

Manual Backtesting for NanoTrader Full

or

How to test your strategies

Latest Update: July 2017

Content

1. Basics.....	3
2. Create an example strategy	6
3. Required modifications at the study.....	10
4. Saving the study	14
5. Analysis tools and backtesting analysis	15
6. Optimising a strategy	21
7. Sensitivity analysis	26
8. Tips and tricks	30

Attention:

Before you actively work with this manual, you should have read the Charting and Trading Manual of NanoTrader Full.

You can find further details on the following content in the manual

TradingSystems.

This symbol leads to accompanying educational videos:



Risk Disclaimer:

WH SelfInvest offers only consultancy-free services. The content of these records contain no investment advice or investment recommendation (and may not be understood as such) and does not constitute an invitation to purchase any financial instruments or products. WH SelfInvest is not liable for damages which would be/are due to single comments and statements and assumes no liability in relation to the completeness and correctness of the presented content. The investor is therefore solely responsible for the risk of his investment decisions. The presented analyses and comments do not contain any consideration of your personal investment objectives, your financial conditions or needs. The content was not prepared in accordance with the legal requirements for financial analysis and must therefore be considered by the reader as marketing information. WH SelfInvest prohibits duplication or publication without explicit permission. FX and CFDs are leveraged products. They are not suitable for all investors since they have a high degree of risk for your capital and the fact that you can lose more than your original deposit. Please make sure that you understand all risks.

1. Basics

In this manual, the backtesting principle is explained and the NanoTrader’s exceptional usefulness in this field, mainly thanks to the sentimentors in general and the Meta Sentimentor in particular, illustrated. The manual mainly focuses on the backtesting of full-automated strategies.



Backtesting

Backtesting is, together with paper trading (demo), one of the most important aspects in the development of a successful trading system. Backtesting makes it possible for the trader to check the profitability of a strategy in a specific time frame. It results in (amongst other things) an equity curve, that shows whether a strategy is subject to strong fluctuations or not. Backtesting also enables the trader to optimise the individual elements of a strategy.

Thanks to NanoTrader’s instant backtesting technology, the trader receives constant feedback and a clear visualisation of the situation throughout the analysis. This is called a “White-Box System”, because all settings and parameters are completely transparent and adaptable. “Instant technology” means that NanoTrader systematically evaluates all incoming data real-time and, in addition and without the need of a restart, adapts these results as soon as a parameter is changed.

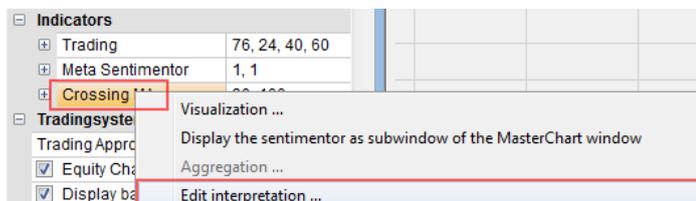
NanoTrader provides several tools to evaluate a strategy. Furthermore, the different components of a strategy can easily be optimised and evaluated with the help of a sensitivity analysis.

Sentimentors

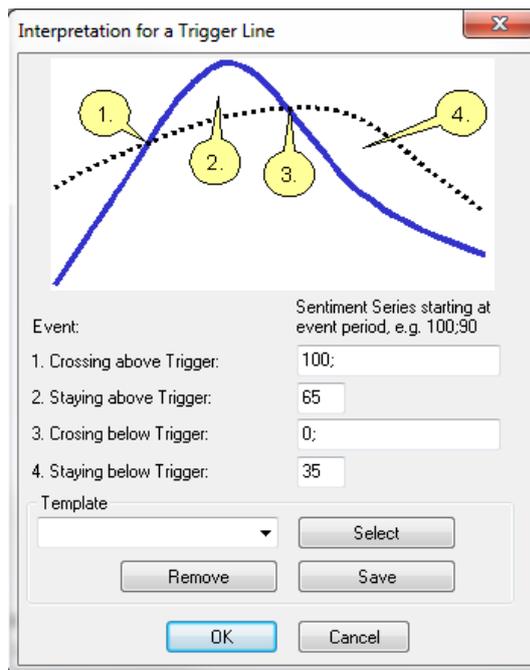
Sentimentors are the basis of all trading systems in NanoTrader. A sentimentor is a building block that assigns a sentiment to each period of the chart. The sentiments are valued on a scale from 0 to 100. 0 stands for a short sentiment; 100 for a long sentiment.

