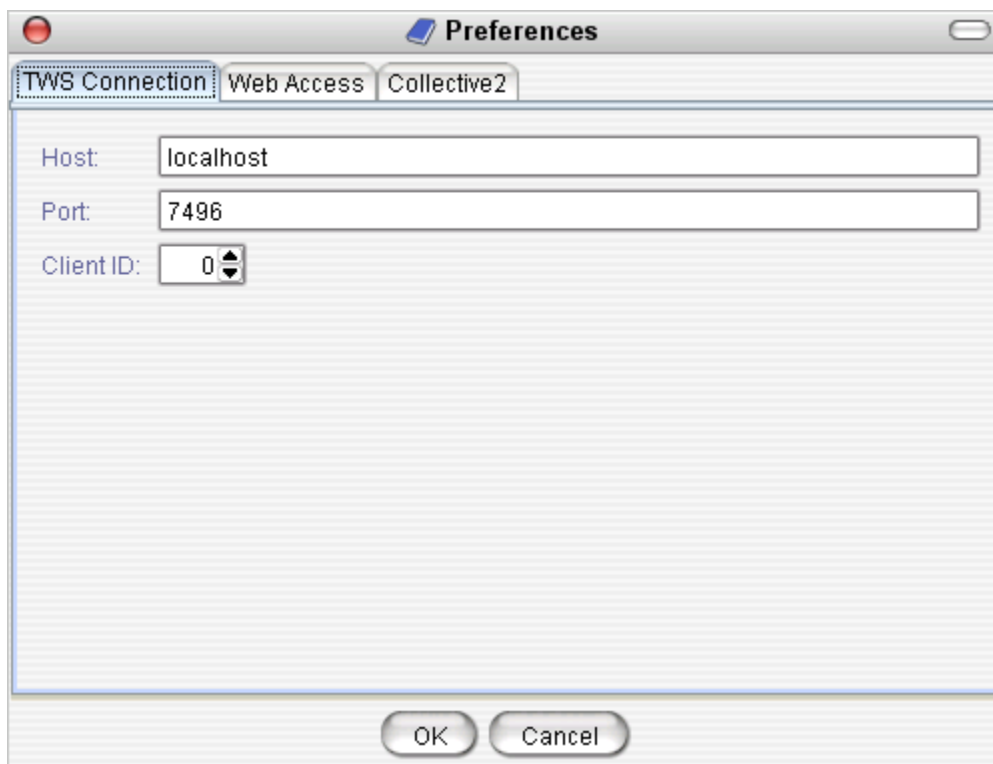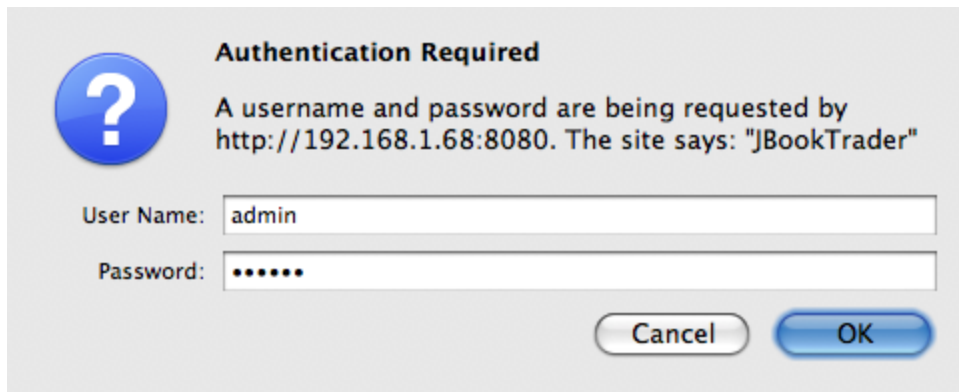

Web Access

It is also possible to monitor JBookTrader via a web interface. If enabled, JBookTrader's in-built web server will provide basic information about a running strategy.

