StrategyQuant
Computer-Generated Trading Strategies
Algo Trading - Create - Improve - Optimize

StrategyQuant

User's Guide

Version 3.6.1 *Last updated: 21.4.2014*

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Table of Contents

1 Introduction

1.1 What is StrategyQuant?

StrategyQuant is a program that automatically generates new unique trading strategies for forex, stocks or ETFs.

Using StrategyQuant, you can find profitable trading strategies for virtually any market, any timeframe and any chart type. No programming or trading knowledge is required.

The resulting strategies can be saved as a MetaTrader 4 Expert Advisor with complete source code.

With StrategyQuant you can:

- **Generate an unlimited number of unique trading strategies for virtually any market or timeframe**
- Save your strategies as a **MetaTrader Expert Advisor** or **Ninja Trader strategy** with full source code
- Eliminate the manual labor previously required when developing a trading strategy
- **Find new trading strategies** that are not only unique, but also non-obvious
- **Reduce the time required to build a strategy** from weeks and months to minutes!
- Improve your existing strategies
- Optimize your strategies and find the best parameters
- Test your strategies for robustness and analyze their performance

Is StrategyQuant Right for You?

If you trade using automatic trading system (called also robots or Expert Advisors) or you plan to develop your own trading strategies then **StrategyQuant can save you money and hundreds of hours of your time**.

Some traders prefer to purchase an existing trading robot; there is a multitude of offers especially for Forex.
While this can be an effective way, by purchasing someone's forex robot you are usually purchasing a black box - you don't know how it works, what are the exact rules and you are at mercy of its creator with potential adaptations to changed market conditions.

StrategyQuant allows you to **create your own trading strategies**, exportable to a plain Expert Advisor source code, so you have full control over your strategy.

What If You Are a Manual Trader?

You can still use for StrategyQuant to generate the trading ideas. You'll be surprised to find many profitable strategies based on relatively simple rules that you wouldn't think of.
Every strategy that is created by StrategyQuant can be exported to readable pseudo code with full description of the trading rules and can be traded also manually.

What to Expect

Please keep in mind that **StrategyQuant is a powerful tool, but it is not a magic box** that will start making you money with a click on a button. It has to be used in the right way to get the results.

Generating new strategies in StrategyQuant is only about 50% of the work.

The rest of the work has to go into evaluating the generated strategies to filter out the ones that are curve fitted or not robust enough.
It is up to you to evaluate your new strategies properly and know their strengths, weaknesses and limitations before you put them to live trading.

It can easily happen that from all the profitable strategies generated by StrategyQuant **only 1 out of 10 passes the evaluation** and we can consider using it for live trading.
But - the number of strategies we can generate is almost endless, so even 5-10% from infinity is a pretty big number :-)

There are few steps to evaluate the strategies quality and measure how good they will be in real live trading. Please read the **Evaluating Generated Strategies** section for more information.

1.2 System Requirements

StrategyQuant is not an EA, it is a normal program (EXE file) for Microsoft Windows and it will run on all standard computers **with Internet connection.**

Minimum system requirements:

- 1.2 GHz processor
- 512 MB RAM
- 500 MB hard disk space
- Windows XP, Vista, Windows 7 or Windows 8 operating system

Computing power
Strategy generation and backtesting requires a lot of processing power, so the faster computer you have, the more strategies will be generated and tested.

The most important component that affects the speed of testing is processor (CPU). StrategyQuant is able to use all processor cores,
so the best results will be achieved by using multi-core processor, such as i5 or i7.

1.3 Installation

StrategyQuant comes with standard setup wizard, you just download and run the installation EXE file and then follow the steps in the installation wizard.

Important !!!
Please DON'T install StrategyQuant to standard C:\Program Files directory !

It might not work correctly because Windows security settings don't allow the program to write to its data files.

Instead install it to any normal drive or directory on the disk, like C:\StrategyQuant
or C:\Trading\StrategyQuant

1.3.1 Post-Installation steps

there are few things you should do after installation depending on trading platform you use.

MetaTrader4
Some of the technical indicators used in StrategyQuant are not standard MT4 indicators and you need to add them to MT4. All these additional indicators are a part of the installation package, you can find them in **{StrategyQuant}/custom_indicators/mt4** folder.

Simply copy all the *.mq4 files from this folder to your MetaTrader installation to path:
{Your MetaTrader installation directory}/experts/indicators

If you use more than one MetaTrader installations, you have to repeat this step for every installed MetaTrader.

Important Note! If you updated to MT4 Build 600+ then the folders MetaTrader folders have changed. Indicators folder is NO LONGER in MetaTrader installation directory, you can instead get its location by opening MetaTrader, **File** -> **Open Data Folder**.

You should save the indicators to this folder:
C:\Users\[username]\AppData\Roaming\MetaQuotes\Terminal\[unique_string_id]\MQL4\Indicators

----

NinjaTrader
In order to make SQ strategies work withNinjaTrader, you have to import some NinjaTrader scripts into your NinjaTrader.

Open your NinjaTrader, go to File -> Utilities -> Import Ninja Script...
then find the file:
{StrategyQuant}/custom_indicators/SQ_NinjaTrader.zip and import it.

This will import all the additional indicators and base classes StrategyQuant uses, so your new strategies will run in NinjaTrader.

1.4 Backtesting engines - NinjaTrader & MetaTrader4

StrategyQuant can export trading strategies to multiple trading platforms:

- **MetaTrader4** - forex, CFDs
- **NinjaTrader** - futures, stocks, forex

There are some differences between these platforms in how each platform handles trades, opens and closes positions, manages the open trades, etc.

StrategyQuant allows you to switch the **backtesting engine** between MetaTrader4/NinjaTrader so that internal testing engine knows how to treat the trades in a way that matches the selected platform.

Each trading platform and backtesting engine also allows you to configure some settings that are specific for a given platform.

Why one strategy can have different results in different backtesting engine

As mentioned earlier, **there are differences in how each platform handles trades** and how its backtesting and trading engine works internally.

For this reason, strategy might have different results when you test it with another backtesting engine.

Another reason is Data handling differences between MetaTrader and NinjaTrader.

Note

Please make sure you test your strategy by trading it on paper account before putting it to real money.

Data handling differences between MetaTrader and NinjaTrader

Difference in data

There is difference how candles (bars) are computed and drawn in each platform, for example:

- in MetaTrader4, 15 minute candle with time 13:15 means candle that **started** at at 13:15:00, and it contains data from 13:15:00 to 13:29:59
- in NinjaTrader, 15 minute candle with time 13:15 means candle that **ended** at 13:15, so it contains data from 13:00:01 to 13:15:00

Moreover, unlike forex, futures and stocks don't trade 24/7. They trade on exchanges with given trading hours, so trading sessions come into play when you work for example with futures data.

Because of this, it is now necessary to choose the type of data when you are importing it to StrategyQuant and it is recommended to use only the data for given platform during strategy generation.

Also, for this reason there is a difference how each data is handled by StrategyQuant to match each platform. As a result, StrategyQuant can automatically compute higher timeframes from minute data for forex, but it cannot do it for NinjaTrader data (because trading sessions would have to be considered).

To simplify work with trading sessions, you have to import directly the target timeframe to StrategyQuant.

2 How does it work?

StrategyQuant is a program, it doesn't have the brain or experience of a trader, and it doesn’t know how to create a profitable strategy.
What it does is that it randomly combines available building blocks (indicators, prices, etc.) to create new trading rules. The resulting strategy is then tested on a history data to see if it is profitable.

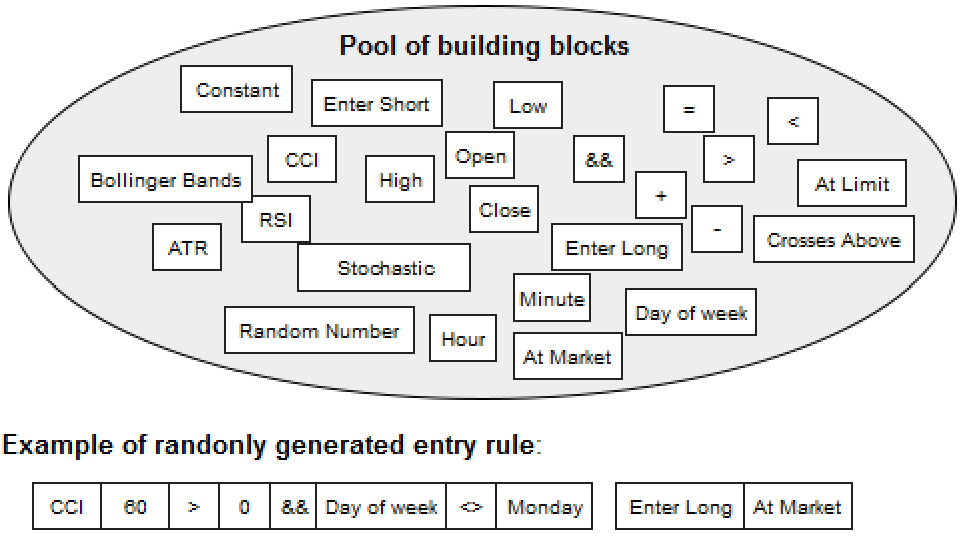
Random generation is the foundation of StrategyQuant. Strategies generated this way can be further improved (evolved) using **Genetic evolution**.

2.1 Random generation of trading strategies

A trading strategy in the initial population is constructed using a combination of price patterns, technical indicators, order types, and other parts to form the entry and exit rules.

StrategyQuant can use all standard technical indicators and oscillators (like CCI, RSI, Stochastic, etc.), time values (like time of day, day of week) and price patterns. These building blocks are then combined using logical and equality operators (and, or, >, <, etc.) to form an entry or exit rule.
In addition, it supports different entry and exit order types (market order, limit order, fixed profit target, exit after X bars, etc.).

With all the possible combinations of rules and orders, StrategyQuant is capable of generating literally trillions of different possible trading strategies.



if (CCI(60) > 0 && Day of week <> Monday) then Enter Long At Market

The building process itself is completely random - builder randomly picks different building blocks from the available pool and combines them to create entry rule, order type and exit rule.
There are some validity constraints that ensure that, for example price is not compared to time value, etc.
The result is a completely new random trading strategy. Of course, not every randomly created

strategy is profitable, but StrategyQuant can produce and test thousands of new strategies per hour, and there are many profitable ones in this amount.

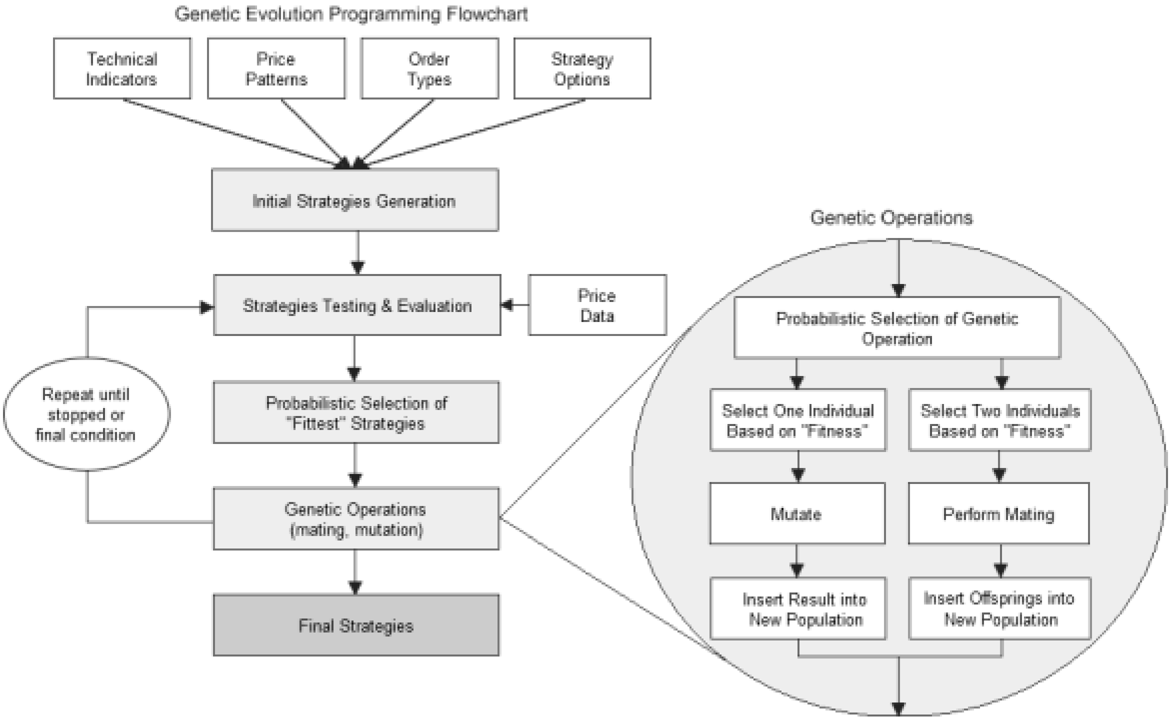
2.2 Genetic Evolution

Genetic Evolution takes the process of finding suitable trading strategies even further.
In this mode StrategyQuant first creates a number of random strategies, which are used as the initial population in the evolution.

This initial generation of strategies is then "evolved" over successive generations using genetic programming technology.

This process imitates the evolution - the algorithm chooses the fittest strategies (using selected performance criteria) in every generation, and the group of fittest candidates is then used to produce new generation of trading strategies.

As in evolution, this should result in better and better candidates, in our case in strategies that are more profitable, more stable, or generally better in the selected performance criteria.


Genetic Evolution Programming Flowchart
Technical Indicators
Price Patterns
Order Types
Strategy Options
Initial Strategies Generation
Strategies Testing & Evaluation
Price Data
Repeat until stopped or final condition
Probabilistic Selection of "Fittest" Strategies
Genetic Operations (mating, mutation)
Final Strategies
Genetic Operations
Probabilistic Selection of Genetic Operation
Select One Individual Based on "Fitness"
Select Two Individuals Based on "Fitness"
Mutate
Perform Mating
Insert Result into New Population
Insert Offsprings into New Population

2.3 Example strategy code

Below if an example pseudo code of a strategy generated by StrategyQuant. You can see that strategy consists of entry orders, exit orders and trade management commands – such as trailing stop movements, etc.

Every strategy generated by the program can be viewed in this pseudo code or exported in the form of MetaTrader Expert Advisor (EA) or NinjaTrader NinjaScript C# strategy.

```
====================================================================
== Entry conditions
====================================================================
LongEntryCondition = (Stoch(40, 1, 3) < 50)
ShortEntryCondition = (Stoch(40, 1, 3) > 50)

====================================================================
== Entry orders
====================================================================
-- Long entry
if LongEntryCondition is true {
  if No position is open then Buy at Ichimoku(6, 18, 38, Kijun-sen) + (0.4 * ATR(86)) Limit;
  Stop/Limit order expires after 34 bars.

  Stop Loss = 190 pips;
  Profit Target = (0.74 * ATR(87)) pips;

  // Move SL to BE (on close)
  Move Stop Loss to Entry price when in profit at least (77 * ATR(12)) pips;

  // Profit trailing (on close)
  Profit Trailing by 222 pips;

  // Stop trailing (on close)
  Move Stop to (Close(1) + (0.5) * BBWidthRatio(20, 2.0))) on bar close;
}

-- Short entry
if ShortEntryCondition is true {
  if No position is open then Sell at Ichimoku(6, 18, 38, Kijun-sen) + (-0.4 * ATR(86)) Limit;
  Stop/Limit order expires after 34 bars.

  Stop Loss = 190 pips;
  Profit Target = (0.74 * ATR(87)) pips;
}

====================================================================
== Exit orders
```

```
=================================================================
-- Long exit
if MarketPosition is Long {
  if (Bars Since Entry >= 33) {
    Close position at market;
  }
}
```

2.4 3 data parts approach

Since version 3.5 it is possible to use 3 data parts approach when using genetic evolution for strategy generation.

Traditionally, only **In Sample + Out of sample** (2 data parts) were used in evolution. Strategies were evolved only on In Sample data, and tested on Out of Sample data.

With 3 data parts approach we can divide In Sample data to additional two parts, so we'll get three parts:

In Sample Training (IS Training)
this part is used for evolution of the strategies. Strategy fitness is measured on tis data part and the strategies with best fitness are chosen to produce the next generation.

In Sample Validation (IS Validation)
this part is used to compare performance with Training part. Strategy fitness is measured on this part too and you can restart the evolution once the fitness or performance starts to stagnate on Validation data, or if strategy performance (Net Profit, Profit factor, etc.) on Validation data doesn't match the performance on Training data.

Out of Sample (OOS)
third part of data is used to verify the strategy on unknown data. Because we use IS Validation to influence evolution, so it is no longer an "unknown" part of data, we should test the strategy on new, unknown (OOS) part of data to verify its performance independently.

What is the advantage of 3 parts approach

traditionally only two parts (In Sample, Out of Sample) were used for genetic evolution of trading strategies.
Dividing data to three parts allows us to control the evolution better. By comparing performance on Training vs. Validation part we can decide to restart the evolution to avoid wasting time on evolution going nowhere.
Scientific papers suggest that using 3 data parts approach can bring better results faster.

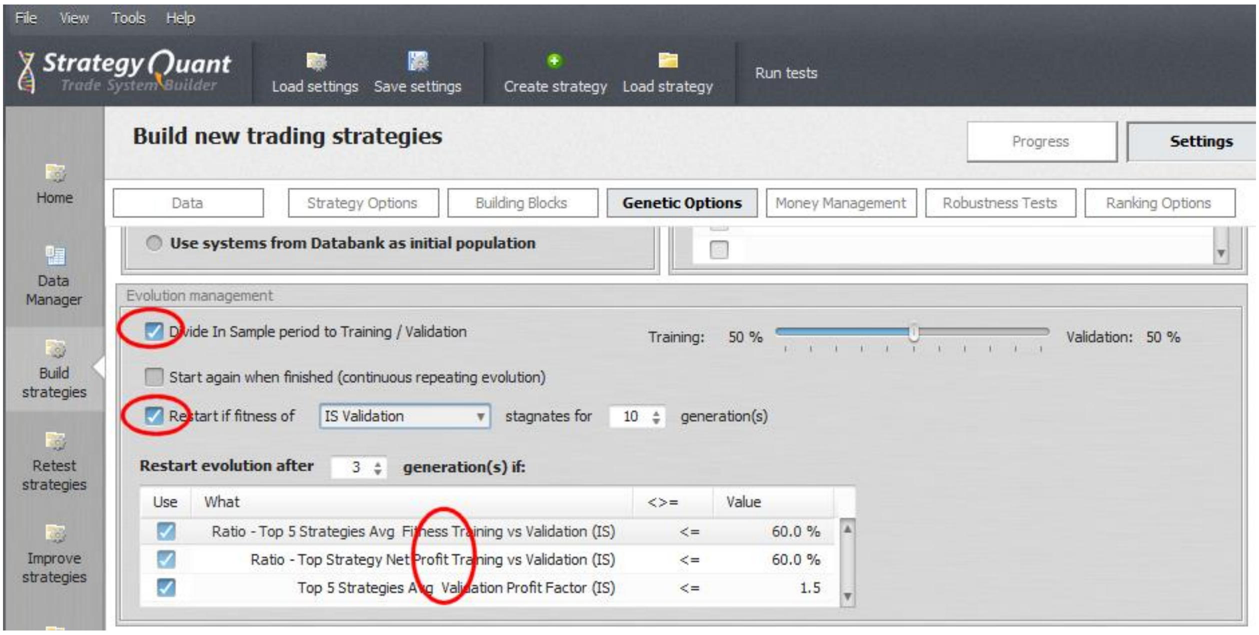
How to use 3 parts approach

You can use 3 parts approach only for Genetic evolution mode. In Random generation there is no evolution to manage, so it wouldn't make sense there.

All the settings are in **Genetic options** tab, in **Evolution management** section. Here you can set that you want to use 3 part approach by checking "Divide In Sample period to Training / Validation".
A good rule is to divide In Sample art to 50%. So if your Out of Sample period is about 30% of the data and you divide In Sample part to half then all three parts will be around 1/3 of the whole data available.

For example:
Let's say whole data is 900 days.
Out of Sample part is around 1/3 of this, which is 300 days. In Sample part if the rest : 600 days.
When we divide In Sample to half between Training / Validation, IS Training will be 50% of the whole In Sample data (50% of 600 days) which is 300 days, and the same applies for IS Validation part.

So as a result IS Training will be 1/3 (300 days), IS Validation will be 1/3 (300 days) and Out of Sample will be 1/3 (300 days).



Build new trading strategies

○ Use systems from Databank as initial population

Evolution management

☑ Divide In Sample period to Training / Validation   Training: 50 %   Validation: 50 %

□ Start again when finished (continuous repeating evolution)

☑ Restart if fitness of IS Validation stagnates for 10 generation(s)

Restart evolution after 3 generation(s) if:

Use	What	<>=	Value
☑	Ratio - Top 5 Strategies Avg Fitness Training vs Validation (IS)	<=	60.0 %
☑	Ratio - Top Strategy Net Profit Training vs Validation (IS)	<=	60.0 %
☑	Top 5 Strategies Avg Validation Profit Factor (IS)	<=	1.5

Dividing the In Sample period to Training / Validation is the first step, now we should also use it to manage the evolution.

The simplest setting is to **Restart the evolution if fitness stagnates for X generations on IS Validation part**
- if this stagnation happens it means that evolution possibly reached the end of improvements and further evolution would not create better strategies, so we should restart it.

Use special custom conditions for evolution management
These are special conditions that you can use to compare performance **Ratios** or exact **performance**

of top strategy / top 5 strategies between Training and Validation part. Keep in mind that you are comparing top strategy or average of top 5 strategies found so far in evolution.

Ratios

All ratios are in percent, so for example:

Ratio - Top StrategyNet Profit Training vs Validation is the percentage ratio of Net Profit of the best strategy on Training data vs Validation data.
For example if top strategy made $5000 on Training part and $3000 on Validation part then this ratio will be 60%, because strategy made only 60% of Net Profit in validation part versus Training part.
If ratio between Training / Validation is too small, it is also a good sign that the evolution reached dead end and we should restart it.

Exact performance

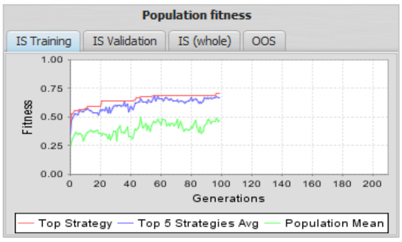
in addition to ratios you can choose to restart the evolution also by checking the performance results of the top strategy / top 5 strategies on validation data. For example:

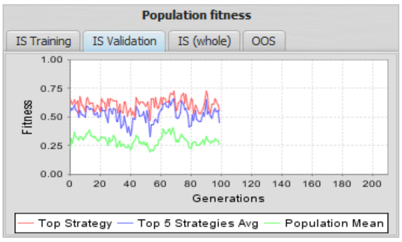
Top 5 Strategies Avg Validation Profit Factor returns top 5 strategies average Profit Factor on validation part (not a ratio between training / validation). For example, we can restart the evolution if top 5 strategies average Profit Factor on validation data is smaller than 1.5.

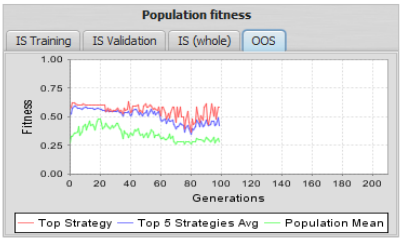
Viewing the three parts performance

You can watch the fitness chart in real time in Population fitness in Progress panel. There are now 4 different tabs for each part of the data.

The charts below is in example evolution run for 100 generations without any restarting. You can see that in this example even if strategy performance (fitness) is improving for IS Training part, it is stagnating in IS Validation part or even getting worse in OOS part.

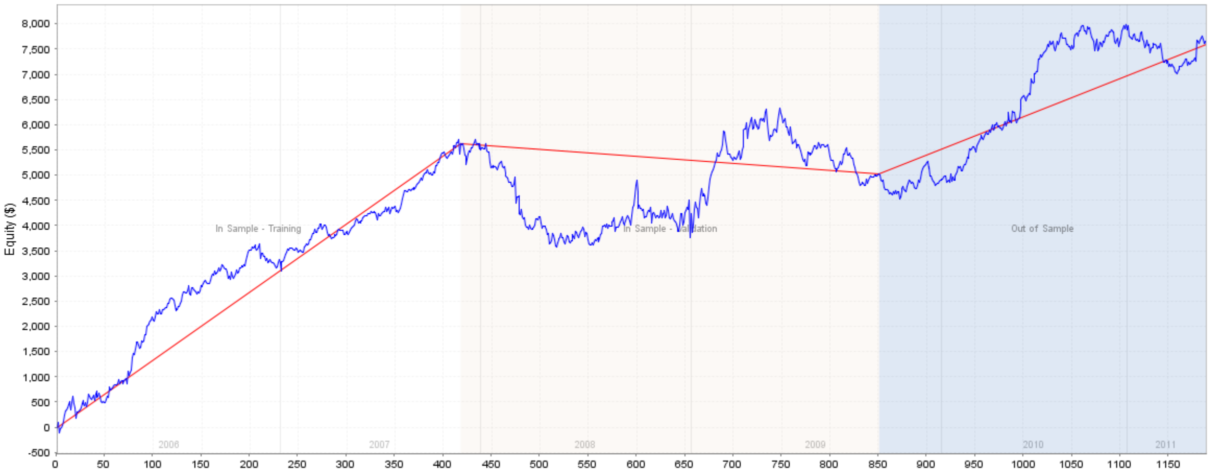




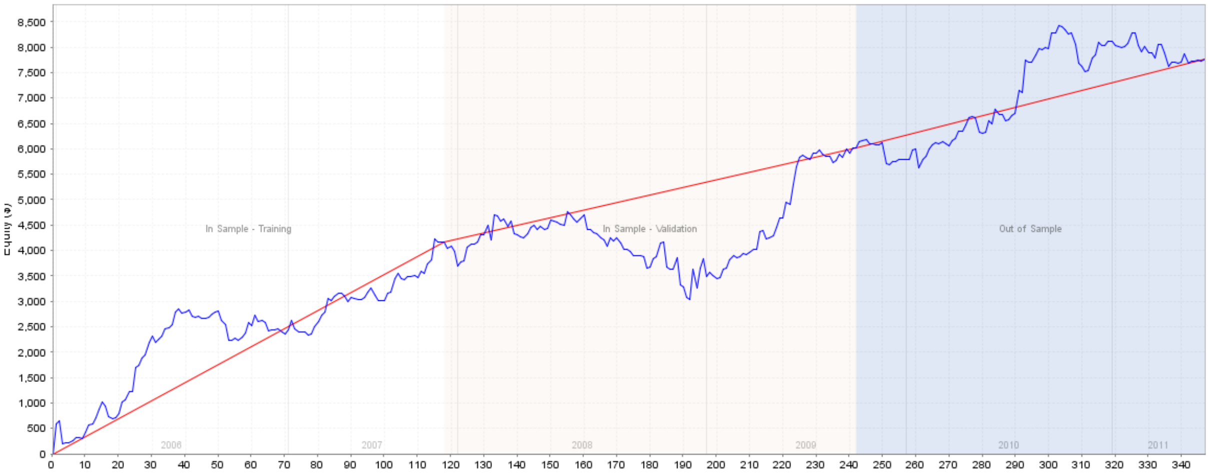


So the evolution could have been restarted somewhere around 20-30 generation, because since then there was no improvement on unknown parts of data.

If you'll choose some strategy from databank and look at its equity chart you can see how it is divided to three parts and the performance in each of them. In this example the strategy performs negatively in the IS Validation part.

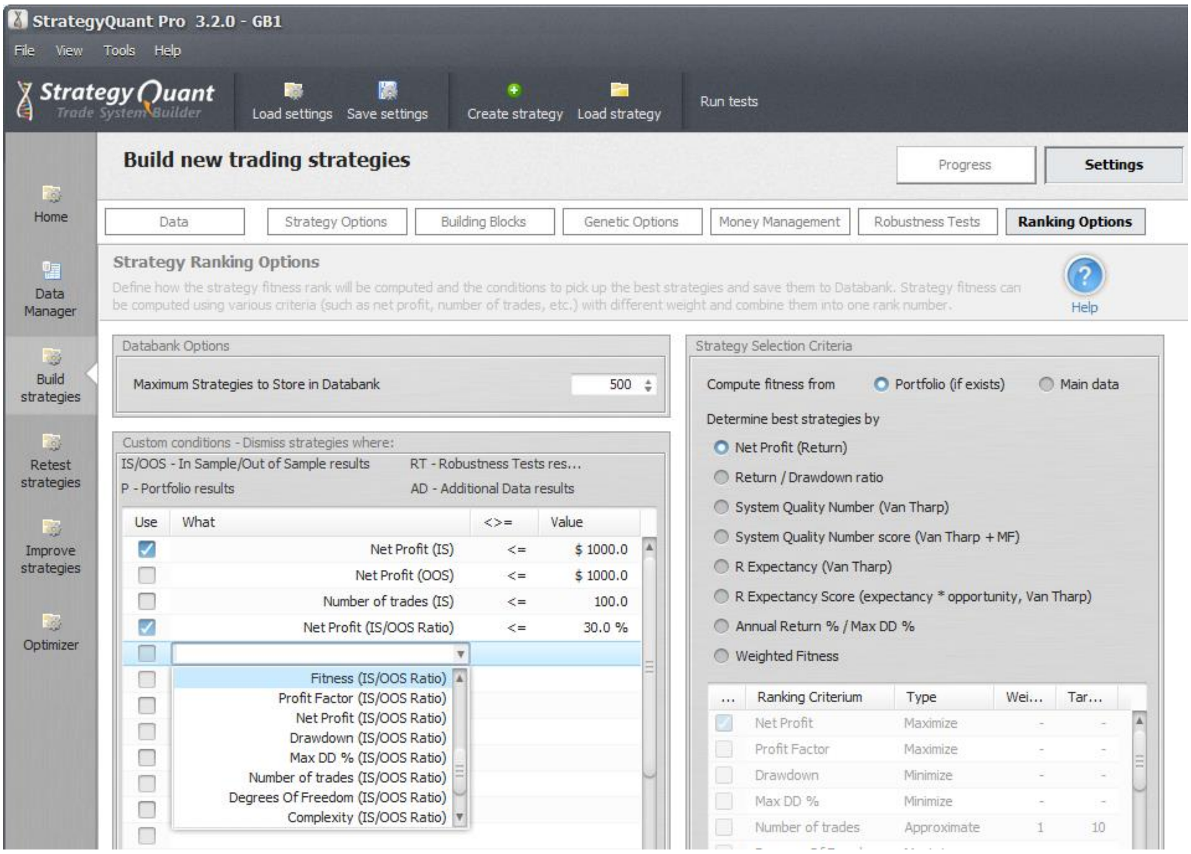


Better strategy should look more like the example below, where all three parts have roughly the same performance (visible by red line). This strategy is still not perfect (too big drawdowns), it is just an example.



New custom conditions for databank

The settings in Genetic options tab described above are used to manage the evolution. In addition to this, there is a new group of **Ratio-based** custom conditions in **Ranking** -> **Custom conditions**, which we can use to control which strategies will get to the databank and which will be dismissed.
These new custom conditions are technically not related to 3 parts approach, but they are inspired by this idea and allow to measure performance ratio of given characteristics between In Sample and Out of Sample results.



Build new trading strategies

Strategy Ranking Options

Define how the strategy fitness rank will be computed and the conditions to pick up the best strategies and save them to Databank. Strategy fitness can be computed using various criteria (such as net profit, number of trades, etc.) with different weight and combine them into one rank number.

Databank Options

Maximum Strategies to Store in Databank: 500

Custom conditions - Dismiss strategies where:

IS/OOS - In Sample/Out of Sample results RT - Robustness Tests res...
P - Portfolio results AD - Additional Data results

Use	What	<>=	Value
☑	Net Profit (IS)	<=	$ 1000.0
□	Net Profit (OOS)	<=	$ 1000.0
□	Number of trades (IS)	<=	100.0
☑	Net Profit (IS/OOS Ratio)	<=	30.0 %
□			

Fitness (IS/OOS Ratio)
Profit Factor (IS/OOS Ratio)
Net Profit (IS/OOS Ratio)
Drawdown (IS/OOS Ratio)
Max DD % (IS/OOS Ratio)
Number of trades (IS/OOS Ratio)
Degrees Of Freedom (IS/OOS Ratio)
Complexity (IS/OOS Ratio)

Strategy Selection Criteria

Compute fitness from ● Portfolio (if exists) ○ Main data

Determine best strategies by
● Net Profit (Return)
○ Return / Drawdown ratio
○ System Quality Number (Van Tharp)
○ System Quality Number score (Van Tharp + MF)
○ R Expectancy (Van Tharp)
○ R Expectancy Score (expectancy * opportunity, Van Tharp)
○ Annual Return % / Max DD %
○ Weighted Fitness

...	Ranking Criterium	Type	Wei...	Tar...
☑	Net Profit	Maximize	-	-
□	Profit Factor	Maximize	-	-
□	Drawdown	Minimize	-	-
□	Max DD %	Minimize	-	-
□	Number of trades	Approximate	1	10

All ratios are in %, so as in previous example:

If strategy makes $6000 on whole In Sample period, and $4000 on Out of sample period, then its Net Profit (IS/OOS Ratio) will be 66.6% (because $4000 is 66.6% from $6000).

These new custom conditions can be used to filter out strategies that perform much worse on Out of Sample data part than on In Sample.

2.5 Range / Renko bars support

Support for Range/Renko bars is the newest addition to StrategyQuant features. Now you can use StrategyQuant to generate strategies that will be trading on these non-standard charts.

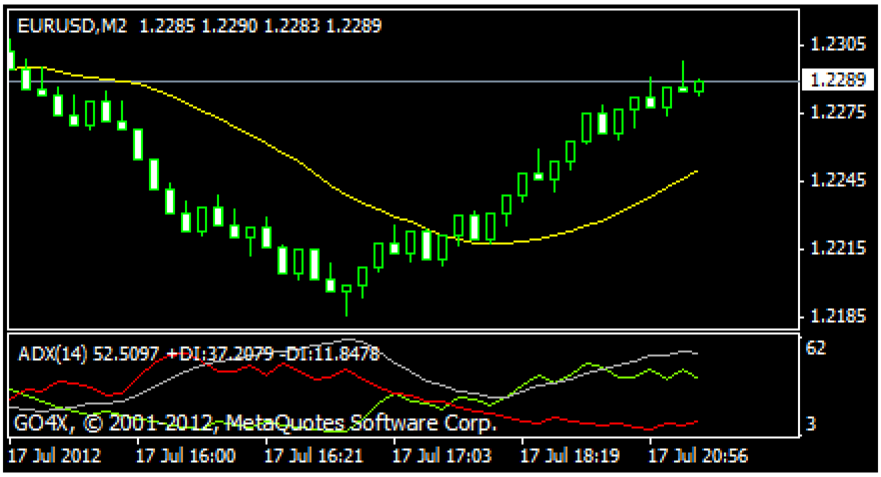
Support for Range/Renko in trading platforms:

NinjaTrader platform has build-in support for these chart types, so the only thing you need to do to use these charts in SQ is to export the chart data (see more information about this in next chapters).

MetaTrader4 platform doesn’t natively support Range or Renko charts, in order to display and use them you need third-party plugin.
Very affordable provider of Range/Renko plugins for MT4 that we tested and can recommend is AZ-INVEST.EU

What are Range and Renko charts?

They are alternative charts that don't display data in blocks grouped by time (5 minutes, 15 minutes, 1 hour) but by other criterion. For Range bar, one candle on the chart represents given range, for example 10 pips. So every time market moves by another 10 pips a new candle is drawn.



Example of range chart

For more information on Range or Renko charts please check google or AZ-INVEST.EU website.

How do Range/Renko charts work in StrategyQuant?

It works as same as with standard timeframe data – you have to import the range or renko chart data just like any other history data, and run the strategies generation as usual.

Limitations of using range / Renko data in StrategyQuant:

1. Only the "Selected Timeframe" precision is available for these types of charts, so you won't be able to test them using tick precision

2. You should generate data for Range / Renko charts using fixed spreads. StrategyQuant is not able to test the strategies using variable spreads on these charts.

2.6 Supported building blocks

StrategyQuant currently supports the following components to build entry and exit rules:

Indicators

Simple Moving Average
Exponential Moving Average
Weighted Moving Average
Commodity Channel Index (CCI)
Relative Strength Index (RSI)
Stochastic
MACD
Bollinger Bands
Qualitative Quantitative Estimation (QQE)
Triple Exponential Moving Average
Custom Indicators ***

Average Directional Movement Index (ADX)
Average True Range (ATR)
Momentum
Williams % Range
True Range
Price Difference
Highest, Lowest
Keltner Channel
Parabolic SAR
Ichimoku

Price Values

Open
High
Open Daily
High Daily
Heiken Ashi Open
Heiken Ashi High
Today Open
Pivots

Low
Close
Low Daily
Close Daily
Heiken Ashi Low
Heiken Ashi Close
This Bar Open

Candle Patterns

Doji
Hammer
Bullish Engulfing

Shooting Star
Dark Cloud Cover
Piercing Line
Bearish Engulfing

Operators

Greater
Lower
Crosses Above
Crosses Below
And
Or
Closes Below
Addition (+)
Subtraction (-)
Multiplication (*)
Equals
Not Equals
Closes Above

Time Values

Hour
Minute
Day of Week

Order Types

Enter at Market
Enter/Reverse at Market
Enter at Stop
Enter at Limit

Exit Types

Stop Loss
Exit After X Bars
Exit Rule (Price + Operators + Indicators, ...)
Profit Target
Move Stop Loss to Break-even
Stop Trailing
Profit Trailing

We will be continually adding new technical indicators and other features to the Builder.
If you have your favorite indicator you'd like to see in StrategyQuant, just let us know.

An explanation: What is the difference between Closes Above and Crosses Above?

Closes above operator works only for Close price vs an indicator and is true if price opens below given indicator and closes above it.

Crosses above operator works for any indicator versus Indicator and it checks that Indicator1 was below Indicator2 on previous candle, and now crossed above Indicator2 on current candle.

2.7 Custom Indicators

Since version 2.0 the program offers almost infinite flexibility of building blocks with custom indicators. In contrast with build-in indicators, StrategyQuant doesn't know how to compute custom indicators; they are defined by their data. This will enable you to use virtually any of your favorite indicators in StrategyQuant.
There are no real limits – you can use multi-timeframe or multi-symbol indicators, generally every indicator that works in MetaTrader can be used in StrategyQuant.

The way it works is that you have to export the values of the indicator computed on a specific symbol and timeframe to a file, and then import this file as a custom indicator to the Builder.
This way you'll create new custom indicator (with values computed in another program, such as MT4) for this specific symbol and timeframe also in SQ.

Remember, every custom indicator is defined for a specific combination of symbol and timeframe (on which it was computed).
To use the same indicator on another symbol or timeframe, you have to recomputed its data in MT4, export it and create a new custom indicator for this symbol/timeframe combination.

You can find more information about custom indicators in these topics:

Manage Custom indicators

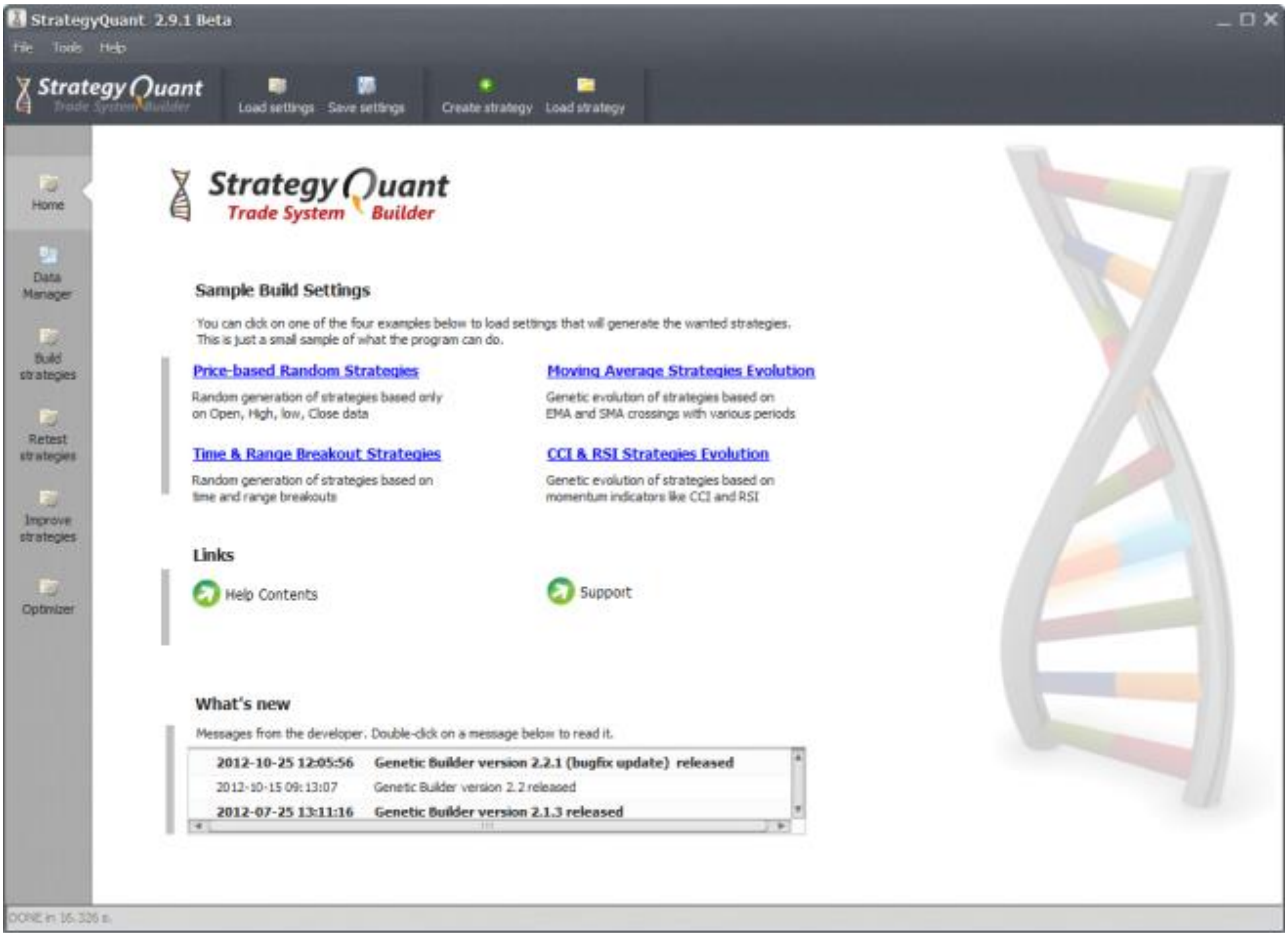
How to ... Import new custom indicator

3 Quick start with the program

3.1 Main concepts

3.1.1 Layout

When you'll first start the program you'll see the main screen as in the picture below.



Sample Build Settings

You can click on one of the four examples below to load settings that will generate the wanted strategies. This is just a small sample of what the program can do.

Price-based Random Strategies

Random generation of strategies based only on Open, High, low, Close data

Moving Average Strategies Evolution

Genetic evolution of strategies based on EMA and SMA crossings with various periods

Time & Range Breakout Strategies

Random generation of strategies based on time and range breakouts

CCI & RSI Strategies Evolution

Genetic evolution of strategies based on momentum indicators like CCI and RSI

Links

What's new

Messages from the developer. Double-click on a message below to read it.

2012-10-25 12:05:56	**Genetic Builder version 2.2.1 (bugfix update) released**
2012-10-15 09:13:07	Genetic Builder version 2.2 released
2012-07-25 13:11:16	**Genetic Builder version 2.1.3 released**

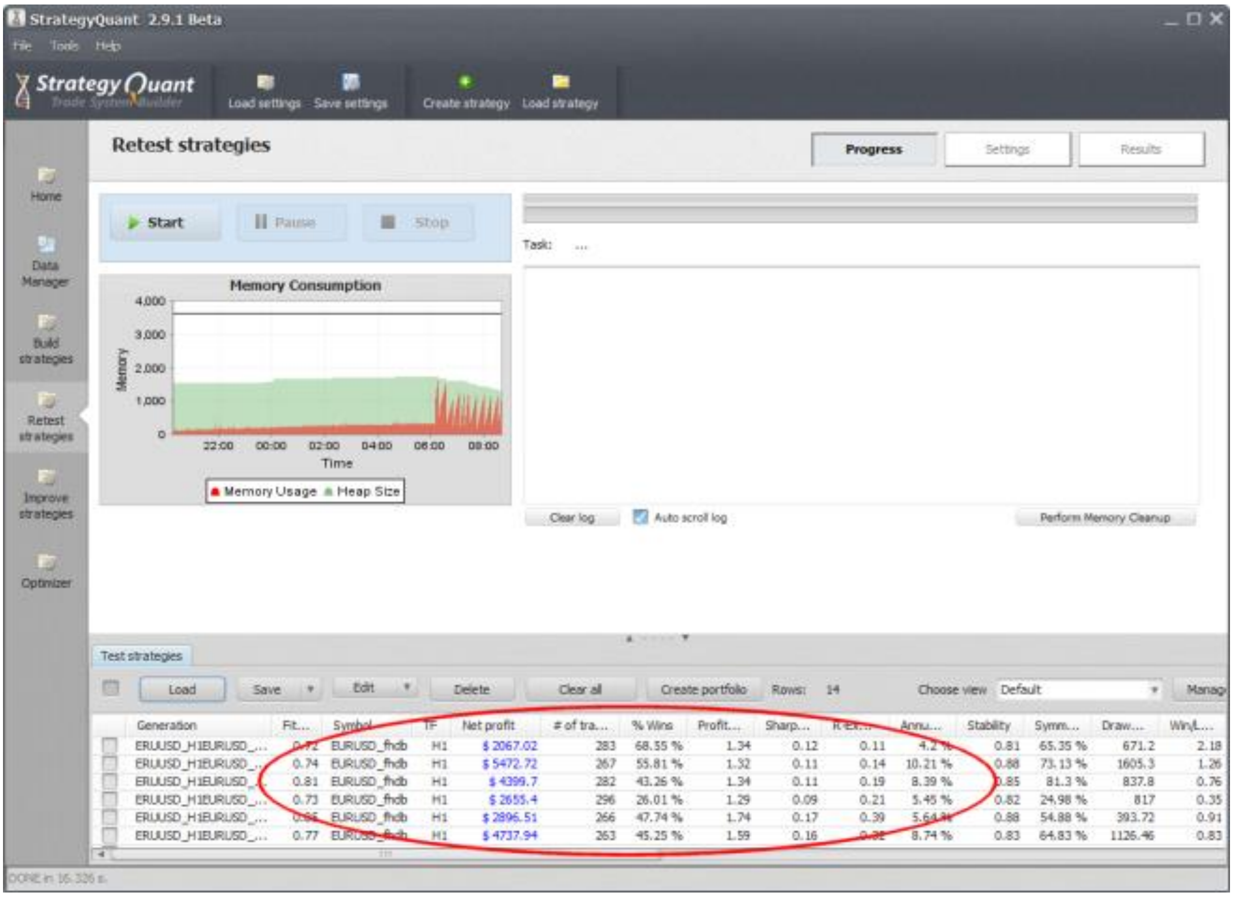
The program functionality is divided into tabs on the left side.

These tabs are:

- **Home** - starting screen of the program, it contains the sample settings, news and helpful links
- Data manager
- Build strategies
- Retest strategies
- Improve strategies
- Optimizer

3.1.2 Databanks

Databank is the most important concept you should understand when using StrategyQuant. Doesn't matter which mode you use, the best resulting strategies are always stored in the Databank.



	Generation	Fit...	Symbol	TF	Net profit	# of tra...	% Wins	Profit...	Sharp...	R Ex...	Annu...	Stability	Symm...	Draw...	Win/L...
□	ERUUSD_H1EURUSD_...	0.72	EURUSD_fhdb	H1	$ 2067.02	283	68.55 %	1.34	0.12	0.11	4.2 %	0.81	65.35 %	671.2	2.18
□	ERUUSD_H1EURUSD_...	0.74	EURUSD_fhdb	H1	$ 5472.72	267	55.81 %	1.32	0.11	0.14	10.21 %	0.88	73.13 %	1605.3	1.26
□	ERUUSD_H1EURUSD_...	0.81	EURUSD_fhdb	H1	$ 4399.7	282	43.26 %	1.34	0.11	0.19	8.39 %	0.85	81.3 %	837.8	0.76
□	ERUUSD_H1EURUSD_...	0.73	EURUSD_fhdb	H1	$ 2655.4	296	26.01 %	1.29	0.09	0.21	5.45 %	0.82	24.98 %	817	0.35
□	ERUUSD_H1EURUSD_...	0.86	EURUSD_fhdb	H1	$ 2896.51	266	47.74 %	1.74	0.17	0.39	5.64 %	0.88	54.88 %	393.72	0.91
□	ERUUSD_H1EURUSD_...	0.77	EURUSD_fhdb	H1	$ 4737.94	263	45.25 %	1.59	0.16	0.32	8.74 %	0.83	64.83 %	1126.46	0.83

There you can sort the strategies by its properties, load and save them, and when you double click on a row, it will open the strategy test details in the results window above.

You can configure how many top strategies (10, 100 or 500) will be stored in Databank, what comparison criterion to use and which strategies to dismiss automatically (for example those with negative P/L).

3.1.3 Working with files

Strategies in StrategyQuant are saved in their own proprietary file format (with .str extension) that can be opened only by StrategyQuant.
If you find potentially good strategies you should always save them so that you can work with them later.

Running strategies in MetaTrader
MetaTrader cannot read the strategy .str files. If you want to test or run your new strategies in MetaTrader you have to export the strategy to MQL source code.
Please check the section How To ... Export strategy from StrategyQuant and test it in MetaTrader.

Please note that exported (.MQ4) files are not readable by StrategyQuant, so make sure you always save your strategy also as a normal strategy file (*.str).*

3.2 Flow of work

Please check the Articles section on our website for the most up-to-date tips on how to use the program:

http://www.strategyquant.com/articles/

The general flow of work when generating new strategies can be described as follows:

1. Configure data for backtest

You can use the history data that come with the program or optionally import your own data in MetaTrader format. Then set up the time range and timeframe you want to use.
If you'll use genetic evolution mode you should divide the data to In Sample and Out of Sample periods.

You can also use additional data or Robustness tests to automatically test the strategy robustness.

2. Configure settings

Go through all the settings and configure strategy type, indicators and order types to be used for trading rules. Optionally use time constraints to limit trading to a certain time range.

3. Configure Ranking options

Ranking options allow you to select Strategy Selection Criteria - which is how the best strategies are determined.
You should also set up Custom Conditions to filter only strategies that pass certain criteria.
It makes sense to dismiss all the strategies that have too little profit or trades, or too small Profit Factor, Return/DD ratio or System Quality Number.

4. Run Build

Start the building process. Depending on your settings you can let it run several minutes, several hours or even several days. The more time it will run the more potential strategies it will test.
The best of them will be stored into the databank.

5. Evaluate generated strategies

Go through the generated strategies and evaluate them. You can either evaluate them visually by checking their equity chart, or by sorting them by their parameters in the Databank.
Choose the best ones to pass to the next step and save them to StrategyQuant project file (.sqn) so that you can work with them later.

Evaluation can consist also of Retesting the strategies on additional symbols and/or timeframes, or with different spread and slippage and comparing the results.
You should also run Robustness Tests.

The goal of strategy evaluation is to find strategies that are robust - that means they work in different conditions
and don't break up when there is a small change in parameters or in price data or they miss few trades.

Optional additional steps are:

6. Improve the strategy

You can try to improve the strategy in Improver. You can try to apply different combinations of exit rules or additional conditions to entry rules in search for better performance.

After the improvement you should again run the new strategy variation through robustness tests to make sure it didn't lose its robustness.