As a result of this intuitive approach, each sentimentor becomes “alive”. It is no longer a curve on a chart that requires constant supervision by the trader, but a visualisation of the market situation as it is interpreted by the underlying indicator. If, in a certain periode, the sentiment reaches a certain level, or falls below it, a trading signal is generated.

The interpretation is based upon the value of an indicator on a range of sentiments. The combination of the indicator and its interpretation is a sentimentor



This is an example of the interpretation of Crossing Moving Averages. The chart shows four specific events. The sentiments per event are visible underneath. The Slow Crossing MA is represented by a dotted line, the so-called trigger line. For each type of behaviour of the Fast Crossing MA towards the trigger line, a specific value was assigned. The settings in this illustration are standard.



In total, there are two main events assigned to each period, which have been given a value.

- **1st event** = crossing of the fast MA above the trigger (Slow MA) = Value 100 = Longsentiment
- **2nd event** = crossing below the trigger = Value 0 = Short sentiment

The two secondary events are those in which, firstly, the Fast MA stays above the trigger and secondly, stays underneath the trigger. Those events are valued 65 and 35 respectively.

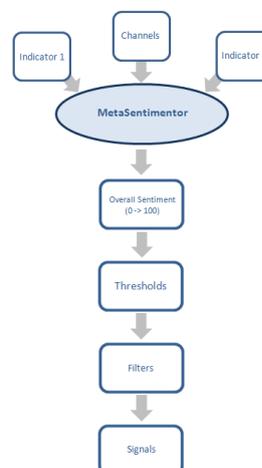
Attention: The values of the interpretation can be changed. However, the modification of the interpretation is an **expert function**.

MetaSentimentor

The Meta Sentimentor evaluates all the inputs generated by the different components of a specific strategy, which results in an overall sentiment (Meta Sentiment). More specifically, the Meta Sentimentor collects the inputs from indicators, trend channels, express sentimentors, etc. and summarises them in one overall sentiment. This overall sentiment has a value between 0 and 100, which, consequently, leads to a buy-, sell- or neutral sentiment. During backtesting, the sentiments are evaluated at the end of each candle. In live trading, however, this can be done on the basis of each new incoming tick.

Depending on the overall sentiment, the thresholds of the MetaSentimentor and the sentiment of the added filters, the following actions are possible:

- Opening a long position
- Opening a short position
- Closing a long position
- Closing a short position
- No action



Buy and Sell Thresholds of the MetaSentimentor

As soon as the Meta Sentimentor is added, a window opens underneath the chart. In addition, an extra row for the MetaSentimentor and trading settings is added in the DesignerBar. Underneath “Trading”, the thresholds (which generate the buy and sell signals) are defined.

The green and pink areas in the window of the MetaSentimentor show which thresholds are responsible for the opening and closing of short and long positions.



The thresholds follow the settings of the parameters underneath “Trading” in the DesignerBar.