The configuration settings as they appear in the Web Access tab:

To access the report from any web browser, connect to the IP address of the computer running JBookTrader and at the port configured in the Web Access preferences. For example, if your machine is at IP address 192.168.1.68 and you've configured the Web Access port to 8,080, then, from your web browser, access http://192.168.1.68:8080/ for your report. **Note that web access is only available when JBookTrader is running in either "trade" or "forward test" mode.**

To access your report, you'll be asked to reproduce the same credentials that were provided in the previous step.
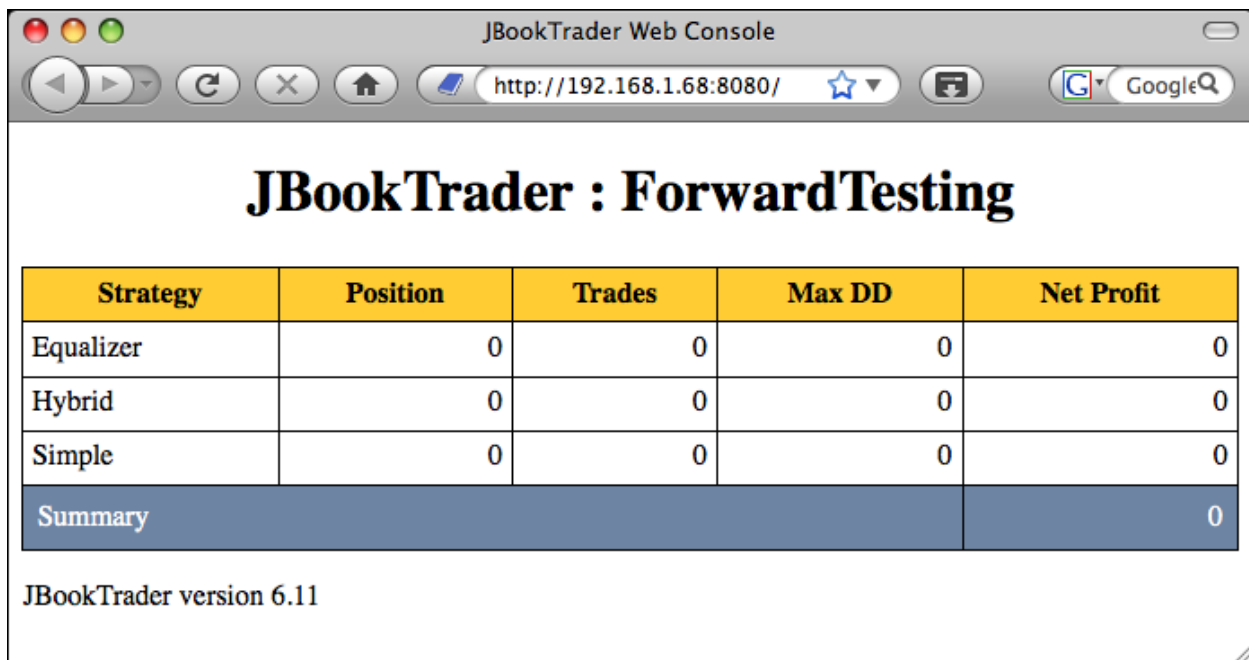
If the authentication challenge is successful, the report will be presented in the client web browser. Here is an example of this report:

JBookTrader : ForwardTesting

Strategy	Position	Trades	Max DD	Net Profit
Equalizer	0	0	0	0
Hybrid	0	0	0	0
Simple	0	0	0	0
Summary				0

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And, specifically for the iPhone/iPod Touch:

If you'd like to access the report via a web browser on the same machine, simply use http://localhost:[port number]/. If you'd like to monitor JBookTrader from any web browser anywhere on the Internet, you must ensure that your JBookTrader computer is accessible from the Internet with a known IP address or domain name. This is beyond the scope of this document.

Collective2

Collective2 is a service for publishing trades manually or automatically as trades are made. It acts as a real time trading system auditor. JBookTrader supports the Collective2 API and can publish your trades automatically as they are made. An account with Collective2 is required. See Collective2's website for more information.