6. Optimize the strategy

You can run simple optimization to find better combination of input parameters of your strategy. You can also run Walk-Forward optimization to find out if the strategy would benefit from periodical reoptimization.
As the last step, you can run Walk-Forward Matrix analysis to determine the best reoptimization period.

There are articles on our website that describe more detailed flow of work:

http://www.strategyquant.com/articles/getting%20started%20with%20StrategyQuant

http://www.strategyquant.com/articles/strategy%20building%20process

4 Program modes

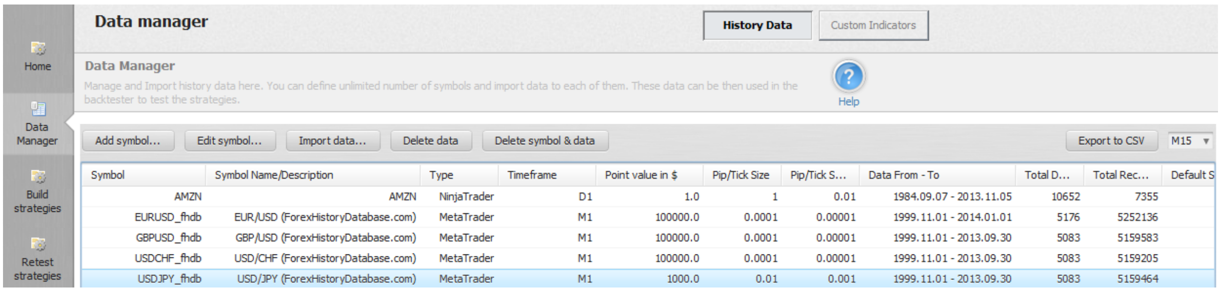
The program is divided into four independent (+ data manager) sections:

4.1 Data Manager

a place where you can manage history data and custom indicators used in the program.

4.1.1 History Data

This screen is where you can manage (create, import, modify) the history data that are used for backtesting.



Data Manager

Manage and Import history data here. You can define unlimited number of symbols and import data to each of them. These data can be then used in the backtester to test the strategies.

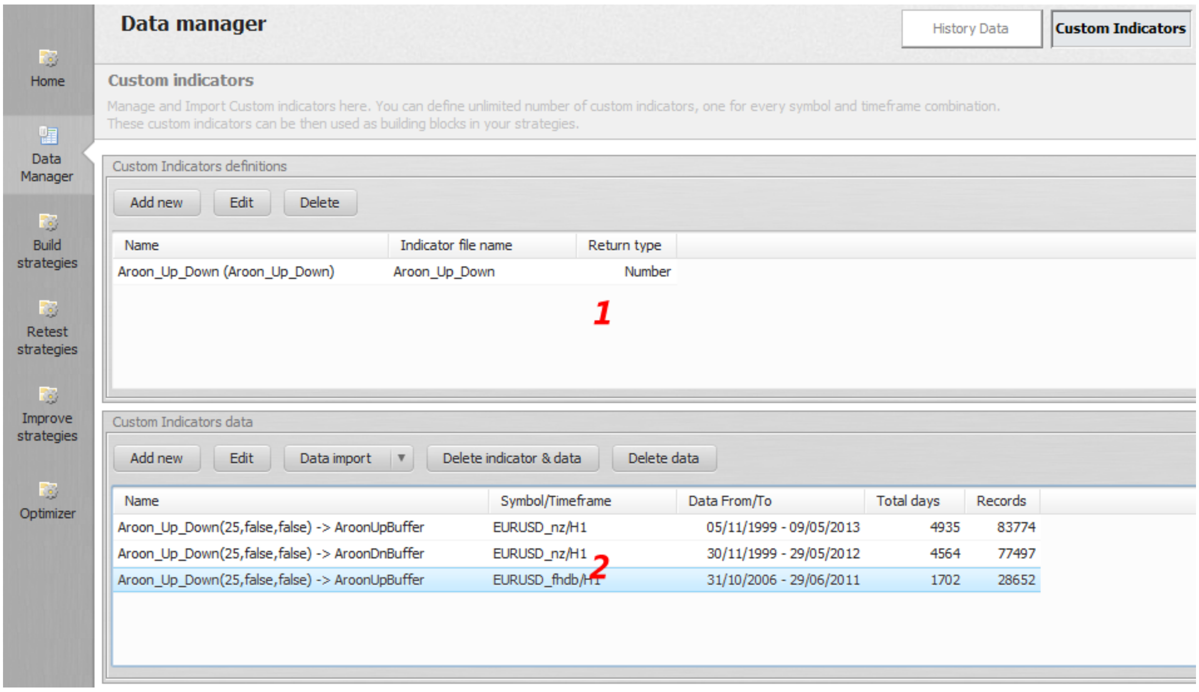
Symbol	Symbol Name/Description	Type	Timeframe	Point value in $	Pip/Tick Size	Pip/Tick S...	Data From - To	Total D...	Total Rec...	Default S
AMZN	AMZN	NinjaTrader	D1	1.0	1	0.01	1984.09.07 - 2013.11.05	10652	7355	
EURUSD_fhdb	EUR/USD (ForexHistoryDatabase.com)	MetaTrader	M1	100000.0	0.0001	0.00001	1999.11.01 - 2014.01.01	5176	5252136	
GBPUSD_fhdb	GBP/USD (ForexHistoryDatabase.com)	MetaTrader	M1	100000.0	0.0001	0.00001	1999.11.01 - 2013.09.30	5083	5159583	
USDCHF_fhdb	USD/CHF (ForexHistoryDatabase.com)	MetaTrader	M1	100000.0	0.0001	0.00001	1999.11.01 - 2013.09.30	5083	5159205	
USDJPY_fhdb	USD/JPY (ForexHistoryDatabase.com)	MetaTrader	M1	1000.0	0.01	0.001	1999.11.01 - 2013.09.30	5083	5159464	

StrategyQuant already comes with 4+ years history data for the major pairs provided by ForexHistoryDatabase.com, but if you have your own history data in Metatrader you can easily import your data

Check the section **Import history data from MetaTrader** for more description.

4.1.2 Custom indicators

In this screen you can manage and import custom indicators to be used in StrategyQuant.



Data manager

Custom indicators

Manage and Import Custom indicators here. You can define unlimited number of custom indicators, one for every symbol and timeframe combination. These custom indicators can be then used as building blocks in your strategies.

Custom Indicators definitions

Name	Indicator file name	Return type
Aroon_Up_Down (Aroon_Up_Down)	Aroon_Up_Down	Number

Custom Indicators data

Name	Symbol/Timeframe	Data From/To	Total days	Records
Aroon_Up_Down(25,false,false) -> AroonUpBuffer	EURUSD_nz/H1	05/11/1999 - 09/05/2013	4935	83774
Aroon_Up_Down(25,false,false) -> AroonDnBuffer	EURUSD_nz/H1	30/11/1999 - 29/05/2012	4564	77497
Aroon_Up_Down(25,false,false) -> AroonUpBuffer	EURUSD_fhdb/H1	31/10/2006 - 29/06/2011	1702	28652

The screen is divided into two tables. Upper table (1) contains list of all custom indicators that are defined in the system.

Bottom table (2) contains indicator data - data for an indicator with given parameters, output values and symbol/timeframe.
It is important to understand that StrategyQuant is not able to run indicator code, so the only way how to work with custom indicators in SQ is by importing their data.
Data are dependent on indicator parameter values as well as on symbol and timeframe on which it was generated.

To find out more about how to work with custom indicators, check the section How to ... Import new custom indicator

4.2 Build strategies

the heart of the program. Here you can generate new trading strategies using different configuration options and building blocks.
The resulting strategies should be saved to StrategyQuant file (.str) so you can work with them later.

Available build modes:

Genetic Evolution

StrategyQuant first generates initial population of random candidates (using the Random Generation mode) and then uses genetic evolution process
to evolve the population and produce better and better candidates with each generation.

The process ends when predefined number of generations is reached or when there's no further improvement.

Pros:

- in theory it should lead to strategies better than the initial random generation
- this means that the already good strategies in the first generation can be further improved
- search for profitable strategy in the trillions of possible combinations can be more effective with the power of evolution

Cons:

- evolution can be slower
- sometimes the evolution can lead to the dead end, so the generation should be watched
- the group of generated strategies is limited by population size

Random Generation

In this mode StrategyQuant continually generates and tests new random strategies, one after another, until it is stopped.
The top candidates (based on predefined criteria) are stored into Databank so you can review them later.

Pros:

- faster and simpler than genetic evolution
- it will run until it is stopped, so if you let it run for a few days it can generate and evaluate millions of strategies

Cons:

- once the strategies are generated they are not further improved

4.3 Retest strategies

this section is used for retesting already existing strategies. You can retest the strategy on another historical data or timeframe; run Robustness tests on the strategy,
try different options (for example trading only during certain hours per day).

4.4 Improve strategies

this section can be used to improve existing strategy created in the Build step. "Improving" strategy means replacing some of its part (entry rule, order type, exit rule)
or adding new condition to make strategy "better".

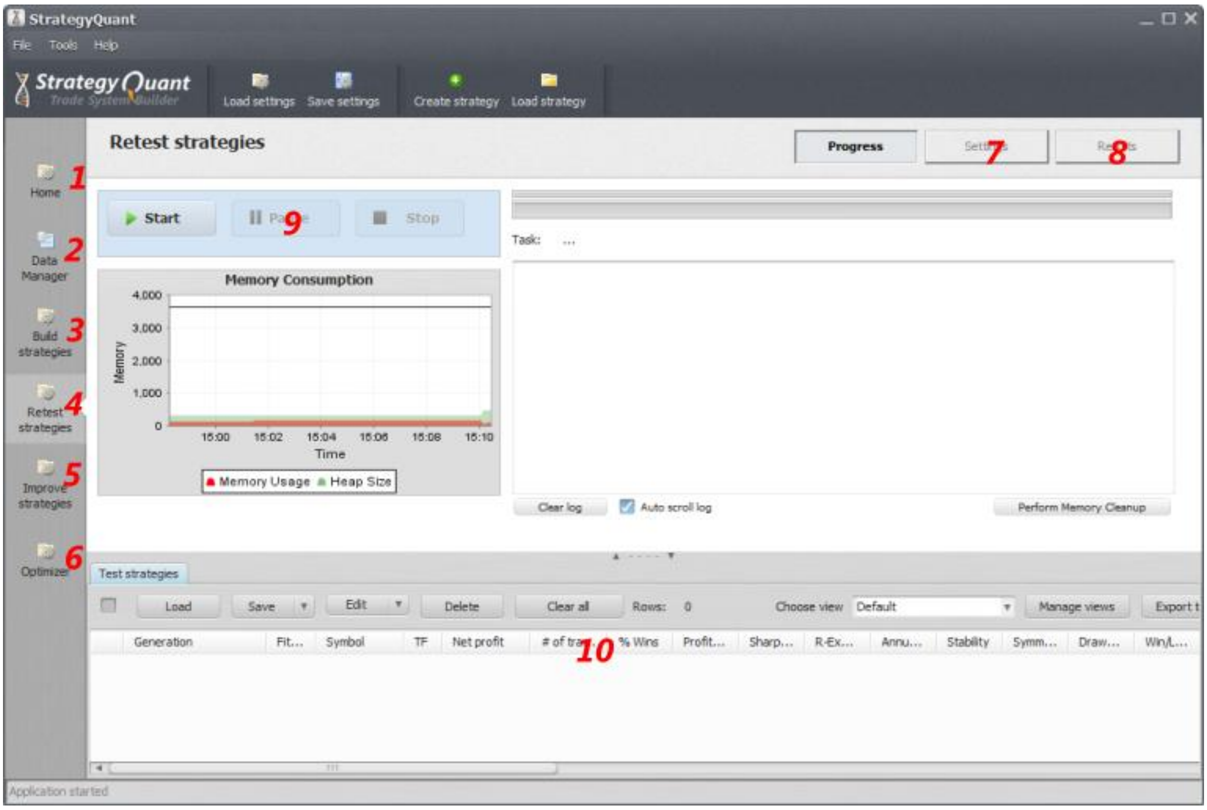
Improver works in a way that it randomly generates the selected part of the strategy, while keeping the other strategy parts intact.
This way you can look for better exit rule or for additional entry rule condition that will improve strategy performance.

4.5 Optimizer

optimizer can be used to optimize strategy parameters to optimal values, as well as for Walk-Forward optimization and Walk-Forward Matrix analysis.

5 Program Layout

The program is divided into several independent sections that correspond with the main functionality.


StrategyQuant
File Tools Help
Strategy Quant Trade System Builder
Load settings Save settings Create strategy Load strategy
Retest strategies
Progress Settings Results
Home 1
Data Manager 2
Build strategies 3
Retest strategies 4
Improve strategies 5
Optimizer 6
7
8
Start Pause 9 Stop
Task: ...
Memory Consumption
4,000 3,000 2,000 1,000 0
Memory
15:00 15:02 15:04 15:06 15:08 15:10
Time
Memory Usage Heap Size
Clear log Auto scroll log Perform Memory Cleanup
Test strategies
Load Save Edit Delete Clear all Rows: 0 Choose view Default Manage views Export t
Generation Fit... Symbol TF Net profit # of tra 10 % Wins Profit... Sharp... R-Ex... Annu... Stability Symm... Draw... Win/L...
Application started

1. Home
   starting screen of the program, it contains sample settings, news and helpful links

2. Data Manager
   here you can manage your history data and custom indicators

3. Build strategies
   section to build new trading strategies

4. Retest strategies
   section to retest existing strategies with different settings, or on different symbols/timeframes

5. Improve strategies
   section to improve existing strategy by generating additional rule conditions

6. Optimizer
   with features of simple and Walk-Forward optimization and Walk-Forward Matrix

7. Settings area
   each section has its own independent settings area where you can configure the build/test process

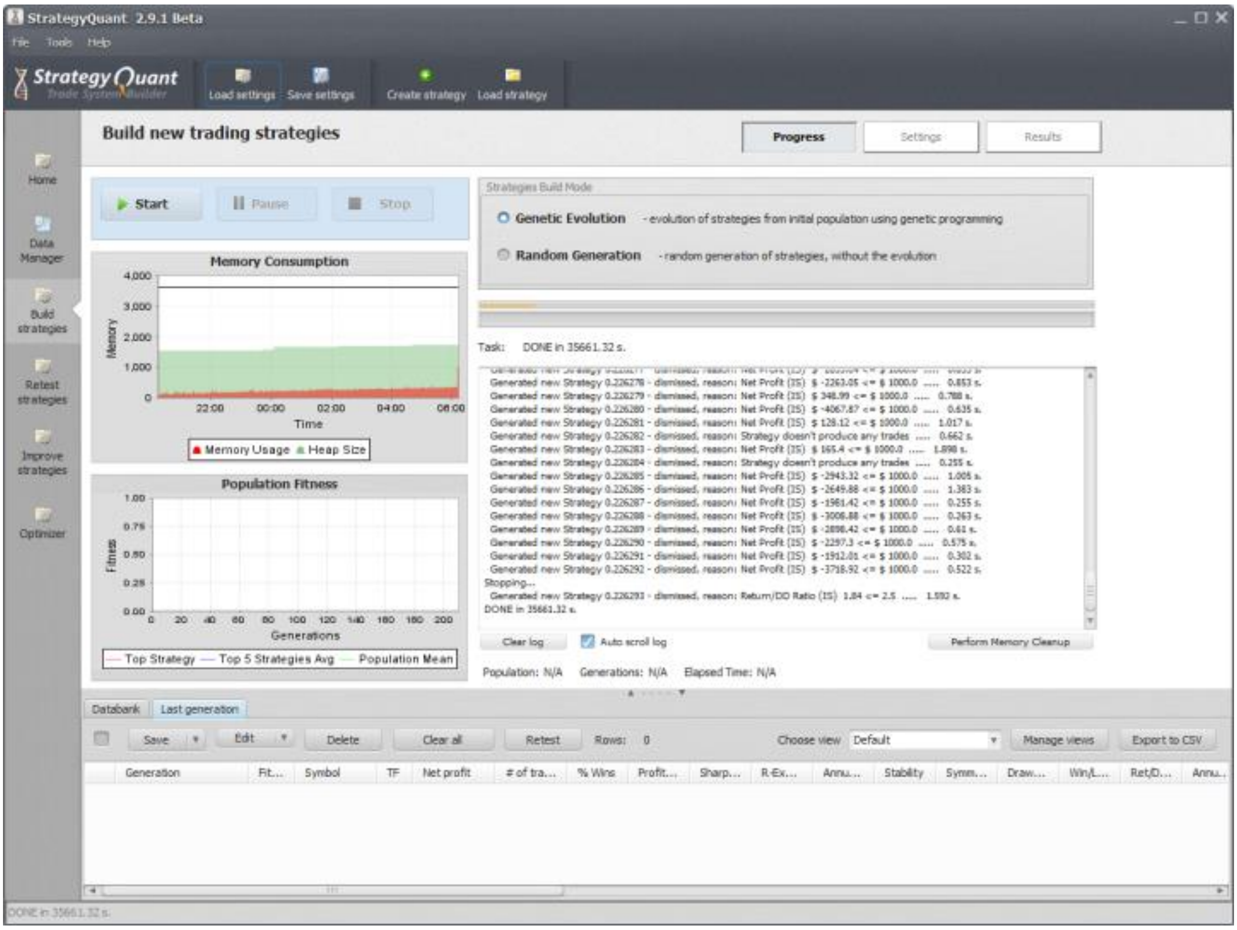
8. Results area
   here you can see performance of the selected strategy and get its EA code

9. buttons for starting, pausing and stopping the process

10. databanks - lists where generated strategies are stored
    storage area for strategies, it contains all the built / tested strategies

5.1 Progress

Progress screen is the place where you can start, pause or stop the building/testing process, it also shows you the log and memory consumption.



Strategies Build Mode

● Genetic Evolution - evolution of strategies from initial population using genetic programming

○ Random Generation - random generation of strategies, without the evolution

Task: DONE in 35661.32 s.

```
  Generated new Strategy 0.226278 - dismissed, reason: Net Profit (IS) $ -2263.05 <= $ 1000.0 ..... 0.853 s.
  Generated new Strategy 0.226279 - dismissed, reason: Net Profit (IS) $ 348.99 <= $ 1000.0 ..... 0.788 s.
  Generated new Strategy 0.226280 - dismissed, reason: Net Profit (IS) $ -4067.87 <= $ 1000.0 ..... 0.635 s.
  Generated new Strategy 0.226281 - dismissed, reason: Net Profit (IS) $ 128.12 <= $ 1000.0 ..... 1.017 s.
  Generated new Strategy 0.226282 - dismissed, reason: Strategy doesn't produce any trades ..... 0.662 s.
  Generated new Strategy 0.226283 - dismissed, reason: Net Profit (IS) $ 165.4 <= $ 1000.0 ..... 1.898 s.
  Generated new Strategy 0.226284 - dismissed, reason: Strategy doesn't produce any trades ..... 0.255 s.
  Generated new Strategy 0.226285 - dismissed, reason: Net Profit (IS) $ -2943.32 <= $ 1000.0 ..... 1.005 s.
  Generated new Strategy 0.226286 - dismissed, reason: Net Profit (IS) $ -2649.88 <= $ 1000.0 ..... 1.383 s.
  Generated new Strategy 0.226287 - dismissed, reason: Net Profit (IS) $ -1981.42 <= $ 1000.0 ..... 0.255 s.
  Generated new Strategy 0.226288 - dismissed, reason: Net Profit (IS) $ -3006.88 <= $ 1000.0 ..... 0.263 s.
  Generated new Strategy 0.226289 - dismissed, reason: Net Profit (IS) $ -2898.42 <= $ 1000.0 ..... 0.61 s.
  Generated new Strategy 0.226290 - dismissed, reason: Net Profit (IS) $ -2297.3 <= $ 1000.0 ..... 0.575 s.
  Generated new Strategy 0.226291 - dismissed, reason: Net Profit (IS) $ -1912.01 <= $ 1000.0 ..... 0.302 s.
  Generated new Strategy 0.226292 - dismissed, reason: Net Profit (IS) $ -3718.92 <= $ 1000.0 ..... 0.522 s.
Stopping...
  Generated new Strategy 0.226293 - dismissed, reason: Return/DD Ratio (IS) 1.84 <= 2.5 ..... 1.592 s.
DONE in 35661.32 s.
```

☑ Auto scroll log

Population: N/A Generations: N/A Elapsed Time: N/A

Rows: 0

Choose view: Default

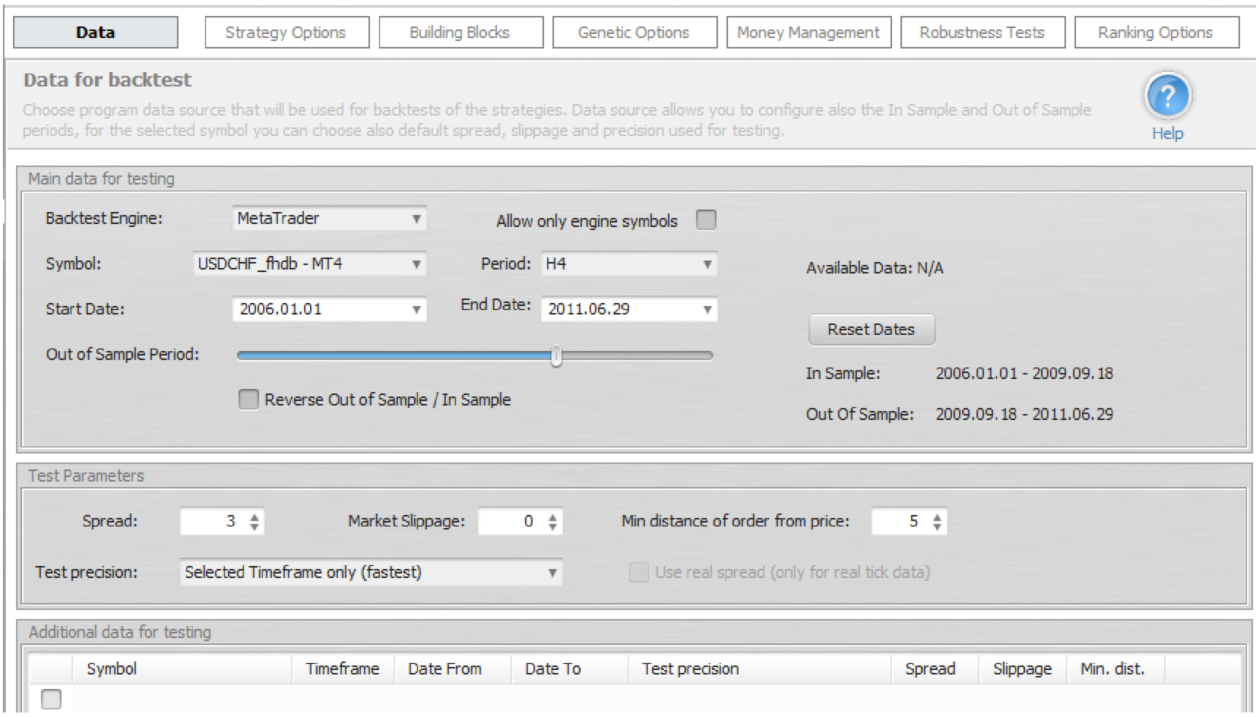
DONE in 35661.32 s.

Before starting the build or test you should have the data and settings configured. The results (generated top strategies) will be continually stored in the **databank** on the bottom.

5.2 Settings

5.2.1 Data

in Data you have to select the symbol, timeframe and time range on which the strategies will be backtested.



Data for backtest

Choose program data source that will be used for backtests of the strategies. Data source allows you to configure also the In Sample and Out of Sample periods, for the selected symbol you can choose also default spread, slippage and precision used for testing.

Main data for testing

Backtest Engine: MetaTrader

Allow only engine symbols □

Symbol: USDCHF_fhdb - MT4

Period: H4

Available Data: N/A

Start Date: 2006.01.01

End Date: 2011.06.29

Out of Sample Period:

□ Reverse Out of Sample / In Sample

In Sample: 2006.01.01 - 2009.09.18

Out Of Sample: 2009.09.18 - 2011.06.29

Test Parameters

Spread: 3

Market Slippage: 0

Min distance of order from price: 5

Test precision: Selected Timeframe only (fastest)

□ Use real spread (only for real tick data)

Additional data for testing

	Symbol	Timeframe	Date From	Date To	Test precision	Spread	Slippage	Min. dist.
□								

Backtesting Engine

allows you to choose which of the available backtesting engines (MetaTrader4 / NinjaTrader) should be used for testing the strategy.

More about differences in backtestign engines is described in Backtesting engines - NinjaTrader & MetaTrader4

Allow only engine symbols

if you check this you'll be able to choose only from the symbols that belong to a given engine. For example, you wouldn't be able to run test withNinjaTrader engine on MT4 data.

Symbol, Period, Start and End Dates

StrategyQuant tests all the generated strategies on a given history data and this screen allows you to choose the symbol and timeframe to be used for backtests.

There is an option to choose also the testing period (Date From, Date To).

Out of Sample Period

Allows you to split the history data to two parts:

- **In Sample** - it is used during genetic evolution to compute the rank of the strategies, so that the program is able to compare them

- **Out of Sample** - this part of the data is used to verify if strategy really works as expected also on data that it was not evolved

Test parameters

Testing precision

testing precision means how is the price data simulated during the backtest.
It is usually sufficient to use Selected Timeframe mode for Market orders, or Tick simulation mode for Stop/Limit orders.
You can also use faster mode for generation, and then slower mode for strategies retest.

Trade On Bar Open
In this mode, the system will check for signals and places trades only at the open of a bar.
This is valid not only for opening the trade, but also for closing the trade on stop loss or profit target.
If the trade reaches its stop loss or profit target, it **is NOT closed immediately** at this level, but only at the open of the next bar!

If you'll use this mode you have to generate a special version of EA that will also trade only on bar open to achieve the same results.

Selected Timeframe only
together with Trade On Bar Open it is the fastest testing mode. It uses only the main timeframe to simulate the prices.
This results in a very fast backtesting with very good accuracy. However, for Stop or Limit orders the testing accuracy might not be sufficient and you should try more precise mode.

1 Minute data
slower testing mode, it uses minute data (if available) to simulate price changes during the testing.

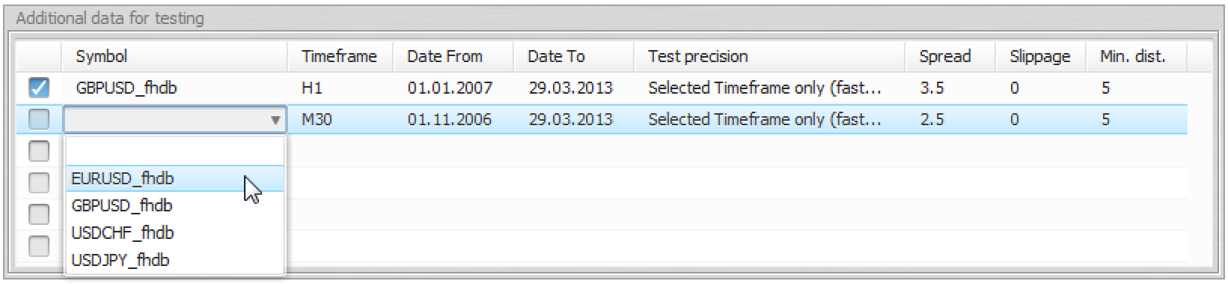
Tick simulation
slow testing mode, it uses tick simulation within minute data to obtain more precise results. This is the most precise testing that can be achieved without real tick data.
This testing mode is accurate enough for any type of orders.

Real Tick
this mode uses real tick data (if available) for exact price simulation. It is much slower than the other modes and it should be used for final verification of new strategies.

Note! NinjaTrader backtester can work only with Selected Timeframe precision

Additional data for testing

you can test your strategies automatically on multiple symbols/timeframes by specifying additional data.



Additional data for testing

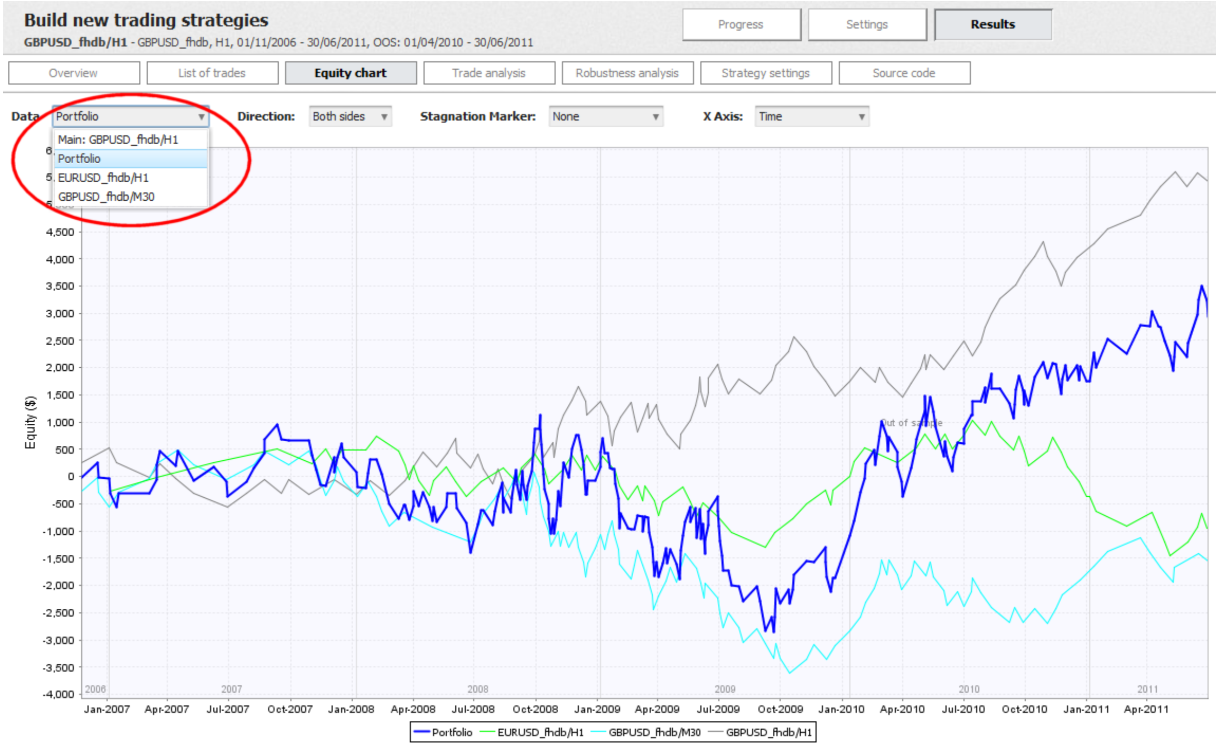
	Symbol	Timeframe	Date From	Date To	Test precision	Spread	Slippage	Min. dist.
☑	GBPUSD_fhdb	H1	01.01.2007	29.03.2013	Selected Timeframe only (fast...	3.5	0	5
☐	▾	M30	01.11.2006	29.03.2013	Selected Timeframe only (fast...	2.5	0	5
☐								
☐								
☐								
☐								

To select additional data, choose the symbol in the combo box and set its timeframe, time range, spread, etc.
The strategy is tested on additional data only if the row is checked.

This way you can test your strategy simultaneously on multiple symbols, **or** on the same symbol and different timeframes or even on the same symbol and timeframe, and only a different spread, slippage or precision.

Viewing the results of additional data tests

If you select any additional data, you'll be able to check the results for each additional symbol/timeframe as well as result for whole **portfolio** (strategy tested on main data + all additional data summarized together)
in the **Results** section.



Build new trading strategies

GBPUSD_fhdb/H1 - GBPUSD_fhdb, H1, 01/11/2006 - 30/06/2011, OOS: 01/04/2010 - 30/06/2011

Data: Portfolio
Direction: Both sides
Stagnation Marker: None
X Axis: Time

If you'll use additional data for testing, you'll have also the opportunity to filter the resulting strategies by the performance of the whole portfolio in Ranking Options Custom Conditions.

5.2.2 Building blocks

Building blocks are the core components that are combined together to create rules for every trading strategy.

Entry Rules Building Blocks

Entry building blocks can be divided into four main parts:

- price data - Open, High, Low, Close
- technical indicators -RSI, CCI, Momentum, etc.
- operators that are used for comparison and to combine the rules - <, >, and, or, etc.
- time constants - Hour, Minute of day, Day of week
- simple predefined rules - CCI > 0, Stochastic < 50 etc.

You can choose each component that you want to use in the strategy, so you can select your favorite indicators,
or choose for example only price data + operators if you want to generate strategies based only on price.

Good practice
According to our experience, you can sometimes get better results if you don't check all the available components, but narrow your choice to a smaller group of indicators or price values.

You can find description of all Entry and Exit nodes here.

5.2.3 Strategy options

These settings allow you to specify the properties of the generated strategies as well as testing conditions.

Market Sides

You can choose to generate strategies that trade only to one direction (Long or Short) or to both directions (which is standard).
You can also select that you want the entry or exit rules to be symmetrical. If they are symmetrical, then the rules for both directions are the same, only reversed.

An example of symmetrical rules:
Go Long if CCI > 0
Go Short if CCI < 0

As an alternative, you can choose to use non-symmetrical rules, in this case the rules for Long and Short sides will be generated independently.

An example of non-symmetrical rules:
Go Long if CCI > 0
Go Short if RSI < 0 and Momentum < 100

This settings can be used for both entry and exit rules, for example you can have symmetrical entry rules, but non-symmetrical exit rules,
so the strategy will effectively use (for example) different stop loss and profit target for Long and Short orders.

Trading Logic

Trading logic defines the behavior of the strategy and constraints of the backtester. Because there are two different backtesting engines (MetaTrader/NinjaTrader) there are also some parameters that are exclusive for only one of them.

Fill Type (NinjaTrader only)
Default or Liberal. It defines fill type used in backtesting. For difference between these fill types please refer to NinjaTrader help.

Strict Stop Prices (NinjaTrader only)
there are normally constraints for placing stop/limit orders. For example you can enter long stop order only above the actual price, and short stop only below actual price.
if you set StrictStopPrices=true, it will use this standard behavior, refusing orders with price levels outside these constraints.
If you set it to false, it will check if the stop order price is correct and if for example you want to enter to long stop below actual price it will instead enter at Market.
So setting StrictStopPrices to false will allow your orders to enter at market if the price already went above the allowed level.

Pending Orders Valid One Bar (NinjaTrader only)
if set to true, your pending orders will be valid for one bar only. They would have to be resubmitted on every bar to be valid.
If you set it to false, pending orders are valid until they expire or until they are cancelled.
In MetaTrader pending orders are always valid until they expire.

Replace Pending Orders
this is an important setting that has big influence on Stop and Limit orders. If set to true, the stop orders are replaced with updated version every time there is new signal and order is still pending.
In the older versions of StrategyQuant this setting was implicitly set to false and it was hidden.
It seems that setting it to true leads to better and more successful breakout strategies, and it is generally recommended.

Maximum Trades Per Day
you can limit maximum trades the strategy takes per day

Maximum Total Trades
you can limit maximum total trades to a given number. It is usually good to use this limit and set it to some big number (1000-5000, depending on how many trades you expect during a tested period).

Exit at end of day/end of range
if selected, the strategy will close all position at the end of the day or end of the trading range (if defined). This way you'll have no position open overnight.

Limit Signals to Time Range, Time Range From, Time Range To
this limits the hours the strategy is checking for entry signal to a given time range.
If used in combination with **Exit At End Of Range** then all open positions are closed at the end of the range.
If you don't check the **Exit At End Of Range** then the strategy will not open new trades outside the trading range, but the already opened positions will be not closed.

Exit At End Of Range, Exit At End Of Day, Exit On Friday
three settings that manage whether trades should be closed at the end of range, day or week.

Stop Loss & Profit Target Options

These settings allows you to specify whether Stop Loss and Profit Target should be mandatory in the strategy, and what is the minimum and maximum of the SL/PT values in pips.
You can also define the desired Risk Reward ratio.
Having defined SL/PT in the strategy is the simplest and many times the most effective approach.

If you unselect the mandatory SL/PT then the randomly generated strategy can (but doesn't have to) have fixed SL/PT. It is advisable to use different exit rule if you uncheck this setting, for example exit after X bars, otherwise the strategy will have no way to exit the trade.

Lookback periods

Here you can set up the periods and coefficients used by the GB when generating the trading rules.

Maximum Period for Indicators

sets the maximum period that will be used for indicators. Usually we don't use periods bigger than 100-300 in the trading system (depending on the type of trading strategy), so it is advisable to set the desired maximum period value.

Maximum Period for Price Patterns

this is the maximum lookback period for price patterns (Open, High, Low, Close prices). It doesn't really make sense to set it to more than 10-20, because the older price usually has no relation with the current market movement.

Minimum and Maximum ATR Multiple

these are coefficients that are used in adaptive Stop Loss or Profit Target, if it is based on Average True Range value.

For example, setting Minimum to 0.5 and Maximum to 5 tells SQ that it can use minimum 0.5 * ATR as the SL or PT value and maximum 5 * ATR as the SL or PT value.

5.2.4 Genetic options

settings that affect genetic evolution.

An important thing is that there is not one ideal configuration. You can experiment with genetic evolution settings to obtain results that you want.

Genetic Options

Population size

is the number of different strategies in one population. It should be at least 50, the ideal value will be between 100 - 1000 or perhaps even more.

Max # of Generations

is the count of how many generations the evolution should be performed.

Mutation Probability

is the probability that a strategy will be mutated, it should be around 5-15%.

Crossover Probability

is the probability that the strategy is selected for crossover operation. Every generation there is a crossover of strategies performed during which the two parent strategies "mate" and produce two children. Recommended value if 95%.

Initial Population Generation

for initial population you can choose two options:

Generate random population

Initial population will be generated randomly using the predefined settings and building blocks.

Decimation coefficient

decimation means that the system generates more strategies than needed for initial population, and then chooses only the best. For decimation coefficient is 1 it means there is no decimation.

For decimation coefficient = 2 system generates 2 x population size strategies and then chooses the best half for the initial population.

For decimation coefficient = 3 system generates 3 x population size strategies and then chooses the best third for the initial population.

Max tree depth

allows you to specify maximum depth of strategy conditions tree. If you don't check 'Force...' it will be enforced only for the initial generation, subsequent generations might get trees with bigger depths that are the result of strategy cloning and mutation.

If you check Force for all generations, then the maximum tree depth will be enforced for all generated strategies.

Use systems from databank as initial population

existing strategies can be used as initial population. These strategies have to be loaded to the **Initial population** databank.

Initial Population Conditions

when generating initial population you can specify additional settings to filter bad strategies you don't want to use. For example you can configure it to dismiss (throw away) strategies where Net Profit is below zero or where number of trades is below certain level.

Evolution Management

this was updated in version 3.5, now it allows you to split In Sample period to two parts for 3 parts approach and to control the evolution in more ways.

Please read 3 data parts approach for more information about the new functionality and examples.

Start again when finished

if checked, it will restart the evolution when it finished (reached maximum number of generations).

Restart when fitness stagnates for X generations

if checked, it will restart if fitness stagnates for given number of generation. Fitness is the strategy score. If it stagnates for 5-10 generations it is usually a sign that evolution reached its potential or went into a dead end, so it might be a good idea to just restart it.

5.2.5 Money management

Money management (or position sizing) specifies how many lots or shares are traded on each trade.

StrategyQuant contains three different money management options that can be used in the program and also later n real trading in MetaTrader.

Fixed size

strategy will trade with fixed number of lots. This is recommended setting when you generate new strategy, because it gives you clear overview of strategy real performance.

Fixed amount

strategy will risk a fixed amount of money for every trade.

This is basic money management without compounding. It can be used to test real performance of strategies where Stop Loss is based on volatility (ATR),
or if you want to compare the performance of strategies with different Stop Loss.

Risk fixed % of account

advanced money management that is recommended for real trading. The strategy will risk a given % of equity on every trade.
This is simple, but very effective money management that will allow the strategy to increase number of lots as your account grows.

It is generally recommended to risk maximum 2-5% of account equity per one trade.

5.2.6 Robustness tests

Robustness tests are additional tests that can be applied to your strategy. The idea behind robustness testing is to verify how well the strategy will behave when there are small changes in inputs, history data or other components of the strategy.

Robust strategy should have good performance even when the input parameters are slightly changed, or when some orders are skipped.

StrategyQuant allows you to use Robustness tests in a form of Monte Carlo analysis.
This means that the program will run a specified number of strategy tests with given random changes. As a result you'll receive a number of output results and output equities, one for each test.

You can then check these results to see how the strategy behaves when the inputs are changed, which helps you decide if you can trade such strategy.

Monte Carlo Simulation Settings

Testing the strategy with randomized input or history data provides only one alternative that can be compared to the original result.
In order to get more complete picture the robustness test can be repeated, until we receive bigger set of different results.

You can specify number of tests in the **Number of simulations** variable. The more simulations will be run, the better statistical significance of the results,
but it comes at a price. Each test takes its time, so the more tests you run, the longer it will take to completely backtest the strategy.
The best value of tests is between 10 and 100.

Confidence level for reporting is simply a confidence level that is marked with a dark background in the Robustness analysis table (see below).
Usual confidence level to use is 95%.

Types of Robustness Tests

Below is an explanation of different types of tests you can use. If more than one option is checked, the tests are combined.

Randomize Trades Order

this is the simplest test, in the **Exact** variation it only randomly shuffles order of the trades. This doesn't change the resulting Net Profit, but it is very useful in examining different variations of Drawdown that can be a result of different order of trades.

In more advanced **Resampling** variation of this test the trades are not just shuffled. Instead the program randomly picks total number of trades from the pool of all trades in history. The difference is that in this method the list of trades might not be the same. It can pick one trade multiple times and some other trade might not be picked at all.
This will give yet another view of the system. This method will usually change both Net Profit and Drawdown and it is quite extreme test.

Randomly Skip Trades

it will randomly skip trades with given probability. In real trading you can often miss a trade because of platform or Internet failure, or simply because you paused trading for some time.
This test will give you an idea how the equity curve might look like if some trades are randomly skipped.

Randomize Strategy Parameters

every strategy uses parameters, such as period of an indicator or constant that is used in comparison. This test checks the sensitivity of the strategy to a small change of parameter value.
Probability of change is a probability that any parameter changes its value. Max parameter change is the maximum percentage to which the parameter changes its value.
For example if you set Max parameter change to 10%, then a parameter with value 60 can be randomly changed to a range 54 - 66 (+- 10% of its original value of 60).

Randomize Starting Bar

this will test the strategy behavior when the testing starts on a different starting bar. It is obvious that a good strategy cannot be sensitive to which bar you start the test.

Randomize History Data

one very common case of curve fitting is when strategy is too dependent on history data. This option checks the behavior of the strategy to a change in history data.
The Probability of change sets for every bar how probable it is that open, high, low or close price will be changed. The Max price change is a percentage value of the change in relation to ATR (Average True Range).
So if for example close price is randomly chosen to be changed, ATR value is 10 pips, and Max price change is 20%, then the price can change by +- 2 pips

Randomize Spread, Slippage, Min distance from price

these simulations will run the test with spread, slippage or minimum distance of stop order from price randomly chosen from the given range.

For information about how to use Robustness tests and how to interpret the results, check the Robustness tests and analysis section.

5.2.7 Ranking options

When the strategies are generated, every new strategy is backtested on a history data and the results of the backtest are then used to compute the *Fitness* (rank) of the strategy.
Fitness is number from 0 to 1 and it should reflect the "quality" of the strategy according to the given criteria.

In this screen you can configure:

- how this *Fitness* value is computed (Strategy Selection criteria)
- how many top strategies are stored in the databank
- which strategies are stored to databank and which are thrown away (Custom conditions)

Databank Options

The best strategies found are continually stored into the **Databank**.
It is not possible to store every strategy (remember that StrategyQuant can create thousands of new strategies every hour) so we have to specify
how many strategies should be stored in the databank, how they should be sorted to find out the best ones and which strategies should be thrown away.

Maximum Strategies to Store in Databank
simply the maximum number of strategies remembered in the program

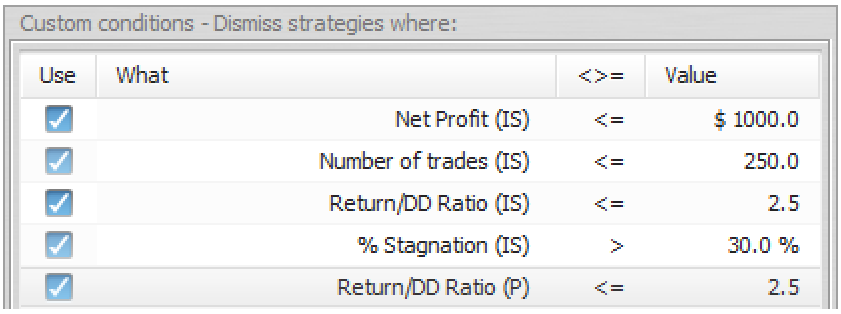
Dismiss strategies that have 100% duplicate orders
if checked, strategies that have exactly the same orders as some strategy in databank will be dismissed. It is recommended to check this,
if there is a strategy with duplicate orders, it will be likely the same strategy with redundant rules.

Custom Conditions

You can define rules to throw away strategies with bad properties. For example it usually makes sense to throw away strategies that result in loss or these that have too little number of trades.

Custom conditions allow you to specify your own custom rules that will be evaluated for every strategy.
If the strategy matches any of the rules, it will be dismissed.
This is useful to quickly dismissing strategies that result in loss or with too little number of trades.

There are separate values for In Sample and Out of Sample performance, and for Robustness Tests (if used) or Portfolio (if you used additional data).



Custom conditions - Dismiss strategies where:

Use	What	<>=	Value
☑	Net Profit (IS)	<=	$ 1000.0
☑	Number of trades (IS)	<=	250.0
☑	Return/DD Ratio (IS)	<=	2.5
☑	% Stagnation (IS)	>	30.0 %
☑	Return/DD Ratio (P)	<=	2.5

The abbreviations used in custom conditions are:
IS (In Sample) - result of In Sample part of data
OOS (Out of Sample) - result of Out of Sample part of data
RT (Robustness Tests) - result of robustness tests
P (Portfolio) - results for portfolio (if exists)

Strategy Selection Criteria

Here you can choose from which data the strategy criteria will be computed and what criteria should be used to compute the total Fitness of the strategy.

Compute fitness from:

You can select if you want to compute fitness (strategy fitness score) from main data or from portfolio (if you use also additional data).
It is generally recommended to use Portfolio, then the strategy fitness will be computed from the sum of all trades across all the symbols in your portfolio.
If you use this setting and you don't have any additional data, fitness will be automatically computed from main data.

Determine best strategies by

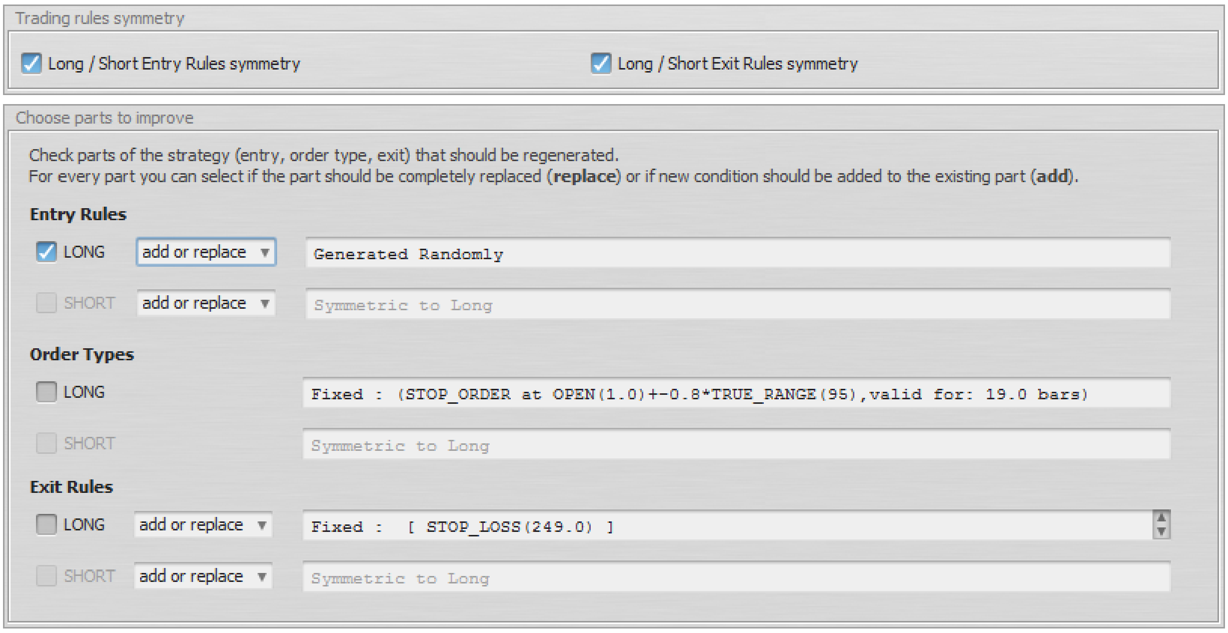
You can choose from the predefined most used criteria, or you can build your own complex fitness function based on multiple criteria, each with a different weight.
Note that if you choose to combine too many criteria, they might "fight" against each other without achieving what you expected. **Profit Factor**
criterion to maximize Profit Factor of a strategy.

You can find explanation for every ranking criteria here.

5.2.8 Parts to improve

Strategy consists of three parts - Entry rules, Order type and Exit rules. Each of these parts can be improved independently.

This way you can for example look for better exit rules, or generate a new rule for long entry while keeping the short entry rule from original strategy.



Trading rules symmetry

☑ Long / Short Entry Rules symmetry ☑ Long / Short Exit Rules symmetry

Choose parts to improve

Check parts of the strategy (entry, order type, exit) that should be regenerated.
For every part you can select if the part should be completely replaced (**replace**) or if new condition should be added to the existing part (**add**).

Entry Rules

☑ LONG add or replace ▼ Generated Randomly

□ SHORT add or replace ▼ Symmetric to Long

Order Types

□ LONG Fixed : (STOP_ORDER at OPEN(1.0)+-0.8*TRUE_RANGE(95),valid for: 19.0 bars)

□ SHORT Symmetric to Long

Exit Rules

□ LONG add or replace ▼ Fixed : [STOP_LOSS(249.0)]

□ SHORT add or replace ▼ Symmetric to Long

You have to check the part you want to improve. There is also a possibility to improve long/short parts independently.

Addition types:
add - adds new condition to the rule
replace - replace the whole rule with new condition
add or replace - randomly determines if to add or replace

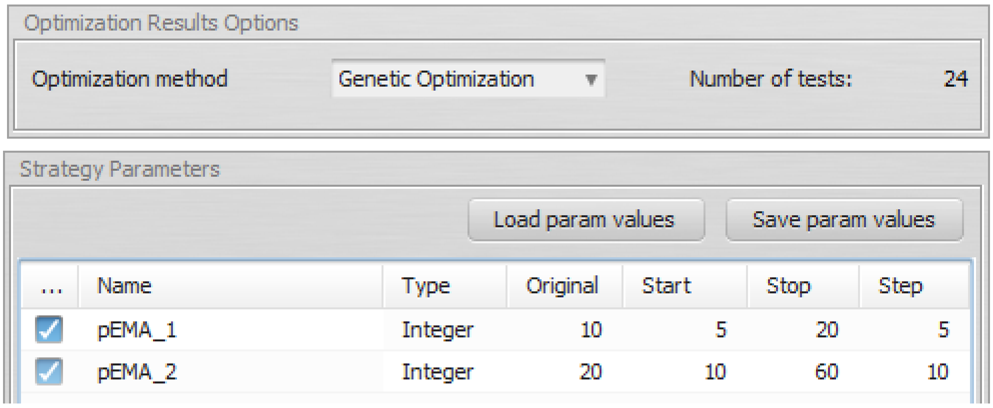
Improvement process

Improvement means that StrategyQuant will make a copy the original strategy and randomly generate new conditions that will replace or add to the selected strategy part.