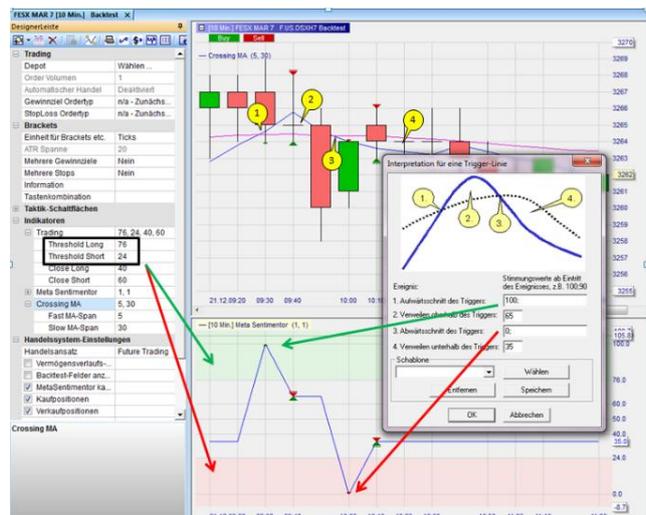
These are the default settings in NanoTrader: a long position is opened when the MetaSentimentor has a value above 76, and a short position when the MetaSentimentor has a value below 24. Short positions are closed at a threshold of 60 and long positions are closed at a threshold of 40.

Indicators	
Trading	76, 24, 40, 60
Threshold Long	76
Threshold Short	24
Close Long	40
Close Short	60

Attention: The settings underneath “Trading” can be changed. However, the modification of these parameters is an **expert function**.

The example on the right shows a strategy based on one single indicator, the Crossing MA. The Meta Sentimentor will therefore base its sentiment 100% upon the sentiment of this indicator. As a result of this, a signal will be generated as soon as a crossing takes place.

If there were more indicators, the MetaSentimentor would derive an overall sentiment out of the sentiment rows of these different indicators. This is the unique strength of the MetaSentimentor.



Each modification of a setting in the trading system and every incoming tick is automatically evaluated by the MetaSentimentor. The MetaSentimentor is therefore an essential component of instant backtesting in NanoTrader.

2. Create an example strategy

This manual explains the essential aspects of backtesting by means of an example strategy. It is not necessary for the trader to completely programme the strategy himself. Simply modifying a few parameters suffices. As a rule, a strategy can be built simply by choosing and combining a few building blocks by means of the Drag & Drop-function. This manual explains how. For the user to be able to follow this explanation, the platform needs to be configured as such:



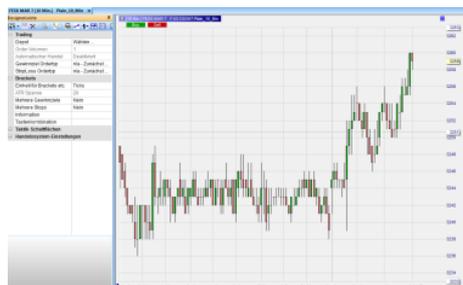
<i>Description of the strategy</i>	
<i>Category</i>	<i>Setting</i>
Contract	EuroStoxx 50Future
Possible positions	One contract
Trade direction	Long positions, no turning of positions possible
Chart	10 minutescandle chart
Signalling	Crossing of two moving averages. The averages are calculated over 5 or 30 periods respectively.
Filters	No trades between 12:00 - 13:00 pm. No overnight positions. Closing of positions at 21:00 pm
Stop	Trailing Stop
Duration	100 days

Building the strategy

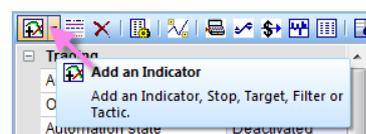
- Open the EuroStoxx 50 in the WorkspaceBar
- Use a 10-minutes candle chart
- If necessary, make the following changes in the DesignerBar :

If you see indicators, filters and/or stops in the DesignerBar, please remove them. The study should not be preconfigured.

- In the DesignerBar and the window “Add an Indicator”, choose the Crossing MA as a sentimentor to the masterchart.



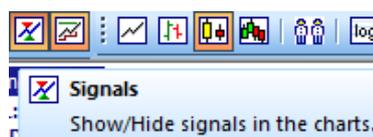
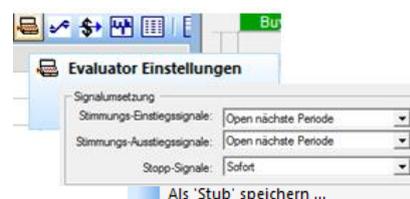
- Configure the parameters of the Crossing MA as follows: P1=5 and P2=30.
- Click again on “Add an Indicator” in the DesignerBar. Now add the MetaSentimentor in a Sub-window.
- Make sure that the Evaluator settings are set to “Open next bar”.