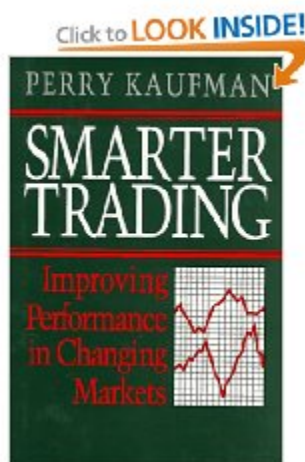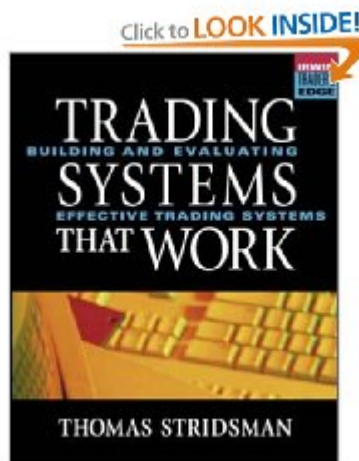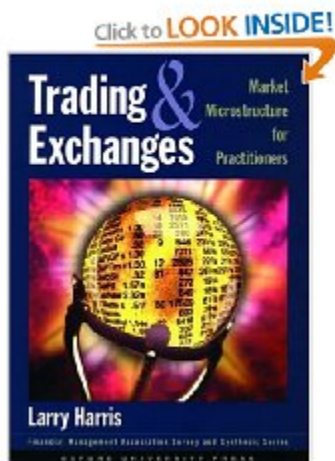This is the preference pane:
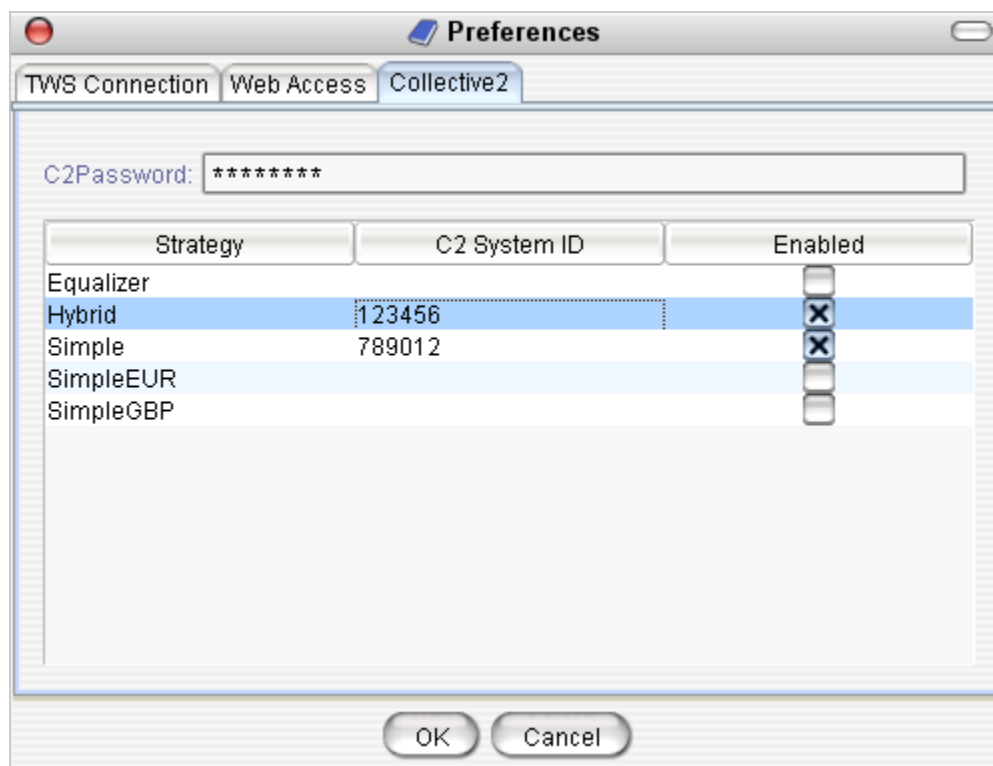
Once you have created an account and a system with Collective2, you must configure JBookTrader with your details. Your Collective2 password should be typed into the C2 Password field. Also, you should obtain your system ID from Collective2. This can usually be found in the URL following the parameter name 'systemid=' as you are configuring your system at Collective2.

Type your system ID into the C2 System ID field and check the enabled box for the strategy you wish to use with your Collective2 system. Once you press OK, you should restart JBookTrader to see that your changes have been accepted.

18. Adding your own trading strategy

to be completed

19. Literature

Click to **LOOK INSIDE!**

Trading & Exchanges
Market Microstructure for Practitioners
Larry Harris

Click to **LOOK INSIDE!**

TRADING SYSTEMS THAT WORK
BUILDING AND EVALUATING EFFECTIVE TRADING SYSTEMS
THOMAS STRIDSMAN

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PERRY KAUFMAN
SMARTER TRADING
Improving Performance in Changing Markets

link   link   link

could not figure out how to set up the images so that clicking on the image links to the corresponding book page on Amazon -Eugene Kononov 7/7/09 11:27 AM

to be completed

20. Technical Support

JBookTrader technical support is provided by the author and the users of this software in the [JBookTrader Discussion Group](#).

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