Then it'll test the new strategy variation to check if the "improvement" resulted in better performance.
Strategies that have better performance that original strategy are then stored to databank.

5.2.9 Parameters

this settings screen is available only for Optimizer. When you load a strategy to optimizer then you have to specify which parameters should be optimized in the Parameters screen.



Optimization Results Options

Optimization method: Genetic Optimization

Number of tests: 24

Strategy Parameters

...	Name	Type	Original	Start	Stop	Step
☑	pEMA_1	Integer	10	5	20	5
☑	pEMA_2	Integer	20	10	60	10

Every parameter that you want to optimize has to be checked and you have to define its Start, Stop and Step values.
The optimization engine will try every value from start to stop making steps.
Original value is there for comparison with original strategy performance.

Number of tests

The value in the Number of tests shows you how many tests in total have to be performed.

If you'll choose to optimize more than one parameter, the optimization engine will test every combination of all parameters.
If you'll choose too many parameters to optimize, it can result to thousands or even millions of tests.

Optimization method

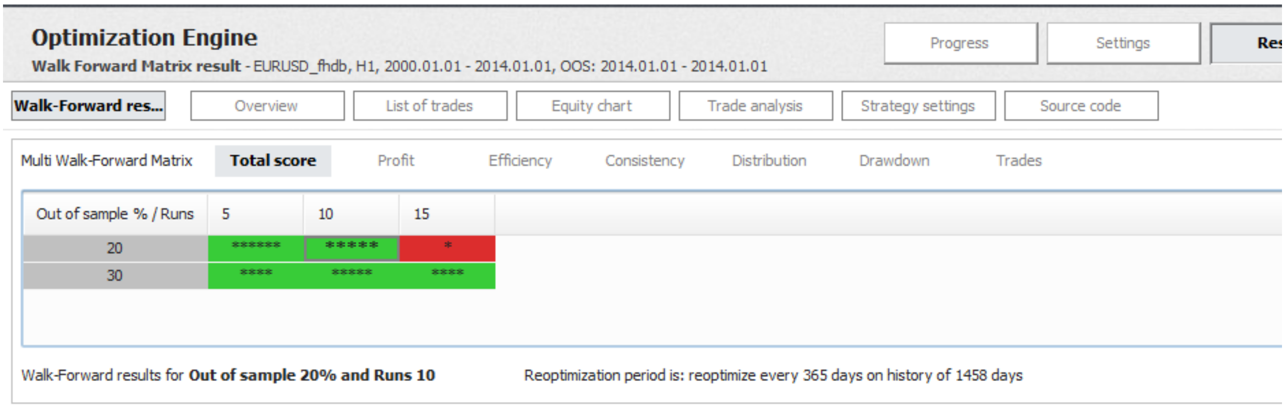
There are two optimization methods available:
Brute force - brute force methods goes through every possible combination of parameters. It could be very slow when you optimize many parameters.

Genetic optimization - for every optimization with number of tests bigger than 500 or 1000 you should use Genetic Optimization method.

5.2.10 Success criteria

Note - Change in version 3.5
Walk-Forward Success Criteria are no longer configured in Settings, instead there are fully dynamic success criteria available on the Walk-Forward results page.
Instead of in Settings you'll now find this page in **Results** -> **Walk-Forward results** when you double-click on a Walk-Forward result in databank after optimization.

The first part of Walk-Forward result page shows the Total strategy score (computed from Success criteria, see below) and other characteristics of Walk-Forward runs,such as Profit, Efficiency or Consistency values.



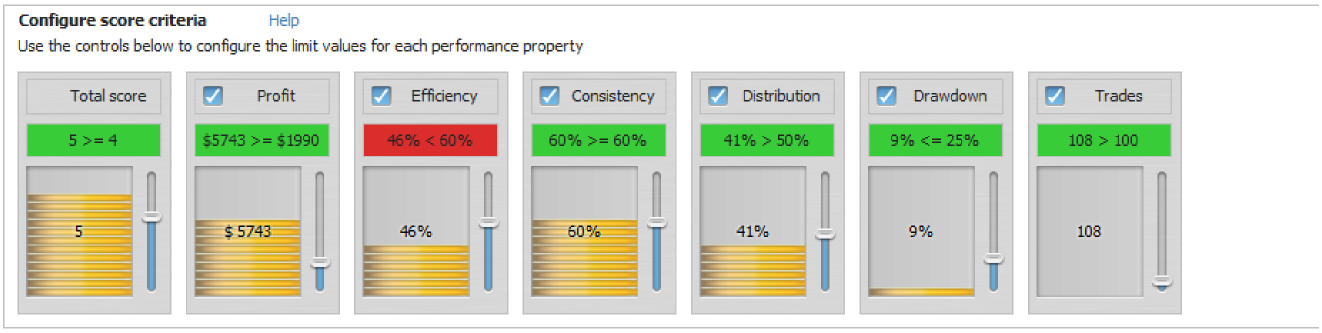
Optimization Engine
Walk Forward Matrix result - EURUSD_fhdb, H1, 2000.01.01 - 2014.01.01, OOS: 2014.01.01 - 2014.01.01

Out of sample % / Runs	5	10	15
20	******	*****	*
30	****	*****	****

Walk-Forward results for **Out of sample 20% and Runs 10**

Reoptimization period is: reoptimize every 365 days on history of 1458 days

The second part contains dynamically configurable **Score criteria**. You can check any criteria you want to evaluate on WF run evaluation as well as set its limit value.



Configure score criteria Help
Use the controls below to configure the limit values for each performance property

Total score	☑ Profit	☑ Efficiency	☑ Consistency	☑ Distribution	☑ Drawdown	☑ Trades
5 >= 4	$5743 >= $1990	46% < 60%	60% >= 60%	41% > 50%	9% <= 25%	108 > 100
5	$ 5743	46%	60%	41%	9%	108

List of available tests:

Total score

a special criterion, here you set how many of the following criteria have to pass in order to consider the run passed. In our case we need at least 4 criteria
from available (Profit, Efficiency, Consistency, Distribution, Drawdown, Trades) to be successful.
In our case 5 tests were successful, which is more than 4 required, so the run passed the Score criteria test.

Profit (Overall Profitability)

overall profitability checks if the net profit result from optimization test is bigger than given value.
In our case the total profit was % 5743 which is more than required $1990.

Efficiency (Walk-Forward Robustness)

this criterion measures robustness of walk-forward runs. For example, if the optimization parts earned $10.000 and run parts earned $5.000,
then the Walk-Forward Efficiency is exactly 50% (run parts earned 50% of what optimization parts).
In our case test for efficiency failed, because the run part earned only 46% of the optimization part and the required value to pass the test is 60%.

Consistency (of Profits)

it checks how big percentage of run parts are profitable and compares it to given minimum percentage.
In our case Consistency was 60% which is exactly the minimum required value.

Distribution (of Profits)

this measures how big was the impact of every run to overall strategy profit. For example, if one period contributed to more than 50% of total strategy profit
it means that the rest of periods performed quite poorly.
In our case this test passed, because no run produced more that 50% of total profit.

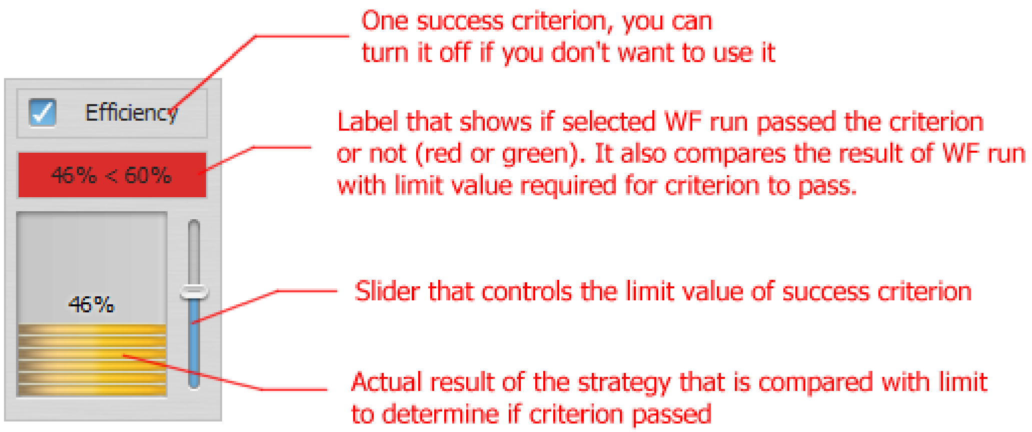
Drawdown (Maximum Drawdown)

it checks if maximum percentage drawdown any run exceeded given maximum.
In our case the maximum drawdown was only 9%, of up to 25 % allowed.

Minimum trades

it checks that there is at least minimum number of trades produced in every run. If a run produces too little trades, it is less statistically significant.
In our case each run had more than 100 trades.

Score criteria control explained


☑ Efficiency
46% < 60%
46%
One success criterion, you can turn it off if you don't want to use it
Label that shows if selected WF run passed the criterion or not (red or green). It also compares the result of WF run with limit value required for criterion to pass.
Slider that controls the limit value of success criterion
Actual result of the strategy that is compared with limit to determine if criterion passed

5.2.11 Global options

Global options are available through menu **Tools -> Options**.

General

general tab allows you to set up general things like the title of the program, how to save log messages or date and time format.

Performance

performance tab allows you to set up how many cores of your CPU will be used for computation. The more cores you'll choose, the higher will be the load of your computer.

Don't store list of trades in memory

If you check this option, all the strategies that are stored in databank will have their trades stored in temporary files. This greatly saves memory, because history of list of trades consumes the biggest part of the memory for every strategy.
If trades are stored in temporary files, they are loaded only when they are needed, for example when you'll switch to list of trades or to equity chart.

Don't store expired and replaced pending orders

if you check this options, expired and replaced pending orders are not saved to the strategy history. This is default setting, you should uncheck it only if you need to investigate something with the expired orders.

Strategy parameters

this tab allows you to set the global parameters behavior. Strategy contains two set of rules, one for long and one for short side. Usually they are symmetric.

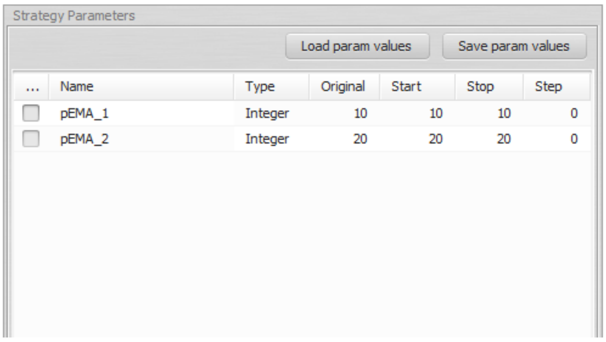
Use the same parameters for long and short rules

Parameters used in these rules (for example periods for indicator) can be named by common names same for long and short rule, or separate for every direction.
Unless you want to optimize the strategy especially for long and short rule, you should leave it checked.

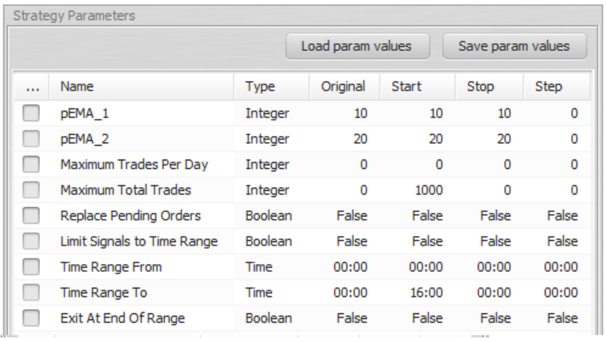
Add parameters for strategy options

this setting applies to Optimizer -> Parameters settings. When you'll optimize the strategy you can choose to display only strategy parameters, or also parameters for general trading options, such as time range for trade, etc.

Parameters without and with strategy options:



...	Name	Type	Original	Start	Stop	Step
□	pEMA_1	Integer	10	10	10	0
□	pEMA_2	Integer	20	20	20	0



...	Name	Type	Original	Start	Stop	Step
□	pEMA_1	Integer	10	10	10	0
□	pEMA_2	Integer	20	20	20	0
□	Maximum Trades Per Day	Integer	0	0	0	0
□	Maximum Total Trades	Integer	0	1000	0	0
□	Replace Pending Orders	Boolean	False	False	False	False
□	Limit Signals to Time Range	Boolean	False	False	False	False
□	Time Range From	Time	00:00	00:00	00:00	00:00
□	Time Range To	Time	00:00	16:00	00:00	00:00
□	Exit At End Of Range	Boolean	False	False	False	False

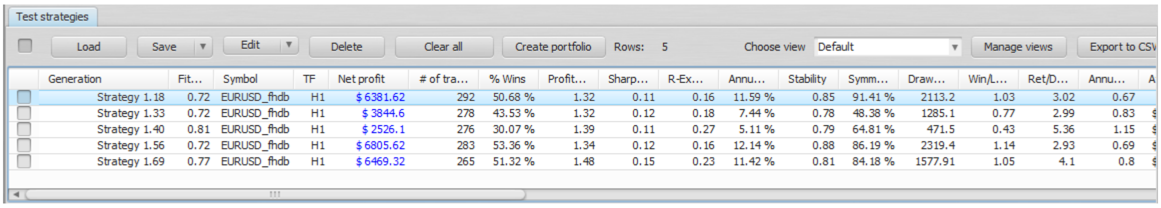
HTML reports

possibility to customize HTML reports produced by the program. You can customize which charts you want to see in the strategy performance report.

5.3 Results

5.3.1 Databanks

Databank is a storage place where the generated/tested strategies are stored with their results.



	Generation	Fit...	Symbol	TF	Net profit	# of tra...	% Wins	Profit...	Sharp...	R-Ex...	Annu...	Stability	Symm...	Draw...	Win/L...	Ret/D...	Annu...	A
□	Strategy 1.18	0.72	EURUSD_fhdb	H1	$ 6381.62	292	50.68 %	1.32	0.11	0.16	11.59 %	0.85	91.41 %	2113.2	1.03	3.02	0.67	
□	Strategy 1.33	0.72	EURUSD_fhdb	H1	$ 3844.6	278	43.53 %	1.32	0.12	0.18	7.44 %	0.78	48.38 %	1285.1	0.77	2.99	0.83	$
□	Strategy 1.40	0.81	EURUSD_fhdb	H1	$ 2526.1	276	30.07 %	1.39	0.11	0.27	5.11 %	0.79	64.81 %	471.5	0.43	5.36	1.15	$
□	Strategy 1.56	0.72	EURUSD_fhdb	H1	$ 6805.62	283	53.36 %	1.34	0.12	0.16	12.14 %	0.88	86.19 %	2319.4	1.14	2.93	0.69	$
□	Strategy 1.69	0.77	EURUSD_fhdb	H1	$ 6469.32	265	51.32 %	1.48	0.15	0.23	11.42 %	0.81	84.18 %	1577.91	1.05	4.1	0.8	$

Each mode (Build/Test/Improve/Optimize) has its own independent databank table.

For memory reasons Databank cannot keep unlimited number of strategies, instead it stores the selected number of top strategies, for example top 100 or top 1000 strategies.
The configuration how many strategies to store in the Databank and how to sort them can be set in the Settings -> Ranking Options

Databank functions

Every strategy result in the Databank can be viewed in the Results screen by using double-click.

Load

this button is available only in **Retest** databank, it loads Strategy projects (.str files) so they can be retested.

Save (as Strategy/Portfolio/HTML report/Source code)

this way you can save your strategy, you should always save good strategies to a Strategy Project (.str) so that you can work with them later.

Edit (Parameters/Trading rules)

here you can manually edit the selected strategy - either the values of its parameters or the trading rules.

Delete/Clear all

this will delete selected or all strategies from the list

Create portfolio

it will combine selected strategies to a portfolio - a special report that combines trading results of multiple strategies. You can then check/analyze the results of whole portfolio of strategies.

Views

Each row in the table represents one strategy plus, the results of the strategy backtest - number of trades, total profit/loss, Fitness score, etc. are visible in the table columns.
Results are divided into In Sample and Out of Sample parts.

All the columns in the databank are customizable, you can choose which columns you want to see using views.

Export to CSV
you can also export the whole table content to a CSV file

5.3.2 Overview

Overview screen displays various statistics computed from the backtest data.

5.3.3 List of trades

Contains complete list of trades generated by the backtest.

If you backtested your strategy on multiple symbols/timeframes, you can switch between the results or check the list of trades for whole portfolio.

5.3.4 Equity chart

Displays equity chart of the strategy.

Stagnation marker shows the maximum stagnation period - this is the longest period that it took strategy to make new high on the equity.

In case of portfolio, it displays charts for every symbol/timeframe tested, plus equity of complete portfolio.

5.3.5 Trade analysis

This screen displays yearly performance of the strategy plus configurable small charts with trades per hour, day of week, day of month, etc.

5.3.6 Robustness analysis

This screen is empty if you didn't configure any Robustness Tests.

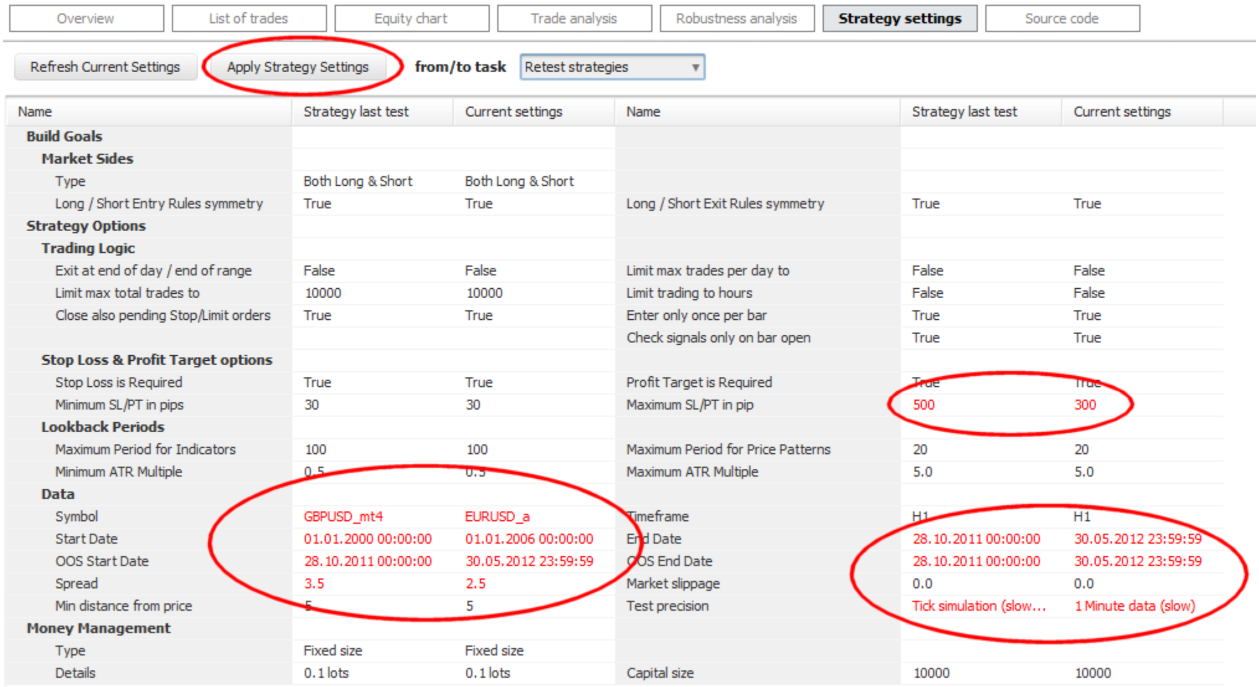
Otherwise it contains equity chart for every robustness test simulation and table of important confidence levels computed using Monte Carlo analysis of simulations.

For information about how to use Robustness tests and how to interpret the results, check the Robustness tests and analysis section.

5.3.7 Strategy settings

This screen displays current settings of the program versus settings that were used when the strategy was last time backtested/generated.
The differences are highlighted with red color.

To quickly load settings from the strategy you can use the button **Apply Strategy Settings.**
This will load settings from the strategy and applies it to the selected program section.



Name	Strategy last test	Current settings	Name	Strategy last test	Current settings
Build Goals					
Market Sides					
Type	Both Long & Short	Both Long & Short			
Long / Short Entry Rules symmetry	True	True	Long / Short Exit Rules symmetry	True	True
Strategy Options					
Trading Logic					
Exit at end of day / end of range	False	False	Limit max trades per day to	False	False
Limit max total trades to	10000	10000	Limit trading to hours	False	False
Close also pending Stop/Limit orders	True	True	Enter only once per bar	True	True
			Check signals only on bar open	True	True
Stop Loss & Profit Target options					
Stop Loss is Required	True	True	Profit Target is Required	True	True
Minimum SL/PT in pips	30	30	Maximum SL/PT in pip	500	300
Lookback Periods					
Maximum Period for Indicators	100	100	Maximum Period for Price Patterns	20	20
Minimum ATR Multiple	0.5	0.5	Maximum ATR Multiple	5.0	5.0
Data					
Symbol	GBPUSD_mt4	EURUSD_a	Timeframe	H1	H1
Start Date	01.01.2000 00:00:00	01.01.2006 00:00:00	End Date	28.10.2011 00:00:00	30.05.2012 23:59:59
OOS Start Date	28.10.2011 00:00:00	30.05.2012 23:59:59	OOS End Date	28.10.2011 00:00:00	30.05.2012 23:59:59
Spread	3.5	2.5	Market slippage	0.0	0.0
Min distance from price	5	5	Test precision	Tick simulation (slow…	1 Minute data (slow)
Money Management					
Type	Fixed size	Fixed size			
Details	0.1 lots	0.1 lots	Capital size	10000	10000

5.3.8 Source code

Source code tab is where you'll get the result of the program. For every selected strategy it generates selected source code.

Source Code Type

There are three types of source code that can be generated:

Pseudo Code
human readable pseudo code of the strategy. You can see the strategy logic and you can use it for manual trading.

MetaTrader4 Expert Advisor
the EA code for MetaTrader. You can save the EA code to MetaTrader/experts directory and you'll be able to run your new EA in MetaTrader.

MT4 Special EA - Trade on Bar Open
special version of MetaTrader4 EA - it checks for signals and **places trades only at the open of a bar**. This is valid not only for opening the trade, but also for closing the trade on stop loss or profit target. If the trade reaches its stop loss or profit target, it **is NOT closed immediately** at this level, but at the open of the next bar!

EA generated this way will be 100% compatible with the strategy tested in SQ using the **Trade on Bar Open** test precision.

NinjaTrader code
Strategy code for NinjaTrader. You can copy & paste the code into new NinjaTrader strategy.
Check more about this in section Exporting the strategy from StrategyQuant to NinjaTrader

Put values to parameters

by checking this checkbox you can generate code where all the number constants like indicator periods, comparison constants etc.
will be parameterized - a parameter will be added for every constant.
This will allow you to optimize your EA in MetaTrader, or test it with different parameter values.

6 Advanced functionality

6.1 Robustness tests and analysis

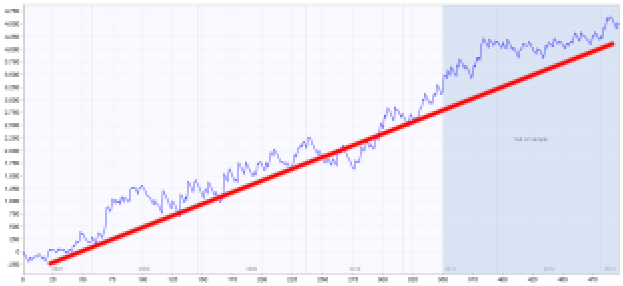
Curve-fitting strategy to the historical data on which it was build is the biggest danger of strategies generated using any machine learning process.
After developing new strategy you should make sure your strategy is robust - which should increase the probability that it will work also in the future.

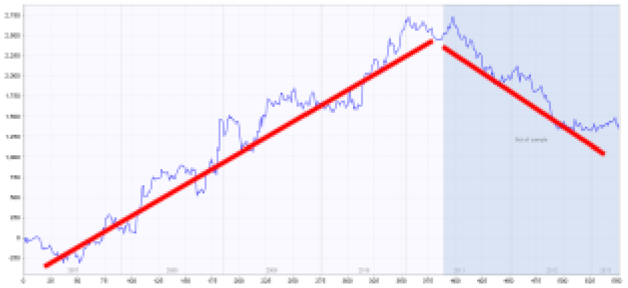
What is robustness?
It is simply the property of strategy of being able to cope with changing conditions.
- First of all, strategy should work on unknown data (if the market characteristics didn't change) either with or without periodic parameter reoptimization.
- It should not break apart if some trades are missed.
- Robust strategy should not be too sensitive to input parameters - it should work even if you slightly change the input parameter values, such as indicator period or some constant.

How to test strategies for robustness

1. Make use of In Sample and Out of Sample periods

the most basic test for robustness is testing the strategy on Out of Sample data. If you run genetic evolution, the strategy is evolved only on the In Sample part of data. The Out of Sample part is "unknown" to the strategy, so it can be used to determine if the strategy performs also on unknown part of data.

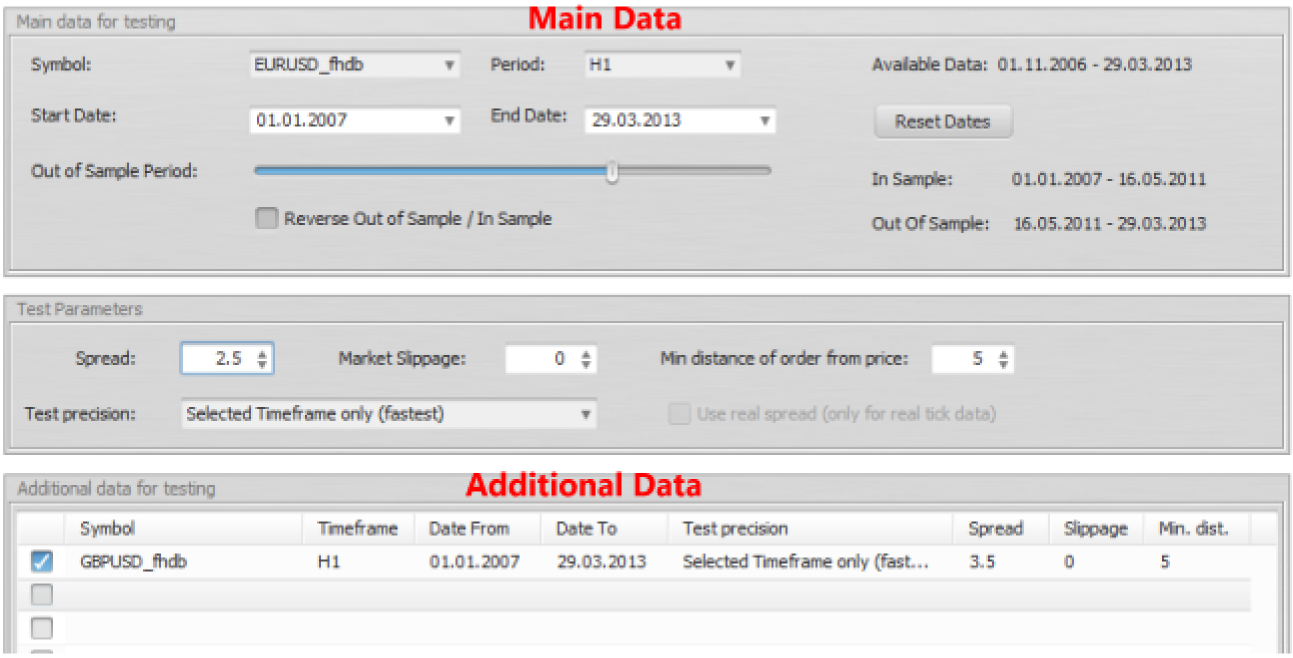




The blue part of each chart is the Out of Sample (unknown) data., We can see that the strategy on the left performs well also on this part, while strategy on the right fails on the unknown data - it is almost certain to be curve fitted.

2. Test strategies on multiple symbols and timeframes

second test for robustness is very though - it means testing the same strategy on different symbol(s) and/or another timeframe(s). Robust strategy should ideally work on multiple symbols/timeframes.
In reality, because each market has its own characteristics, daily volatility, etc., it will be not easy to find a strategy that has the same perfect performance on multiple symbols using just one set of settings.
We can be satisfied if the strategy performs on other markets with at least some degree of profitability, or just slightly losing.



Main data for testing **Main Data**

Symbol: EURUSD_fhdb ▾ Period: H1 ▾ Available Data: 01.11.2006 - 29.03.2013

Start Date: 01.01.2007 ▾ End Date: 29.03.2013 ▾ Reset Dates

Out of Sample Period: In Sample: 01.01.2007 - 16.05.2011

□ Reverse Out of Sample / In Sample Out Of Sample: 16.05.2011 - 29.03.2013

Test Parameters

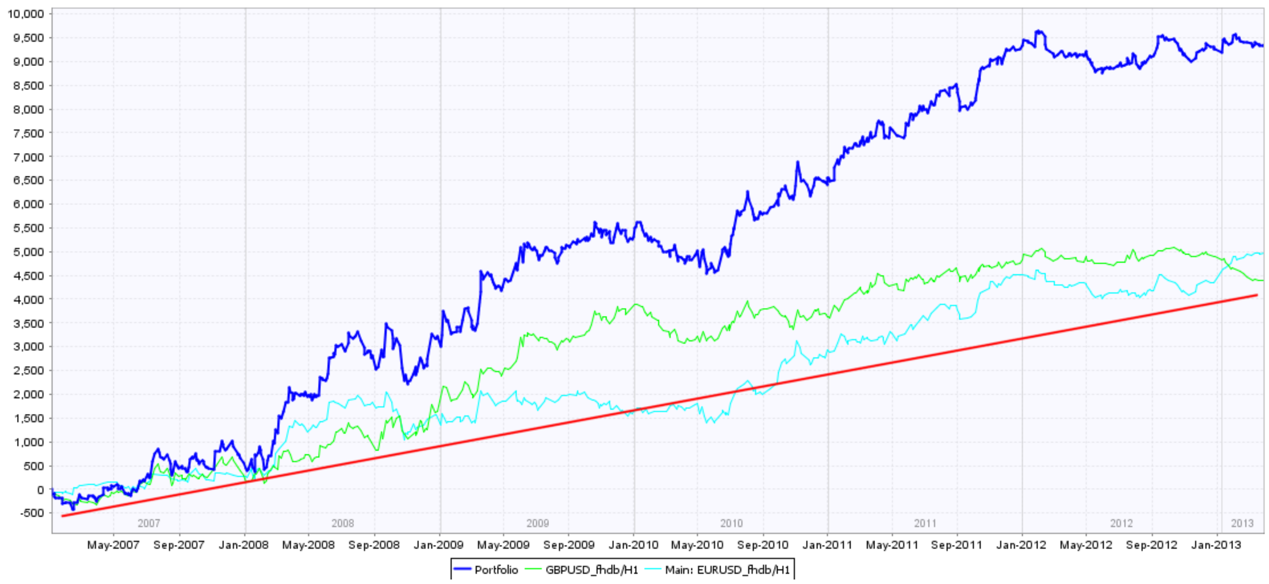
Spread: 2.5 Market Slippage: 0 Min distance of order from price: 5

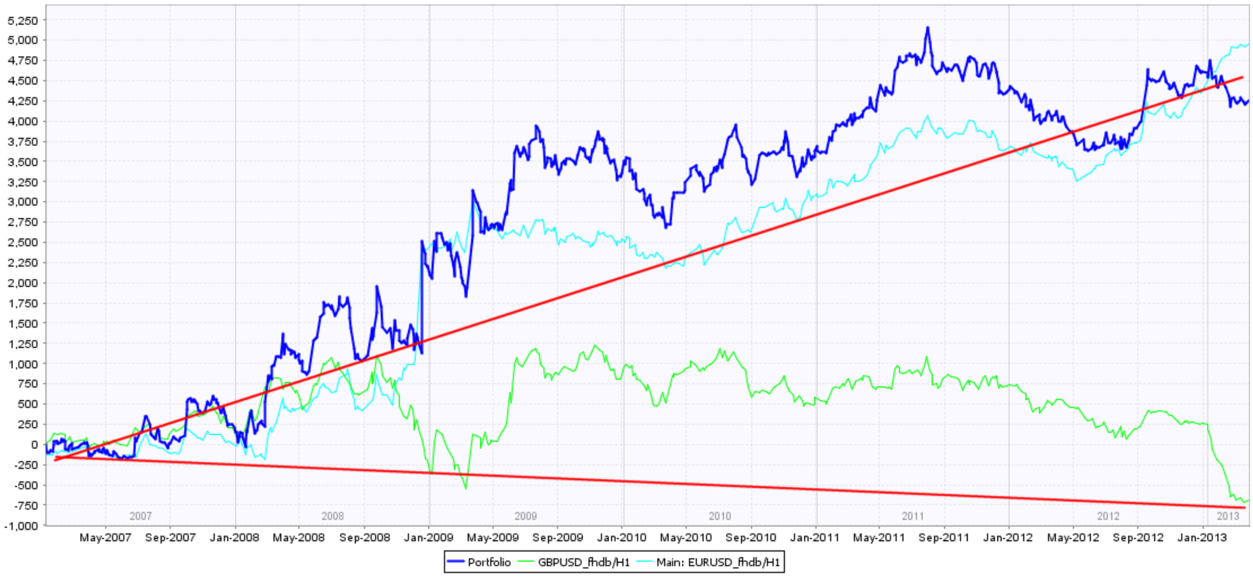
Test precision: Selected Timeframe only (fastest) ▾ □ Use real spread (only for real tick data)

Additional data for testing **Additional Data**

	Symbol	Timeframe	Date From	Date To	Test precision	Spread	Slippage	Min. dist.
☑	GBPUSD_fhdb	H1	01.01.2007	29.03.2013	Selected Timeframe only (fast...	3.5	0	5
□								
□								

StrategyQuant allows you to specify additional symbols for building/testing the startegies in the Additional data section. You can even test the strategy on the same symbol with different timeframe.

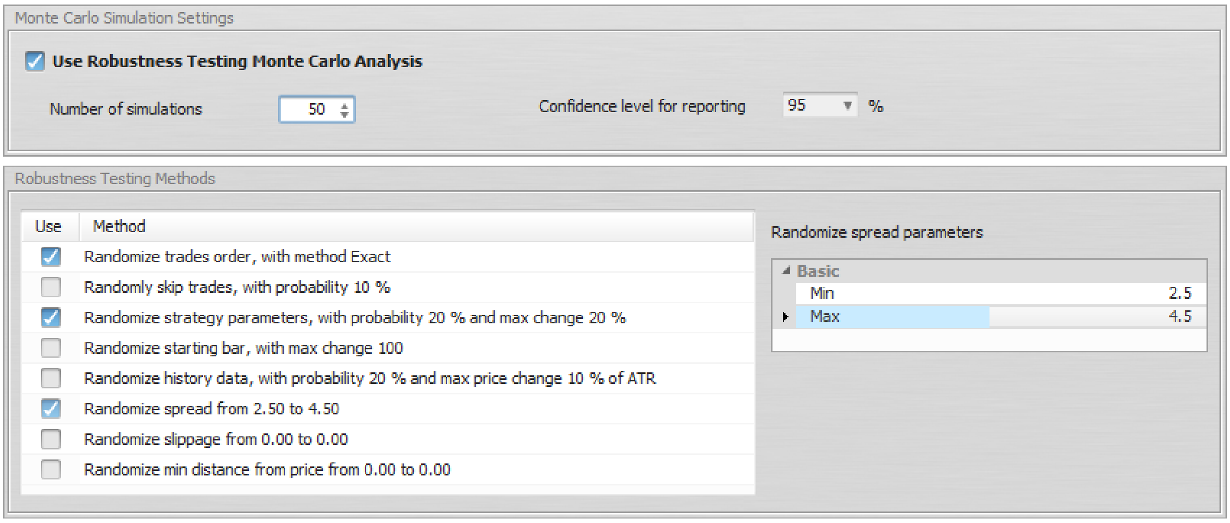




In the two charts above you can see test of strategy on EURUSD (green line), GBPUSD (cyan line) and portfolio of both (blue line).
While on the left chart the strategy performs well on both currencies, on the right chart you can see that performance on GBPUSD is bad. This startegy is probably not robust enough.

3. Use Robustness Tests tool in StrategyQuant

StrategyQuant allows you to turn on Robustness Tests. Robustness Tests tool simply repeatedly tests the strategy with different random changes in the input parameters and data performing Monte Carlo simulation.
The idea behind this robustness testing is to verify how well the strategy performs when there are small changes in inputs, history data or other components of the strategy.



Monte Carlo Simulation Settings

☑ **Use Robustness Testing Monte Carlo Analysis**

Number of simulations 50

Confidence level for reporting 95 %

Robustness Testing Methods

Use	Method
☑	Randomize trades order, with method Exact
☐	Randomly skip trades, with probability 10 %
☑	Randomize strategy parameters, with probability 20 % and max change 20 %
☐	Randomize starting bar, with max change 100
☐	Randomize history data, with probability 20 % and max price change 10 % of ATR
☑	Randomize spread from 2.50 to 4.50
☐	Randomize slippage from 0.00 to 0.00
☐	Randomize min distance from price from 0.00 to 0.00

Randomize spread parameters

Basic	
Min	2.5
Max	4.5

You can simulate different properties:

- **Randomize Trades Order** - this is the simplest test, it randomly shuffles order of the trades. This doesn't change the resulting Net Profit, but it is very useful in examining different variations of Drawdown that can be a result of different order of trades.

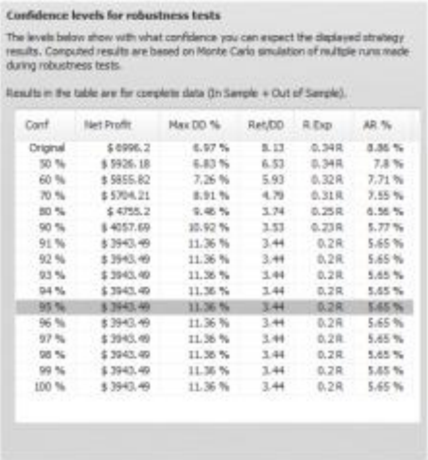
- **Randomly Skip Trades** - it will randomly skip trades with given probability. In real trading you can often miss a trade because of platform or Internet failure, or simply because you paused trading for some time. This test will give you an idea how the equity curve might look like if some trades are randomly skipped.

- **Randomize Starting Bar** - this will test the strategy behavior when the testing starts on a different starting bar. It is obvious that a good strategy cannot be sensitive to which bar you start the test.

- **Randomize Strategy Parameters** - every strategy uses parameters, such as period of an indicator or constant that is used in comparison. This test checks the sensitivity of the strategy to a small change of parameter value. Probability of change is a probability that any parameter changes its value. Max parameter change is the maximum percentage to which the parameter changes its value. For example if you set Max parameter change to 10%, then a parameter with value 60 can be randomly changed to a range 54 - 66 (+- 10% of its original value of 60).

- **Randomize History Data** - one very common case of curve fitting is when strategy is too dependent on history data. This option checks the behavior of the strategy to a change in history data.
The Probability of change sets for every bar how probable it is that open, high, low or close price will be changed. The Max price change is a percentage value of the change in relation to ATR (Average True Range).
So if for example close price is randomly chosen to be changed, ATR value is 10 pips, and Max price change is 20%, then the price can change by +- 2 pips

Interpreting the results
Robustness tests output the results as a set of equity charts for each testing run AND a table showing the results of Monte Carlo simulation.

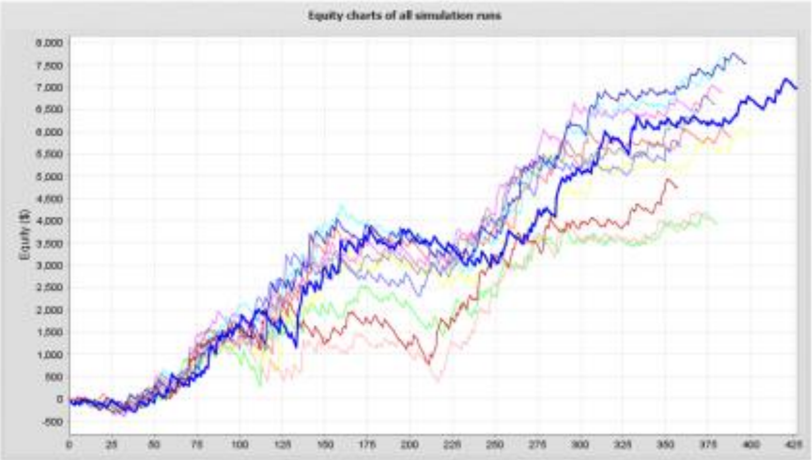


Confidence levels for robustness tests

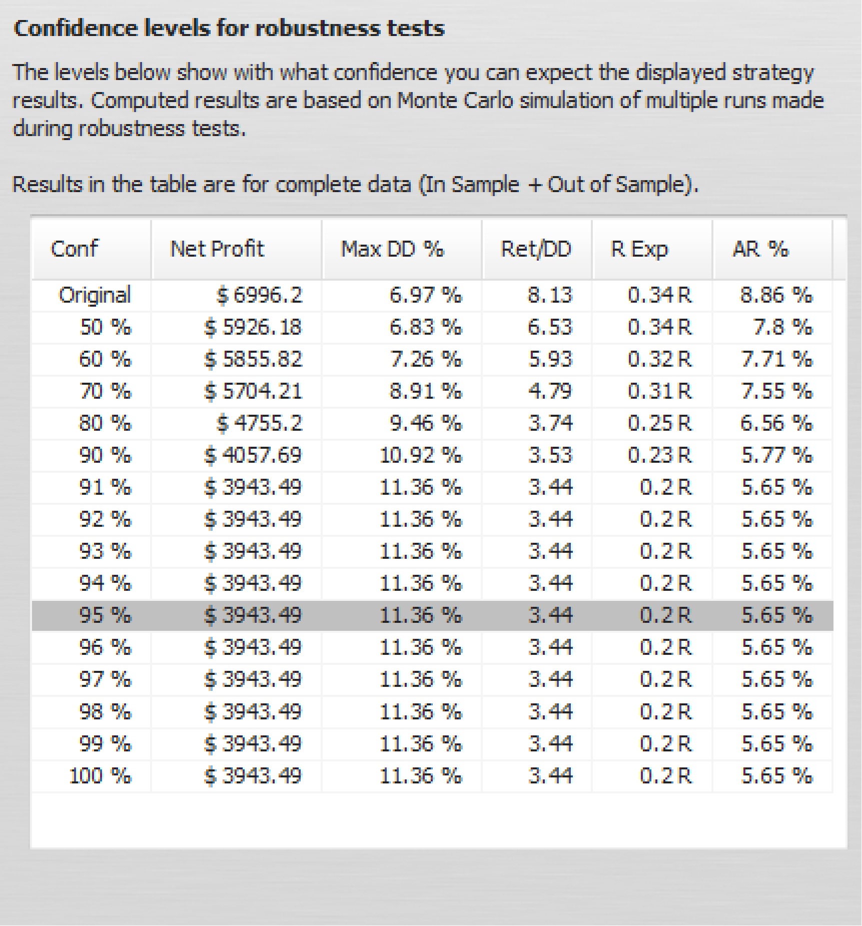
The levels below show with what confidence you can expect the displayed strategy results. Computed results are based on Monte Carlo simulation of multiple runs made during robustness tests.

Results in the table are for complete data (In Sample + Out of Sample).

Conf	Net Profit	Max DD %	Ret/DD	R Exp	AR %
Original	$ 6996.2	6.97 %	8.13	0.34R	8.86 %
50 %	$ 5926.18	6.83 %	6.53	0.34R	7.8 %
60 %	$ 5855.82	7.26 %	5.93	0.32R	7.71 %
70 %	$ 5704.21	8.91 %	4.79	0.31R	7.55 %
80 %	$ 4755.2	9.46 %	3.74	0.25R	6.56 %
90 %	$ 4057.69	10.92 %	3.53	0.23R	5.77 %
91 %	$ 3943.49	11.36 %	3.44	0.2R	5.65 %
92 %	$ 3943.49	11.36 %	3.44	0.2R	5.65 %
93 %	$ 3943.49	11.36 %	3.44	0.2R	5.65 %
94 %	$ 3943.49	11.36 %	3.44	0.2R	5.65 %
95 %	$ 3943.49	11.36 %	3.44	0.2R	5.65 %
96 %	$ 3943.49	11.36 %	3.44	0.2R	5.65 %
97 %	$ 3943.49	11.36 %	3.44	0.2R	5.65 %
98 %	$ 3943.49	11.36 %	3.44	0.2R	5.65 %
99 %	$ 3943.49	11.36 %	3.44	0.2R	5.65 %
100 %	$ 3943.49	11.36 %	3.44	0.2R	5.65 %



In this example we've run 10 simuations, with random changes in strategy parameters, history data and randomly skipped trades.
We can see what would be the equity for each of these simulations and the table on the left provides us the valuable information on the strategy properties during these simulations.



Confidence levels for robustness tests

The levels below show with what confidence you can expect the displayed strategy results. Computed results are based on Monte Carlo simulation of multiple runs made during robustness tests.

Results in the table are for complete data (In Sample + Out of Sample).

Conf	Net Profit	Max DD %	Ret/DD	R Exp	AR %
Original	$ 6996.2	6.97 %	8.13	0.34 R	8.86 %
50 %	$ 5926.18	6.83 %	6.53	0.34 R	7.8 %
60 %	$ 5855.82	7.26 %	5.93	0.32 R	7.71 %
70 %	$ 5704.21	8.91 %	4.79	0.31 R	7.55 %
80 %	$ 4755.2	9.46 %	3.74	0.25 R	6.56 %
90 %	$ 4057.69	10.92 %	3.53	0.23 R	5.77 %
91 %	$ 3943.49	11.36 %	3.44	0.2 R	5.65 %
92 %	$ 3943.49	11.36 %	3.44	0.2 R	5.65 %
93 %	$ 3943.49	11.36 %	3.44	0.2 R	5.65 %
94 %	$ 3943.49	11.36 %	3.44	0.2 R	5.65 %
95 %	$ 3943.49	11.36 %	3.44	0.2 R	5.65 %
96 %	$ 3943.49	11.36 %	3.44	0.2 R	5.65 %
97 %	$ 3943.49	11.36 %	3.44	0.2 R	5.65 %
98 %	$ 3943.49	11.36 %	3.44	0.2 R	5.65 %
99 %	$ 3943.49	11.36 %	3.44	0.2 R	5.65 %
100 %	$ 3943.49	11.36 %	3.44	0.2 R	5.65 %

What do these values mean?
The first row displays values of Net Profit, Maximum % Drawdown etc. of original strategy for comparison.
The rest of the rows display values at different confidence levels.
These numbers are a result of Monte Carlo analysis applied on our 10 random simulations.

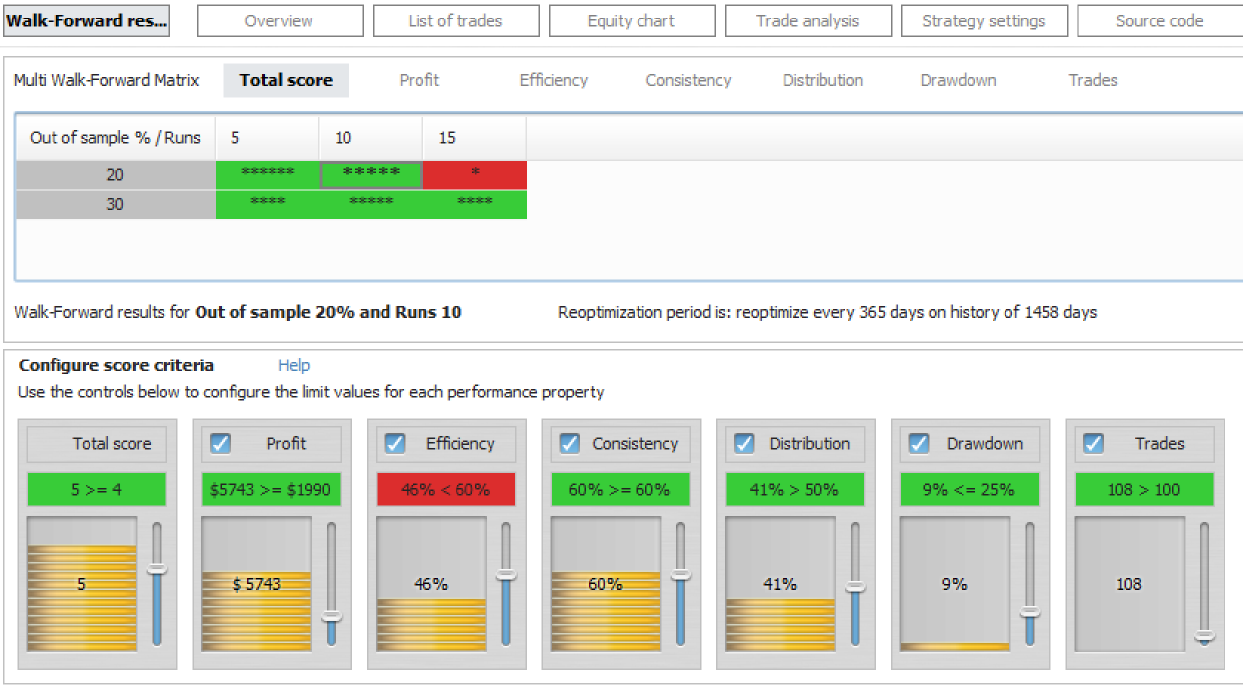
For example, values at 80% confidence level mean that there is 20% chance that Net Profit, Drawdown etc. will be worse than the confidence level values.
Values at 90% confidence level mean that there is 10% chance that Net Profit, Drawdown etc. will be worse than the confidence level values.
Values at 95% confidence level mean that there is only a 5% chance that Net Profit, Drawdown, etc. will be worse than these values.

So Monte Carlo simulation of our strategy shows us that by skipping 10% of random trades and small random changes in input parameters and data our Net Profit can decrease from $ 6990 to $ 3943, and Maximum Drawdown can increase from 6.97% to 11.36%.
This means that there is only 5% chance that Net Profit will be lower than $ 3943. By looking at the higher confidence levels we can see that none of our tests had worse results than $ 3943, so the strategy seems to be relatively robust to the changes we exposed it to.

Because robustness tests are generated randomly, equity charts and values in the table will slightly differ every time you retest the strategy. Also, the more simulations you'll run, the bigger statistical significance of this test.

4. Use Walk-Forward Matrix as robustness test

Fourth type of robustness check is test using Walk-Forward Matrix. If the strategy passes this test it means that with the help of parameter reoptimization it is adaptable to a big range of market conditions.