Indicators	
[-] Crossing MA	5, 30
Fast MA-Span	5
Slow MA-Span	30
Indicators	
[+] Trading	76, 24, 40, 60
[+] Meta Sentimentor	1, 1
[+] Crossing MA	5, 30

Save the study under a new name by clicking on the floppy-disk symbol.

- Activate the symbol „Show/Hide signals in the charts“. This is used to visualise entries and exits via triangles in the chart.



Note: If you are not familiar with these instructions, please read our NanoTrader Manual for Beginners:

http://www.whselfinvest.de/docs/NanoTraderFull_Starter_Manual_EN.pdf

Chart Analysis

The chart with the implemented strategy is shown below. Relevant elements are numbered and explained underneath.



1. MetaSentimentor window.
2. The Fast MA (blue) starts after 5 periods. The Slow MA (pink) only starts after the 30th candle. This is due to the defined parameters 5 and 30.
3. As long as the condition is not “met”, the Meta Sentimentor has the value 50, which means neutral. Afterwards, the values 0, 35, 65 and 100 are shown.
4. The MetaSentimentor is 0. There is a short sentiment (red triangle).
5. Depending on the settings, the position is opened at the start of the new period. The short position is shown in the chart. The Fast MA has sunk underneath the Slow MA (red arrow).
6. The MetaSentimentor shows the value 100. The short position is closed and a long one is opened (green and red triangle). The chart shows how, at that moment, the Fast MA climbed

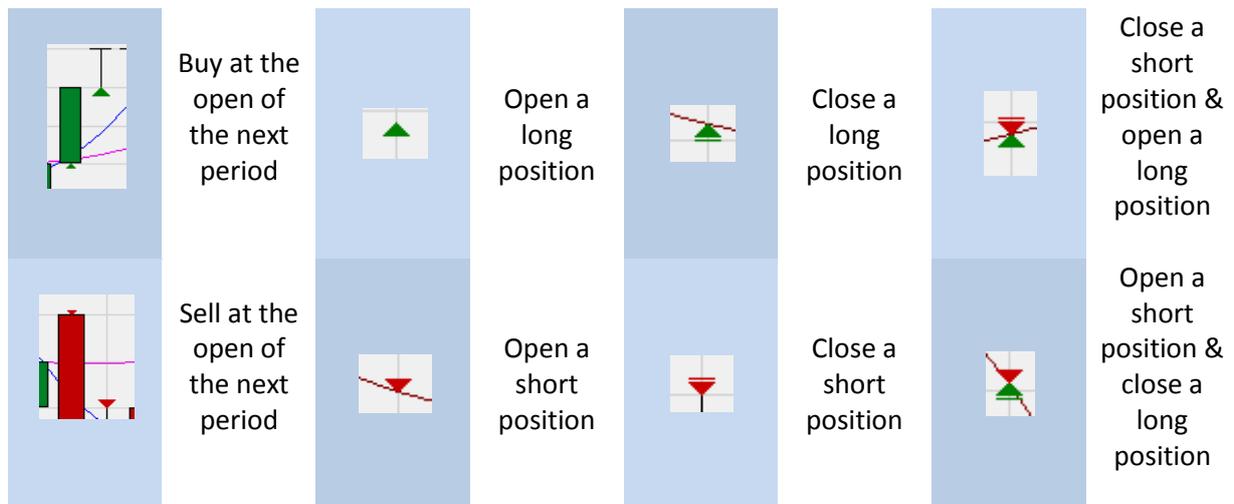


over the Slow MA (green arrow).

7. Long positions are opened between 76 and 100 in the green area.
8. Short positions are opened between 24 and 0 in the red area.