Out of sample % / Runs	5	10	15
20	******	*****	*
30	****	*****	****

Walk-Forward results for **Out of sample 20% and Runs 10**

Reoptimization period is: reoptimize every 365 days on history of 1458 days

Configure score criteria Help

Use the controls below to configure the limit values for each performance property

Total score	☑ Profit	☑ Efficiency	☑ Consistency	☑ Distribution	☑ Drawdown	☑ Trades
5 >= 4	$5743 >= $1990	46% < 60%	60% >= 60%	41% > 50%	9% <= 25%	108 > 100
5	$ 5743	46%	60%	41%	9%	108

6.2 Optimization

6.2.1 Simple optimization

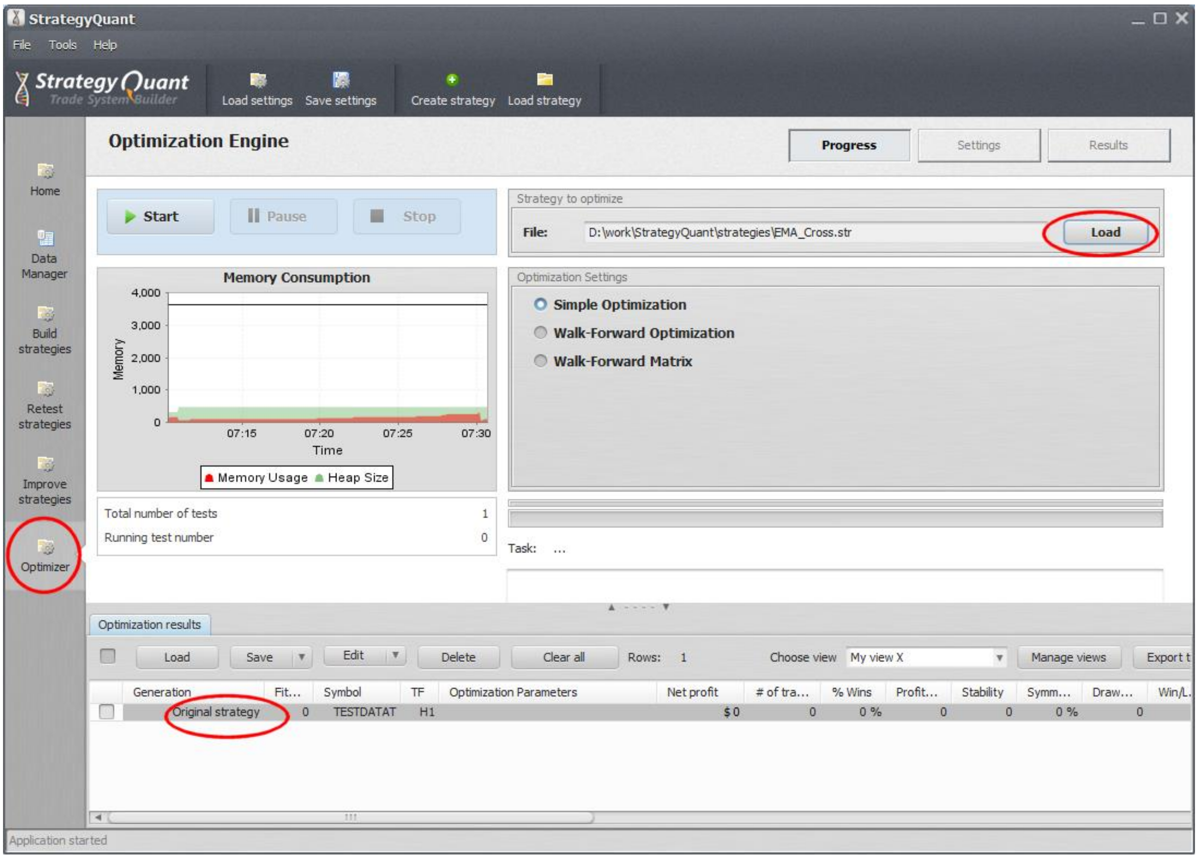
The idea behind an optimization is simple. First you have to have a trading system, this may be a simple moving average crossover for example.

In almost every system there are some parameters (indicator periods, comparative constants, etc.) that decide how given system behave. The optimization means to test the system with different parameter values
to find the optimal values of these parameters (giving highest profit or best Return/DD ratio).

Optimization example

Step 1: Loading a strategy for optimization

First of all, you have to switch to Optimizer window and load the strategy you want to optimize.



File: D:\work\StrategyQuant\strategies\EMA_Cross.str

● Simple Optimization
○ Walk-Forward Optimization
○ Walk-Forward Matrix

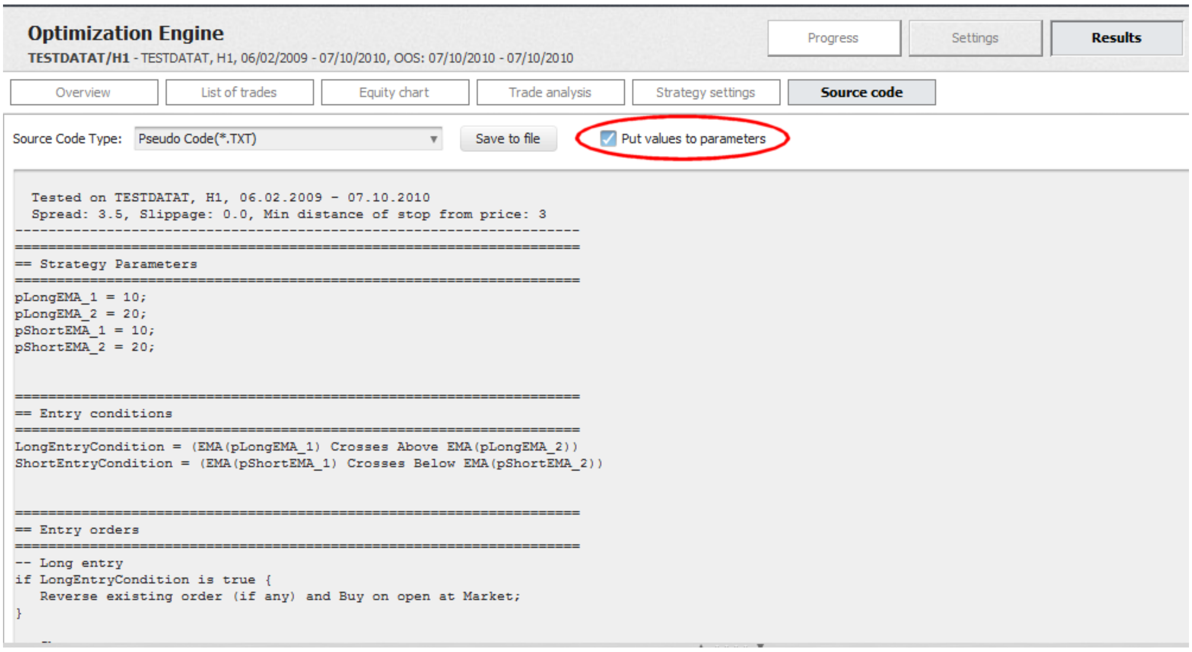
Total number of tests 1
Running test number 0

Rows: 1

	Generation	Fit...	Symbol	TF	Optimization Parameters	Net profit	# of tra...	% Wins	Profit...	Stability	Symm...	Draw...	Win/L...
□	Original strategy	0	TESTDATAT	H1		$ 0	0	0 %	0	0	0 %	0	

For this example we'll use simple EMA_Cross strategy that goes long when faster EMA crosses above slower EMA, and go short when faster EMA crosses below slower EMA.
After you loaded the strategy, it is added also as Original strategy to the Optimization results databank.

You can double click on the Original strategy and then go to Results -> Source code to see its rules.



Source Code Type: Pseudo Code(*.TXT)

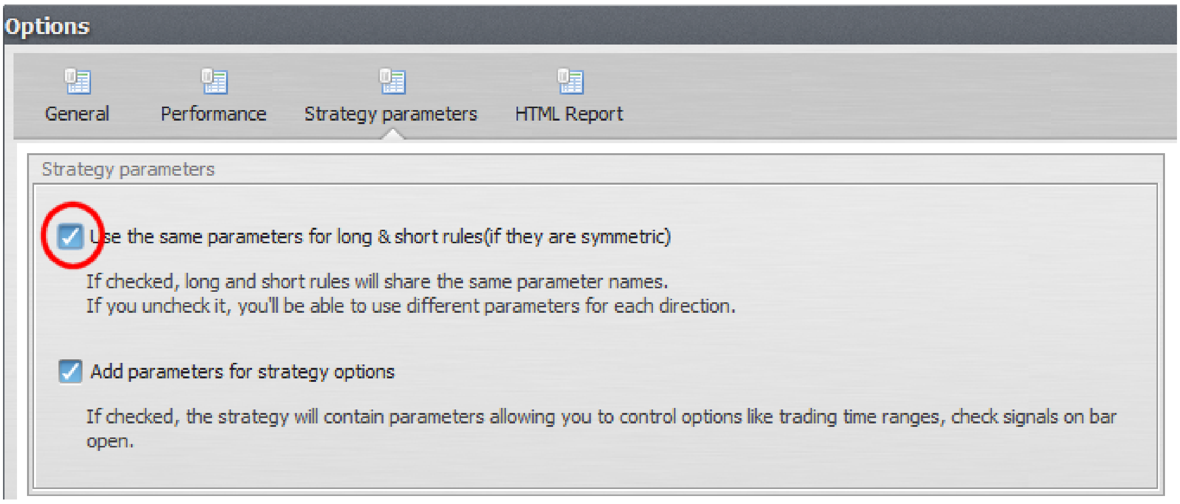
☑ Put values to parameters

```
  Tested on TESTDATAT, H1, 06.02.2009 - 07.10.2010
  Spread: 3.5, Slippage: 0.0, Min distance of stop from price: 3
--------------------------------------------------------------------
====================================================================
== Strategy Parameters
====================================================================
pLongEMA_1 = 10;
pLongEMA_2 = 20;
pShortEMA_1 = 10;
pShortEMA_2 = 20;


====================================================================
== Entry conditions
====================================================================
LongEntryCondition = (EMA(pLongEMA_1) Crosses Above EMA(pLongEMA_2))
ShortEntryCondition = (EMA(pShortEMA_1) Crosses Below EMA(pShortEMA_2))


====================================================================
== Entry orders
====================================================================
-- Long entry
if LongEntryCondition is true {
   Reverse existing order (if any) and Buy on open at Market;
}
```

Make sure you check the **Put values to parameters** checkbox so that you see that variables pLongEMA_1, pLongEMA_2, pShortEMA_1, pShortEMA_1 are used to store indicator parameters. In our optimization we'll try to find optimal values of these parameters.

There's still one small problem. We can see that the strategy uses different parameters for long and for short direction.
We can use it like this if we want to find optimal values independently for long and short side, but for our example we'd like to use the same parameter for long and short side.

We can do it in program **Tools -> Options -> Strategy parameters**.



Strategy parameters

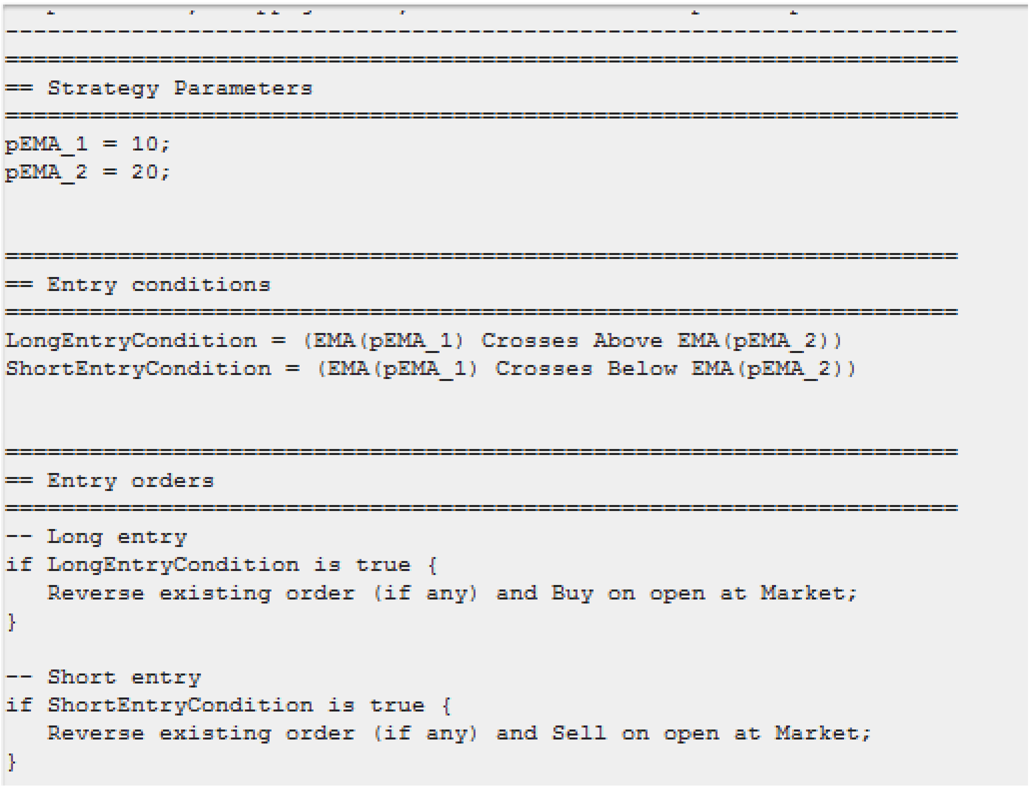
☑ Use the same parameters for long & short rules(if they are symmetric)

If checked, long and short rules will share the same parameter names.
If you uncheck it, you'll be able to use different parameters for each direction.

☑ Add parameters for strategy options

If checked, the strategy will contain parameters allowing you to control options like trading time ranges, check signals on bar open.

If you check the first checkbox, it will use the same parameters for long and short direction (providing the rules are the same).
Click OK to store the settings and refresh the source code.

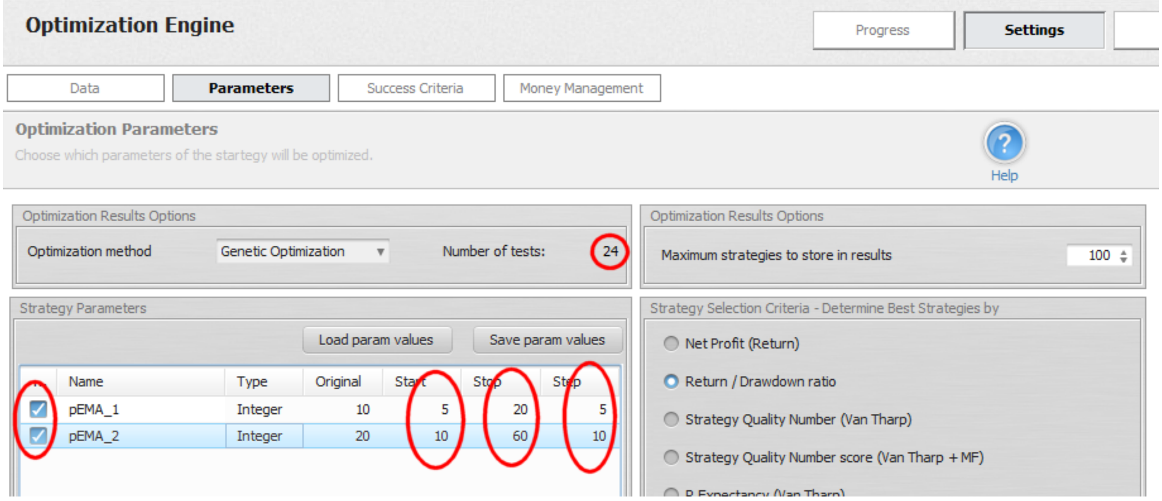


```
-------------------------------------------------------------------
===================================================================
== Strategy Parameters
===================================================================
pEMA_1 = 10;
pEMA_2 = 20;


===================================================================
== Entry conditions
===================================================================
LongEntryCondition = (EMA(pEMA_1) Crosses Above EMA(pEMA_2))
ShortEntryCondition = (EMA(pEMA_1) Crosses Below EMA(pEMA_2))


===================================================================
== Entry orders
===================================================================
-- Long entry
if LongEntryCondition is true {
   Reverse existing order (if any) and Buy on open at Market;
}

-- Short entry
if ShortEntryCondition is true {
   Reverse existing order (if any) and Sell on open at Market;
}
```

Now you can see that the strategy contains only parameters pEMA_1, pEMA_2 that are used for both directions.

Step 2: Setting optimization values

To set up values that will be optimized we have to go to Settings -> Parameters



Optimization Parameters

Choose which parameters of the startegy will be optimized.

Optimization Results Options

Optimization method: Genetic Optimization ▾ Number of tests: 24

Optimization Results Options

Maximum strategies to store in results: 100

Strategy Parameters

	Name	Type	Original	Start	Stop	Step
☑	pEMA_1	Integer	10	5	20	5
☑	pEMA_2	Integer	20	10	60	10

Strategy Selection Criteria - Determine Best Strategies by

○ Net Profit (Return)
● Return / Drawdown ratio
○ Strategy Quality Number (Van Tharp)
○ Strategy Quality Number score (Van Tharp + MF)
○ R Expectancy (Van Tharp)

Here you can see the list of all strategy parameters that are available for optimization. Optimization simply means trying different values of input parameters.

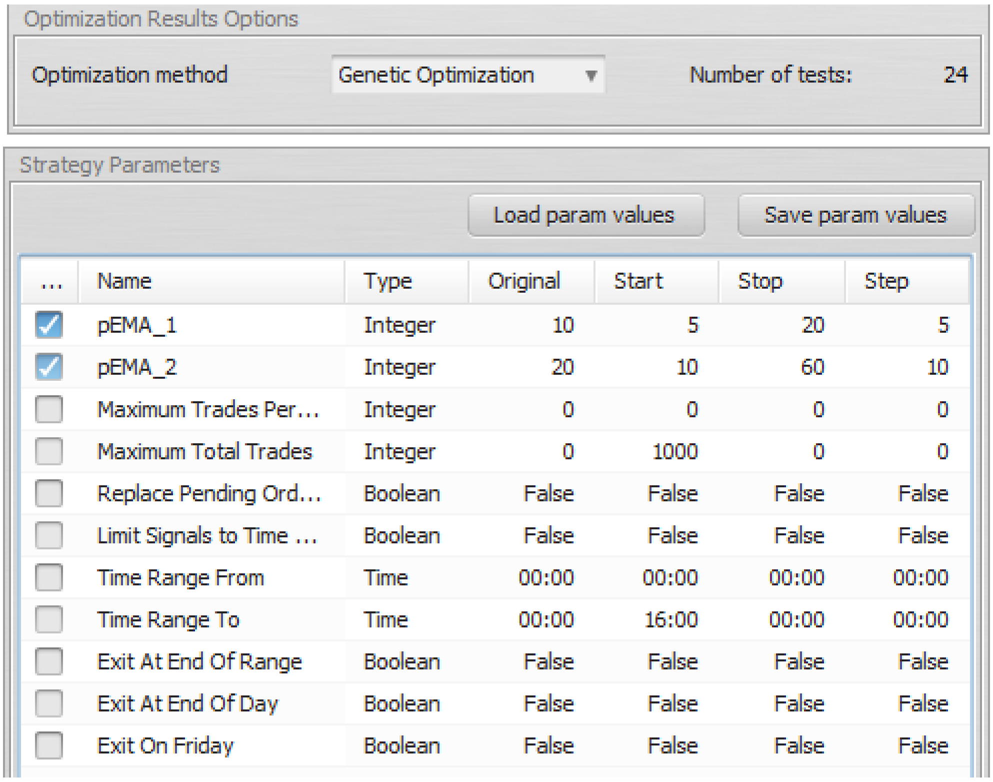
For every parameter you want to optimize you have to **check** the line of the parameter and choose **Start**, **Stop** and **Step** values. The optimizer will iterate the value from Start to Stop, taking Steps.

Original value is also configurable, it will be used to retest the original strategy. You can use this value to compare performance of new results with the "original" settings.

The **Number of tests** value shows us how many tests have to be performed to test all the combinations of the values.

Note!

It is possible that your parameters table will contain much more parameters, it could look like this:



Optimization Results Options

Optimization method: Genetic Optimization

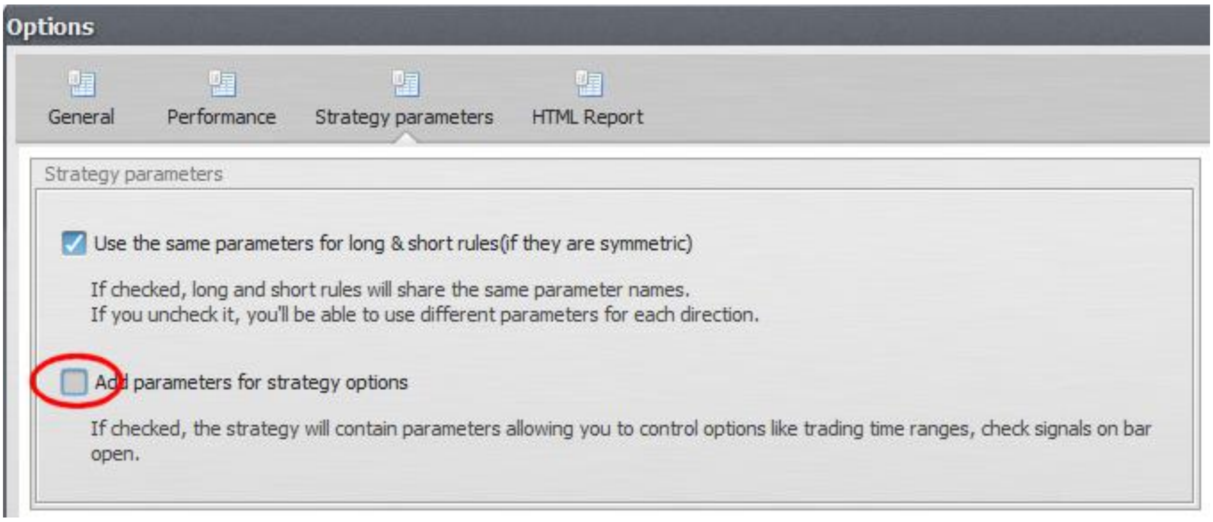
Number of tests: 24

Strategy Parameters

...	Name	Type	Original	Start	Stop	Step
☑	pEMA_1	Integer	10	5	20	5
☑	pEMA_2	Integer	20	10	60	10
□	Maximum Trades Per...	Integer	0	0	0	0
□	Maximum Total Trades	Integer	0	1000	0	0
□	Replace Pending Ord...	Boolean	False	False	False	False
□	Limit Signals to Time ...	Boolean	False	False	False	False
□	Time Range From	Time	00:00	00:00	00:00	00:00
□	Time Range To	Time	00:00	16:00	00:00	00:00
□	Exit At End Of Range	Boolean	False	False	False	False
□	Exit At End Of Day	Boolean	False	False	False	False
□	Exit On Friday	Boolean	False	False	False	False

This is another powerful feature of StrategyQuant. It allows you to optimize not only strategy parameters, but also other trading options, such as how many trades to take per day, or what should be the time range for trading.
These settings are normally a part of Strategy Options, but you can also optimize their values.

If you don't want to use them and see them in Parameters table, go once again to **Tools -> Options -> Strategy parameters** and uncheck the checkbox for **Add parameters for strategy options**.



☑ Use the same parameters for long & short rules(if they are symmetric)

If checked, long and short rules will share the same parameter names.
If you uncheck it, you'll be able to use different parameters for each direction.

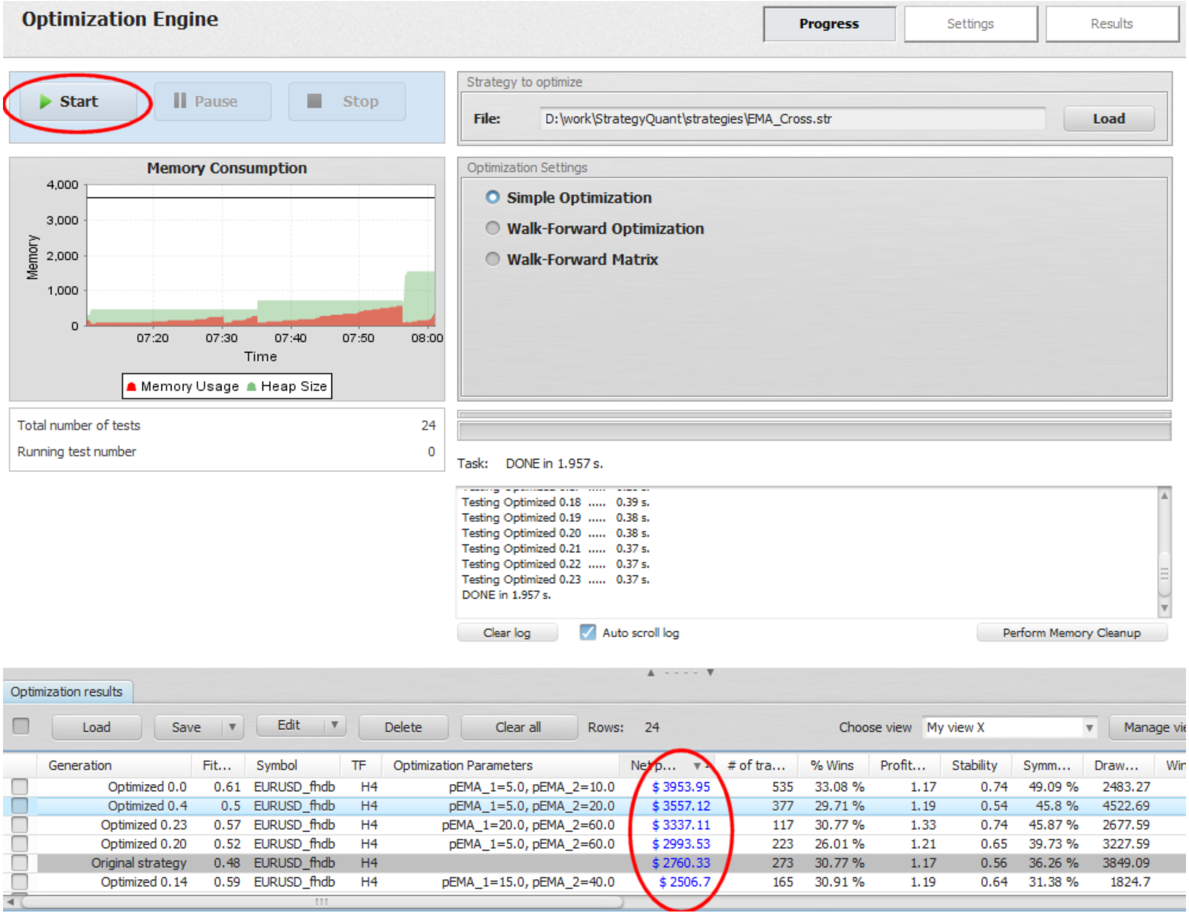
□ Add parameters for strategy options

If checked, the strategy will contain parameters allowing you to control options like trading time ranges, check signals on bar open.

The last thing we have to configure is the data that will be used for testing. We can choose EURUSD on H4 timeframe for this example.

Step 3: Running the optimization

Now we are ready to run the optimization. We'll go back to Progress screen and click on **Start** button. The optimization engine will test all the possible combinations of selected input parameters and store the results for each combination to the databank on the bottom.



Strategy to optimize

File: D:\work\StrategyQuant\strategies\EMA_Cross.str

Optimization Settings

● Simple Optimization
○ Walk-Forward Optimization
○ Walk-Forward Matrix

Total number of tests 24
Running test number 0

Task: DONE in 1.957 s.

```
Testing Optimized 0.18  .....  0.39 s.
Testing Optimized 0.19  .....  0.38 s.
Testing Optimized 0.20  .....  0.38 s.
Testing Optimized 0.21  .....  0.37 s.
Testing Optimized 0.22  .....  0.37 s.
Testing Optimized 0.23  .....  0.37 s.
DONE in 1.957 s.
```

☐ Clear log ☑ Auto scroll log

Rows: 24 Choose view: My view X

	Generation	Fit...	Symbol	TF	Optimization Parameters	Net p...	# of tra...	% Wins	Profit...	Stability	Symm...	Draw...	Wir
□	Optimized 0.0	0.61	EURUSD_fhdb	H4	pEMA_1=5.0, pEMA_2=10.0	$ 3953.95	535	33.08 %	1.17	0.74	49.09 %	2483.27	
□	Optimized 0.4	0.5	EURUSD_fhdb	H4	pEMA_1=5.0, pEMA_2=20.0	$ 3557.12	377	29.71 %	1.19	0.54	45.8 %	4522.69	
□	Optimized 0.23	0.57	EURUSD_fhdb	H4	pEMA_1=20.0, pEMA_2=60.0	$ 3337.11	117	30.77 %	1.33	0.74	45.87 %	2677.59	
□	Optimized 0.20	0.52	EURUSD_fhdb	H4	pEMA_1=5.0, pEMA_2=60.0	$ 2993.53	223	26.01 %	1.21	0.65	39.73 %	3227.59	
□	Original strategy	0.48	EURUSD_fhdb	H4		$ 2760.33	273	30.77 %	1.17	0.56	36.26 %	3849.09	
□	Optimized 0.14	0.59	EURUSD_fhdb	H4	pEMA_1=15.0, pEMA_2=40.0	$ 2506.7	165	30.91 %	1.19	0.64	31.38 %	1824.7	

We can sort the databank by Net Profit and we can see that the best input values in terms of maximum profit are pEMA_1= 5 and pEMA_2 = 10.
We can also see the results of original strategy (gray background) that used pEMA_1= 10 and pEMA_2 = 20

Interpreting the results

Now we've got input parameters that were optimized for our given symbol and timeframe.

What we've really done is we found out what worked best in the past. We have to be very careful because the parameters might be ideal for the history data,
but there is no guarantee that what worked best on history data will work also in the future.

It is called curve fitting - usually the more parameters the strategy has, the bigger is the danger of curve fitting.

There are two approaches to curve fitting:

- make sure the strategy is robust and not optimizing its values at all
- make sure the strategy benefits from periodic reoptimization

So the question is - will periodical reoptimization improve the results of my strategy?
If yes, how often should I do it?

StrategyQuant can give you answers to these questions using another of its advanced functionality - Walk-Forward Optimization and Walk-Forward Matrix.

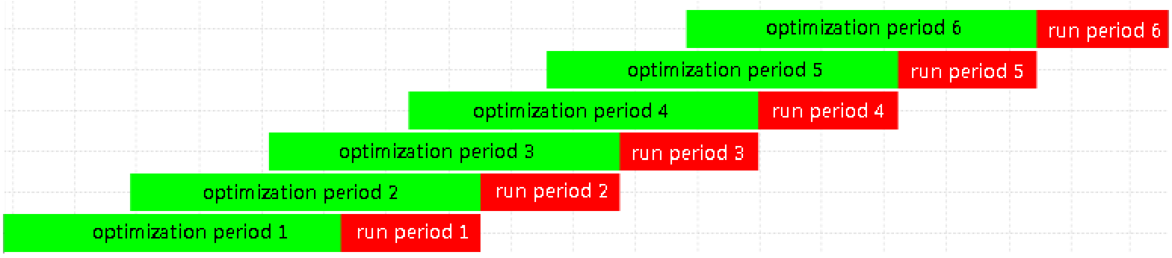
6.2.2 Walk-Forward Optimization

Walk-Forward optimization is generally a set of simple optimizations followed by trading using the best parameters.

It is a technique in which you optimize the parameter values on a past segment of market data, then verify the performance of the system by testing it forward in time on data following the optimization segment,
and the process can be repeated over subsequent time segments.

How Walk-Forward optimization works

in walk-forward optimization, the data are divided into a configurable number of periods (6 in this example).
Each period consists of optimization part and run part.



The program starts with optimization period 1. It will run the simple optimization on optimization period 1 to find the best parameter values.
These parameter values are then applied to run period 1 - strategy is tested by trading with the optimized parameters on the run period.

At the end of run period 1, the system again runs simple optimization on a part of data marked as optimization period 2.
It finds the best set of parameter values and they are again used for trading in run period 2.

This continues until the period 6, which is also the end of history data used in test.

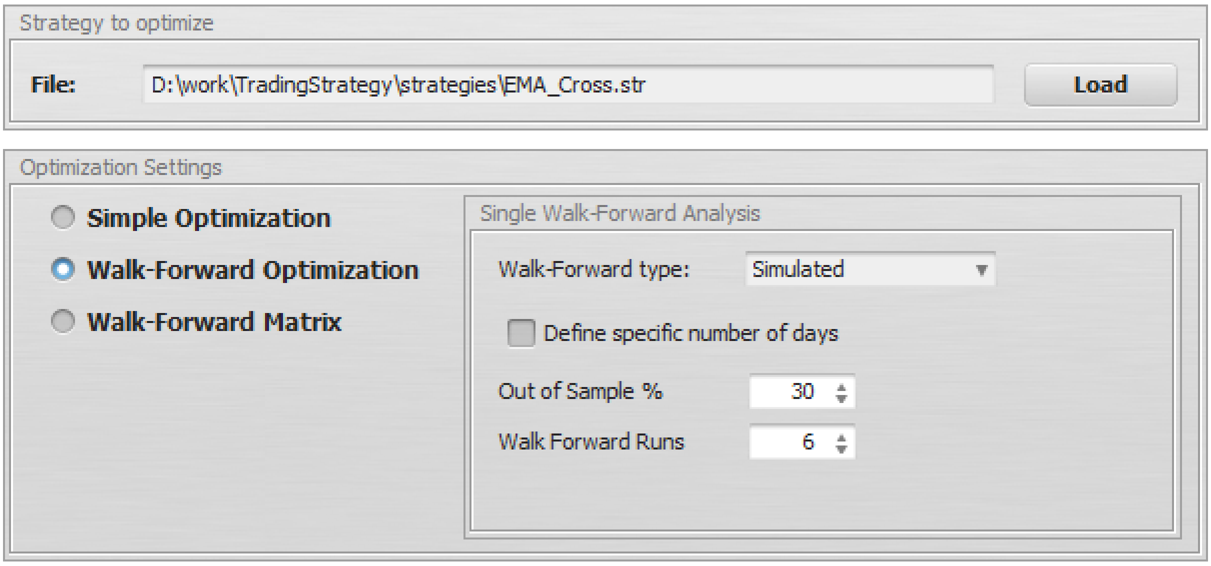
Walk-Forward optimization simulates how you'd work with the strategy during real trading - you'd optimize it on some historical data and then trade it with the optimal values.
After some time you'd want to reoptimize it and let it trade again.

Analysis of walk-forward results can tell you if the strategy is a good candidate for periodic reoptimization.

Walk-Forward optimization example

Step 1: Configuring walk-forward runs

we'll follow with our Simple optimization example, we have to load our strategy and choose the parameter values to be optimized,
only now we'll choose **Walk-Forward Optimization** option in the Progress screen.



Strategy to optimize

File: D:\work\TradingStrategy\strategies\EMA_Cross.str

Optimization Settings

○ Simple Optimization

● Walk-Forward Optimization

○ Walk-Forward Matrix

Single Walk-Forward Analysis

Walk-Forward type: Simulated

□ Define specific number of days

Out of Sample % 30

Walk Forward Runs 6

For this option we have to specify also the walk-forward settings.

Walk-Forward type

There are two types to choose: Exact and Simulated.
Exact optimization will run full optimization for every run. When you have 6 runs it means the optimization (on a given section of data) is performed 6x.

Simulated WF optimization can be much faster (10-100x) than Exact one. In this type the optimization is made only once in the beginning for the whole period,
and results for each run are computed from this one optimization.
Simulated optimization is slightly less accurate than Exact one, but the differences are acceptable and the speed is much higher. What could take you days using Exact type can be made in hours or minutes using the Simulated type.

Out of Sample %

this means how much of the whole period is left for run. If we'll set it to 30 %, it means that in each period 70% of the data are used for optimization, and 30% will be used for trading using the optimized values.

Walk Forward Runs

this means how many optimization runs there will be, which means how many times we'll reoptimize the strategy.

It is also possible to specify the optimization (In Sample) and run (Out of Sample) periods by exact days, you can do it by checking **Define specific number of days**.

Step 2: Configuring optimization criteria

This functionality was updated in version 3.5. There is no longer Success criteria settings, instead there are fully dynamic success criteria available on the results table, it is not necessary to configure this upfront.

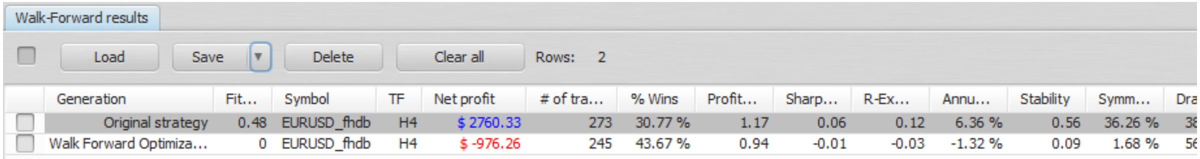
To find more information about what each criterion means, check the Success Criteria page.

Now we can go back to progress panel and click on the **Start** button.

Step 3: Checking the results

Walk-Forward optimization takes longer than a simple one, because there are 6 (or more) optimization steps instead of just one.

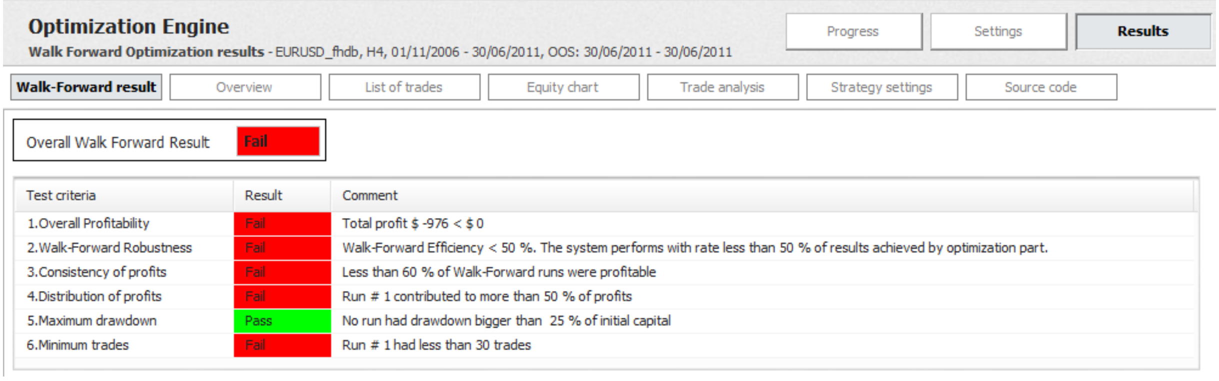
When it finishes, we'll see that we have only two results in the databank - Original strategy and Walk-Forward result.



Rows: 2

	Generation	Fit...	Symbol	TF	Net profit	# of tra...	% Wins	Profit...	Sharp...	R-Ex...	Annu...	Stability	Symm...	Dra
☐	Original strategy	0.48	EURUSD_fhdb	H4	$ 2760.33	273	30.77 %	1.17	0.06	0.12	6.36 %	0.56	36.26 %	38
☐	Walk Forward Optimiza...	0	EURUSD_fhdb	H4	$ -976.26	245	43.67 %	0.94	-0.01	-0.03	-1.32 %	0.09	1.68 %	56

We can see that Walk-Forward result ended up in loss, $ - 976.
When we'll double click on the result in the databank, the strategy results will open.



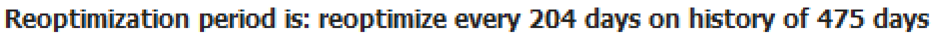
Optimization Engine
Walk Forward Optimization results - EURUSD_fhdb, H4, 01/11/2006 - 30/06/2011, OOS: 30/06/2011 - 30/06/2011

Overall Walk Forward Result: Fail

Test criteria	Result	Comment
1.Overall Profitability	Fail	Total profit $ -976 < $ 0
2.Walk-Forward Robustness	Fail	Walk-Forward Efficiency < 50 %. The system performs with rate less than 50 % of results achieved by optimization part.
3.Consistency of profits	Fail	Less than 60 % of Walk-Forward runs were profitable
4.Distribution of profits	Fail	Run # 1 contributed to more than 50 % of profits
5.Maximum drawdown	Pass	No run had drawdown bigger than 25 % of initial capital
6.Minimum trades	Fail	Run # 1 had less than 30 trades

We can see that the strategy failed in walk-forward test, based on our success criteria.
On the top you have the overall result, and in the Test criteria table below you can see the results broken down by each success criteria used.

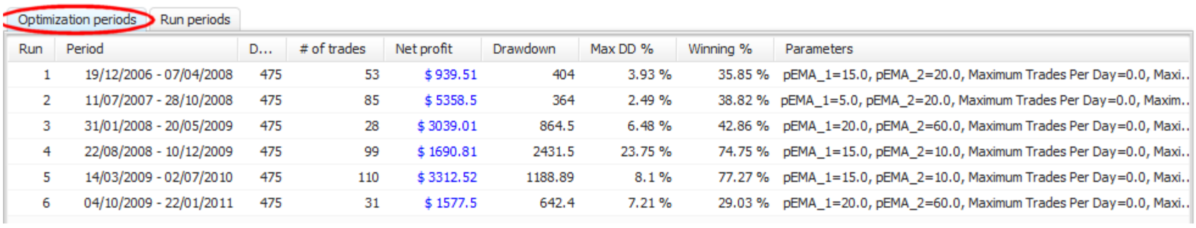
Below this table we'll see the reoptimization period that was used:



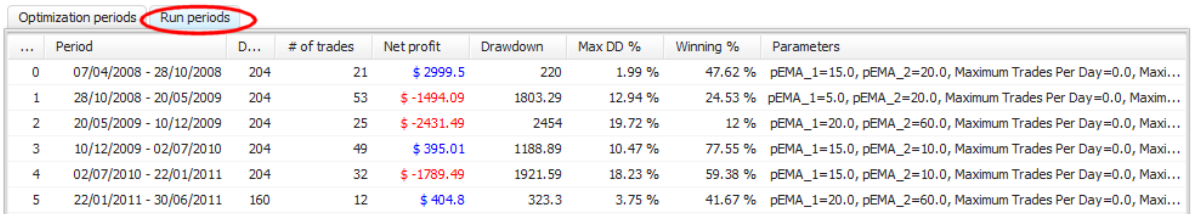
Reoptimization period is: reoptimize every 204 days on history of 475 days

We didn't specify the days exactly (we could by checking the Define specific number of days check in the Progress panel).
These values (204 days of run and 475 days of optimization) were computed from the available history data because we specified we want to have 6 runs and 30% Out of sample (run) data.

Below this information we can check the results for each optimization and run period:


Optimization periods
Run periods

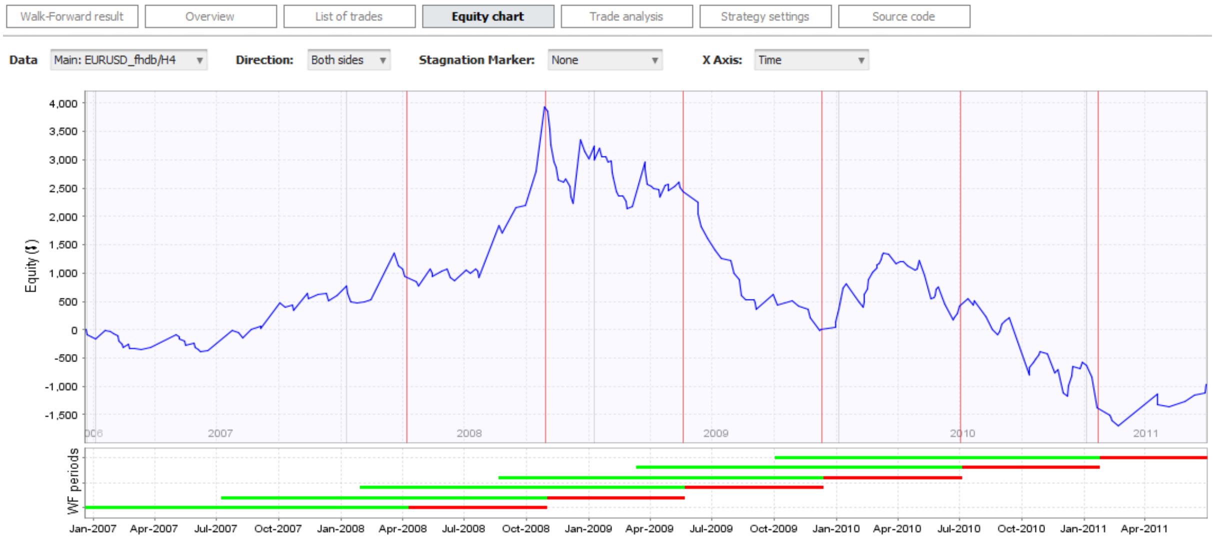
Run	Period	D...	# of trades	Net profit	Drawdown	Max DD %	Winning %	Parameters
1	19/12/2006 - 07/04/2008	475	53	$ 939.51	404	3.93 %	35.85 %	pEMA_1=15.0, pEMA_2=20.0, Maximum Trades Per Day=0.0, Maxi..
2	11/07/2007 - 28/10/2008	475	85	$ 5358.5	364	2.49 %	38.82 %	pEMA_1=5.0, pEMA_2=20.0, Maximum Trades Per Day=0.0, Maxim..
3	31/01/2008 - 20/05/2009	475	28	$ 3039.01	864.5	6.48 %	42.86 %	pEMA_1=20.0, pEMA_2=60.0, Maximum Trades Per Day=0.0, Maxi..
4	22/08/2008 - 10/12/2009	475	99	$ 1690.81	2431.5	23.75 %	74.75 %	pEMA_1=15.0, pEMA_2=10.0, Maximum Trades Per Day=0.0, Maxi..
5	14/03/2009 - 02/07/2010	475	110	$ 3312.52	1188.89	8.1 %	77.27 %	pEMA_1=15.0, pEMA_2=10.0, Maximum Trades Per Day=0.0, Maxi..
6	04/10/2009 - 22/01/2011	475	31	$ 1577.5	642.4	7.21 %	29.03 %	pEMA_1=20.0, pEMA_2=60.0, Maximum Trades Per Day=0.0, Maxi..


Optimization periods
Run periods

...	Period	D...	# of trades	Net profit	Drawdown	Max DD %	Winning %	Parameters
0	07/04/2008 - 28/10/2008	204	21	$ 2999.5	220	1.99 %	47.62 %	pEMA_1=15.0, pEMA_2=20.0, Maximum Trades Per Day=0.0, Maxi...
1	28/10/2008 - 20/05/2009	204	53	$ -1494.09	1803.29	12.94 %	24.53 %	pEMA_1=5.0, pEMA_2=20.0, Maximum Trades Per Day=0.0, Maxim...
2	20/05/2009 - 10/12/2009	204	25	$ -2431.49	2454	19.72 %	12 %	pEMA_1=20.0, pEMA_2=60.0, Maximum Trades Per Day=0.0, Maxi...
3	10/12/2009 - 02/07/2010	204	49	$ 395.01	1188.89	10.47 %	77.55 %	pEMA_1=15.0, pEMA_2=10.0, Maximum Trades Per Day=0.0, Maxi...
4	02/07/2010 - 22/01/2011	204	32	$ -1789.49	1921.59	18.23 %	59.38 %	pEMA_1=15.0, pEMA_2=10.0, Maximum Trades Per Day=0.0, Maxi...
5	22/01/2011 - 30/06/2011	160	12	$ 404.8	323.3	3.75 %	41.67 %	pEMA_1=20.0, pEMA_2=60.0, Maximum Trades Per Day=0.0, Maxi...

You can see that only 3 out of 6 runs ended up in profit.

We can also check the equity chart:



Data Main: EURUSD_fhdb/H4 Direction: Both sides Stagnation Marker: None X Axis: Time

Interpreting the results

How should we interpret these results?

First of all, it is clear that this particular strategy will not benefit from reoptimization, at least not from the reoptimization using the periods we specified - 6 reoptimizations in 5 years, which is roughly reoptimization every 200 days.

It is possible that this strategy simply not robust enough and it will fail in the future.

But there is also a possibility that the strategy could be profitable if different, more frequent periods of reoptimizations are chosen.
How can we tell what is the best reoptimization period for strategy?

This is where Walk-Forward Matrix comes to play.

6.2.3 Walk-Forward Matrix

Walk-Forward Matrix is a powerful feature that can help you with two things:

1. Find the optimal period for strategy reoptimization
it will help you identify the best optimization frequency

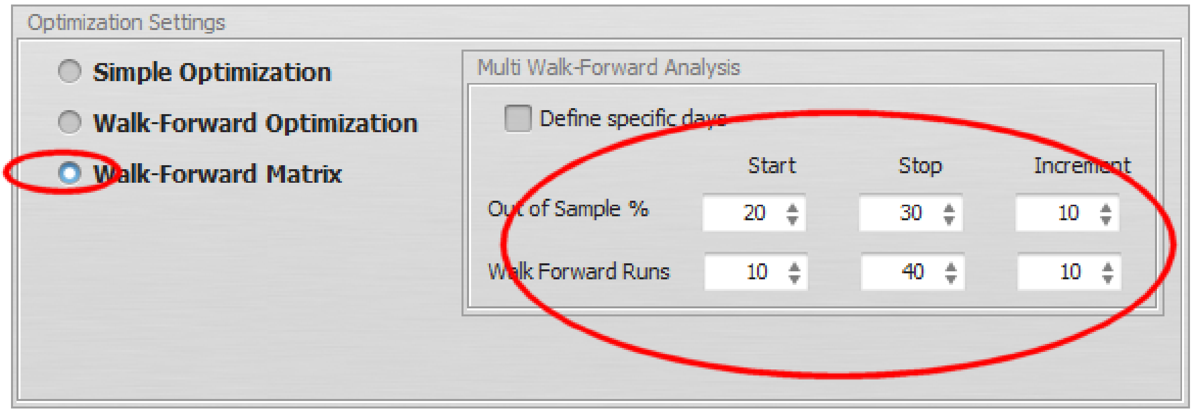
2. Test the strategy for robustness
if the strategy passes Walk-Forward Matrix test it means that with the help of parameter reoptimization it is adaptable to a big range of market conditions.

Standard Walk-Forward optimization tests the strategy results if it is periodically reoptimized, let's say every 300 days.
But how do we know how often it is the best to reoptimize the strategy?
We can only guess, unless we'll use Walk-Forward Matrix that will test various combinations of reoptimization periods.

Walk-Forward Matrix example

Step 1: Configuring Walk-Forward Matrix

We'll continue with our example where we left it in the Walk-Forward Optimization part.
This time we'll choose Walk-Forward Matrix option.



Optimization Settings

○ Simple Optimization
○ Walk-Forward Optimization
● Walk-Forward Matrix

Multi Walk-Forward Analysis

□ Define specific days

	Start	Stop	Increment
Out of Sample %	20	30	10
Walk Forward Runs	10	40	10

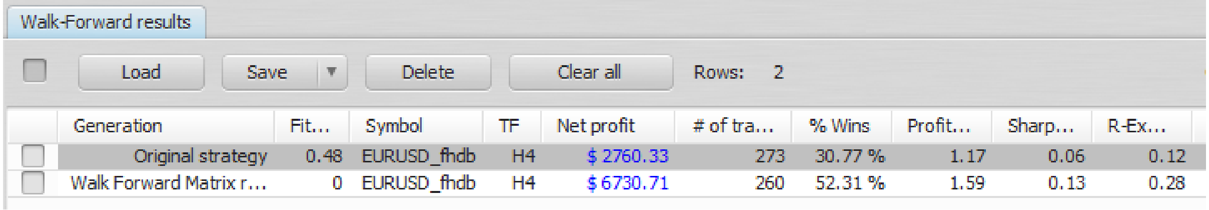
In the matrix we have to specify which combinations we want to test for Walk-Forward Optimization.

All the other settings (combination of parameter values to test and success criteria) are already set by previous examples,
so we can click on the **Start** button to start testing.

Computation of Walk-Forward Matrix is very time-consuming, because it has to run full Walk-Forward optimization for every combination in the matrix.
It is better to not set too many steps, at least if you want to have the results relatively quickly.

Step 2: Checking the results

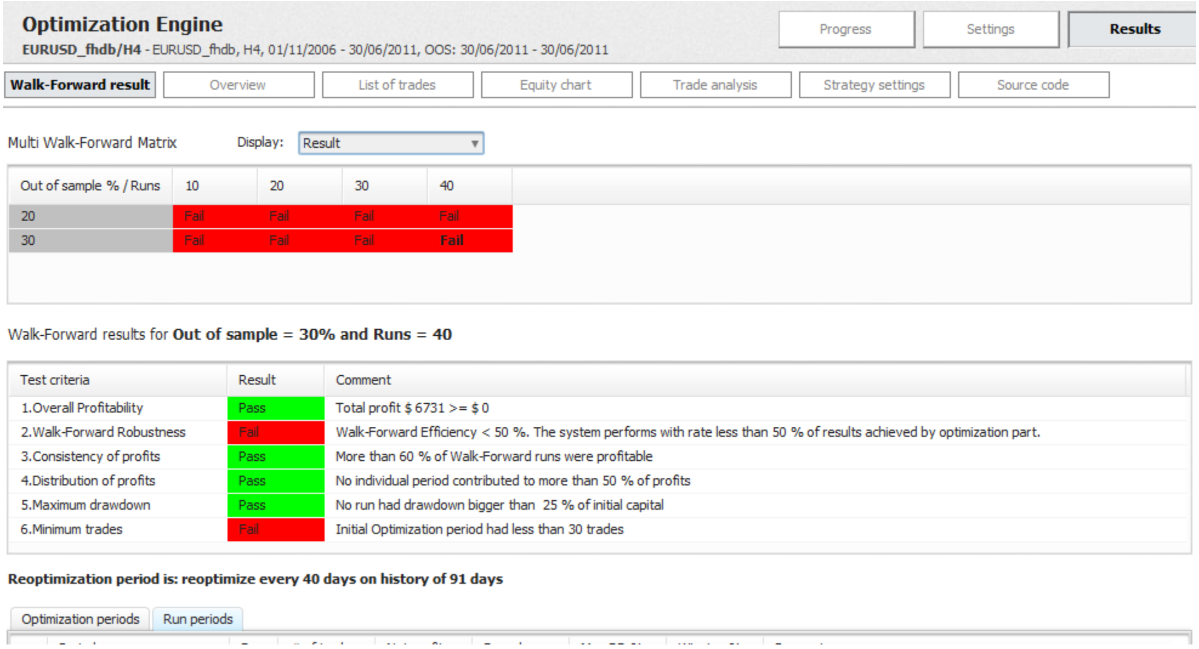
When the optimization is over, we once again get a new **Walk-Forward Matrix result** in our databank.



Rows: 2

□	Generation	Fit...	Symbol	TF	Net profit	# of tra...	% Wins	Profit...	Sharp...	R-Ex...
□	Original strategy	0.48	EURUSD_fhdb	H4	$ 2760.33	273	30.77 %	1.17	0.06	0.12
□	Walk Forward Matrix r...	0	EURUSD_fhdb	H4	$ 6730.71	260	52.31 %	1.59	0.13	0.28

Double-click on it to load it to the Results screen.



EURUSD_fhdb/H4 - EURUSD_fhdb, H4, 01/11/2006 - 30/06/2011, OOS: 30/06/2011 - 30/06/2011

Multi Walk-Forward Matrix   Display: Result

Out of sample % / Runs	10	20	30	40
20	Fail	Fail	Fail	Fail
30	Fail	Fail	Fail	**Fail**

Walk-Forward results for **Out of sample = 30% and Runs = 40**

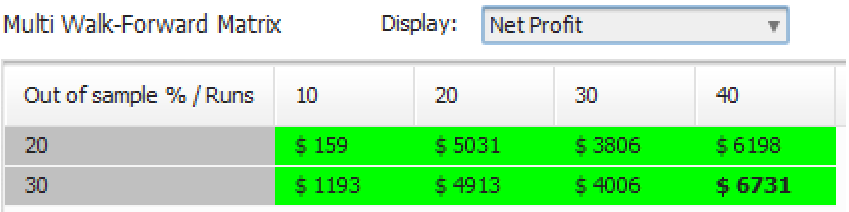
Test criteria	Result	Comment
1.Overall Profitability	Pass	Total profit $ 6731 >= $ 0
2.Walk-Forward Robustness	Fail	Walk-Forward Efficiency < 50 %. The system performs with rate less than 50 % of results achieved by optimization part.
3.Consistency of profits	Pass	More than 60 % of Walk-Forward runs were profitable
4.Distribution of profits	Pass	No individual period contributed to more than 50 % of profits
5.Maximum drawdown	Pass	No run had drawdown bigger than 25 % of initial capital
6.Minimum trades	Fail	Initial Optimization period had less than 30 trades

Reoptimization period is: reoptimize every 40 days on history of 91 days

We can see that all the combinations of WF optimization failed (according to the success criteria we defined before).
You can click on any of the cell on Multi Walk-Forward Matrix table to update the results for the selected combination. Let's choose combination 30 / 40 on the bottom right.

If you'll look at the Test criteria table, you'll see that it failed only in 2 out of 6 criteria - in Walk-Forward Robustness and number of trades.

We can switch the Display combo box to show us net profit.



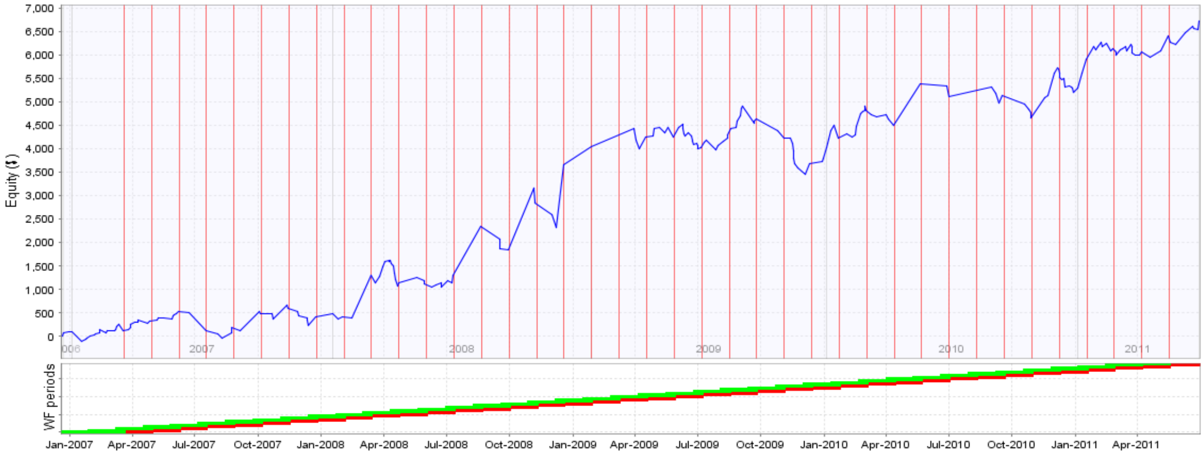
Multi Walk-Forward Matrix   Display: Net Profit

Out of sample % / Runs	10	20	30	40
20	$ 159	$ 5031	$ 3806	$ 6198
30	$ 1193	$ 4913	$ 4006	**$ 6731**

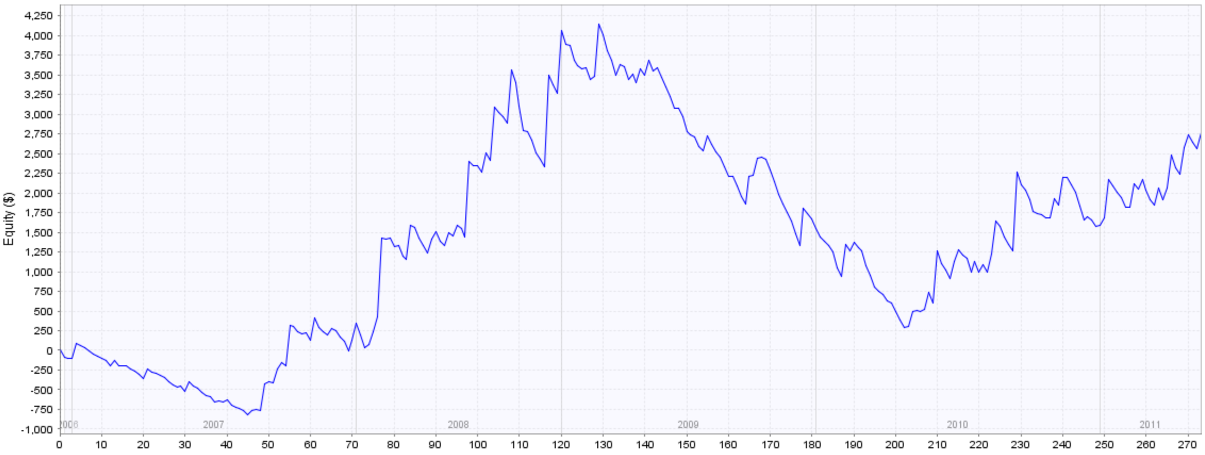
This is not bad at all, the best result was achieved for combination of 30% Out of Sample and 40 optimization runs, which corresponds to reoptimization every 40 days with history of 91 days.

The strategy then made profit $ 6731, while the original strategy without reoptimizations made only $ 2760.
So it seems that frequent reoptimization does benefit the strategy.

We can look at the equity chart for this combination.



it is not bad, the chart is not ideal, but it is a big improvement from our original strategy chart that looked like this:



We can see that reoptimized strategy remained profitable for most of the time, even during the periods when the original strategy was losing.

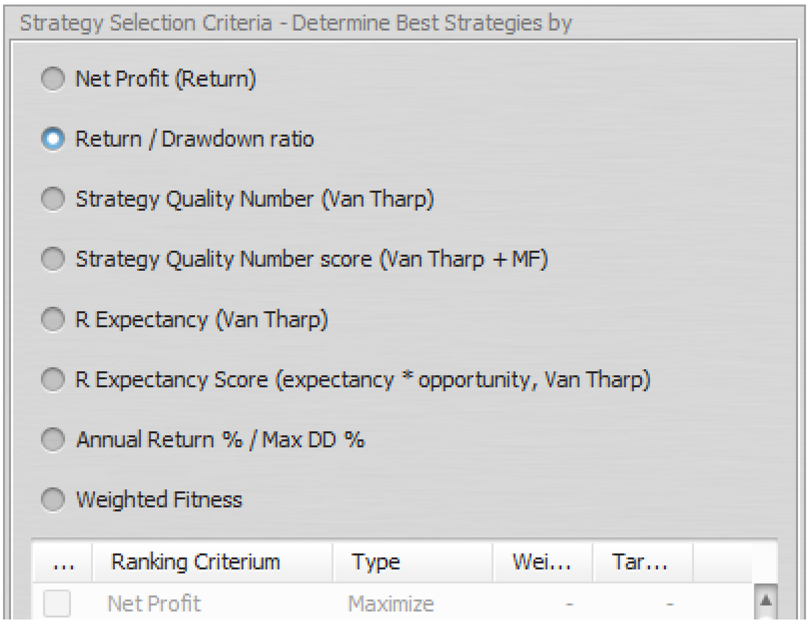
Final conclusion

We saw that this particular strategy benefited from frequent reoptimization. It still failed our success criteria, but perhaps with some additional filter its efficiency can be improved further.

Possible improvements

There are several possible improvements of our Walk-Forward analysis, for example we can choose different steps for the parameter values.
We chose pEMA_1 to go from 5 to 20 in steps of 5, and pEMA_2 to go from 10 to 60 in steps of 10. Perhaps the Walk-Forward result would be better if both values are optimized to range from 5 to 50 with steps 5.

Another setting that influences Walk-Forward result is our choice of Selection Criteria.



Strategy Selection Criteria - Determine Best Strategies by

○ Net Profit (Return)
● Return / Drawdown ratio
○ Strategy Quality Number (Van Tharp)
○ Strategy Quality Number score (Van Tharp + MF)
○ R Expectancy (Van Tharp)
○ R Expectancy Score (expectancy * opportunity, Van Tharp)
○ Annual Return % / Max DD %
○ Weighted Fitness

...	Ranking Criterium	Type	Wei...	Tar...
□	Net Profit	Maximize	-	-

In our examples we chose to select the best strategy by Return / Drawdown ratio.
Who knows, maybe the Walk-Forward optimization would have better results if we'd choose Strategy Quality Number score, or R Expectancy.

You can repeat the optimization with another Selection Criteria to check it out.

6.3 Portfolios

There are two possibilities how to create a portfolio:

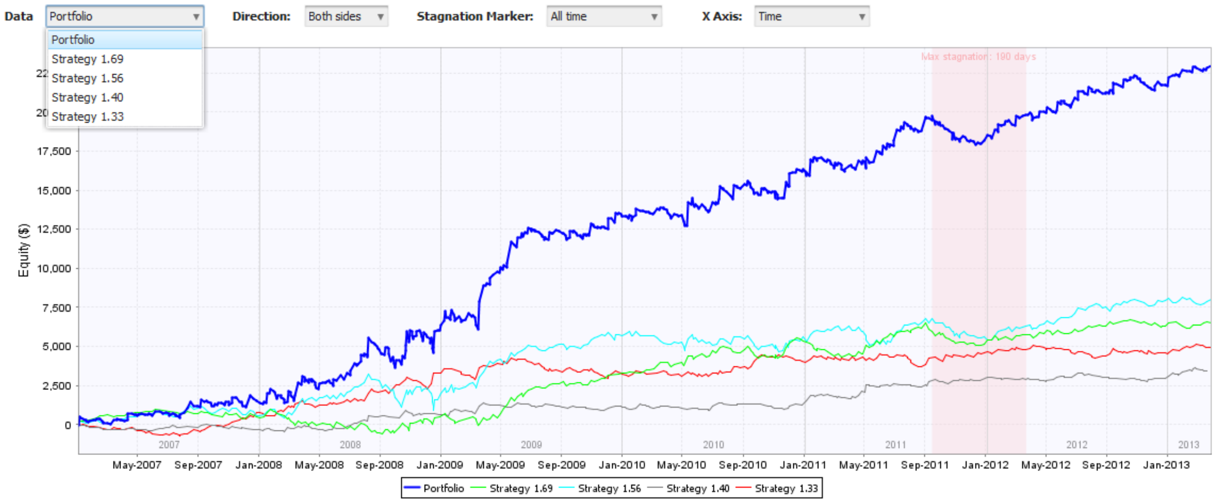
1. **Use Additional data to build/test strategy on multiple symbols or timeframes** - this will create a portfolio that will contain results
   of the same strategy tested on different data

2. **Manually combine strategies to a portfolio** - this will create a portfolio of different strategies combined together, trading on the same or different symbols & timeframes

Portfolio results are a summary results of all the strategies it contains. For portfolios created manually (2) there is a special "Portfolio #" result created in databank that can be saved to a file for later use.

Portfolio chart

Equity chart for portfolio combines equity of the portfolio as well as equity for every strategy in the portfolio. When viewing a portfolio you can switch between portfolio chart and
charts of substrategies using a combo box on the top left corner of the chart.



Data: Portfolio
Direction: Both sides
Stagnation Marker: All time
X Axis: Time

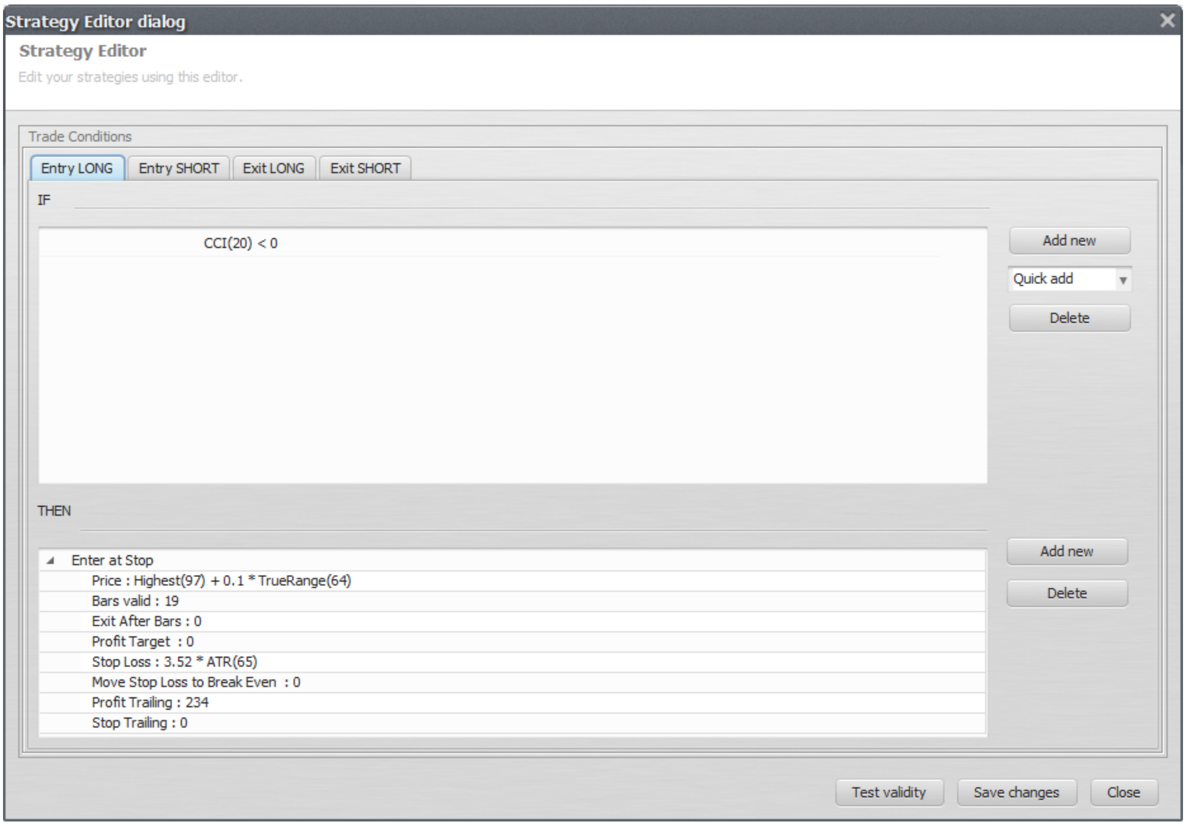
6.4 Strategy Editor

Note!

StrategyQuant strategies have a fixed format, and editor matches this format with 4 tabs, for Entry Long, Entry Short, Exit Long
(if we want to close the trade using some rule other than Stop Loss or Profit Target) and Exit Short.

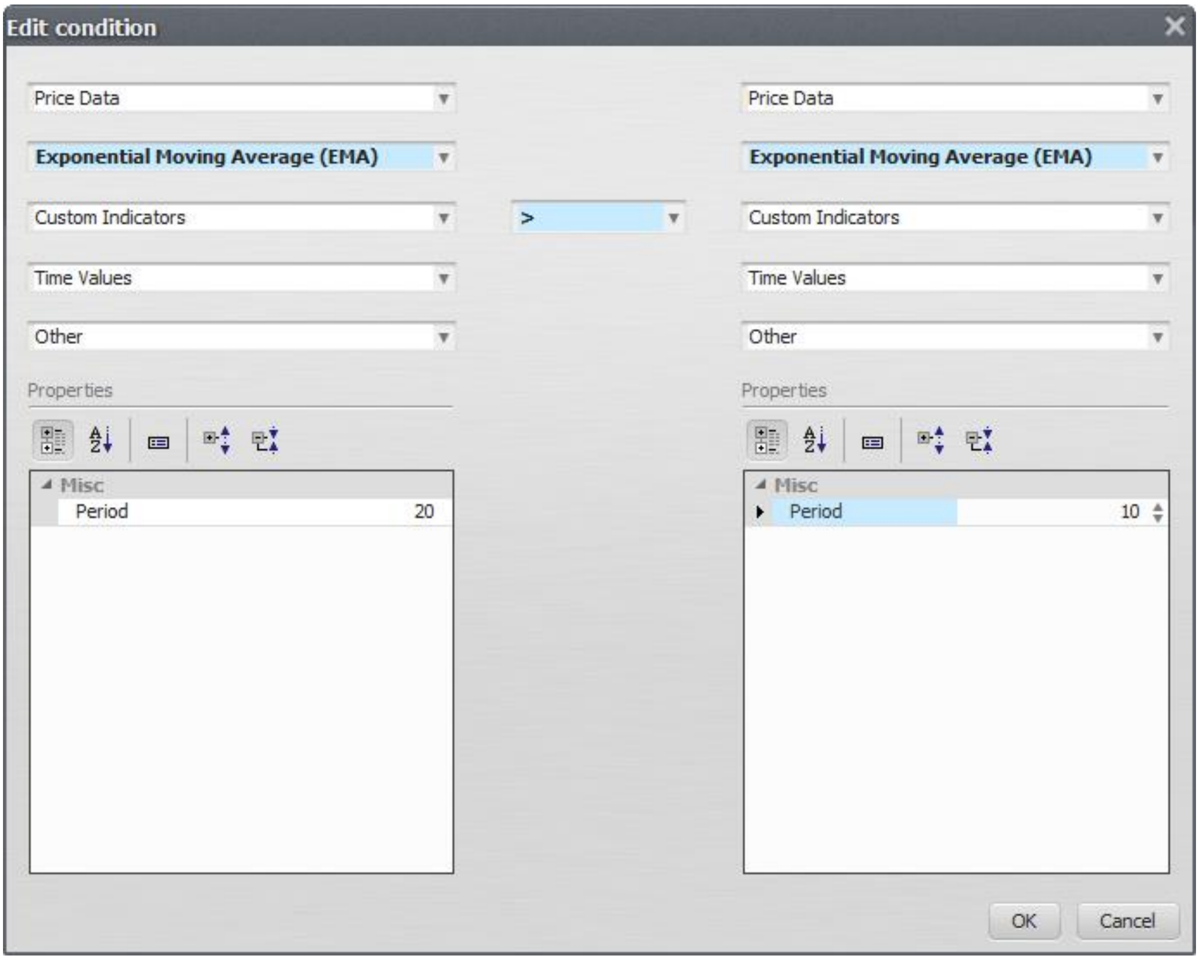
Each tab has IF and THEN part – in the IF part you define the conditions, and in the THEN part you define what should happen once the conditions are true.

To **CREATE** new strategy, go to menu File -> Create strategy or click on the icon on the toolbar.
To **EDIT** existing strategy just select it in the databank and click Edit.



CCI(20) < 0

Enter at Stop
Price : Highest(97) + 0.1 * TrueRange(64)
Bars valid : 19
Exit After Bars : 0
Profit Target : 0
Stop Loss : 3.52 * ATR(65)
Move Stop Loss to Break Even : 0
Profit Trailing : 234
Stop Trailing : 0



Exponential Moving Average (EMA)

Misc

Period 20

>

Exponential Moving Average (EMA)

Misc

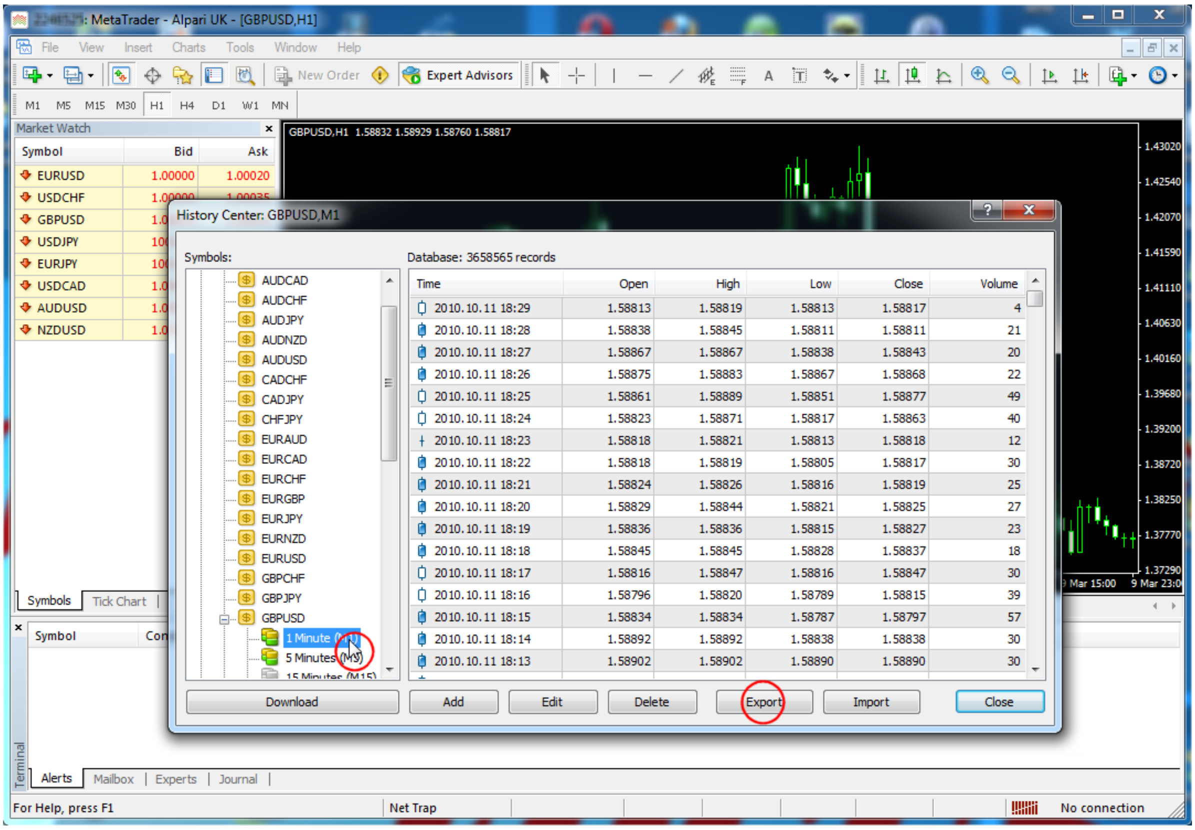
Period 10

7 How to…

7.1 Import history data from MetaTrader

Step 1: Export data from Metatrader

Open your Metatrader and go to **Tools** -> **History Center**.



Database: 3658565 records

Time	Open	High	Low	Close	Volume
2010.10.11 18:29	1.58813	1.58819	1.58813	1.58817	4
2010.10.11 18:28	1.58838	1.58845	1.58811	1.58811	21
2010.10.11 18:27	1.58867	1.58867	1.58838	1.58843	20
2010.10.11 18:26	1.58875	1.58883	1.58867	1.58868	22
2010.10.11 18:25	1.58861	1.58889	1.58851	1.58877	49
2010.10.11 18:24	1.58823	1.58871	1.58817	1.58863	40
2010.10.11 18:23	1.58818	1.58821	1.58813	1.58818	12
2010.10.11 18:22	1.58818	1.58819	1.58805	1.58817	30
2010.10.11 18:21	1.58824	1.58826	1.58816	1.58819	25
2010.10.11 18:20	1.58829	1.58844	1.58821	1.58825	27
2010.10.11 18:19	1.58836	1.58836	1.58815	1.58827	23
2010.10.11 18:18	1.58845	1.58845	1.58828	1.58837	18
2010.10.11 18:17	1.58816	1.58847	1.58816	1.58847	30
2010.10.11 18:16	1.58796	1.58820	1.58789	1.58815	39
2010.10.11 18:15	1.58834	1.58834	1.58787	1.58797	57
2010.10.11 18:14	1.58892	1.58892	1.58838	1.58838	30
2010.10.11 18:13	1.58902	1.58902	1.58890	1.58890	30

There, open the currency you want to export (for example GBPUSD) and double click on **1 Minute (M1)** so that it is refreshed on the right side of the screen.

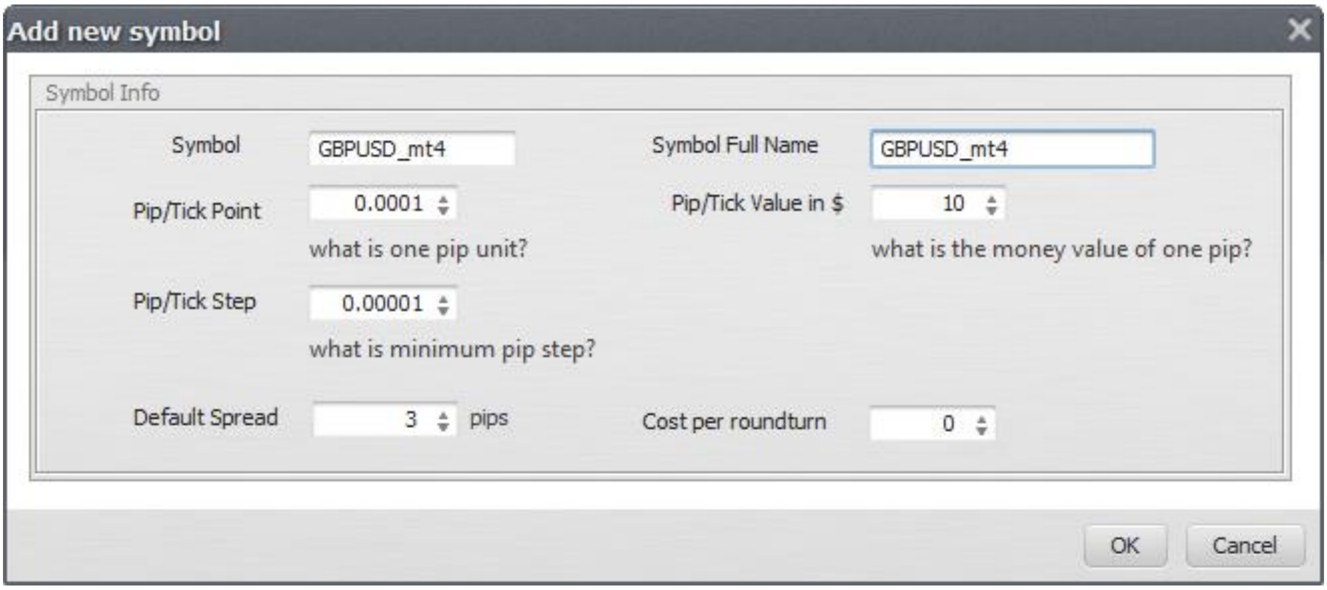
Then just click on the **Export** button and choose your destination file.

Note
StrategyQuant supports import of only 1 Minute data, it will compute the higher timeframes automatically.

Now we have the data ready to be imported to StrategyQuant.

Step 2: Create a new symbol in StrategyQuant

We can import data to already existing symbol, but that will overwrite its data, so it is better to define a new symbol.
Start StrategyQuant, go to **Data manager** screen**, History Data** and click on **Add symbol..**.



Symbol: GBPUSD_mt4

Symbol Full Name: GBPUSD_mt4

Pip/Tick Point: 0.0001 — what is one pip unit?

Pip/Tick Value in $: 10 — what is the money value of one pip?

Pip/Tick Step: 0.00001 — what is minimum pip step?

Default Spread: 3 pips

Cost per roundturn: 0

Fill out the symbol and full name, check the default spread and tick value.

Pip/Tick point

is the value of pip. It means what number is 1 pip. is usually 0.0001. For **JPY** based pairs 1 pip is 0.01.

Pip/Tick value in $

is a value how much is one pip worth in money, it is usually 10 for all the currencies.

Pip/Tick Step

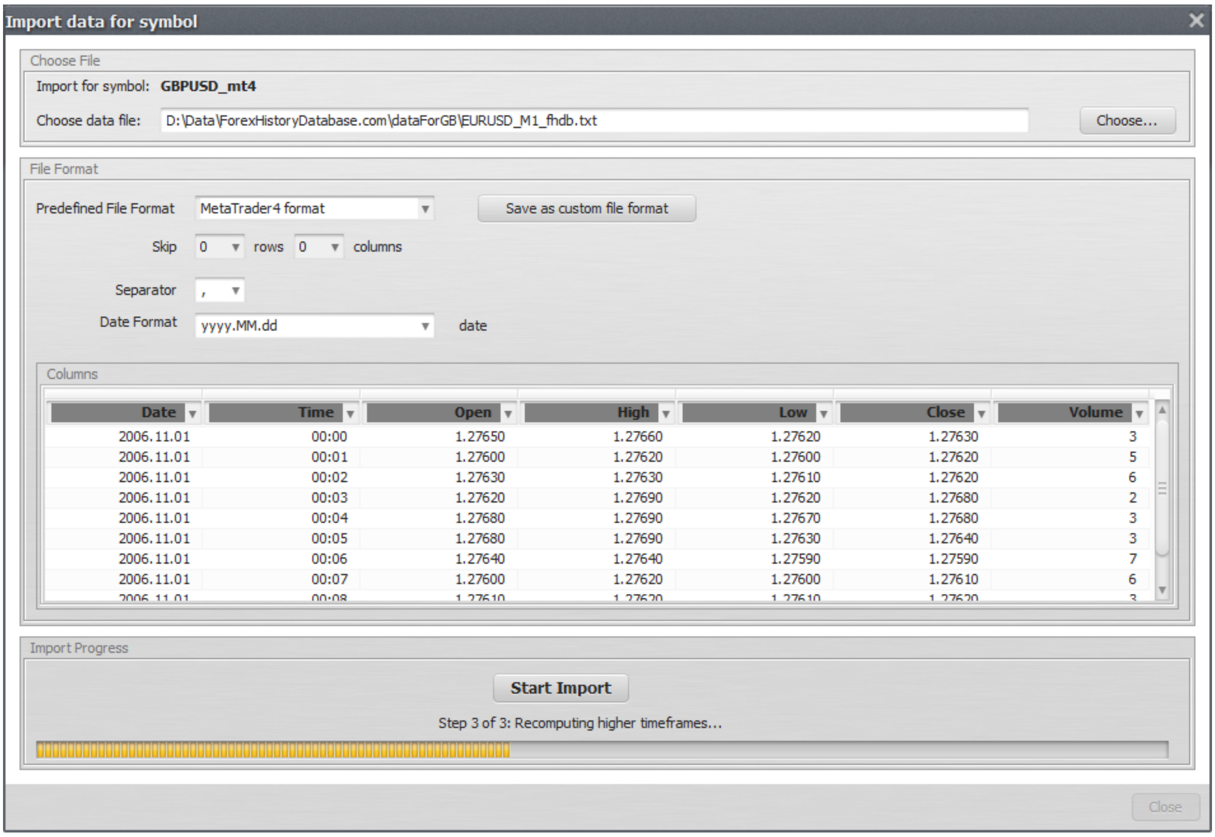
is a value by how much one pip can move. Virtually all brokers now use 5-digit data, so the value will be 0.00001 (or 0.001 for JPY based pairs).

Click OK and the new symbol will be created. The symbol doesn't have any data yet, but we are going to import them in the next step.

Step 3: Import data to StrategyQuant

Now select your new row with the symbol and click on **Import data ...** button on the top. This will open the import dialog.

Import dialog is configurable; it allows importing data from various file formats. Since we use data from MetaTrader, choose MetaTrader4 as a Predefined File Format.



Import data for symbol

Choose File

Import for symbol: **GBPUSD_mt4**

Choose data file: D:\Data\ForexHistoryDatabase.com\dataForGB\EURUSD_M1_fhdb.txt

File Format

Predefined File Format: MetaTrader4 format

Skip 0 rows 0 columns

Separator ,

Date Format yyyy.MM.dd date

Columns

Date	Time	Open	High	Low	Close	Volume
2006.11.01	00:00	1.27650	1.27660	1.27620	1.27630	3
2006.11.01	00:01	1.27600	1.27620	1.27600	1.27620	5
2006.11.01	00:02	1.27630	1.27630	1.27610	1.27620	6
2006.11.01	00:03	1.27620	1.27690	1.27620	1.27680	2
2006.11.01	00:04	1.27680	1.27690	1.27670	1.27680	3
2006.11.01	00:05	1.27680	1.27690	1.27630	1.27640	3
2006.11.01	00:06	1.27640	1.27640	1.27590	1.27590	7
2006.11.01	00:07	1.27600	1.27620	1.27600	1.27610	6
2006.11.01	00:08	1.27610	1.27620	1.27610	1.27620	3

Import Progress

Step 3 of 3: Recomputing higher timeframes...

Choose the data file and click on Start Import button. This will start the import process. It could take few minutes, depending on speed of your computer and data size.

When the import is finished it will display information window and asks you to close the dialog.

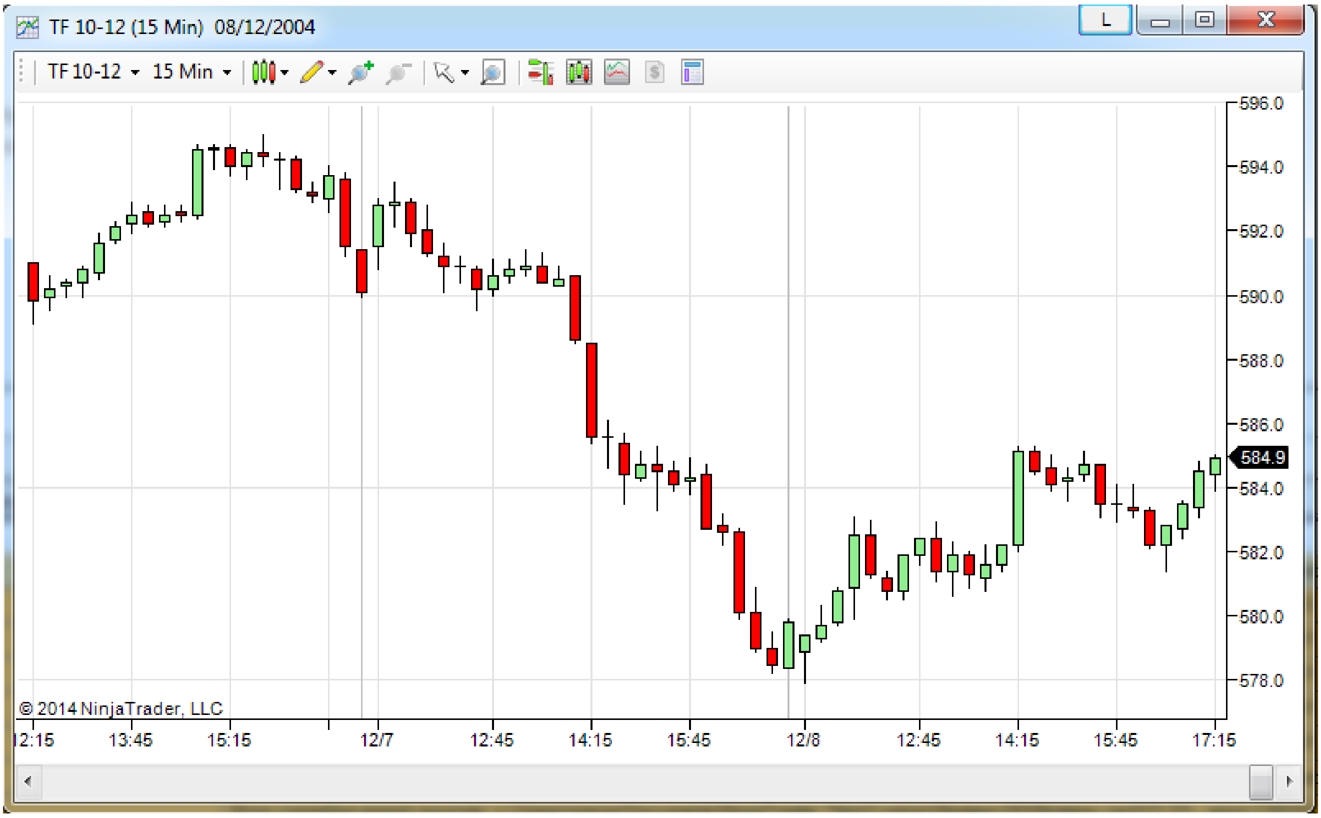
Now we have the new data successfully imported into StrategyQuant and we can use them for tests or new strategies generation.

7.2 Import history data from NinjaTrader

Step 1: Export data from NinjaTrader

Open your NinjaTrader and then go to File -> New -> Chart and open any chart that you want to use for automatic trading.
You have to select proper period (timeframe) and proper data range and session template, as the data will be exported with the settings you choose.

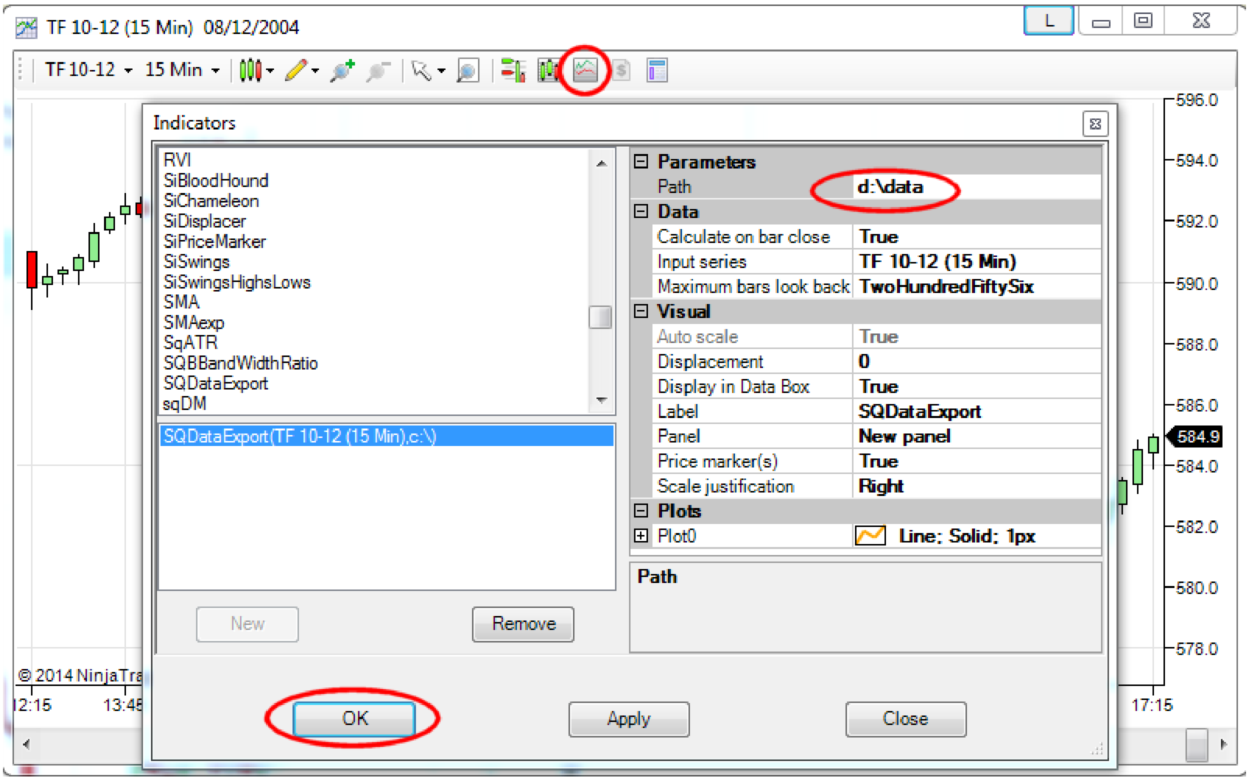
This will open a new chart in NinjaTrader:



Now you have to add a special indicator to the chart that will take care of exporting the data. Click on the Indicators icon on top of the chart to add new indicator
and choose SQDataExport indicator from the list.

If you don't see this indicator in the list make sure you installed SQ indicators in your NinjaTrader as specified in Post installation steps.

It has just one important parameter - Path - set up the path where you want the data to be written. You'll have to use that file in the next step.

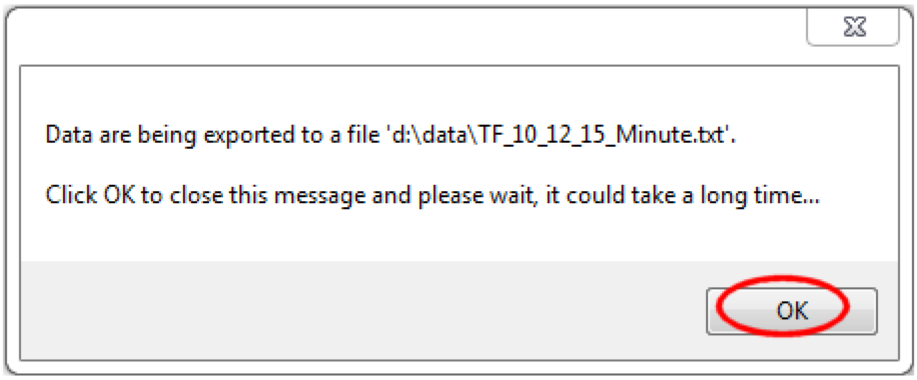


SQDataExport(TF 10-12 (15 Min),c:\)

Parameters	
Path	d:\data
Data	
Calculate on bar close	True
Input series	TF 10-12 (15 Min)
Maximum bars look back	TwoHundredFiftySix
Visual	
Auto scale	True
Displacement	0
Display in Data Box	True
Label	SQDataExport
Panel	New panel
Price marker(s)	True
Scale justification	Right
Plots	
Plot0	Line; Solid; 1px

Path

When you have this click on **OK** and the export process will begin.



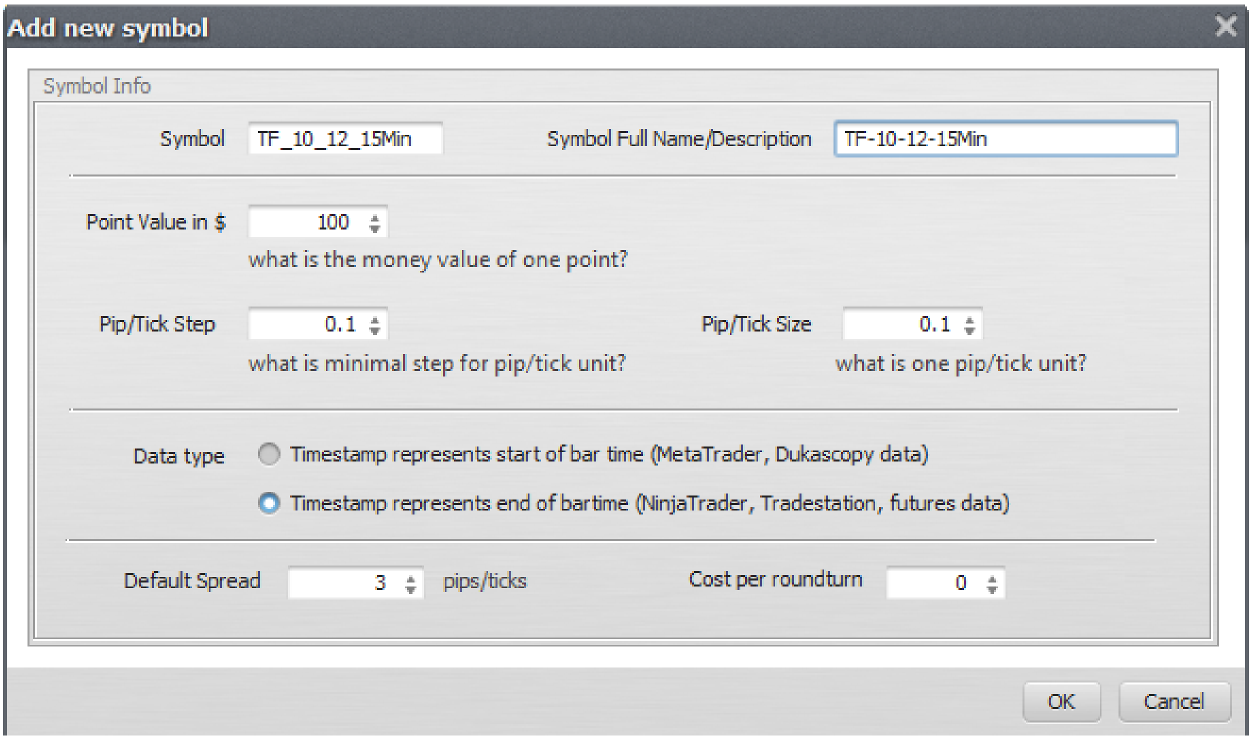
Data are being exported to a file 'd:\data\TF_10_12_15_Minute.txt'.

Click OK to close this message and please wait, it could take a long time...

It will first display a message informing you where the data will be written. Click **OK** on this dialog again and the data export will start.
It might take a few seconds or minutes, depending on the size of your data and speed of your computer.

Step 2: Create a new symbol in StrategyQuant

We can import data to already existing symbol, but that will overwrite its data, so it is better to define a new symbol.
Start StrategyQuant, go to **Data manager** screen**, History Data** and click on **Add symbol..**.



Add new symbol

Symbol Info

Symbol: TF_10_12_15Min

Symbol Full Name/Description: TF-10-12-15Min

Point Value in $: 100

what is the money value of one point?

Pip/Tick Step: 0.1

what is minimal step for pip/tick unit?

Pip/Tick Size: 0.1

what is one pip/tick unit?

Data type:

○ Timestamp represents start of bar time (MetaTrader, Dukascopy data)

● Timestamp represents end of bartime (NinjaTrader, Tradestation, futures data)

Default Spread: 3 pips/ticks

Cost per roundturn: 0

Fill out the symbol and full name, check the default spread value.

Note

If you are not sure how to fill these values check How to find Point value, Pip/Tick step in NinjaTrader?

Point value in $

is a value how much is one point worth in money, it depends on symbol. For TF (Russel 2000) it is 100.

Pip/Tick Step

is a value by how much one pip can move. This is the smallest decimal place that tick can have. For TF (Russel 2000) it is 0.1. For stocks it will be usually 0.01.

Pip/Tick Size

this makes sense only for forex/MetaTrader data. For futures and stocks it should be the same value as Pip/Tick Step.

Data type

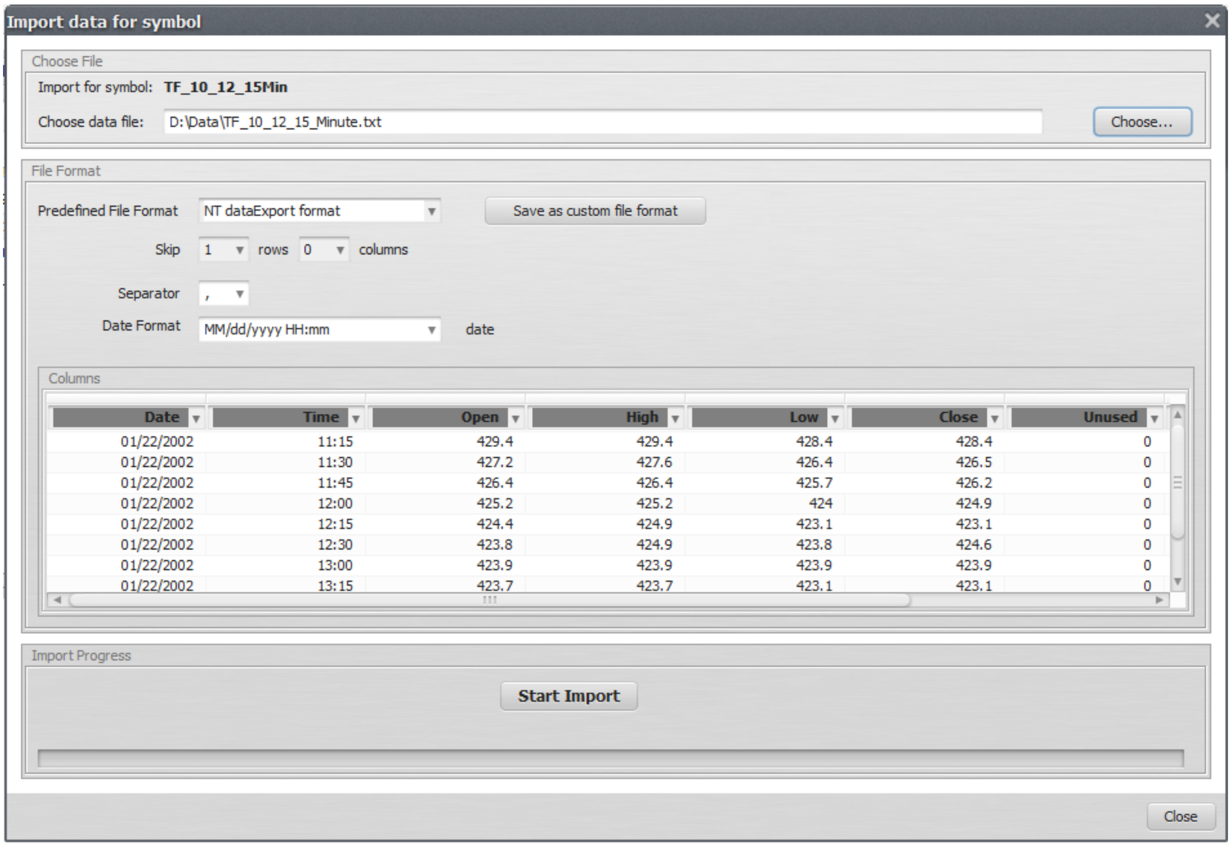
for NinjaTrader data choose **Timestamp represents end of bar time**

Click OK and the new symbol will be created. The symbol doesn't have any data yet, but we are going to import them in the next step.