Interpretation of the signals

The interpretation of the most important trend signals can be read as follows:



3. Required modifications to the study

Some changes to the study are still required, because it does not yet reflect the described strategy.

- Short positions are still being opened, although we only want to open long positions.
- Positions can still be turned, although it is not desired.
- Overnight positions are still possible.

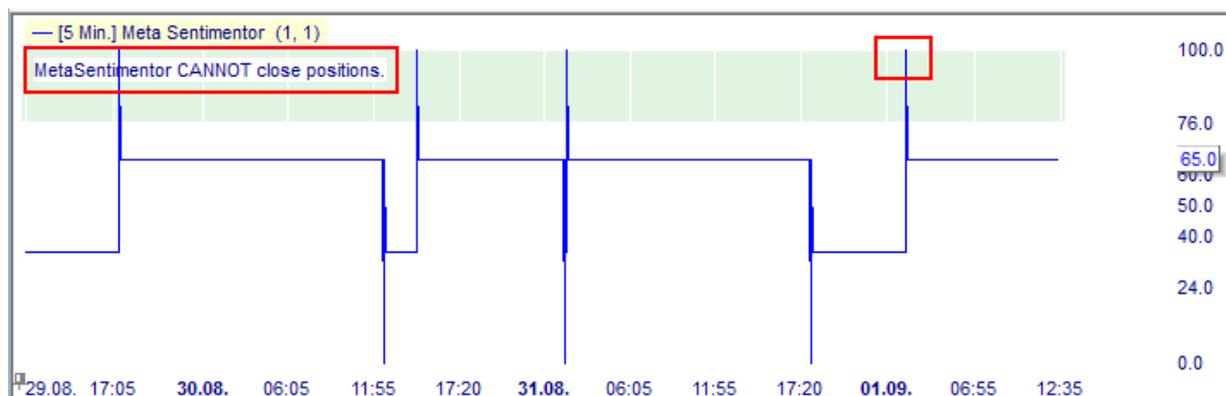
Preventing the opening of short positions and the turning of positions

The following settings have to be changed in the DesignerBar under “Tradingsystem Settings” :

- Untick the field “MetaSentimentor can close positions” so as to prevent the MetaSentimentor from turning positions.
- Untick the option “Go short”, so as to prevent the MetaSentimentor from opening short positions.

Tradingsystem Settings	
Trading Approach	Future Trading
<input type="checkbox"/> Equity Chart	
<input checked="" type="checkbox"/> Display backtest controls	
<input type="checkbox"/> MetaSentimentor can close positions	
<input checked="" type="checkbox"/> Go Long	
<input type="checkbox"/> Go Short	
More Settings	

The result looks like this:

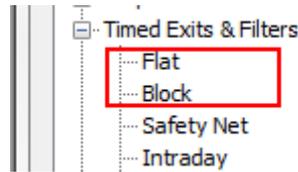


The red area (0-24) is not available anymore: no short positions are opened. Furthermore, no indicator can close a position. Positions can only be closed by the Trailing Stop EoP or the flatfilter.

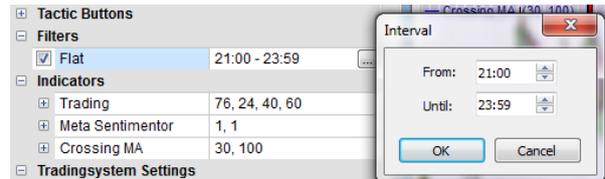
Note : only one position is opened, even if the MetaSentimentor reaches the green area several times. After a position has been opened, the MetaSentimentor does not open any new ones.

Configuring the Flat Filter

This configuration is done by a time filter. Click on “Add an Indicator” and, under “Timed Exits & Filters” choose both the flat filter and the block filter.



Configure the flat filter to 21:00-23:59, to avoid overnight positions.



Configure the Block Filter to 12:00-13:00.