Step 3: Import data to StrategyQuant

Now select your new row with the symbol and click on **Import data ...** button on the top. This will open the import dialog.

Import dialog is configurable; it allows to import data from various file formats. Since we use data from MetaTrader, choose MetaTrader4 as a Predefined File Format.



Import for symbol: TF_10_12_15Min

Choose data file: D:\Data\TF_10_12_15_Minute.txt

Predefined File Format: NT dataExport format

Skip 1 rows 0 columns

Separator ,

Date Format MM/dd/yyyy HH:mm date

Date	Time	Open	High	Low	Close	Unused
01/22/2002	11:15	429.4	429.4	428.4	428.4	0
01/22/2002	11:30	427.2	427.6	426.4	426.5	0
01/22/2002	11:45	426.4	426.4	425.7	426.2	0
01/22/2002	12:00	425.2	425.2	424	424.9	0
01/22/2002	12:15	424.4	424.9	423.1	423.1	0
01/22/2002	12:30	423.8	424.9	423.8	424.6	0
01/22/2002	13:00	423.9	423.9	423.9	423.9	0
01/22/2002	13:15	423.7	423.7	423.1	423.1	0

Choose the data file and click on **Start Import** button. This will start the import process. It could take few minutes, depending on speed of your computer and data size.

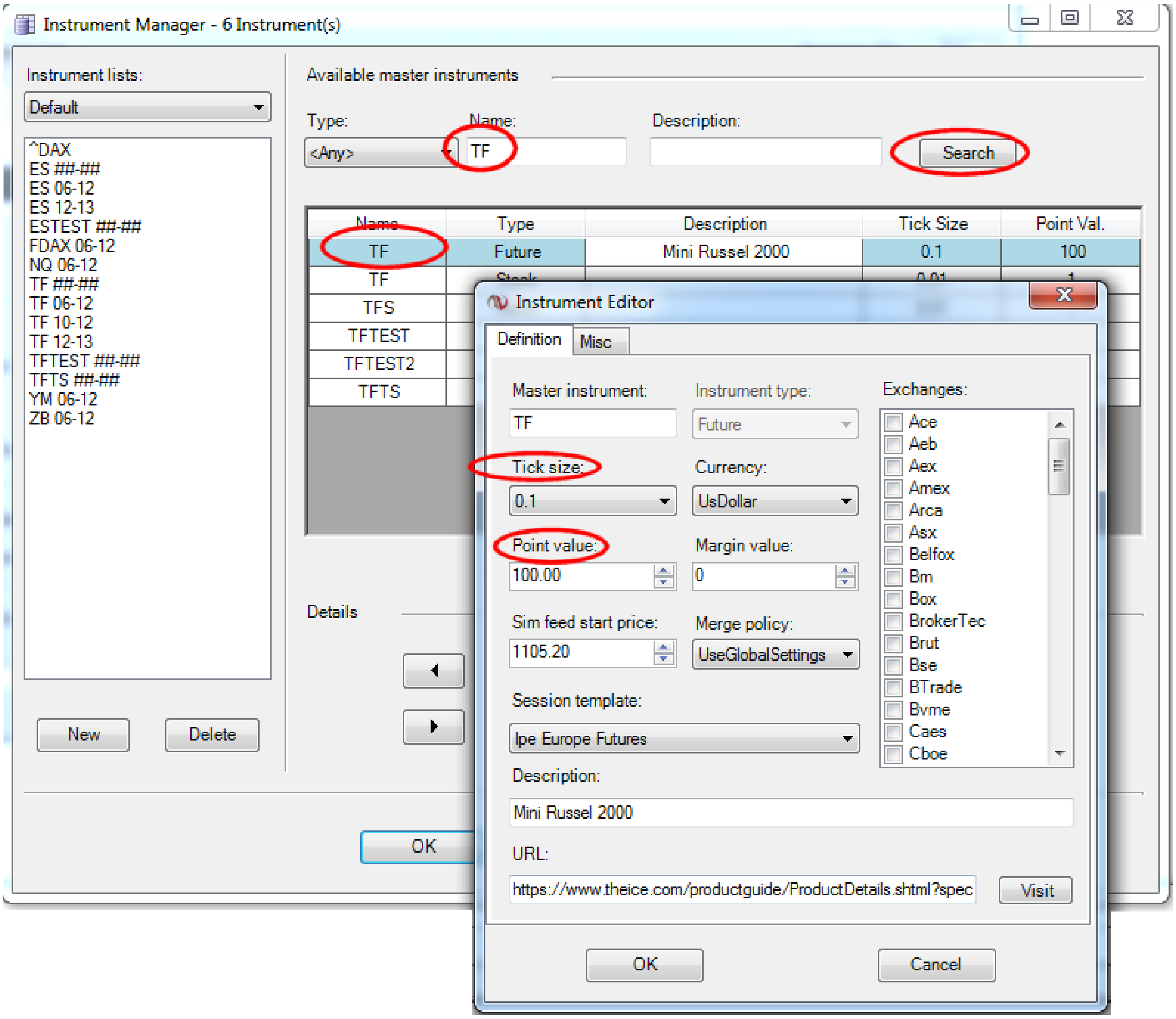
When the import is finished it will display information window and asks you to close the dialog.

Now we have the new data successfully imported into StrategyQuant and we can use them for tests or new strategies generation.

7.3 How to find Point value,Pip/Tick step in NinjaTrader

Fortunately, it is easy to find these settings in NinjaTrader.

Open NinjaTrader, go to **Tools -> Instrument Manager**. There search for your symbol. When you found it double click on it on the table and it will open the instrument detail.



Instrument Manager - 6 Instrument(s)

Instrument lists: Default

^DAX
ES ##-##
ES 06-12
ES 12-13
ESTEST ##-##
FDAX 06-12
NQ 06-12
TF ##-##
TF 06-12
TF 10-12
TF 12-13
TFTEST ##-##
TFTS ##-##
YM 06-12
ZB 06-12

Available master instruments

Type: <Any>
Name: TF
Description:

Name	Type	Description	Tick Size	Point Val.
TF	Future	Mini Russel 2000	0.1	100
TF	Stock		0.01	1
TFS				
TFTEST				
TFTEST2				
TFTS				

Instrument Editor

Master instrument: TF
Instrument type: Future
Tick size: 0.1
Currency: UsDollar
Point value: 100.00
Margin value: 0
Sim feed start price: 1105.20
Merge policy: UseGlobalSettings
Session template: Ipe Europe Futures
Description: Mini Russel 2000
URL: https://www.theice.com/productguide/ProductDetails.shtml?spec

Exchanges:
□ Ace
□ Aeb
□ Aex
□ Amex
□ Arca
□ Asx
□ Belfox
□ Bm
□ Box
□ BrokerTec
□ Brut
□ Bse
□ BTrade
□ Bvme
□ Caes
□ Cboe

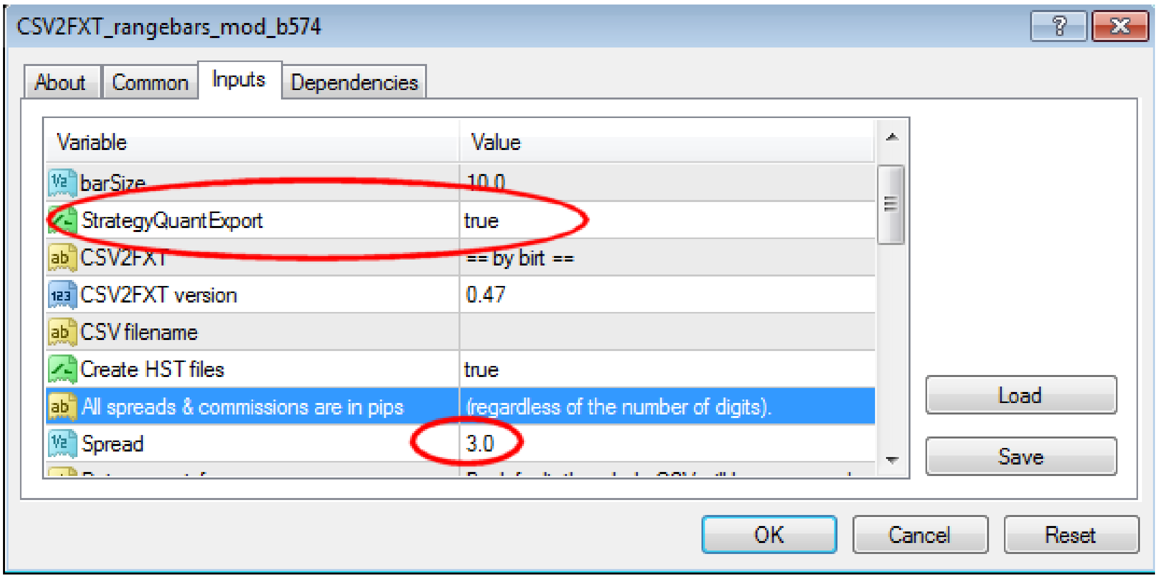
The **Tick size** here should be used as Pip/Tick Step and Pip/Tick Size in StrategyQuant.

Point value should be used as Point value in $ in StrategyQuant.

7.4 Import history data for Range / Renko charts from MetaTrader

Importing Range / Renko data for NinjaTrader is as same as importing any historical data, so it is not described here.
For MetaTrader4 we have to use the plugins and custom CSV2FXT scripts from AZ-INVEST.EU

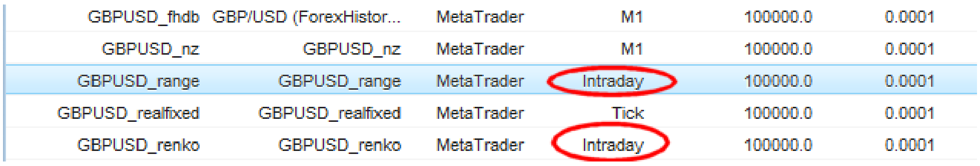
We'll not describe the whole process of obtaining tick or minute history data, this is described in the documentation for the plugins.
To export chart data in a format usable by StrategyQuant you only have to set:
StrategyQuantExport = true
Spread=2.5,3 or 4 – anything, but it should be fixed value



Variable	Value
barSize	10.0
StrategyQuantExport	true
CSV2FXT	== by birt ==
CSV2FXT version	0.47
CSV filename	
Create HST files	true
All spreads & commissions are in pips	(regardless of the number of digits).
Spread	3.0

This will generate data file that you can import to StrategyQuant in a standard way (check the topic How to import data from MetaTrader above).

The data will be recognized as Intraday – this is the same for both Range and Renko data.



GBPUSD_fhdb	GBP/USD (ForexHistor...	MetaTrader	M1	100000.0	0.0001
GBPUSD_nz	GBPUSD_nz	MetaTrader	M1	100000.0	0.0001
GBPUSD_range	GBPUSD_range	MetaTrader	Intraday	100000.0	0.0001
GBPUSD_realfixed	GBPUSD_realfixed	MetaTrader	Tick	100000.0	0.0001
GBPUSD_renko	GBPUSD_renko	MetaTrader	Intraday	100000.0	0.0001

Then you can use these data in the same way as any other standard data.

7.5 Import new custom indicator from MT4 – automatic way

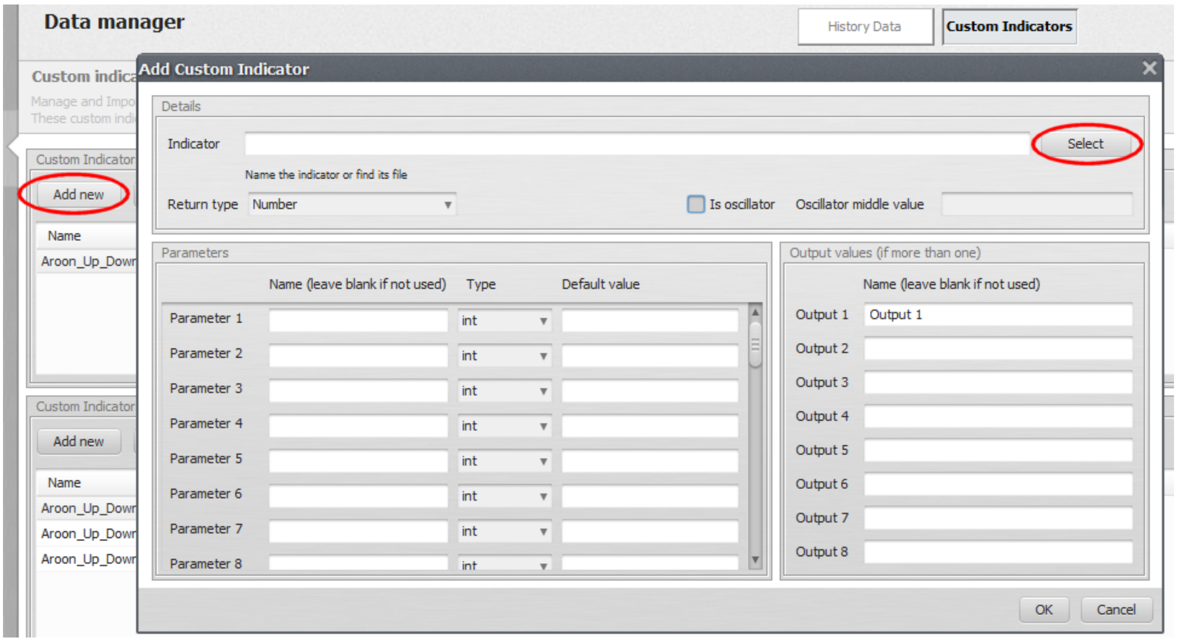
Custom indicators are indicators that run under MetaTrader4 platform and that are not implemented in StrategyQuant.

StrategyQuant is not able to run indicator code, so the only way to work with custom indicators in SQ is by importing their data.

> **Note**
>
> *Custom indicators are computed in MetaTrader, not in SQ. To get the correct results you have to use the same history data in both StrategyQuant and MT4.*
> *It will not work to compute your custom indicator in MetaTrader with your broker data and then use them in StrategyQuant on data from other source.*
> *Before using custom indicators, synchronize your history data so that both SQ and MT4 use the same history*

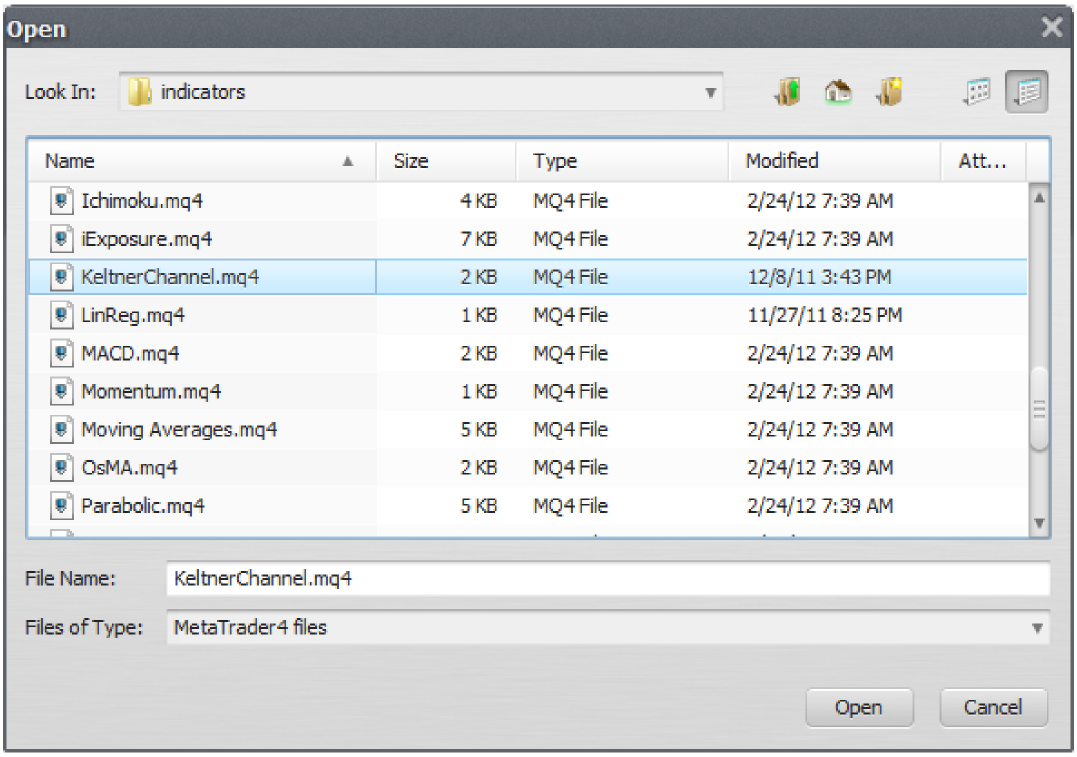
Step 1: Define new custom indicator in StrategyQuant

Go to Data manager -> Custom indicators and click on **Add new** in the Custom Indicators definitions table.
This will open new indicator definition dialog.



You can define your indicator manually, but if you have a source code of your indicator (.mq4 file) you can use automatic recognition.

Click on Select and find your indicator file - it must end with .mq4 extension. We'll try to import Keltner Channel indicator to make an example.



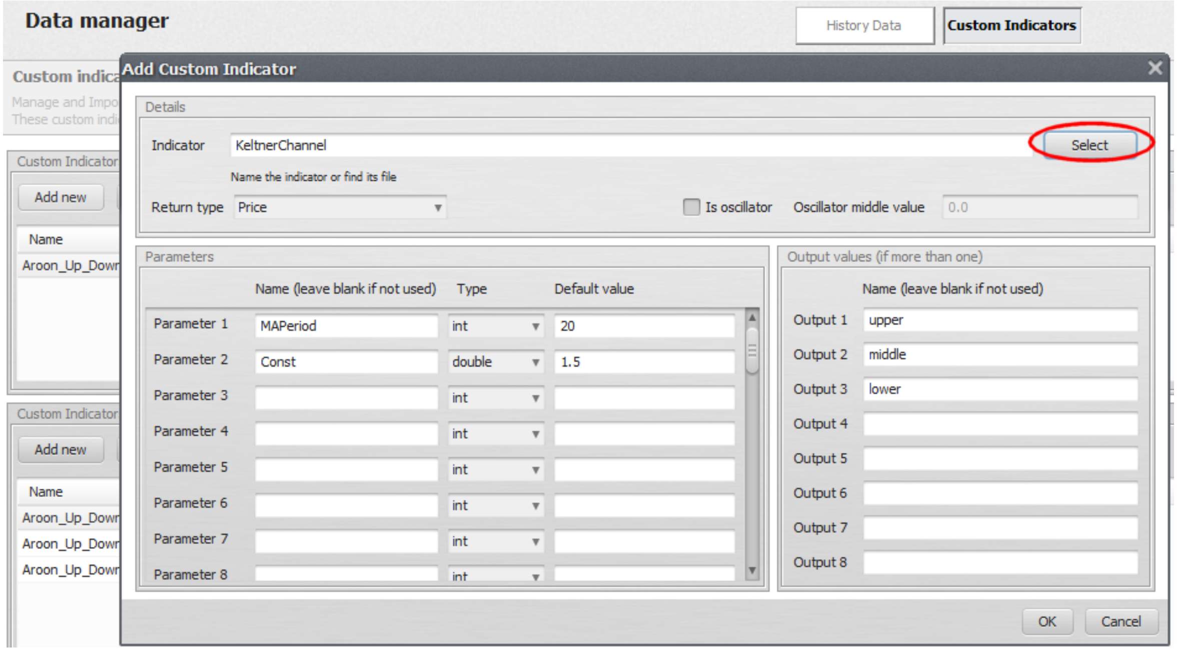
Look In: indicators

Name	Size	Type	Modified	Att...
Ichimoku.mq4	4 KB	MQ4 File	2/24/12 7:39 AM	
iExposure.mq4	7 KB	MQ4 File	2/24/12 7:39 AM	
KeltnerChannel.mq4	2 KB	MQ4 File	12/8/11 3:43 PM	
LinReg.mq4	1 KB	MQ4 File	11/27/11 8:25 PM	
MACD.mq4	2 KB	MQ4 File	2/24/12 7:39 AM	
Momentum.mq4	1 KB	MQ4 File	2/24/12 7:39 AM	
Moving Averages.mq4	5 KB	MQ4 File	2/24/12 7:39 AM	
OsMA.mq4	2 KB	MQ4 File	2/24/12 7:39 AM	
Parabolic.mq4	5 KB	MQ4 File	2/24/12 7:39 AM	

File Name: KeltnerChannel.mq4

Files of Type: MetaTrader4 files

The indicator file will be loaded and parsed and all the fields in Add indicator form will be automatically filled.



Indicator: KeltnerChannel

Name the indicator or find its file

Return type: Price

□ Is oscillator

Oscillator middle value: 0.0

Parameters

	Name (leave blank if not used)	Type	Default value
Parameter 1	MAPeriod	int	20
Parameter 2	Const	double	1.5
Parameter 3		int	
Parameter 4		int	
Parameter 5		int	
Parameter 6		int	
Parameter 7		int	
Parameter 8		int	

Output values (if more than one)

	Name (leave blank if not used)
Output 1	upper
Output 2	middle
Output 3	lower
Output 4	
Output 5	
Output 6	
Output 7	
Output 8	

We can see that StrategyQuant recognized indicator Return type as Price, it has two parameters and three output values.

Return type

is a type of return value indicator generates, it is used by StrategyQuant to properly match this custom indicator to other building blocks in the program, so that it compares price with price, and not for example price with CCI value.
It can be either:

- **Number** - if it is indicator such as CCI, RSI, MACD etc.
- **Price** - if the indicator value is price, like moving average or Bollinger Bands.
- **Price range** – if the indicator value is price range (difference between two prices), such as ATR or Bollinger Bands Range.
- **Boolean** – if the indicator returns true/false values (zero/nonzero in our case). You can have boolean indicator for example to recognize candle patterns or to implement your own simple trading rules.

How to decide the proper return type
generally, if the indicator draws its lines on the same chart as price, then its return type is price. If it draws its lines into a separate window below the main chart then it is Number, with the exception of special indicators like ATR that compute some kind of price difference or range.

Is oscillator

Some indicators like CCI or RSI are oscillators, which means that its value oscillates around some number, like CCI oscillates around 0, or RSI oscillates around 50). If the indicator is an oscillator, check this option.

Oscillator middle value

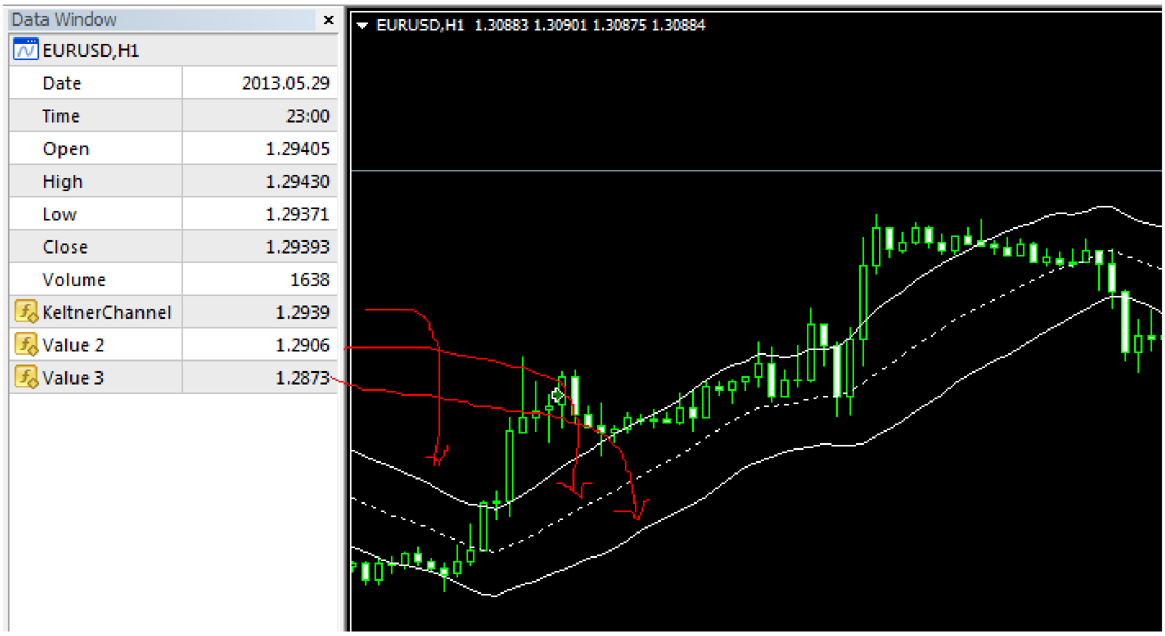
for oscillators put their middle value (the value around which they oscillate) here.

Parameters

parameters are a complete list of parameters together with their types and default values for the indicator. If you define the custom indicator manually you can check its parameters in MetaTrader.

Output values

these are the values indicator outputs. If we'll check the screenshot of Keltner Channel indicator below you can see that it outputs three values in Data window, and they correspond to upper, middle and lower line on the chart.



Data Window

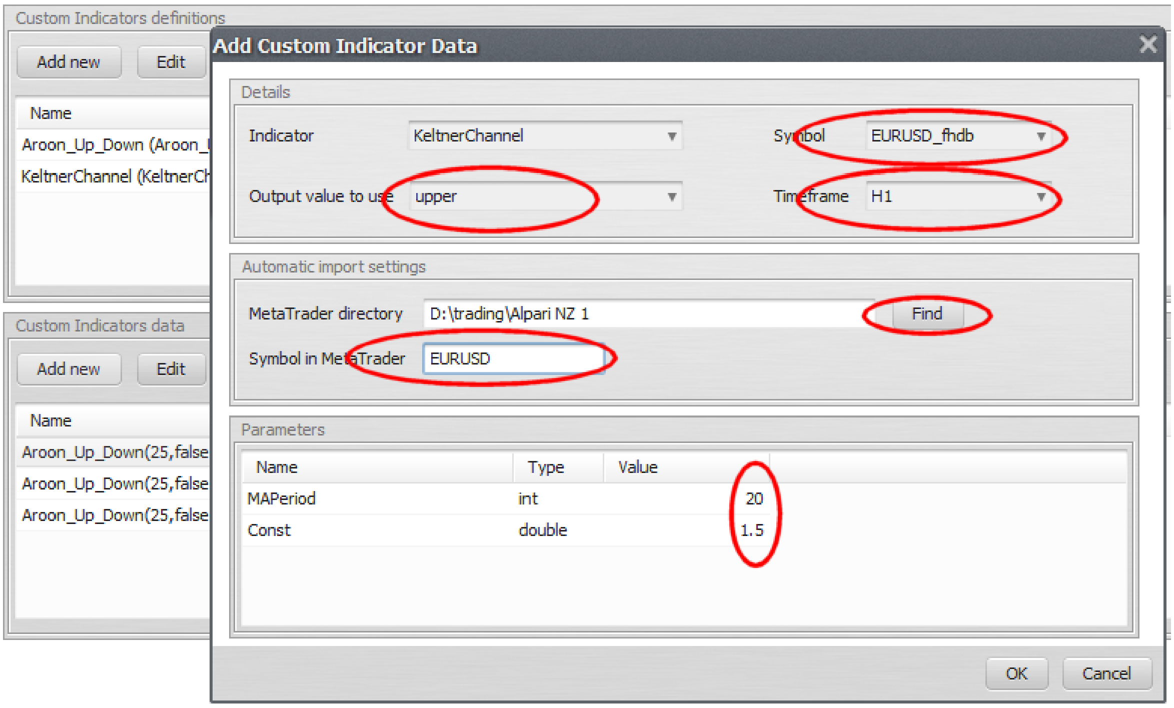
EURUSD,H1

Date	2013.05.29
Time	23:00
Open	1.29405
High	1.29430
Low	1.29371
Close	1.29393
Volume	1638
KeltnerChannel	1.2939
Value 2	1.2906
Value 3	1.2873

Click **OK** on the dialog and your new custom indicator is defined.

Step 2: Define custom indicator data

Now that we defined new custom indicator definition, we have to load the custom indicator data. The definition that we made in the first step is only a "description" of the indicator. To be able to use the indicator in your strategies, you have to configure
which parameter and output values it should use and load data for this indicator computed from MetaTrader.
Click on the **Add new** button in the Custom Indicators data table.



Custom Indicators definitions

Add new | Edit

Name
Aroon_Up_Down (Aroon_
KeltnerChannel (KeltnerCh

Custom Indicators data

Add new | Edit

Name
Aroon_Up_Down(25,false
Aroon_Up_Down(25,false
Aroon_Up_Down(25,false

Add Custom Indicator Data

Details

Indicator: KeltnerChannel
Symbol: EURUSD_fhdb
Output value to use: upper
Timeframe: H1

Automatic import settings

MetaTrader directory: D:\trading\Alpari NZ 1
Symbol in MetaTrader: EURUSD

Parameters

Name	Type	Value
MAPeriod	int	20
Const	double	1.5

Here we have to choose our indicator (Keltner Channel) and choose which of its output values we want to use. We decided for upper line.
If you want to use also middle or lower line, you have to follow this step for each output you want to use.

Then you also have to choose the Symbol and Timeframe for which these indicator data will be valid.
Data will be computed in MetaTrader for a given symbol and timeframe,
so they will be not valid for any other symbol/timeframe. To use this custom indicator on another symbol, simply repeat this Step 2 with another symbol.

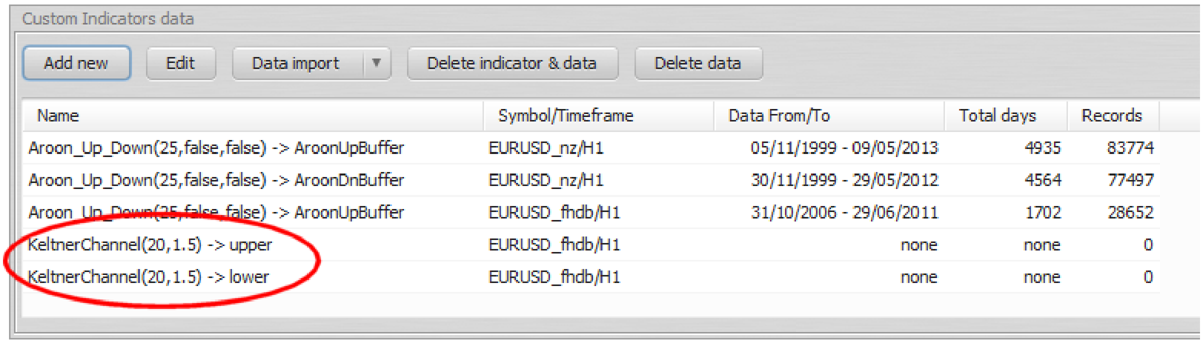
If we want to use automatic import settings (recommended) you also have to fill the path to your MetaTrader - this is MetaTrader that will be called to compute the data for this indicator.
We also have to specify the exact symbol name in that MetaTrader. It is because in StrategyQuant you can use any name, like EURUSD_fhdb, but in order to run an export on MT4 we need the exact symbol name that is used in MT4.

The last thing is set the indicator parameters.

Again, computed indicator data will be valid only for one combination of symbol/timeframe/output/parameters. If you want to use the custom indicator with another set of parameters, you have to define it multiple times.

When all this is done click OK to save new Custom indicator data.

We can repeat the same step for the same indicator and symbol, but this time we'll choose lower output value.
This way we'll have new custom indicator building blocks for upper and lower values of Keltner Channel indicator.



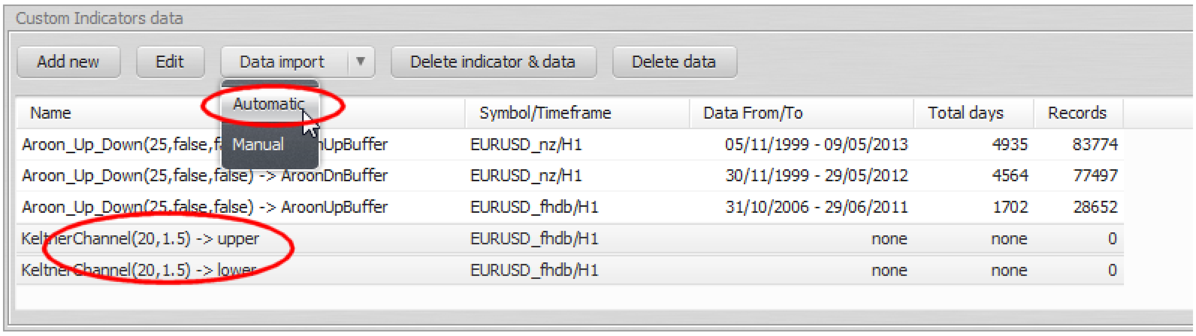
Name	Symbol/Timeframe	Data From/To	Total days	Records
Aroon_Up_Down(25,false,false) -> AroonUpBuffer	EURUSD_nz/H1	05/11/1999 - 09/05/2013	4935	83774
Aroon_Up_Down(25,false,false) -> AroonDnBuffer	EURUSD_nz/H1	30/11/1999 - 29/05/2012	4564	77497
Aroon_Up_Down(25,false,false) -> AroonUpBuffer	EURUSD_fhdb/H1	31/10/2006 - 29/06/2011	1702	28652
KeltnerChannel(20,1.5) -> upper	EURUSD_fhdb/H1	none	none	0
KeltnerChannel(20,1.5) -> lower	EURUSD_fhdb/H1	none	none	0

Step 3: Loading custom indicator data

Now we have two new custom indicators defined, but they still don't contain any data. We can use either automatic or manual import to import the data from MetaTrader.

Step 3.1: Automatic import

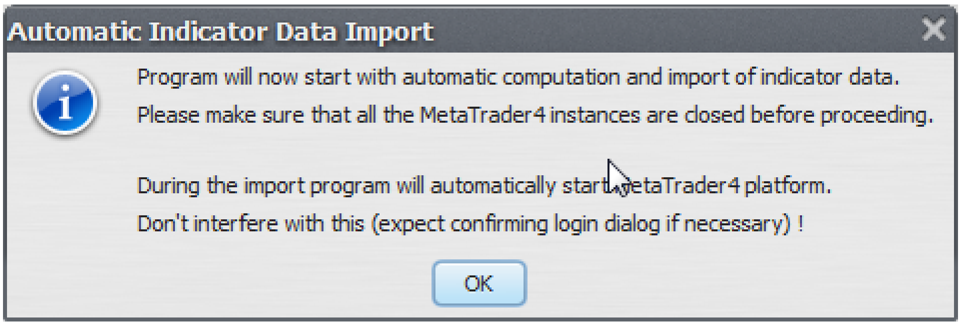
Select your two new records (hold CTRL while clicking on rows to select multiple rows at the same time), and then choose **Data import -> Automatic**



Name	Symbol/Timeframe	Data From/To	Total days	Records
Aroon_Up_Down(25,false,f nUpBuffer	EURUSD_nz/H1	05/11/1999 - 09/05/2013	4935	83774
Aroon_Up_Down(25,false,false) -> AroonDnBuffer	EURUSD_nz/H1	30/11/1999 - 29/05/2012	4564	77497
Aroon_Up_Down(25,false,false) -> AroonUpBuffer	EURUSD_fhdb/H1	31/10/2006 - 29/06/2011	1702	28652
KeltnerChannel(20,1.5) -> upper	EURUSD_fhdb/H1	none	none	0
KeltnerChannel(20,1.5) -> lower	EURUSD_fhdb/H1	none	none	0

Note

Before running automatic import please close your MetaTrader, otherwise the import will fail.

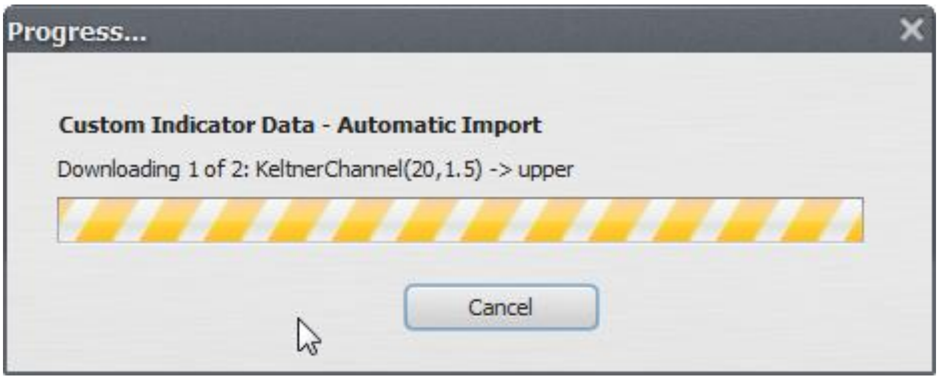


Automatic Indicator Data Import

Program will now start with automatic computation and import of indicator data.
Please make sure that all the MetaTrader4 instances are closed before proceeding.

During the import program will automatically start MetaTrader4 platform.
Don't interfere with this (expect confirming login dialog if necessary) !

Program will now automatically start MetaTrader and initiate custom indicator computation, data export and its import to StrategyQuant.



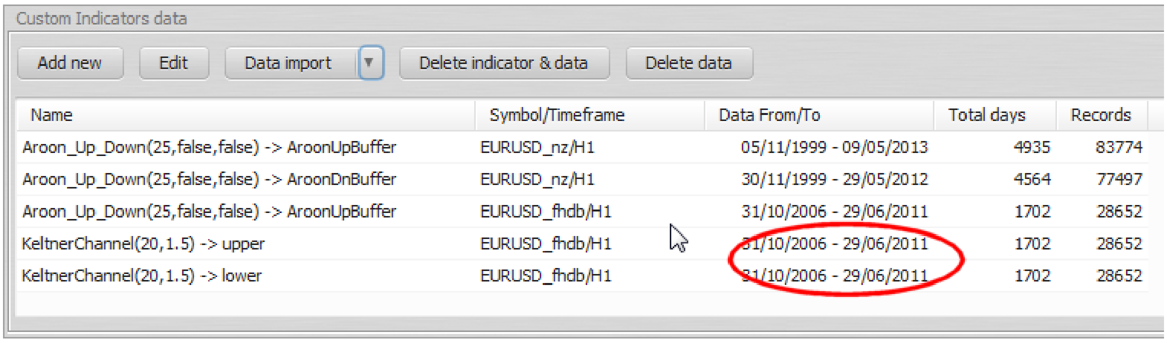
Progress...

Custom Indicator Data - Automatic Import

Downloading 1 of 2: KeltnerChannel(20,1.5) -> upper

All this is automatic, you don't need to interfere with it in any way.

When the process finishes, you'll see that the indicators now contain imported values:



Name	Symbol/Timeframe	Data From/To	Total days	Records
Aroon_Up_Down(25,false,false) -> AroonUpBuffer	EURUSD_nz/H1	05/11/1999 - 09/05/2013	4935	83774
Aroon_Up_Down(25,false,false) -> AroonDnBuffer	EURUSD_nz/H1	30/11/1999 - 29/05/2012	4564	77497
Aroon_Up_Down(25,false,false) -> AroonUpBuffer	EURUSD_fhdb/H1	31/10/2006 - 29/06/2011	1702	28652
KeltnerChannel(20,1.5) -> upper	EURUSD_fhdb/H1	31/10/2006 - 29/06/2011	1702	28652
KeltnerChannel(20,1.5) -> lower	EURUSD_fhdb/H1	31/10/2006 - 29/06/2011	1702	28652

Step 3.2: Manual import

You can use **manual import** in case automatic import fails or you want to have bigger control over exported data.
If you don’t plan to use manual import you can skip directly to ***Step 4***.

Step 3.2.1 - Getting the indicator values from MetaTrader

Custom indicators work in a way that StrategyQuant uses their values computed in another program, for example in MetaTrader. This means we have to compute the indicator in MetaTrader and then import its value(s) to SQ.

This is little bit complicated, but on the other hand it allows us to use virtually any indicator available for MetaTrader, even if we don’t know how exactly it is computed.

For computation of indicator values we’ll use a simple EA called
GenBuilder_IndicatorExportEA

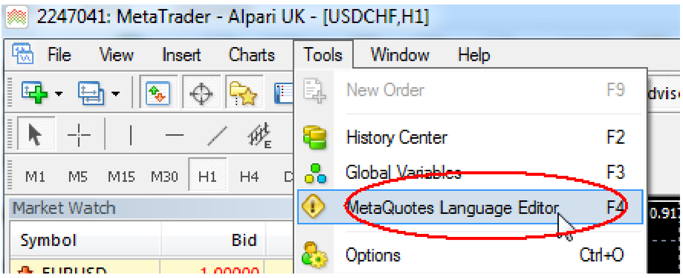
This simple EA ships with StrategyQuant, you can find it in
{StrategyQuant installation directory}/custom_indicators/mq4/ directory.

In order to use it in your MetaTrader you have to copy it to:
{MetaTrader installation directory}/experts

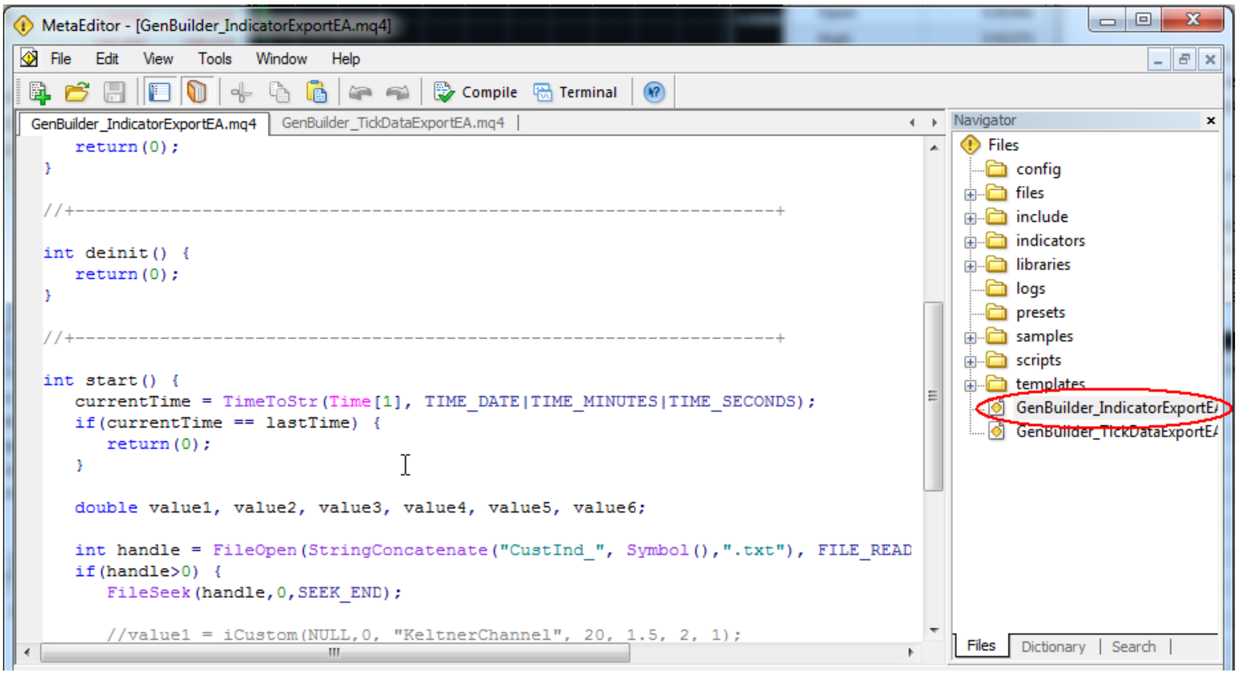
If you use MetaTrader **Build 600+** then the folder structure changed. You have to locate the correct Experts folder in MetaTrader **File ->Open Data Folder**. This will open MT4 data folder, and you have to copy this EA to MQL4/Experts.

Then restart your MetaTrader and the new EA will be available.

We’ll need to open the EA and modify its code a little. Open the MetaQuotes Language Editor from Tools Menu.



This will open the editor that will allow us to modify the EA.


MetaEditor - [GenBuilder_IndicatorExportEA.mq4]
File
Edit
View
Tools
Window
Help
Compile
Terminal
GenBuilder_IndicatorExportEA.mq4
GenBuilder_TickDataExportEA.mq4
Navigator
Files
config
files
include
indicators
libraries
logs
presets
samples
scripts
templates
GenBuilder_IndicatorExportE/
GenBuilder_TickDataExportE/
Files
Dictionary
Search

```
   return(0);
}

//+------------------------------------------------------------------+

int deinit() {
   return(0);
}

//+------------------------------------------------------------------+

int start() {
   currentTime = TimeToStr(Time[1], TIME_DATE|TIME_MINUTES|TIME_SECONDS);
   if(currentTime == lastTime) {
      return(0);
   }

   double value1, value2, value3, value4, value5, value6;

   int handle = FileOpen(StringConcatenate("CustInd_", Symbol(),".txt"), FILE_READ
   if(handle>0) {
      FileSeek(handle,0,SEEK_END);

      //value1 = iCustom(NULL,0, "KeltnerChannel", 20, 1.5, 2, 1);
```

Now find the IndicatorExportEA in Experts and double-click on it, this will open the EA in the editor screen.

The only thing we have to change in the code is a command that gets the value of the indicator and that writes the value to the file. The code looks like this:

value1 = … get indicator value 1 bar ago…
FileWrite(handle, TimeToStr(Time[1], TIME_DATE),TimeToStr(Time[1], TIME_MINUTES), Close[1], value1);

The code is simple, all it does is it gets the value of the desired indicator and then saves the value to the file. So, to export your own indicator just change the code that gets the indicator value.

Example 1 – exporting value of standard MT4 indicator, such as Bears Power

value1 = iBearsPower(NULL, 0, 13, PRICE_CLOSE, 1);
FileWrite(handle, TimeToStr(Time[1], TIME_DATE),TimeToStr(Time[1], TIME_MINUTES), Close[1], value1);

Example 2 – exporting custom indicator from MT4

To get the value of custom indicator in MT4 we have to use the call

iCustom(symbol, timeframe, name, …parameters…, mode, shift)

where

- symbol and timeframe can be left to NULL, 0 to get the actual symbol and timeframe
- name is the exact name of the custom indicator
- parameters are indicator parameters separated by comma
- mode is a line index – it can be from 0..7 and it is usually used if indicator returns more than one value
- shift must be always 1

So for example for Keltner Channel we'll have the code:

```
value1 = iCustom(NULL,0, "KeltnerChannel", 20, 1.5, 2, 1);
FileWrite(handle, TimeToStr(Time[1], TIME_DATE),TimeToStr(Time[1], TIME_MINUTES), Close[1], value1);
```

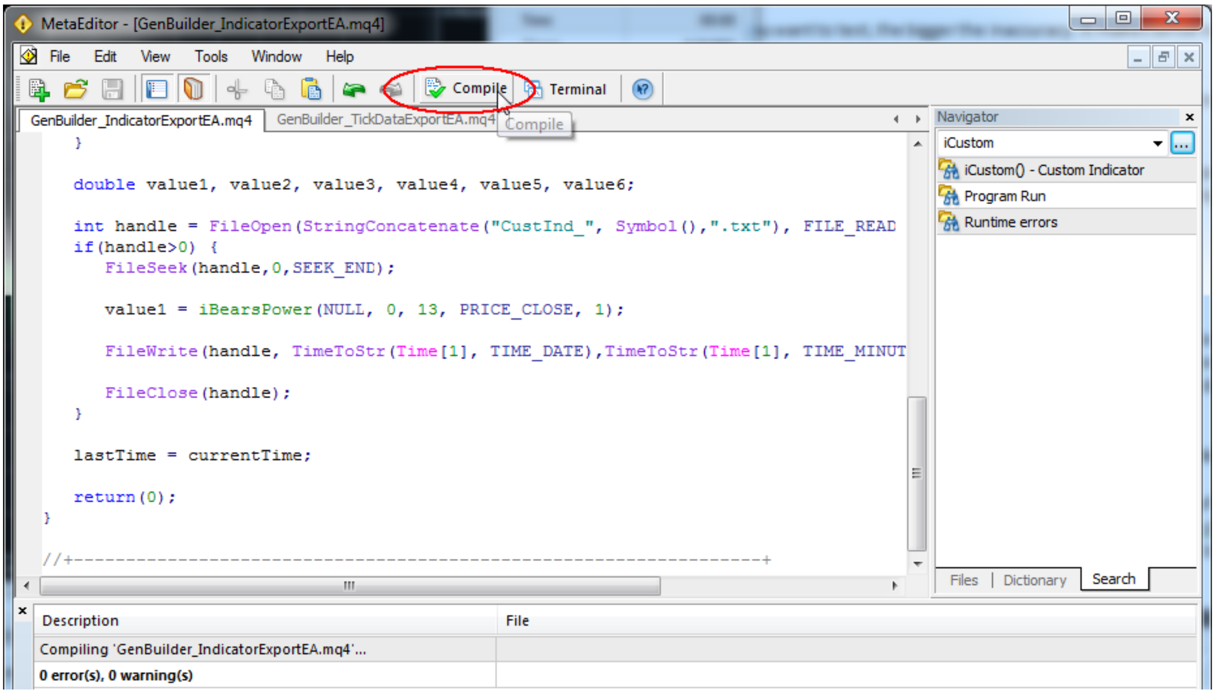
where **20** and **1.5** are the parameters of Keltner Channel indicator and **2** is the line index – we want third value of the indicator (index is zero based) that corresponds to the bottom of Keltner Channel.

Example 3 – exporting multiple indicator values at once - Ichimoku Tenkan Sen and Kijun Sen
it is possible to import multiple indicator values at once, to do this simply use variables value1…value6. And don't forget to add all these values also to the FileWrite function.

```
value1 = iIchimoku(NULL, 0, 9, 26, 52, MODE_TENKANSEN, 1);
value2 = iIchimoku(NULL, 0, 9, 26, 52, MODE_KIJUNSEN, 1);

FileWrite(handle, TimeToStr(Time[1], TIME_DATE),TimeToStr(Time[1], TIME_MINUTES), Close[1], value1, value2);
```

First two lines compute different values of Ichimoku indicator and the third line saves them to the data file.

After we finished altering the code we can click on the **Compile** button on the top and indicator should successfully compile.

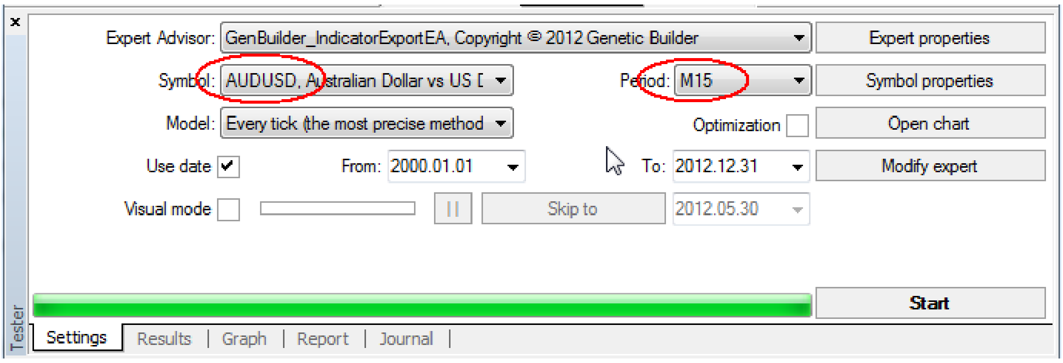

MetaEditor - [GenBuilder_IndicatorExportEA.mq4]
File
Edit
View
Tools
Window
Help
Compile
Terminal
GenBuilder_IndicatorExportEA.mq4
GenBuilder_TickDataExportEA.mq4
Compile
Navigator
iCustom
iCustom() - Custom Indicator
Program Run
Runtime errors
Files
Dictionary
Search

```
   }

   double value1, value2, value3, value4, value5, value6;

   int handle = FileOpen(StringConcatenate("CustInd_", Symbol(),".txt"), FILE_READ
   if(handle>0) {
      FileSeek(handle,0,SEEK_END);

      value1 = iBearsPower(NULL, 0, 13, PRICE_CLOSE, 1);

      FileWrite(handle, TimeToStr(Time[1], TIME_DATE),TimeToStr(Time[1], TIME_MINUT

      FileClose(handle);
   }

   lastTime = currentTime;

   return(0);
}

//+------------------------------------------------------------------+
```

Description	File
Compiling 'GenBuilder_IndicatorExportEA.mq4'...	
0 error(s), 0 warning(s)	

Step 3.2.2 - Exporting the indicator values from MetaTrader

Now we have the export indicator ready and we can use it. In MetaTrader open Strategy Tester (View -> Strategy Tester) and in the list of Expert Advisors find our GenBuilder_IndicatorDataExportEA.



Expert Advisor: GenBuilder_IndicatorExportEA, Copyright © 2012 Genetic Builder

Symbol: AUDUSD, Australian Dollar vs US D

Period: M15

Model: Every tick (the most precise method)

Optimization □

Use date ☑ From: 2000.01.01 To: 2012.12.31

Visual mode □ Skip to 2012.05.30

Now you have to set also the symbol you want this indicator to be computed on and timeframe. Check also Use date and set date From and To.

After this click on **Start** button and the export will begin. The export could take several minutes, so wait until it finishes successfully.

The EA will go through all the data history, computes indicator value for every bar and write generated ticks to a file. This file can be located in {MetaTrader installation directory}/tester/files

Or for MT4 **Build 600+** in {MetaTrader Data Folder}/MQL4/tester/files

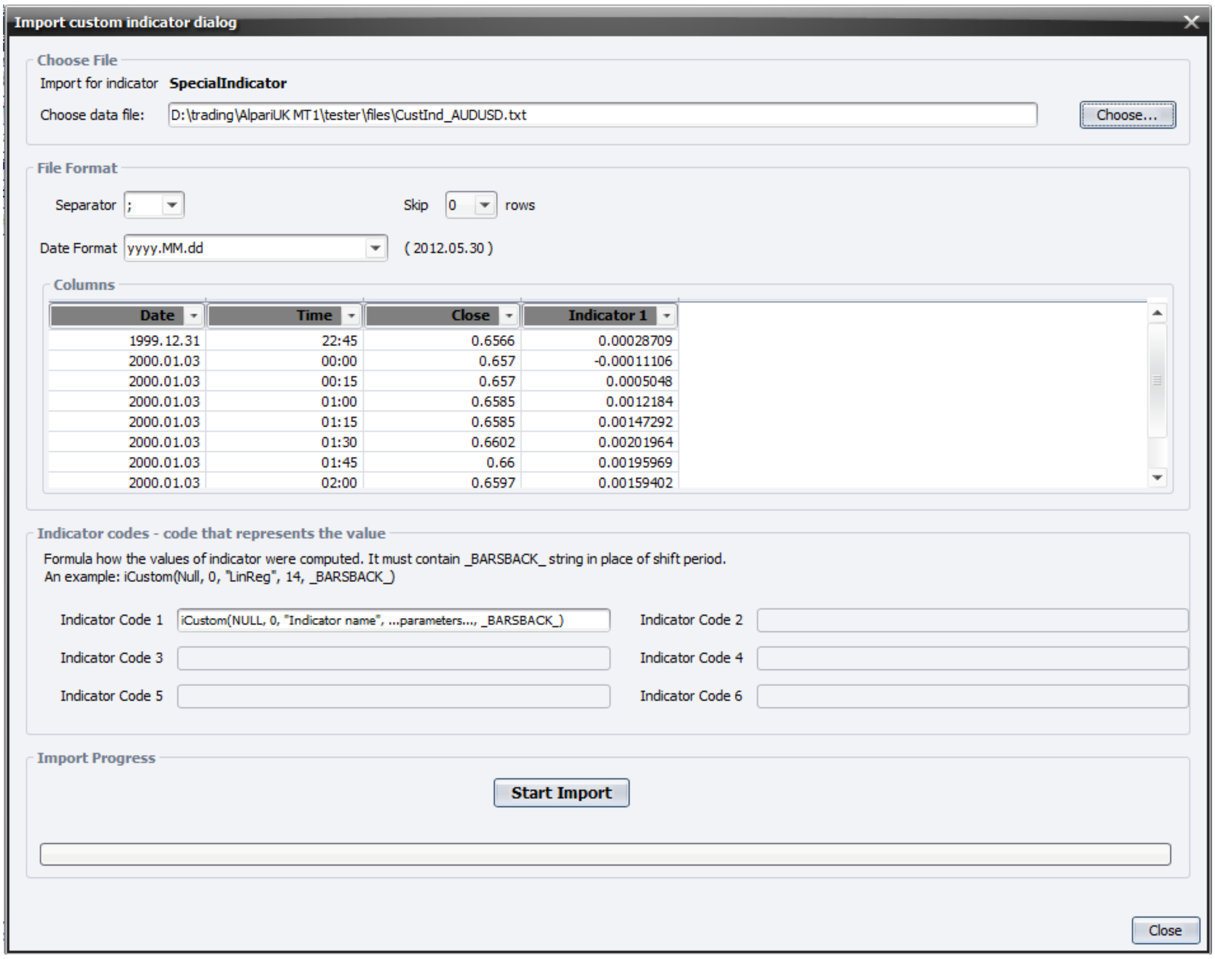
Note

Indicator will have **different values for every symbol and every timeframe** so you should export it for every symbol and timeframe combination that you want to use in Genetic Builder. To do this, just repeat this Step 2 and choose different symbol or timeframe.

Don't forget to rename the exported values file before every export, because otherwise the new values will be added to the end of the file which will make it unusable.
Simply go to the /tester/files directory and rename the export file CustInd_XXX.csv to something else (for example MyIndicator_GBPUSD_M15.csv) before running the export again.

Step 3.2.3 – Importing indicator values to StrategyQuant

Select new record and then choose **Data import -> Manual.** This will open new Import dialog:



Import custom indicator dialog
Choose File
Choose...
File Format
Columns
Indicator codes - code that represents the value
Import Progress
Start Import
Close

Import for indicator **SpecialIndicator**

Choose data file: D:\trading\AlpariUK MT1\tester\files\CustInd_AUDUSD.txt

Separator ;

Skip 0 rows

Date Format yyyy.MM.dd (2012.05.30)

Date	Time	Close	Indicator 1
1999.12.31	22:45	0.6566	0.00028709
2000.01.03	00:00	0.657	-0.00011106
2000.01.03	00:15	0.657	0.0005048
2000.01.03	01:00	0.6585	0.0012184
2000.01.03	01:15	0.6585	0.00147292
2000.01.03	01:30	0.6602	0.00201964
2000.01.03	01:45	0.66	0.00195969
2000.01.03	02:00	0.6597	0.00159402

Formula how the values of indicator were computed. It must contain _BARSBACK_ string in place of shift period.
An example: iCustom(Null, 0, "LinReg", 14, _BARSBACK_)

Indicator Code 1 iCustom(NULL, 0, "Indicator name", ...parameters..., _BARSBACK_)

Indicator Code 2

Indicator Code 3

Indicator Code 4

Indicator Code 5

Indicator Code 6

Choose the data file on the top – for this you have to go to {MetaTrader installation directory}/tester/files or for MT4 Build 600+ to {MetaTrader Data Folder}/MQL4/tester/files and find the file that was exported in the previous step. The importer then loads first few rows of the file and you'll be able to specify the column types.

Indicator file can contain several columns with indicator values, in our example we have only one column.
For every indicator column used you have to specify indicator code – it is the code that was used to generate the indicator values. This code is used by Genetic Builder when it generates the source code of the strategy in MQL code.
Let's assume our custom indicator was Bears Power computed as in our Example 1, and then the indicator code would be:

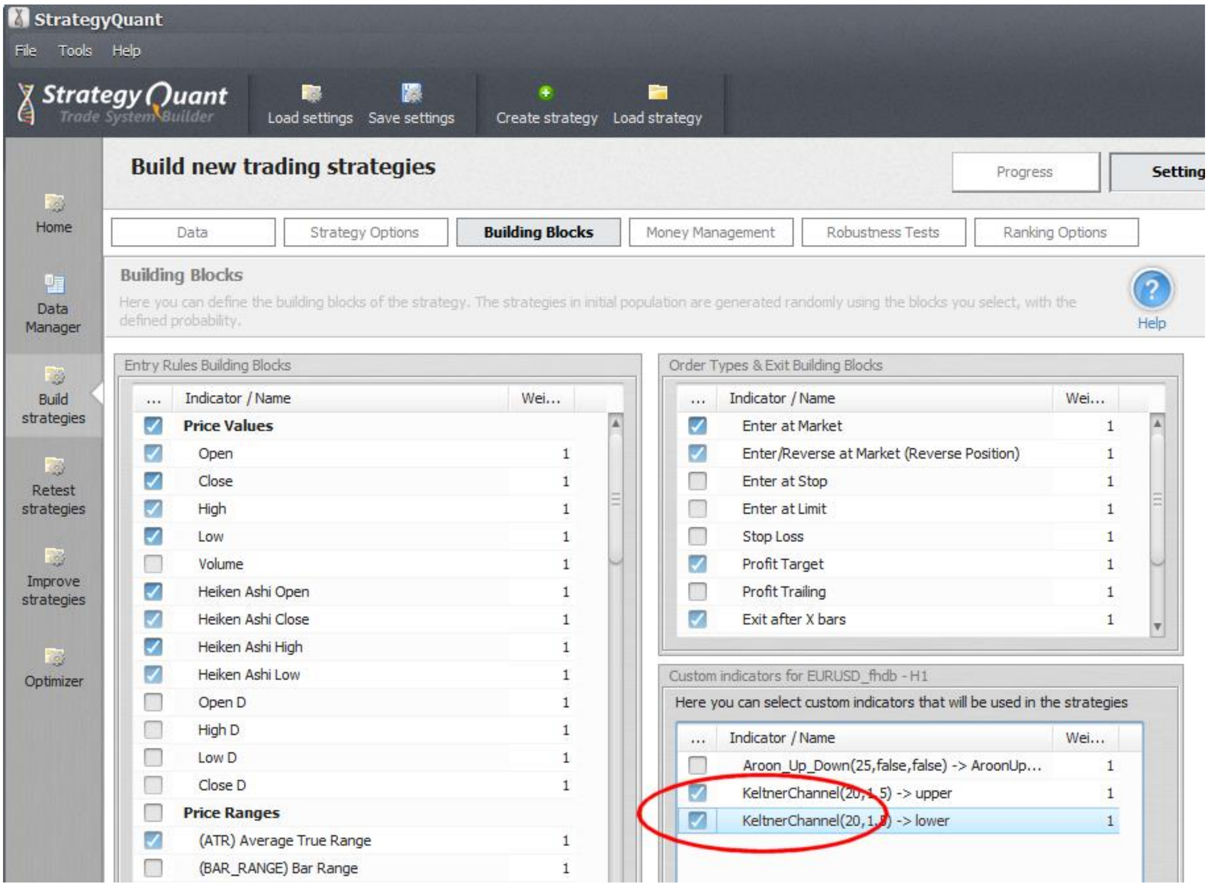
iBearsPower(NULL, 0, 13, PRICE_CLOSE, _BARSBACK_)

Please note that we replaced the last parameter with the _BARSBACK_ constant. It is because Genetic Builder would need to define correct number of bars on which this indicator should be computed.
BARSBACK constant will be replaced by shift (or bars ago) in the generated MQL code.

Now click on **Start Import** and the import engine checks and imports new custom indicator.

Step 4: Using your new custom indicators

Steps 1 - 3 have to be done only once for every new custom indicator and symbol/timeframe/output/parameters you want to add to StrategyQuant.
When the indicator data are successfully imported you can use them in your building blocks.



Build new trading strategies

Building Blocks

Here you can define the building blocks of the strategy. The strategies in initial population are generated randomly using the blocks you select, with the defined probability.

Entry Rules Building Blocks

...	Indicator / Name	Wei...
☑	**Price Values**	
☑	Open	1
☑	Close	1
☑	High	1
☑	Low	1
□	Volume	1
☑	Heiken Ashi Open	1
☑	Heiken Ashi Close	1
☑	Heiken Ashi High	1
☑	Heiken Ashi Low	1
□	Open D	1
□	High D	1
□	Low D	1
□	Close D	1
□	**Price Ranges**	
☑	(ATR) Average True Range	1
□	(BAR_RANGE) Bar Range	1

Order Types & Exit Building Blocks

...	Indicator / Name	Wei...
☑	Enter at Market	1
☑	Enter/Reverse at Market (Reverse Position)	1
□	Enter at Stop	1
□	Enter at Limit	1
□	Stop Loss	1
☑	Profit Target	1
□	Profit Trailing	1
☑	Exit after X bars	1

Custom indicators for EURUSD_fhdb - H1

Here you can select custom indicators that will be used in the strategies

...	Indicator / Name	Wei...
□	Aroon_Up_Down(25,false,false) -> AroonUp...	1
☑	KeltnerChannel(20,1.5) -> upper	1
☑	KeltnerChannel(20,1,5) -> lower	1

To use your new custom indicators in your strategies, you have to check them in Building Blocks -> Custom indicators table.

Note

The custom indicators are valid only for the symbol/timeframe they were computed, in our example only for EURUSD_fhdb / H1.
If you want to use them for another symbol or timeframe, you have to repeats steps 1 - 3.

7.6 Import new custom indicator from NinjaTrader

Custom indicators are indicators that run under NinjaTrader platform and that are not implemented in StrategyQuant.

StrategyQuant is not able to run indicator code, so the only way how to work with custom indicators in SQ is by importing their data.

Note

Custom indicators are computed in NinjaTrader, not in SQ. To get the correct results you have to use the same history data in both StrategyQuant and NT.
It will not work to compute your custom indicator in NinjaTrader with your broker data and then use them in StrategyQuant on data from other source.
You have to compute your custom indicator on exactly the same data, the same data range and trading session as you imported to StrategyQuant.

Step 1: Define new custom indicator in StrategyQuant

As an example we'll create new custom indicator MACD.
First add MACD indicator to the chart in NinjaTrader and open its properties so you can see which parameter and output values (Plots) it uses.

Open StrategyQuant, go to Data manager -> Custom indicators and click on **Add new** in the Custom Indicators definitions table.
This will open new indicator definition dialog. For NinjaTrader you have define your indicator manually, so create some name for your new custom indicator (MACD_NT) and define its parameters and outputs (Plots).
You can do it easily by copying indicator properties in NinjaTrader (see below).

For MACD we set the Return type to Number, because ti returns general number. We also check that it is an oscillator, and that it oscillates around 0.

Return type

is a type of return value indicator generates, it is used by StrategyQuant to properly match this custom indicator to other building blocks in the program, so that it compares price with price, and not for example price with CCI value.
It can be either:

- **Number** - if it is indicator such as CCI, RSI, MACD etc.
- **Price** - if the indicator value is price, like moving average or Bollinger Bands.
- **Price range** – if the indicator value is price range (difference between two prices), such as ATR or Bollinger Bands Range.

- **Boolean** – if the indicator returns true/false values (zero/nonzero in our case). You can have boolean indicator for example to recognize candle patterns or to implement your own simple trading rules.

How to decide the proper return type
generally, if the indicator draws its lines on the same chart as price, then its return type is price. If it draws its lines into a separate window below the main chart then it is Number, with the exception of special indicators like ATR that compute some kind of price difference or range.

Is oscillator

Some indicators like CCI or RSI are oscillators, which means that its value oscillates around some number, like CCI oscillates around 0, or RSI oscillates around 50). If the indicator is an oscillator, check this option.

Oscillator middle value

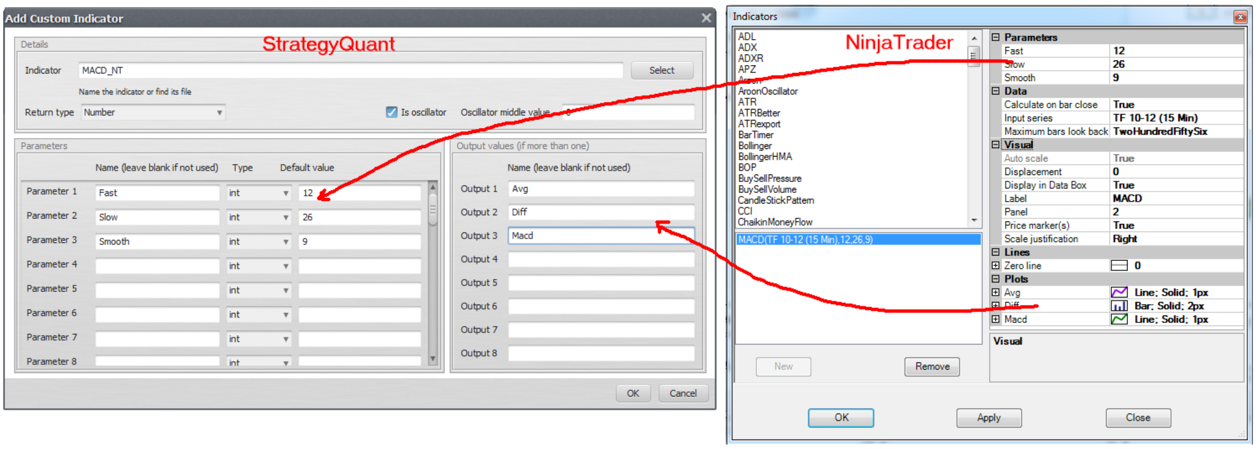
for oscillators put their middle value (the value around which they oscillate) here.

Parameters

parameters are a complete list of parameters together with their types and default values for the indicator. If you define the custom indicator manually you can check its parameters in MetaTrader.

Output values

these are the values indicator outputs. If we'll check the screenshot of Keltner Channel indicator below you can see that it outputs three values in Data window, and they correspond to upper, middle and lower line on the chart.



Details

Indicator: MACD_NT

Name the indicator or find its file

Return type: Number

☑ Is oscillator   Oscillator middle value: 0

Parameters

	Name (leave blank if not used)	Type	Default value
Parameter 1	Fast	int	12
Parameter 2	Slow	int	26
Parameter 3	Smooth	int	9
Parameter 4		int	
Parameter 5		int	
Parameter 6		int	
Parameter 7		int	
Parameter 8		int	

Output values (if more than one)

	Name (leave blank if not used)
Output 1	Avg
Output 2	Diff
Output 3	Macd
Output 4	
Output 5	
Output 6	
Output 7	
Output 8	

MACD(TF 10-12 (15 Min),12,26,9)

Parameters	
Fast	12
Slow	26
Smooth	9
Data	
Calculate on bar close	True
Input series	TF 10-12 (15 Min)
Maximum bars look back	TwoHundredFiftySix
Visual	
Auto scale	True
Displacement	0
Display in Data Box	True
Label	MACD
Panel	2
Price marker(s)	True
Scale justification	Right
Lines	
Zero line	0
Plots	
Avg	Line; Solid; 1px
Diff	Bar; Solid; 2px
Macd	Line; Solid; 1px

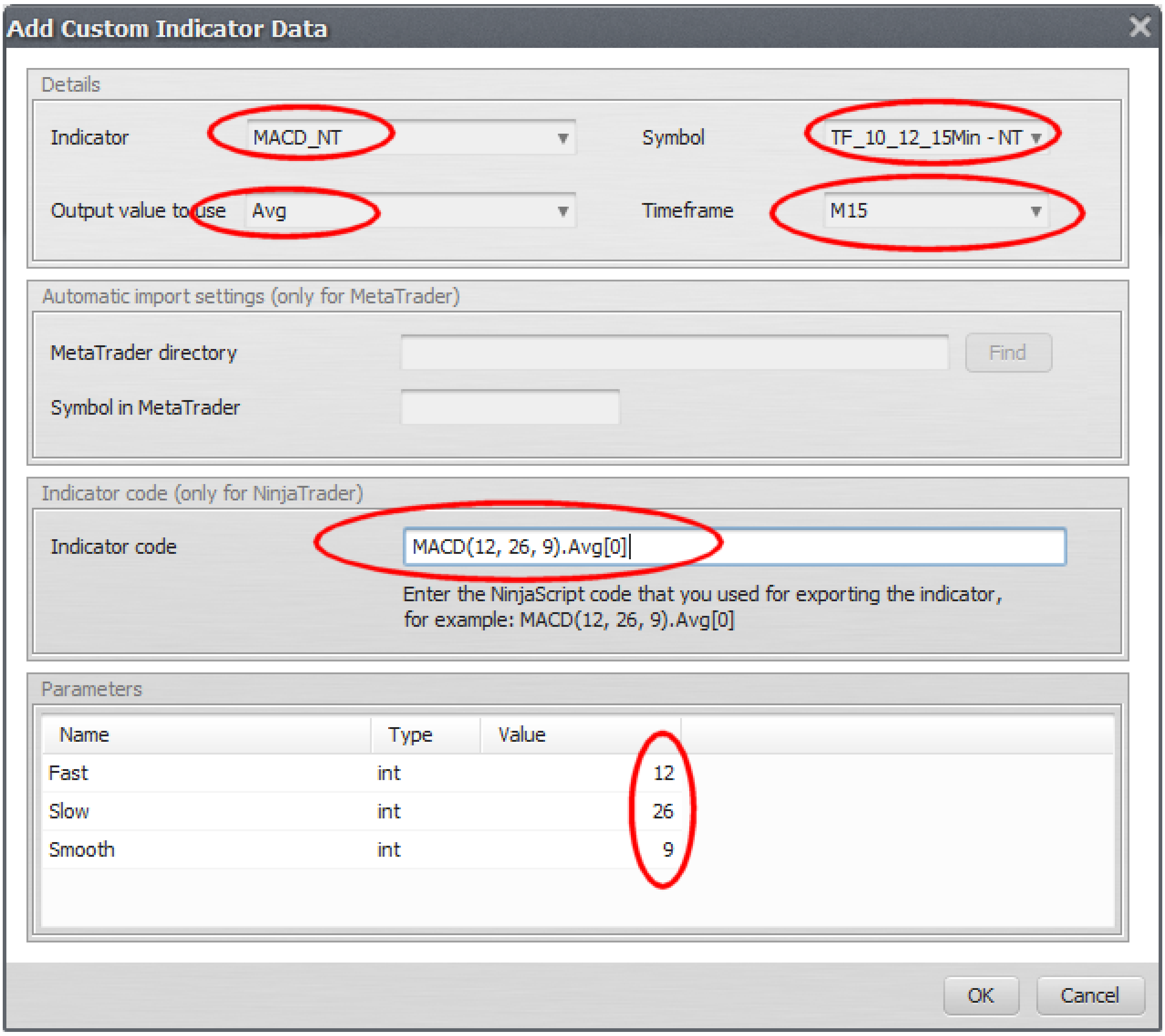
Visual

Click **OK** on the dialog and your new custom indicator is defined.

Step 2: Define custom indicator data

Now that we defined new custom indicator definition, we have to load the custom indicator data. The definition that we made in the first step is only a "description" of the indicator. To be able to use the indicator in your strategies, you have to configure
which parameter and output values it should use and load data for this indicator computed from NinjaTrader.

Click on the **Add new** button in theCustom Indicators data table.


Add Custom Indicator Data
Details
Automatic import settings (only for MetaTrader)
Find
Indicator code (only for NinjaTrader)
Parameters
OK
Cancel

Indicator: MACD_NT
Symbol: TF_10_12_15Min - NT
Output value to use: Avg
Timeframe: M15
MetaTrader directory:
Symbol in MetaTrader:
Indicator code: MACD(12, 26, 9).Avg[0]

Enter the NinjaScript code that you used for exporting the indicator, for example: MACD(12, 26, 9).Avg[0]

Name	Type	Value
Fast	int	12
Slow	int	26
Smooth	int	9

Here we have to choose our **indicator** defined earlier (MACD_NT) and choose which of its **output values** we want to use. We decided for Avg line.
If you want to use also Diff and Macd line, you have to follow this step for each output you want to use.

Then you also have to choose the **Symbol** and **Timeframe** for which these indicator data will be valid. Data will be computed in NinjaTrader for a given symbol and timeframe,
so they will be not valid for any other symbol/timeframe. To use this custom indicator on another symbol, simply repeat this Step 2 with another symbol.

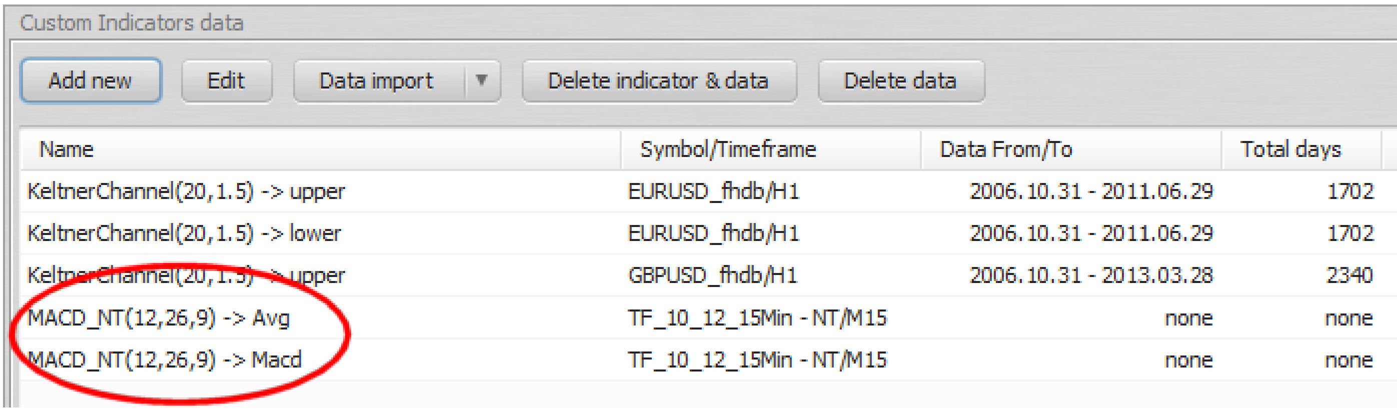
For NinjaTrader automatic import settings is not available and instead we have to specify the **indicator code**. This is the code that we will use in NinjaTrader to compute the indicator value (see next step).

The last thing is set the **indicator parameters**.

Again, computed indicator data will be valid only for one combination of symbol/timeframe/output/parameters. If you want to use the custom indicator with another set of parameters, you have to define it multiple times.

When all this is done click OK to save new Custom indicator data.

We can repeat the same step for the same indicator and symbol, but this time we'll choose Macd output value.
This way we'll have new custom indicator building blocks for Avg and Macd values of MACD indicator.



Name	Symbol/Timeframe	Data From/To	Total days
KeltnerChannel(20,1.5) -> upper	EURUSD_fhdb/H1	2006.10.31 - 2011.06.29	1702
KeltnerChannel(20,1.5) -> lower	EURUSD_fhdb/H1	2006.10.31 - 2011.06.29	1702
KeltnerChannel(20,1.5) -> upper	GBPUSD_fhdb/H1	2006.10.31 - 2013.03.28	2340
MACD_NT(12,26,9) -> Avg	TF_10_12_15Min - NT/M15	none	none
MACD_NT(12,26,9) -> Macd	TF_10_12_15Min - NT/M15	none	none

Step 3: Export indicator data from NinjaTrader

Now we have two new custom indicators defined, but they still don't contain any data. We have to compute indicator values in NinjaTrader, export them to files and import them to StrategyQuant.

First of all, we have to export the indicator from NinjaTarder. For this we'll need to edit a code of SQIndyExport indicator.
Go to Tools -> Edit Ninja Script -> Indicators and find SQIndyExport indicator.

Now we'll have to edit the file so that it computes and exports the indicators we want. There are two functions that we have to edit:

OnStartUp
this is simple, we'll just create new empty files with unique names for every indicator value we want to export

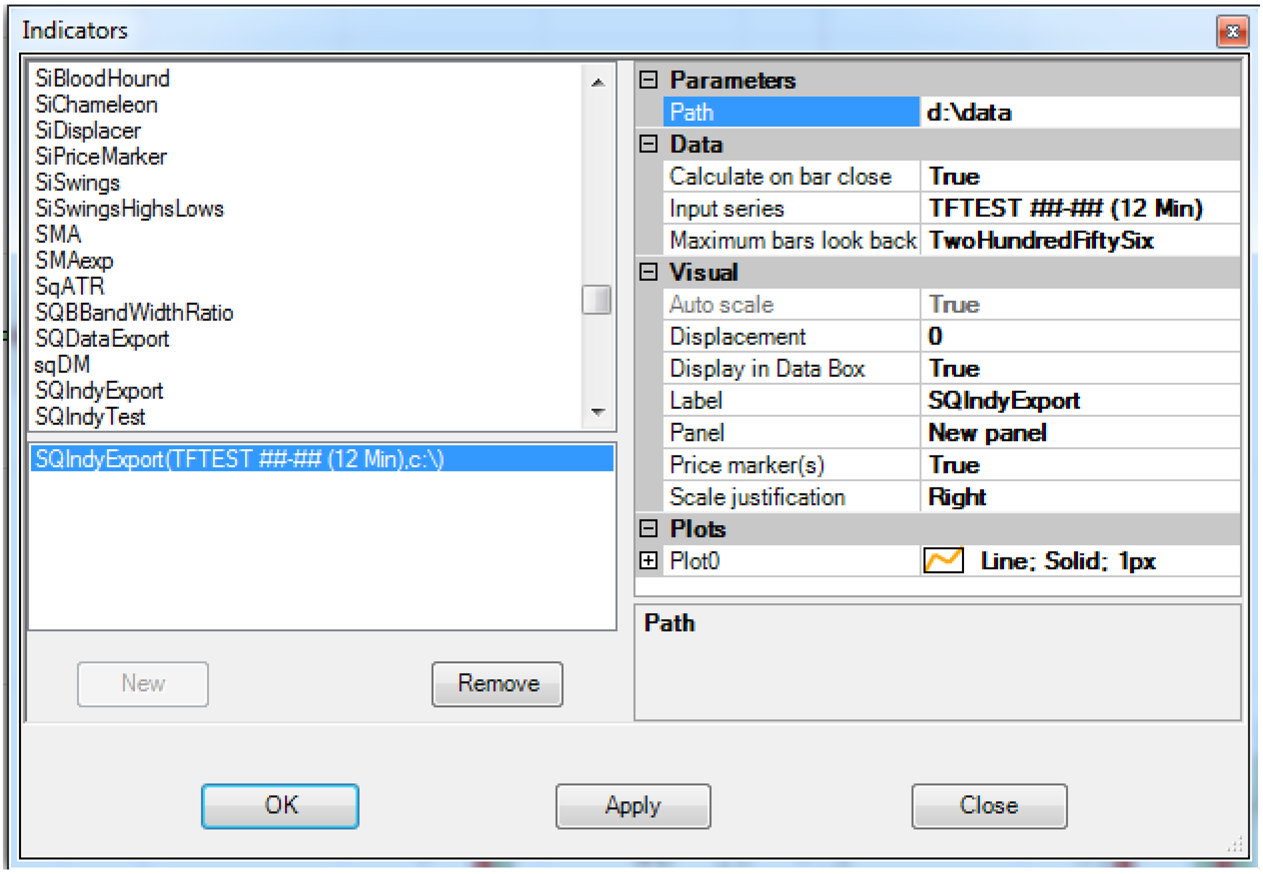
```
protected override void OnStartUp() {
      createEmptyFile("MACD_NT_Avg"); // MACD_NT_Avg is the export file
name, you can choose any name
      createEmptyFile("MACD_NT_Macd");
}
```

OnBarUpdate
this function is called on every bar and we'll use it to compute indicator data and write it to the prepared files. How exactly you'll call the indicator to compute its data depends on the indicator itself, for MACD it works like this:

```
protected override void OnBarUpdate()
{
	appendFile("MACD_NT_Avg", MACD(12, 26, 9).Avg[0]); // MACD(12, 26, 
9).Avg[0] is how the Avg value of MACD is computed
	appendFile("MACD_NT_Macd", MACD(12, 26, 9)[0]);	// every indicator 
has its own code
}
```

That's all, now we can compile this indicator.

When indicator successfully compiled, we can attach it to the chart (the chart must be the same one which we used to export data for use in StrategyQuant).
It has one parameter - Path - we should put there the path where we want the exported data files to be stored.



Indicators

SiBloodHound
SiChameleon
SiDisplacer
SiPriceMarker
SiSwings
SiSwingsHighsLows
SMA
SMAexp
SqATR
SQBBandWidthRatio
SQDataExport
sqDM
SQIndyExport
SQIndyTest

SQIndyExport(TFTEST ##-## (12 Min),c:\)

Parameters	
Path	d:\data
Data	
Calculate on bar close	True
Input series	TFTEST ##-## (12 Min)
Maximum bars look back	TwoHundredFiftySix
Visual	
Auto scale	True
Displacement	0
Display in Data Box	True
Label	SQIndyExport
Panel	New panel
Price marker(s)	True
Scale justification	Right
Plots	
Plot0	Line; Solid; 1px

Path

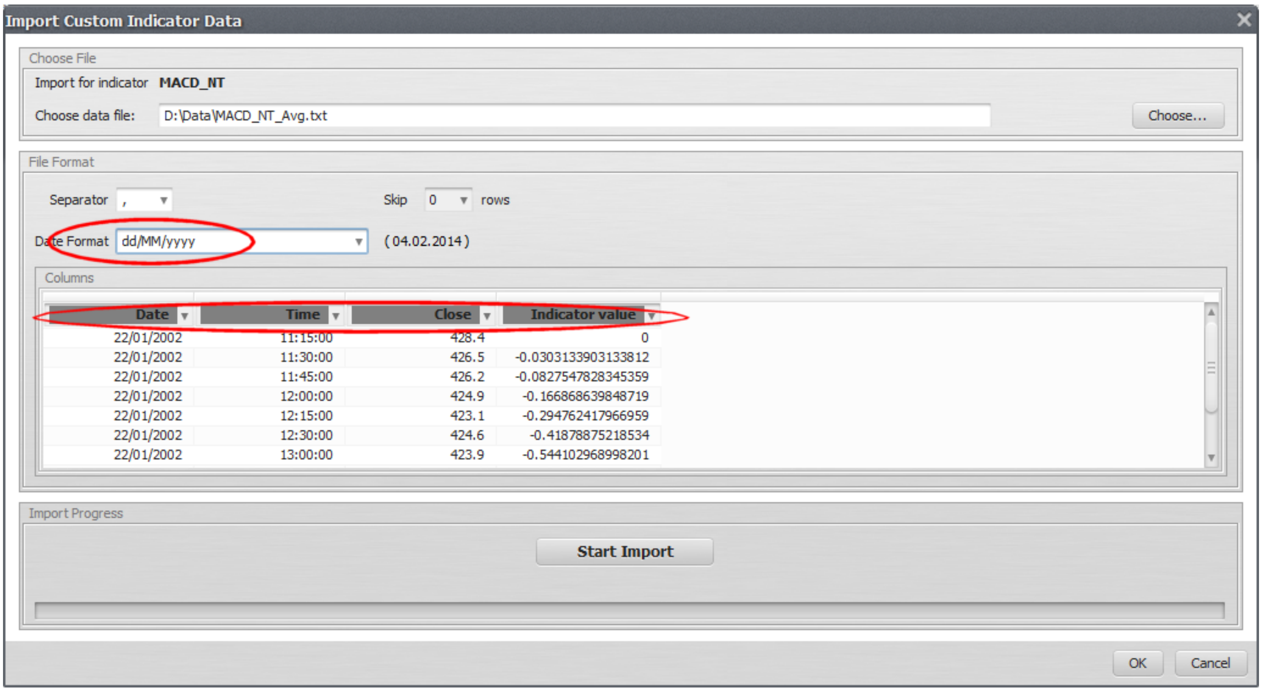
Now click on OK button, SQIndyExport will be added to the chart and it will start computing and exporting our indicator data.
It might take a few seconds or minutes, depending on the size of your data and speed of your computer.

Step 4: Loading custom indicator data

When we successfully exported indicator data from NinjaTrader we can import them to StrategyQuant. Switch to StrategyQuant, go to Data -> Custom Indicators

Select first new record **MACD(12,26, 9) -> Avg** and click on **Data import -> Manual**

This will open import dialog. Find and load your exported file.



Import Custom Indicator Data

Choose File

Import for indicator **MACD_NT**

Choose data file: D:\Data\MACD_NT_Avg.txt

File Format

Separator ,

Skip 0 rows

Date Format dd/MM/yyyy (04.02.2014)

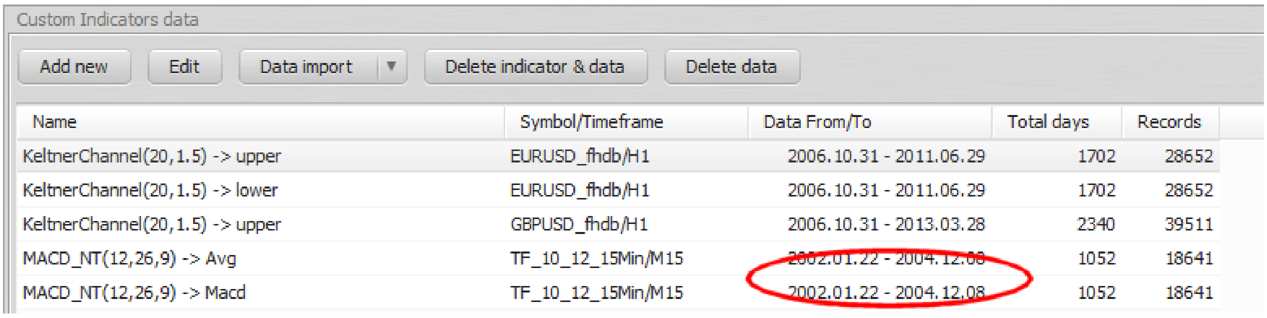
Columns

Date	Time	Close	Indicator value
22/01/2002	11:15:00	428.4	0
22/01/2002	11:30:00	426.5	-0.0303133903133812
22/01/2002	11:45:00	426.2	-0.0827547828345359
22/01/2002	12:00:00	424.9	-0.166868639848719
22/01/2002	12:15:00	423.1	-0.294762417966959
22/01/2002	12:30:00	424.6	-0.41878875218534
22/01/2002	13:00:00	423.9	-0.544102968998201

Import Progress

Now we have to set proper date format (dd/MM/yyyy in this case) and correct column values. File exported from NinjaTrader has 4 columns: Date, Time, Close price and Indicator value.
We can click on Start import to import the indicator data to StrategyQuant.

Now we have to repeat this for **MACD(12,26, 9) -> Macd** and we have successfully imported the new indicator values to StrategyQuant. You'll see that the indicators now contain imported values:

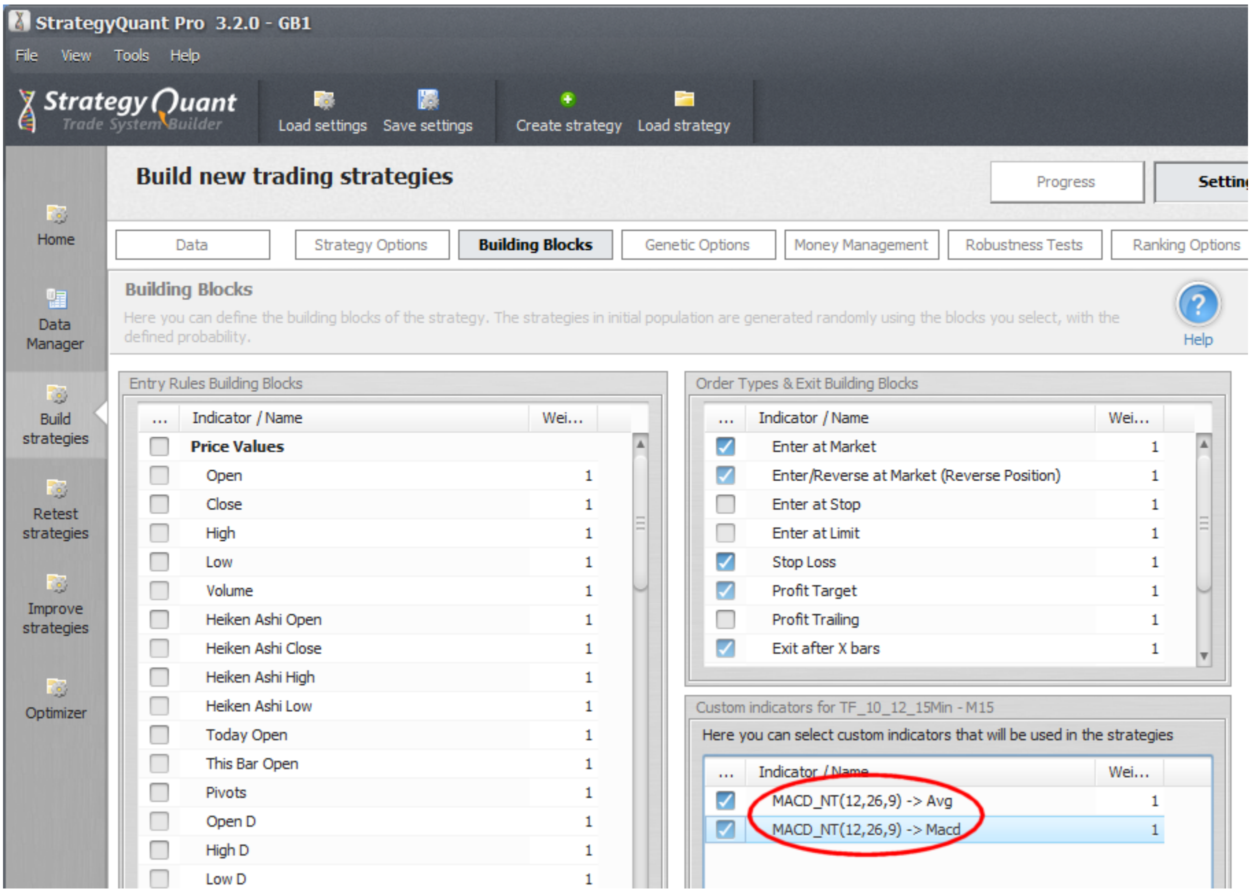


Custom Indicators data

Name	Symbol/Timeframe	Data From/To	Total days	Records
KeltnerChannel(20,1.5) -> upper	EURUSD_fhdb/H1	2006.10.31 - 2011.06.29	1702	28652
KeltnerChannel(20,1.5) -> lower	EURUSD_fhdb/H1	2006.10.31 - 2011.06.29	1702	28652
KeltnerChannel(20,1.5) -> upper	GBPUSD_fhdb/H1	2006.10.31 - 2013.03.28	2340	39511
MACD_NT(12,26,9) -> Avg	TF_10_12_15Min/M15	2002.01.22 - 2004.12.08	1052	18641
MACD_NT(12,26,9) -> Macd	TF_10_12_15Min/M15	2002.01.22 - 2004.12.08	1052	18641

Step 5: Using your new custom indicators

Steps 1 - 3 have to be done only once for every new custom indicator and symbol+timeframe+output+parameters you want to add to StrategyQuant.
When the indicator data are successfully imported you can use them in your building blocks.



Build new trading strategies

Building Blocks

Here you can define the building blocks of the strategy. The strategies in initial population are generated randomly using the blocks you select, with the defined probability.

Entry Rules Building Blocks

...	Indicator / Name	Wei...
□	**Price Values**	
□	Open	1
□	Close	1
□	High	1
□	Low	1
□	Volume	1
□	Heiken Ashi Open	1
□	Heiken Ashi Close	1
□	Heiken Ashi High	1
□	Heiken Ashi Low	1
□	Today Open	1
□	This Bar Open	1
□	Pivots	1
□	Open D	1
□	High D	1
□	Low D	1

Order Types & Exit Building Blocks

...	Indicator / Name	Wei...
☑	Enter at Market	1
☑	Enter/Reverse at Market (Reverse Position)	1
□	Enter at Stop	1
□	Enter at Limit	1
☑	Stop Loss	1
☑	Profit Target	1
□	Profit Trailing	1
☑	Exit after X bars	1

Custom indicators for TF_10_12_15Min - M15

Here you can select custom indicators that will be used in the strategies

...	Indicator / Name	Wei...
☑	MACD_NT(12,26,9) -> Avg	1
☑	MACD_NT(12,26,9) -> Macd	1

To use your new custom indicators in your strategies, you have to **check them** in Building Blocks -> Custom indicators table.

Note

You might need to restart the program after importing new custom indicators in order for them to appear in Building Blocks.

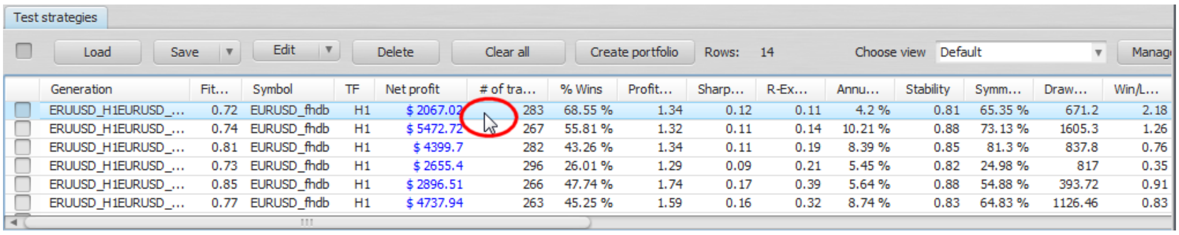
The custom indicators are valid only for the symbol/timeframe they were computed, in our example only for TF_10_12_15Min / M15.
If you want to use them for another symbol or timeframe, you have to repeats steps 1 - 3.

7.7 Export strategy from StrategyQuant and test or trade it in MetaTrader

When you generate some strategies and find the ones you would potentially like to use in real trading, it is time to test them in MetaTrader.

StrategyQuant normally saves strategies in its own proprietary .str file format, which is not readable by MetaTrader.
 In order to test strategies in MT4 you have to export its source code in MQL format

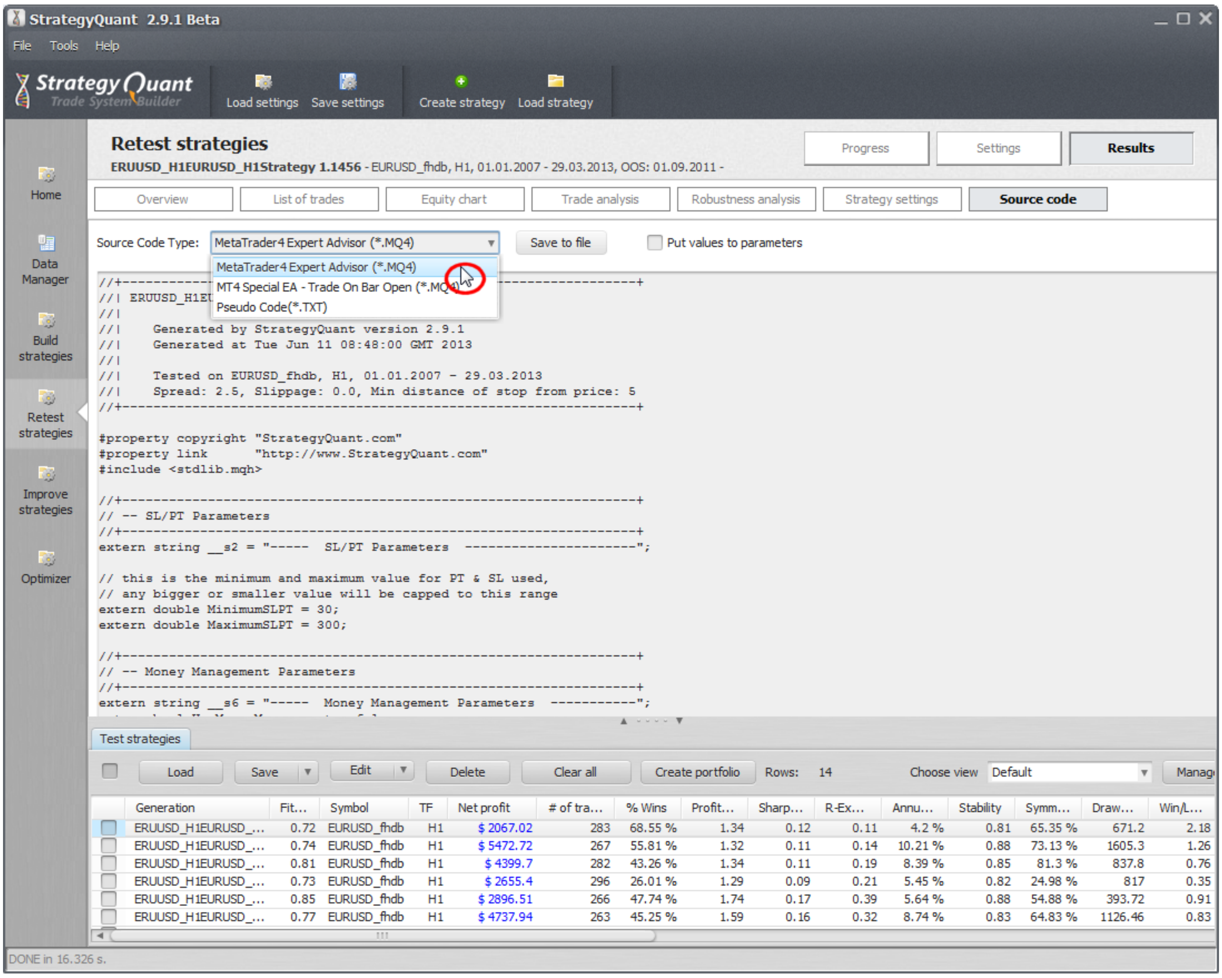
This is simple, go to the databank and find the strategy you want to use. Double-click on it, which opens it in the Result details window above the Databank.



Rows: 14   Choose view: Default

	Generation	Fit...	Symbol	TF	Net profit	# of tra...	% Wins	Profit...	Sharp...	R-Ex...	Annu...	Stability	Symm...	Draw...	Win/L...
□	ERUUSD_H1EURUSD_...	0.72	EURUSD_fhdb	H1	$ 2067.02	283	68.55 %	1.34	0.12	0.11	4.2 %	0.81	65.35 %	671.2	2.18
□	ERUUSD_H1EURUSD_...	0.74	EURUSD_fhdb	H1	$ 5472.72	267	55.81 %	1.32	0.11	0.14	10.21 %	0.88	73.13 %	1605.3	1.26
□	ERUUSD_H1EURUSD_...	0.81	EURUSD_fhdb	H1	$ 4399.7	282	43.26 %	1.34	0.11	0.19	8.39 %	0.85	81.3 %	837.8	0.76
□	ERUUSD_H1EURUSD_...	0.73	EURUSD_fhdb	H1	$ 2655.4	296	26.01 %	1.29	0.09	0.21	5.45 %	0.82	24.98 %	817	0.35
□	ERUUSD_H1EURUSD_...	0.85	EURUSD_fhdb	H1	$ 2896.51	266	47.74 %	1.74	0.17	0.39	5.64 %	0.88	54.88 %	393.72	0.91
□	ERUUSD_H1EURUSD_...	0.77	EURUSD_fhdb	H1	$ 4737.94	263	45.25 %	1.59	0.16	0.32	8.74 %	0.83	64.83 %	1126.46	0.83

There, go to Source code tab and switch the source code to MetaTrader4 Expert Advisor. This will load the MT4 code of the strategy.



Retest strategies

ERUUSD_H1EURUSD_H1Strategy 1.1456 - EURUSD_fhdb, H1, 01.01.2007 - 29.03.2013, OOS: 01.09.2011 -

Source Code Type: MetaTrader4 Expert Advisor (*.MQ4)

□ Put values to parameters

```
//+------------                                    ------------------+
//| ERUUSD_H1EU
//|
//|    Generated by StrategyQuant version 2.9.1
//|    Generated at Tue Jun 11 08:48:00 GMT 2013
//|
//|    Tested on EURUSD_fhdb, H1, 01.01.2007 - 29.03.2013
//|    Spread: 2.5, Slippage: 0.0, Min distance of stop from price: 5
//+------------------------------------------------------------------+

#property copyright "StrategyQuant.com"
#property link      "http://www.StrategyQuant.com"
#include <stdlib.mqh>

//+------------------------------------------------------------------+
// -- SL/PT Parameters
//+------------------------------------------------------------------+
extern string __s2 = "-----  SL/PT Parameters  --------------------";

// this is the minimum and maximum value for PT & SL used,
// any bigger or smaller value will be capped to this range
extern double MinimumSLPT = 30;
extern double MaximumSLPT = 300;

//+------------------------------------------------------------------+
// -- Money Management Parameters
//+------------------------------------------------------------------+
extern string __s6 = "-----  Money Management Parameters  -----------";
```

Rows: 14   Choose view: Default

	Generation	Fit...	Symbol	TF	Net profit	# of tra...	% Wins	Profit...	Sharp...	R-Ex...	Annu...	Stability	Symm...	Draw...	Win/L...
□	ERUUSD_H1EURUSD_...	0.72	EURUSD_fhdb	H1	$ 2067.02	283	68.55 %	1.34	0.12	0.11	4.2 %	0.81	65.35 %	671.2	2.18
□	ERUUSD_H1EURUSD_...	0.74	EURUSD_fhdb	H1	$ 5472.72	267	55.81 %	1.32	0.11	0.14	10.21 %	0.88	73.13 %	1605.3	1.26
□	ERUUSD_H1EURUSD_...	0.81	EURUSD_fhdb	H1	$ 4399.7	282	43.26 %	1.34	0.11	0.19	8.39 %	0.85	81.3 %	837.8	0.76
□	ERUUSD_H1EURUSD_...	0.73	EURUSD_fhdb	H1	$ 2655.4	296	26.01 %	1.29	0.09	0.21	5.45 %	0.82	24.98 %	817	0.35
□	ERUUSD_H1EURUSD_...	0.85	EURUSD_fhdb	H1	$ 2896.51	266	47.74 %	1.74	0.17	0.39	5.64 %	0.88	54.88 %	393.72	0.91
□	ERUUSD_H1EURUSD_...	0.77	EURUSD_fhdb	H1	$ 4737.94	263	45.25 %	1.59	0.16	0.32	8.74 %	0.83	64.83 %	1126.46	0.83

DONE in 16.326 s.

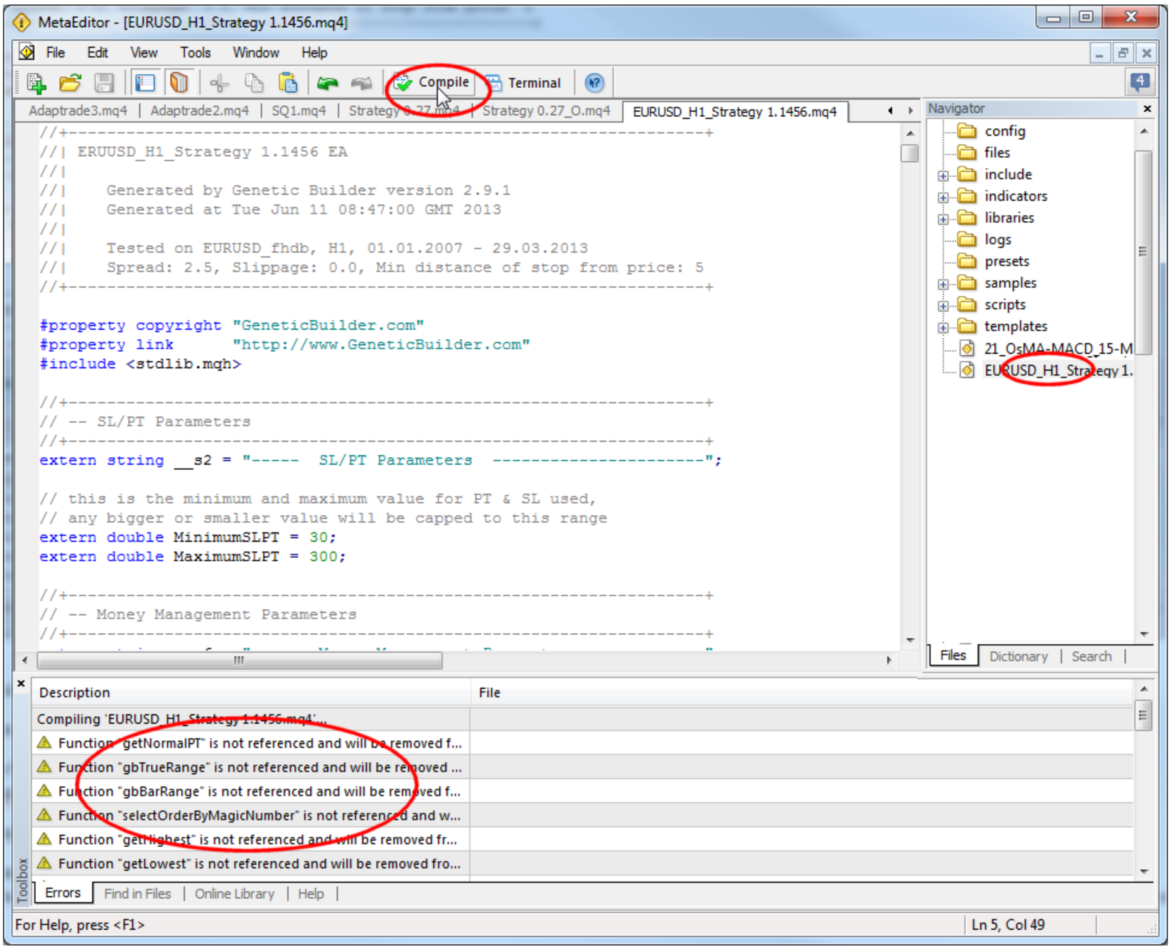
Click on Save to file button, and in the file dialog find the folder where your MetaTrader is installed (for example C:\Program Files\Alpari MT).

In this folder you have to go inside the **experts** directory and save the strategy source code there.

So the full path of the file will be for example
C:\Program Files\Alpari MT\experts\ERUUSD_H1_Strategy 1.1456.mq4

Now the strategy is copied to Metatrader. You can open MetaTrader now.

In Metatrader go to menu **Tools** -> **MetaQuotes Language Editor**, or press **F4**. This will open the language editor.
On the right side of the editor you'll have a list of strategies that are in the **experts** folder. Double-click on our strategy to open it in the editor window and then click on **Compile** on the top toolbar.



```
//+------------------------------------------------------------------+
//| ERUUSD_H1_Strategy 1.1456 EA
//|
//|    Generated by Genetic Builder version 2.9.1
//|    Generated at Tue Jun 11 08:47:00 GMT 2013
//|
//|    Tested on EURUSD_fhdb, H1, 01.01.2007 - 29.03.2013
//|    Spread: 2.5, Slippage: 0.0, Min distance of stop from price: 5
//+------------------------------------------------------------------+

#property copyright "GeneticBuilder.com"
#property link      "http://www.GeneticBuilder.com"
#include <stdlib.mqh>

//+------------------------------------------------------------------+
// -- SL/PT Parameters
//+------------------------------------------------------------------+
extern string __s2 = "-----  SL/PT Parameters  ----------------------";

// this is the minimum and maximum value for PT & SL used,
// any bigger or smaller value will be capped to this range
extern double MinimumSLPT = 30;
extern double MaximumSLPT = 300;

//+------------------------------------------------------------------+
// -- Money Management Parameters
//+------------------------------------------------------------------+
```

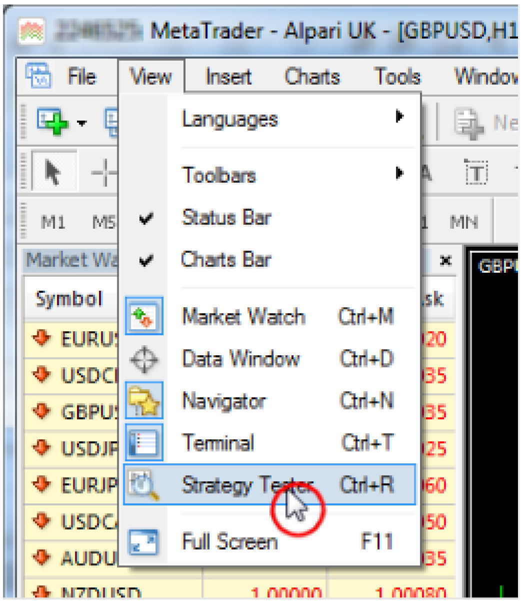
Description	File
Compiling 'EURUSD_H1_Strategy 1.1456.mq4'...	
⚠ Function "getNormalPT" is not referenced and will be removed f...	
⚠ Function "gbTrueRange" is not referenced and will be removed ...	
⚠ Function "gbBarRange" is not referenced and will be removed f...	
⚠ Function "selectOrderByMagicNumber" is not referenced and w...	
⚠ Function "getHighest" is not referenced and will be removed fr...	
⚠ Function "getLowest" is not referenced and will be removed fro...	

The strategy will be compiled and now it is ready for backtest or running live.

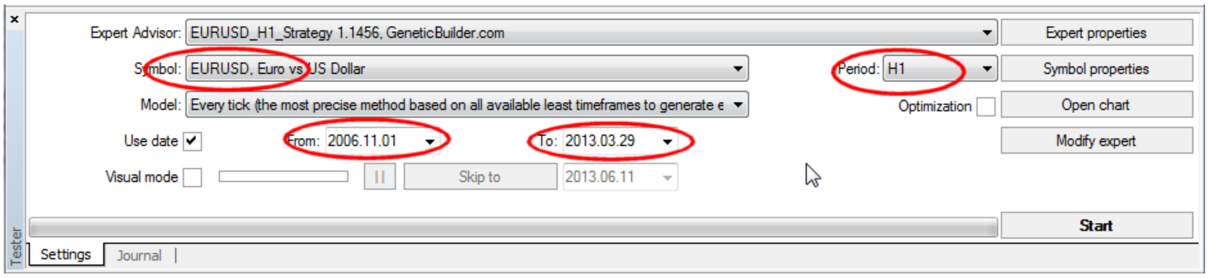
Note - Compilation warnings are normal

Please note that there are some compilation warnings on the bottom. These warnings are normal and they don't influence the strategy work.
There are simply some functions that are not used in the strategy and MetaTrader is informing you about that.

Now that the strategy is compiled , it is ready to be backtested. You can close the **MetaEditor**, go to the main MetaTrader screen and open **Strategy Tester**.



This will open the **Strategy Tester** dialog on the bottom and you can run the backtest.


Expert Advisor: EURUSD_H1_Strategy 1.1456, GeneticBuilder.com

Symbol: EURUSD, Euro vs US Dollar

Period: H1

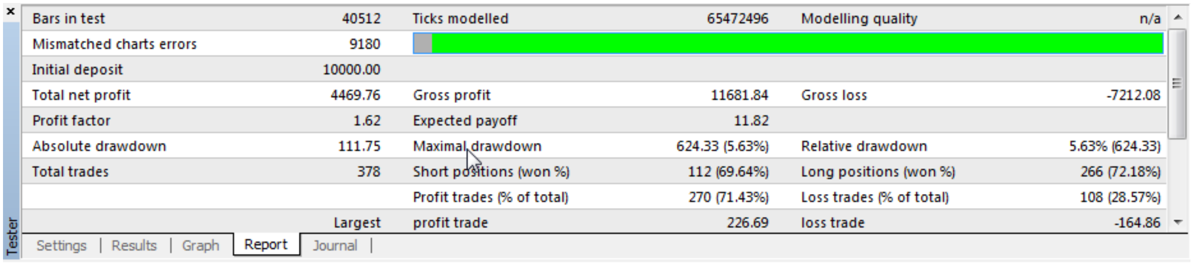
Model: Every tick (the most precise method based on all available least timeframes to generate e

Optimization □

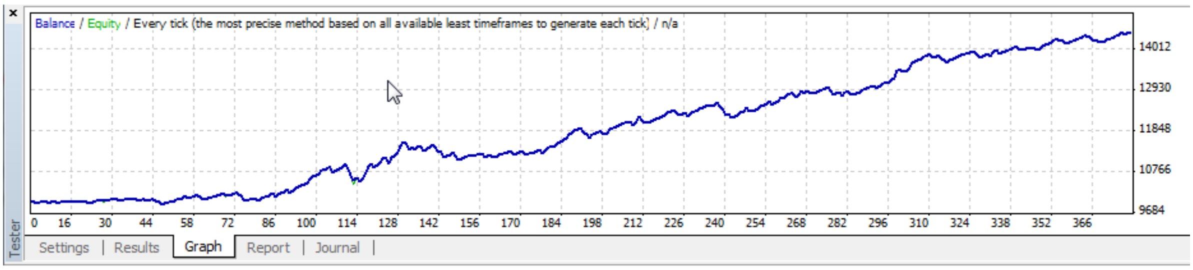
Use date ☑ From: 2006.11.01 To: 2013.03.29

Visual mode □ Skip to 2013.06.11

Make sure you select the correct Expert Advisor, Symbol, Timeframe and Date From and To and then click on the **Start** button. The test will start and after a while you'll get the results:



Bars in test	40512	Ticks modelled	65472496	Modelling quality	n/a
Mismatched charts errors	9180				
Initial deposit	10000.00				
Total net profit	4469.76	Gross profit	11681.84	Gross loss	-7212.08
Profit factor	1.62	Expected payoff	11.82		
Absolute drawdown	111.75	Maximal drawdown	624.33 (5.63%)	Relative drawdown	5.63% (624.33)
Total trades	378	Short positions (won %)	112 (69.64%)	Long positions (won %)	266 (72.18%)
		Profit trades (% of total)	270 (71.43%)	Loss trades (% of total)	108 (28.57%)
	Largest	profit trade	226.69	loss trade	-164.86



Explanation of small differences in backtests

If you'll compare test results in StrategyQuant and in MetaTrader, you'll see that on some cases the backtesting results are not the same.
The results can differ slightly or significantly - depending on the type of strategy.

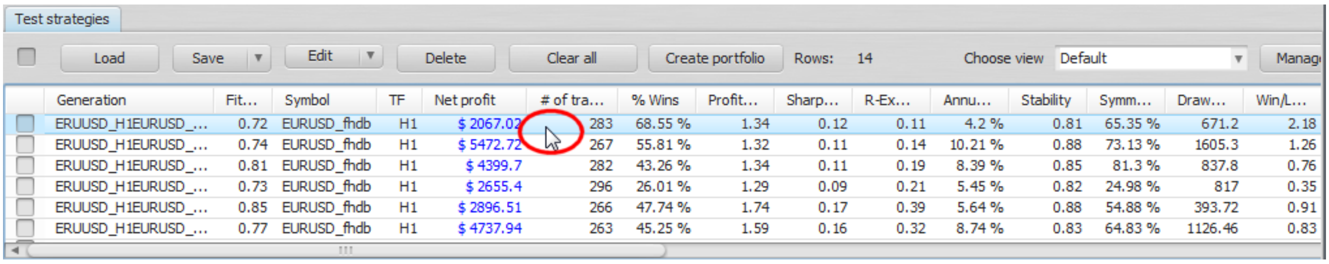
Backtesting algorithm used in StrategyQuant is very accurate, but it is not exactly the same algorithm used in MetaTrader, so it produces slightly different result.
The important thing here is to understand that both testing algorithms are only approximations, one isn't superior to the other.

7.8 Export strategy from StrategyQuant and test or trade it in NinjaTrader

When you generate some strategies and find the ones you would potentially like to use in real trading, it is time to test them in NinjaTrader.

StrategyQuant saves strategies in its own proprietary .str file format, which is nor readable by NinjaTrader.
 In order to test strategies in NinjaTrader you have to export its source code in NinjaScript format

This is simple, go to the databank and find the strategy you want to use. Double-click on it, which opens it in the Result details window above the Databank.

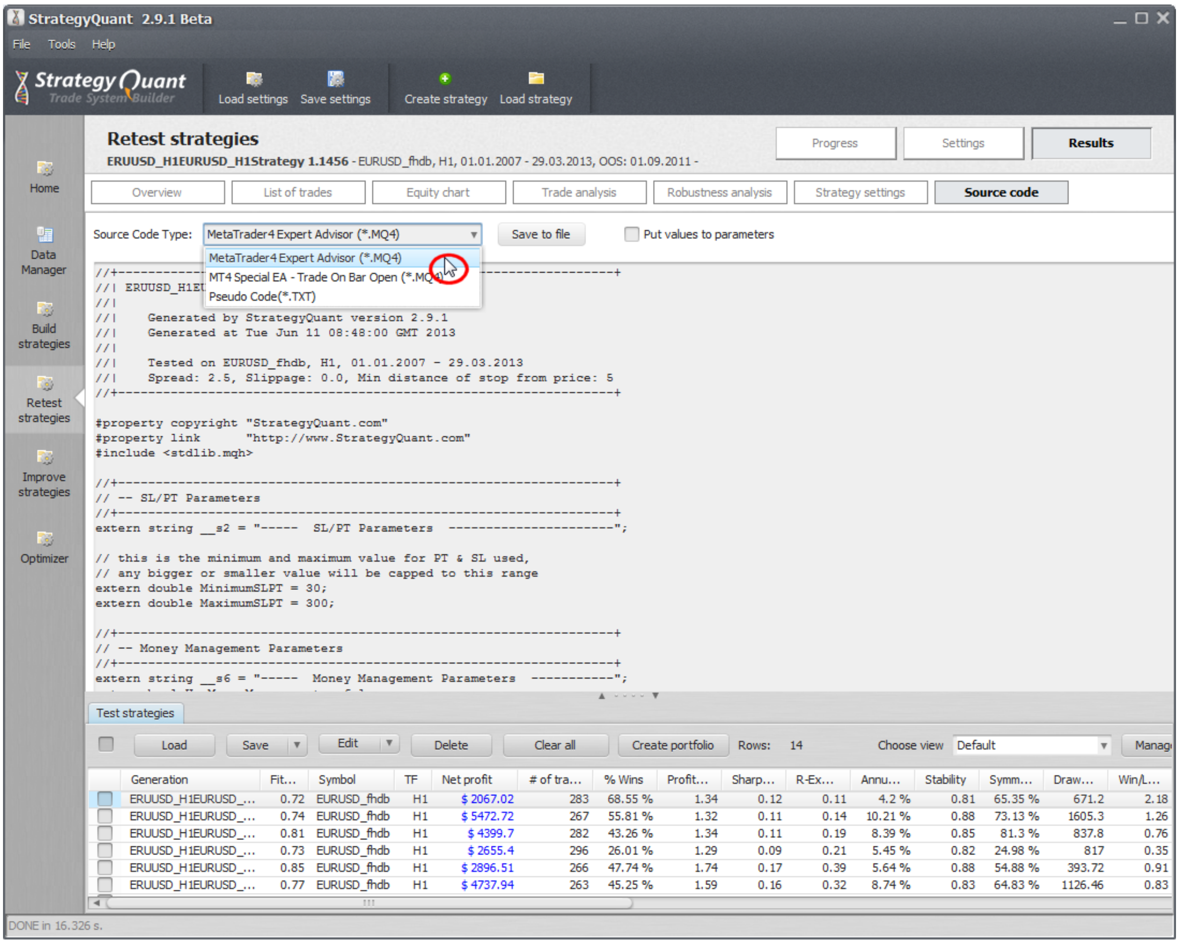


Rows: 14

Choose view: Default

	Generation	Fit...	Symbol	TF	Net profit	# of tra...	% Wins	Profit...	Sharp...	R-Ex...	Annu...	Stability	Symm...	Draw...	Win/L...
□	ERUUSD_H1EURUSD_...	0.72	EURUSD_fhdb	H1	$ 2067.02	283	68.55 %	1.34	0.12	0.11	4.2 %	0.81	65.35 %	671.2	2.18
□	ERUUSD_H1EURUSD_...	0.74	EURUSD_fhdb	H1	$ 5472.72	267	55.81 %	1.32	0.11	0.14	10.21 %	0.88	73.13 %	1605.3	1.26
□	ERUUSD_H1EURUSD_...	0.81	EURUSD_fhdb	H1	$ 4399.7	282	43.26 %	1.34	0.11	0.19	8.39 %	0.85	81.3 %	837.8	0.76
□	ERUUSD_H1EURUSD_...	0.73	EURUSD_fhdb	H1	$ 2655.4	296	26.01 %	1.29	0.09	0.21	5.45 %	0.82	24.98 %	817	0.35
□	ERUUSD_H1EURUSD_...	0.85	EURUSD_fhdb	H1	$ 2896.51	266	47.74 %	1.74	0.17	0.39	5.64 %	0.88	54.88 %	393.72	0.91
□	ERUUSD_H1EURUSD_...	0.77	EURUSD_fhdb	H1	$ 4737.94	263	45.25 %	1.59	0.16	0.32	8.74 %	0.83	64.83 %	1126.46	0.83

There, go to Source code tab and switch the source code to **NinjaTrader code**. This will load the NinjaScript code of the strategy.



Retest strategies

ERUUSD_H1EURUSD_H1Strategy 1.1456 - EURUSD_fhdb, H1, 01.01.2007 - 29.03.2013, OOS: 01.09.2011 -

Source Code Type: MetaTrader4 Expert Advisor (*.MQ4)

□ Put values to parameters

```
//+------------                                         -----------------+
//| ERUUSD_H1EU
//|
//|    Generated by StrategyQuant version 2.9.1
//|    Generated at Tue Jun 11 08:48:00 GMT 2013
//|
//|    Tested on EURUSD_fhdb, H1, 01.01.2007 - 29.03.2013
//|    Spread: 2.5, Slippage: 0.0, Min distance of stop from price: 5
//+--------------------------------------------------------------------+

#property copyright "StrategyQuant.com"
#property link      "http://www.StrategyQuant.com"
#include <stdlib.mqh>

//+--------------------------------------------------------------------+
// -- SL/PT Parameters
//+--------------------------------------------------------------------+
extern string __s2 = "-----  SL/PT Parameters  ---------------------";

// this is the minimum and maximum value for PT & SL used,
// any bigger or smaller value will be capped to this range
extern double MinimumSLPT = 30;
extern double MaximumSLPT = 300;

//+--------------------------------------------------------------------+
// -- Money Management Parameters
//+--------------------------------------------------------------------+
extern string __s6 = "-----  Money Management Parameters  -----------";
```

Rows: 14

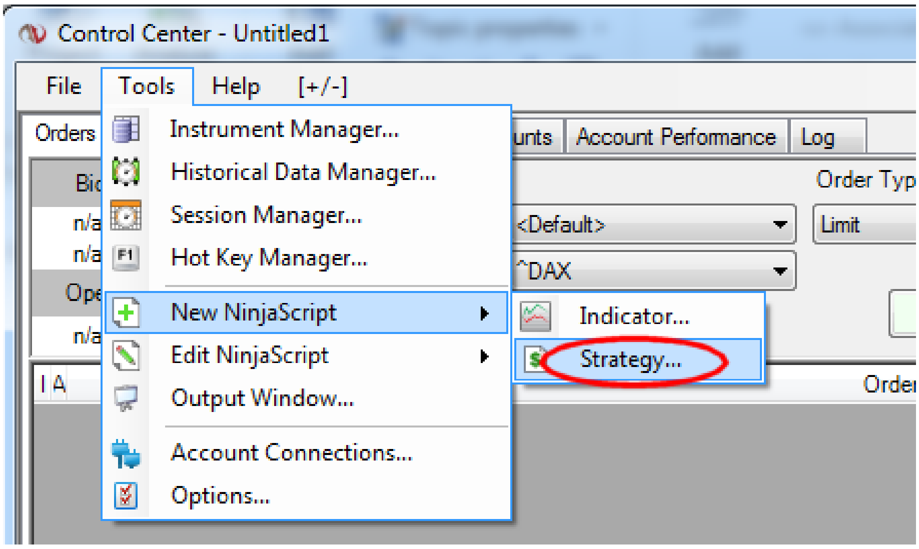
Choose view: Default

	Generation	Fit...	Symbol	TF	Net profit	# of tra...	% Wins	Profit...	Sharp...	R-Ex...	Annu...	Stability	Symm...	Draw...	Win/L...
□	ERUUSD_H1EURUSD_...	0.72	EURUSD_fhdb	H1	$ 2067.02	283	68.55 %	1.34	0.12	0.11	4.2 %	0.81	65.35 %	671.2	2.18
□	ERUUSD_H1EURUSD_...	0.74	EURUSD_fhdb	H1	$ 5472.72	267	55.81 %	1.32	0.11	0.14	10.21 %	0.88	73.13 %	1605.3	1.26
□	ERUUSD_H1EURUSD_...	0.81	EURUSD_fhdb	H1	$ 4399.7	282	43.26 %	1.34	0.11	0.19	8.39 %	0.85	81.3 %	837.8	0.76
□	ERUUSD_H1EURUSD_...	0.73	EURUSD_fhdb	H1	$ 2655.4	296	26.01 %	1.29	0.09	0.21	5.45 %	0.82	24.98 %	817	0.35
□	ERUUSD_H1EURUSD_...	0.85	EURUSD_fhdb	H1	$ 2896.51	266	47.74 %	1.74	0.17	0.39	5.64 %	0.88	54.88 %	393.72	0.91
□	ERUUSD_H1EURUSD_...	0.77	EURUSD_fhdb	H1	$ 4737.94	263	45.25 %	1.59	0.16	0.32	8.74 %	0.83	64.83 %	1126.46	0.83

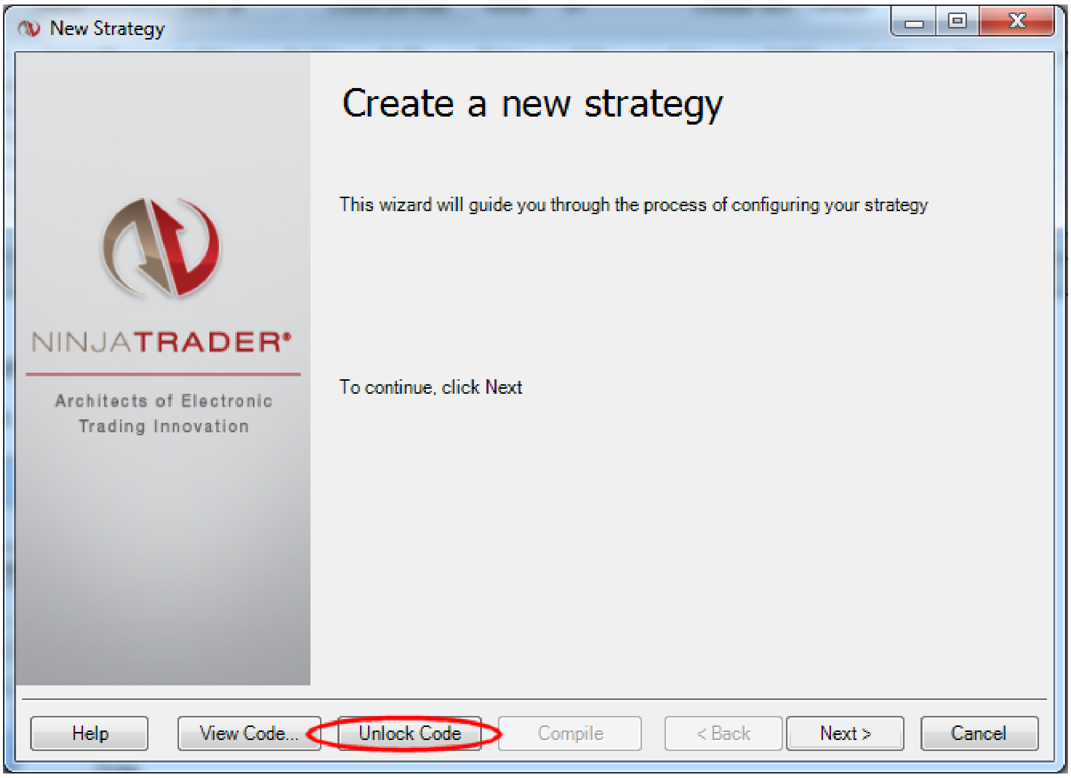
DONE in 16.326 s.

Now right-click into the text area and select Copy to clipboard.

After this open your NinjaTrader, and go to **Tools -> New NinjaScript -> Strategy**



This will open new strategy wizard:

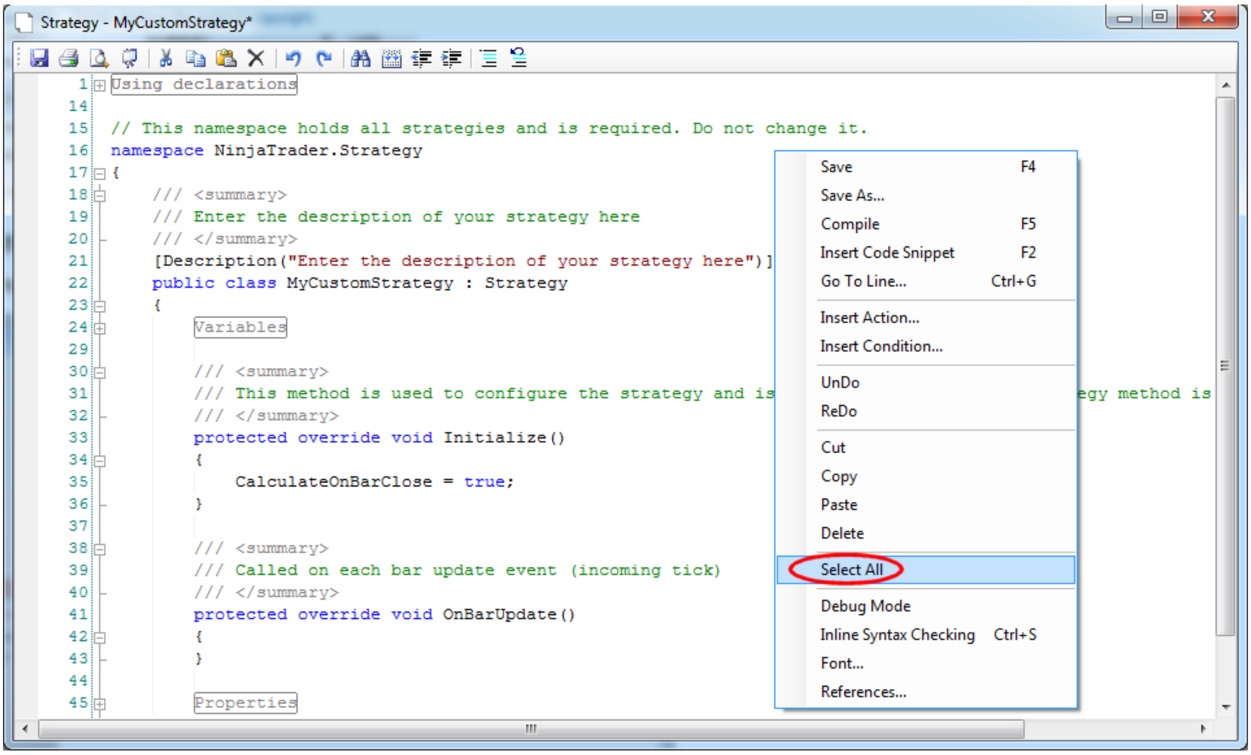


Create a new strategy

This wizard will guide you through the process of configuring your strategy

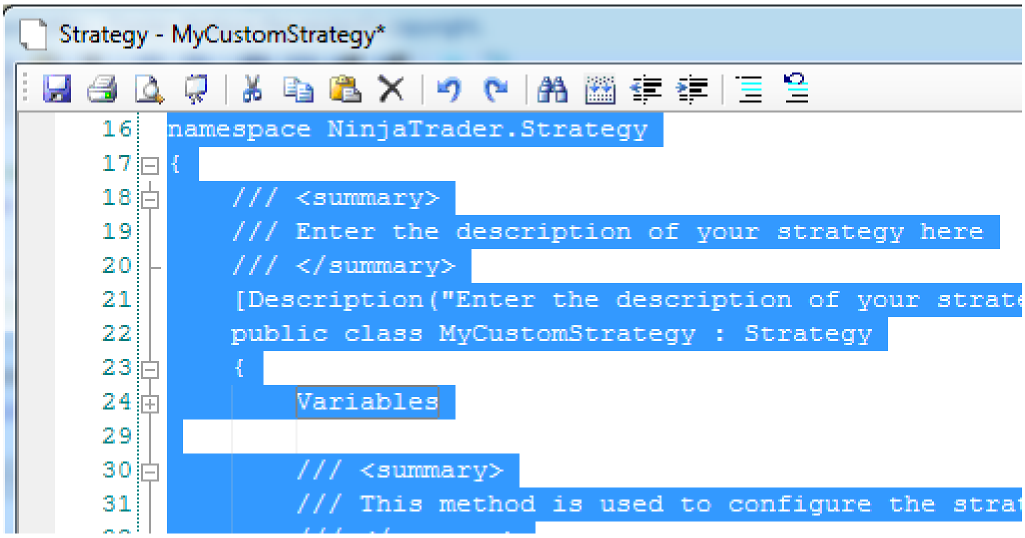
To continue, click Next

Click on Unlock code and confirm the dialog by clicking Yes. This will open new strategy editor with basic strategy code.
Click inside the editor with right mouse and choose Select all from popup menu:



```
Using declarations

// This namespace holds all strategies and is required. Do not change it.
namespace NinjaTrader.Strategy
{
    /// <summary>
    /// Enter the description of your strategy here
    /// </summary>
    [Description("Enter the description of your strategy here")]
    public class MyCustomStrategy : Strategy
    {
        Variables

        /// <summary>
        /// This method is used to configure the strategy and is                              egy method is
        /// </summary>
        protected override void Initialize()
        {
            CalculateOnBarClose = true;
        }

        /// <summary>
        /// Called on each bar update event (incoming tick)
        /// </summary>
        protected override void OnBarUpdate()
        {
        }

        Properties
```

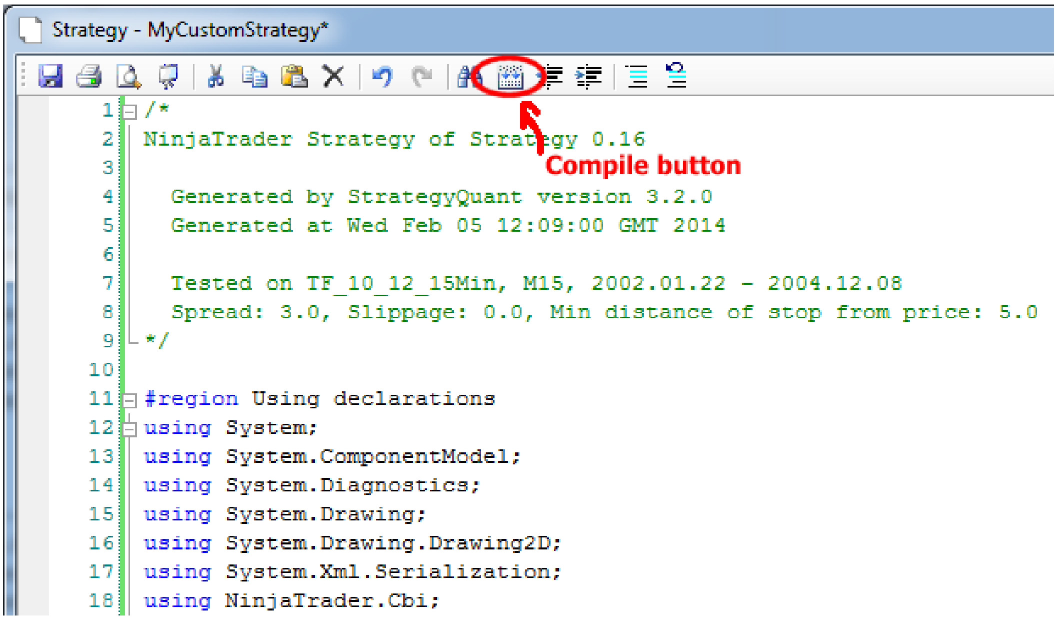
This will select all the text in the strategy. We are doing this because we want to replace the whole strategy code generated by NinjaTrader wizard by our code generated by StrategyQuant.



```
namespace NinjaTrader.Strategy
{
    /// <summary>
    /// Enter the description of your strategy here
    /// </summary>
    [Description("Enter the description of your strate
    public class MyCustomStrategy : Strategy
    {
        Variables

        /// <summary>
        /// This method is used to configure the strat
```

Now that the code is selected press Ctrl + V to paste the code from clipboard (remember, you copied the strategy code to clipboard in StrategyQuant in the beginning.

This will replace the whole code with SQ code. Now press Compile button to compile the strategy code.



```
/*
NinjaTrader Strategy of Strategy 0.16

  Generated by StrategyQuant version 3.2.0
  Generated at Wed Feb 05 12:09:00 GMT 2014

  Tested on TF_10_12_15Min, M15, 2002.01.22 - 2004.12.08
  Spread: 3.0, Slippage: 0.0, Min distance of stop from price: 5.0
*/

#region Using declarations
using System;
using System.ComponentModel;
using System.Diagnostics;
using System.Drawing;
using System.Drawing.Drawing2D;
using System.Xml.Serialization;
using NinjaTrader.Cbi;
```

In the ideal case the strategy should compile and there should be no warnings or errors displayed.

From now on you can test your new strategy in NinjaTrader StrategyAnalyzer or trade it in Strategies tab.

Note

If you see some compilation errors make sure you imported StrategyQuant helper codes for NinjaTrader as described in Post-installation steps

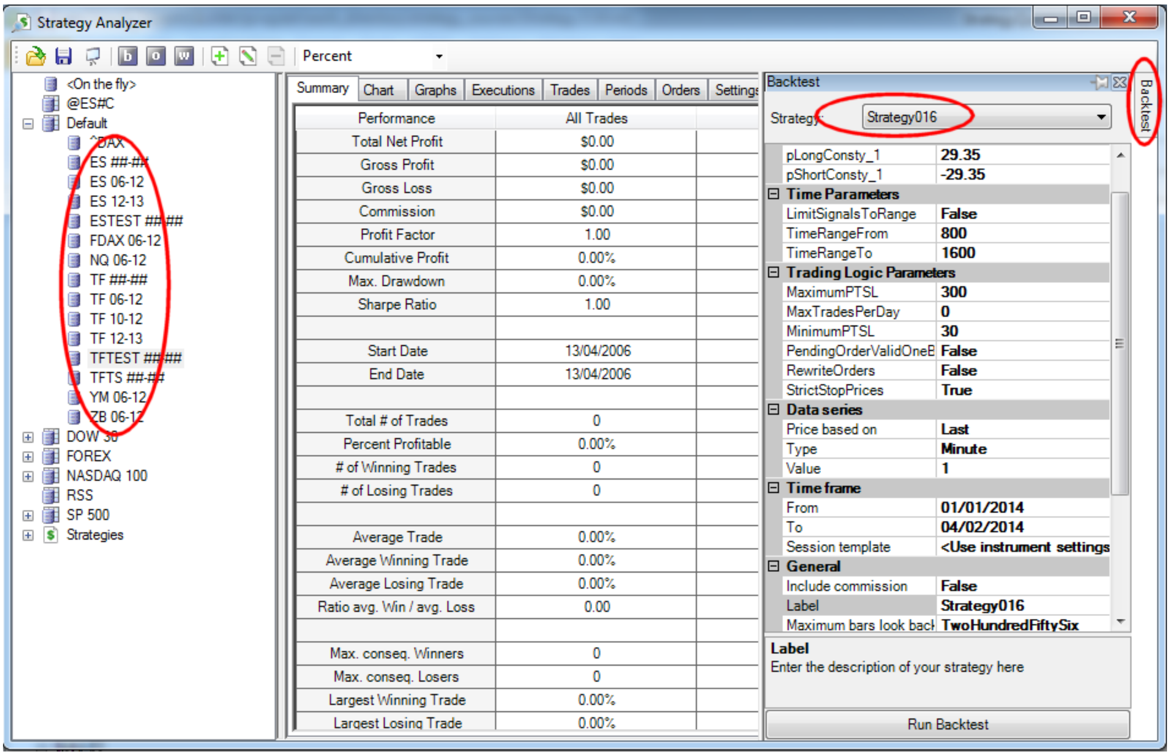
Updating the strategy in NinjaTrader

If you'll make some change in the strategy in StrategyQuant and you'll want to update your strategy in NinjaTrader, go to Tools -> Edit NinjaScript -> Strategy,
find your strategy by the name and open it in editor. Then copy & paste the code from StrategyQuant to NinjaTrader editor and compile it again.

Testing the strategy in NinjaTrader

Testing the strategies is described in NinjaTrader manual, so we'll go through it only very briefly.

NinjaTrader can backtest the strategy using Strategy Analyzer. Go to **File** -> **New** -> **StrategyAnalyzer** there open the Backtest panel on the right and find your strategy.



Performance	All Trades
Total Net Profit	$0.00
Gross Profit	$0.00
Gross Loss	$0.00
Commission	$0.00
Profit Factor	1.00
Cumulative Profit	0.00%
Max. Drawdown	0.00%
Sharpe Ratio	1.00
Start Date	13/04/2006
End Date	13/04/2006
Total # of Trades	0
Percent Profitable	0.00%
# of Winning Trades	0
# of Losing Trades	0
Average Trade	0.00%
Average Winning Trade	0.00%
Average Losing Trade	0.00%
Ratio avg. Win / avg. Loss	0.00
Max. conseq. Winners	0
Max. conseq. Losers	0
Largest Winning Trade	0.00%
Largest Losing Trade	0.00%

Strategy: Strategy016

pLongConsty_1	29.35
pShortConsty_1	-29.35
Time Parameters	
LimitSignalsToRange	False
TimeRangeFrom	800
TimeRangeTo	1600
Trading Logic Parameters	
MaximumPTSL	300
MaxTradesPerDay	0
MinimumPTSL	30
PendingOrderValidOneB	False
RewriteOrders	False
StrictStopPrices	True
Data series	
Price based on	Last
Type	Minute
Value	1
Time frame	
From	01/01/2014
To	04/02/2014
Session template	<Use instrument settings
General	
Include commission	False
Label	Strategy016
Maximum bars look back	TwoHundredFiftySix

Label
Enter the description of your strategy here

You'll also have to choose the proper data, set correct parameters, data series period, Time From - To, Session template, etc.

After this just click on **Run Backtest** and the backtest will be performed.

Explanation of differences in backtests

If you'll compare test results in StrategyQuant and in NinjaTrader, you'll see that on some cases the backtesting results are not the same.
The results can differ slightly or significantly - depending on the type of strategy.

If the results differ too much, usually the problem is in different settings. StrategyQuant and strategies generated by SQ offer you a wide range of settings, make sure you use the same settings in NinjaTrader and StrategyQuant.
Make sure that you test it on the same data, including the Session template.

Backtesting algorithm used in StrategyQuant was made to accurately match NinjaTrader backtesting algorithm, but there might be slight differences in rounding and comparing float numbers, computing indicators, etc.
Depending on the type of strategy, these small differences might not cause any difference in backtest result at all, or they can sum up and the differences could be bigger.

The important thing here is to understand that backtesting is always only an approximation, one algorithm isn't superior than the other.

7.9 Translate program to another language

The program is by default in English, but it supports translation to another language. All you have to do is to create a new language file for your language in **{StrategyQuant}/lang** folder.

There is an English.lng file that contains all language strings used in the program.
All you have to do is to create a copy of this file, rename it for example to Deutsch.lng (for German) and then open it in plain text editor like Notepad and add translation for every string.

The file format is simple – it shows language string in English, then equals (=) sign and after that should be the string in another language.

For example:
version=Your translated string
Homepage=Your translated string
Get Support=Your translated string
etc.

When you created new language file just restart the program and you should see your new language in menu **View -> Language**

Notes for translation!

- If you use any special characters the file has to be saved in UTF-8 format

- For strings that contain special marks like %d, %s these marks will be replaced by the appropriate value by the program.
  You should use them in the correct places also in your translated text

- The length of language string should be not much longer than the length of original string. Use abbreviation if needed.
  The reason is that there is only a limited place on the user interface for the texts. If you'll use too long text it might not fit to the label.

- When you create language file for a new language share it with others! Send it to us and we will include it to the next update of the program.

8 Appendix

8.1 Ranking criteria

Net Profit
Net Profit is a total profit/loss the strategy produced.

Drawdown, Max DD %
Drawdown is the measure of the decline from a historical peak in running cumulative profit of the strategy. Max DD % is the maximum percentage drawdown of the strategy.

Stagnation, % Stagnation
stagnation is a maximum number of days during which strategy stagnates - which means it doesn't make a new high on the equity. Obviously you'd want strategy with as little stagnation as possible.

% of Wins
percentage of winning trades

Annual % Return
average annual percentage return of the strategy. If it is 30 %, it means the strategy makes 30% every year in average.

Annual % Return / Max DD %
important ratio between annual percentage and maximum percentage drawdown. You'd want this number to be as high as possible.

Avg Daily, Monthly, Yearly profit
average profit for given period in $

Return/DD Ratio
a very good measure of strategy quality, the higher the number, the bigger are profits in relation to maximum drawdown.

Expectancy
performance metrics developed by Van Tharp, it is computed as (percentage wins * average win) - (percentage losses * average loss)

R-Expectancy

performance metrics developed by Van Tharp, it gives you the average profit value related to average risk (R) that you can expect from a system over many trades.

You can find more at: http://www.vantharp.com/tharp-concepts/expectancy.asp

R-Expectancy Score

standard R-Expectancy doesn't consider the length of testing period and number of trades produced. There is a difference when you make for example $2000 per year by making 10 trades, or by making 100 trades.
R-Expectancy Score adds a score for trades frequency. It is computed as: `R-Expectancy * averageTradesPerYear`

SQN (System Quality Number)

performance metrics developed by Van Tharp, it is the measure of the quality of a trading system.

You can find more at: http://www.vantharp.com/tharp-concepts/sqn.asp

Standard interpretation of SQN is:

Score:	1.6 – 1.9	Below average, but trade-able
Score:	2.0 – 2.4	Average
Score:	2.5 – 2.9	Good
Score:	3.0 – 5.0	Excellent
Score:	5.1 – 6.9	Superb
Score:	7.0 -	Keep this up, and you may have the Holy Grail.

SQN Score (System Quality Number Score)

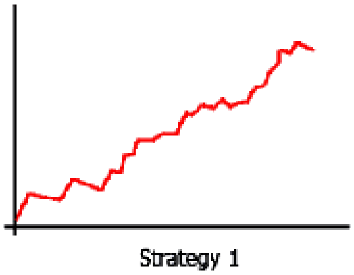
just like in case of R-Expectancy, SQN doesn't consider the length of testing period and number of trades produced. In fact it is more favorable for systems that produce more trades, without considering the length of the testing period.
It is computed as: SQN * `(averageTradesPerYear / 100)`

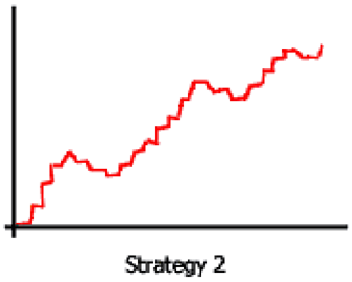
Number of trades

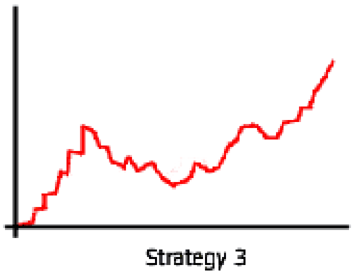
simply a number of trades of this strategy in the backtest. You can use this criterion to approximate some preset value you would like to achieve (for example total 100 trades). The value of this criterion will be bigger for strategies closer to the desired number of trades.

Stability

a special value in range from 0 (worst) to 1 (best) that measures how stable is growth of the equity chart.







You can see three sample strategies on the picture above. All of them finished with the same profit, but Strategy 1 was growing almost linearly (very stable), Strategy 2 was growing with occasional big drawdowns (less stable) and Strategy 3 was moving up and down (very little stability of growth).

Stability is a value that is quite good in representing a "quality" of the trading strategy and it can be used as the only one or the main criterion to compute the total strategy *Fitness*.

Symmetry
criterion to maximize strategy symmetry. Symmetry value is in %, and it is measuring how much is the Profit/Loss for Long direction similar to Short direction.

For example, if strategy makes $600 on Long trades, and $400 on Short trades, symmetry in this case is 66%. ($400 is 66% from $600).

If the strategy makes the same profit on both directions, the symmetry will be 100%. If one of the directions produces loss or 0 profit, the symmetry will be 0%.

Win/Loss Ratio
criterion to maximize the ratio of winning trades vs. losing ones

Average Win, Average Loss
criterion to maximize average win or minimize average loss per trade

Average Bars in Trade
criterion to minimize the average number of bars the trade is open

Average Bars Win, Average Bars Loss
criterion to minimize the average number of bars for the winning/losing trade

Degrees of Freedom
in a trading system relates to the number of criteria that are used to filter price action and/or volume and determine entry points.
The more criteria and variables used to determine entry timing points, the fewer degrees of freedom the system will have and vice versa.

Degrees of freedom are computed from strategy complexity and number of trades.
The simpler the strategy is, the more degrees of freedom it will have. For this property, the bigger value is better.

Complexity
measures the complexity of the strategy. It is simply a count of all the indicators, prices, operators and other building blocks that are used in the strategy. The higher this number is, the more “complicated” the strategy is.
For this property, the smaller value is better.

Both properties can be used also in the ranking to influence the Fitness function.

8.2 Entry and exit types

Profit Target (PT)
is the opposite of the Stop Loss, it can be used to take the profit once the price moves in your favor. As in the example above, you can set up a profit target to close the position once it makes for example 100 pips.

Exit After X Bars
this is very simple exit condition. If used, the strategy will close the trade after given number of bars (time periods on a given timeframe).
This is many times a simple, but effective way to close the trade when the market moves sideways or when we want to lock in the profit.

Move Stop Loss to Break-Even
another simple but quite powerful condition. It tells the strategy to move protective Stop Loss to the entry price (break-even) when the given profit is reached. This will not close the trade, so the strategy will be still in position, but there is zero risk after this move. Because SL is at the entry price we'll not lose anything even if the trade reverses and goes against us.
This condition is evaluated only on open bar (not on every tick).

Profit Trailing
a simple trailing stop that trails the Stop Loss specified distance from highest achieved profit. This condition is evaluated on open bar (not on every tick).

Stop Trailing
more advanced trailing stop that can use a value of indicator or price (Open, High, Low, Close) to trail the Stop Loss. For example the rule can trail SL at Lowest(20) + 20 pips.
This condition is evaluated on open bar (not on every tick).

Exit Rule (Price + Operators + Indicators, ...)
it is a special type of exit where strategy has not only rules for entering the trade (Entry rules) but also rules for exiting it (Exit rules). Exit rules look as same as entry rules - it is a combination of all the selected building blocks(indicators, operators, price values).

Example of entry and exit rule pair:
Entry Rule - if CCI > 0 Enter at Market
Exit Rule - if RSI crosses above 100 and we are in long position then Close Trade

Note on Stop Loss / Profit Target/Move Stop Loss to BE
*Both Stop Loss and Profit Target can have either fixed value in pips (like 30, 50 or 100 pips), or they can be based on ATR (Average True Range), for example 2*ATR.*
This means that the actual value of the SL/PT will be 2 times the value of average true range at the time the trade was opened.

ATR based SL/PT have the advantage that they "adapt" to changed market conditions and changes of volatility. Some strategies (but not all of them) can be more profitable when they use ATR based SL/PT instead of fixed one.

To enable/disable ATR for SL/PT, you can enable/disable the Average True Range indicator in the Entry Building Blocks.

9 Final Words

Congratulations on completing the guide to StrategyQuant. I hope you'll like the program and you'll use it as an important part of your trading.

StrategyQuant is very new program, and it is underactive development. This means you can look forward for new exciting features that will move the program functionality even further.

I'm open to a new ideas or suggestions, so if you are missing something in StrategyQuant or if you think something can work in a different way, don't hesitate to let me know.

I wish you many successful trades,

Mark Fric

P.S. I would love to hear your success stories, so please let me know at mailto:support@strategyquant.com