The Master Chart now shows zones in bright and dark violet. The bright zones (block filter) are the ones during which no new trades in this study can be done (open positions cannot be closed). The dark zones (flat filter) are the ones during which the positions will be closed by means of market orders.



Configuration of the Stop

We choose the Trailing Stop EoP, which follows the market.

- Open the DesignerBar.
- Click on the Button “Add an Indicator“
- Under “Stop”, choose “Trailing Stop EoP“
- Click on „Stop“

This chart shows the movement of the Trailing Stop.

Brackets	
Trailing Stop EoP	30, 30
Stop Long: Ticks	30
Stop Short: Ticks	30
Einheit für Brackets etc.	Ticks



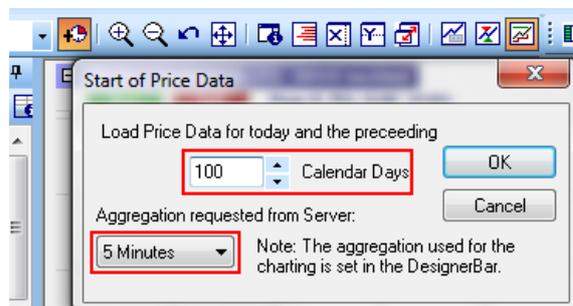
Note: The Trailing Stop is a stop which automatically follows the market price. If the market moves in the desired direction, the stop automatically follows at a, by the trader, predefined distance. If the market moves against the position, the stop remains on the last level. The trader can set the distance according to his preference.

Note: The Trailing Stop EoP is a modified version of the common Trailing Stop. The difference is that the Trailing Stop EoP trails only at the end of the bar, which makes it suitable for backtesting. A position is also closed during a period. The common Trailing Stop is not suitable for backtesting. Each EoP-variety of a stop, however, can be used for backtesting (e.g. the BreakEven Stop EoP)

Loading Historical Data for the Previous 100 Days

To test and optimise the strategy in the best possible conditions, a representative number of days should be loaded.

- In the Tool Bar, click on “Load historical Data”.
- Enter 100 days.
- Set 5 minutes as aggregation.
- Click OK.



Configuration of the MetaSentimentor (weight)

For the sake of completeness, it should be mentioned that the configuration and the weighing of the MetaSentimentor can be changed so as to influence the results of the trading system.

Attention: A modification of these values is an **expert function**.

Indicators	
Trading	76, 24, 40, 60
Meta Sentimentor	1, 1, 1, 1
Smoothness-Sp...	1
Slow Stochastic ...	1
Crossing MAwei...	1
Parabolic SAR w...	1

P1 is the smoothing area „Smoothness-Span“ of the MetaSentimentor. A weighed average is calculated on top of the Meta Sentimentor’s “naked” value. The number of bars on which the weighed average was calculated is determined in “P1”.

P2 till Pn show the individual weight each sentimentor represents in the overall sentiment.

Example 1

3 indicators and their weight

- Crossing MA – P2=1
- Moving Average – P3=1
- Parabolic SAR – P4=1

At candle x, the values of the sentimentors are:

- Crossing MA: **100**
- Moving Average: **100**
- Parabolic SAR: **50**

This is how the overall sentiment is calculated:
 $(1 \times 100 + 1 \times 100 + 1 \times 50) / (1 + 1 + 1) = 83$.

In this example, each sentimentor has the same weight and takes 33,33% of the overall sentiment.

Example 2

3 indicators and their weight

- Crossing MA – P2=3
- Moving Average – P3=0
- Parabolic SAR – P4=5

At candle x, the values of the sentimentors are:

- Crossing MA: **100**
- Moving Average: **100**
- Parabolic SAR: **50**

This is how the overall sentiment is calculated:
 $(3 \times 100 + 0 \times 100 + 5 \times 50) / (3 + 0 + 5) = 68.75$.

In this example, not all sentiments have the same weight, which is why the overall sentiment is only calculated on the basis of two instead of three indicators. The Moving Average was weighed 0. It therefore only serves as a visual support in the chart.

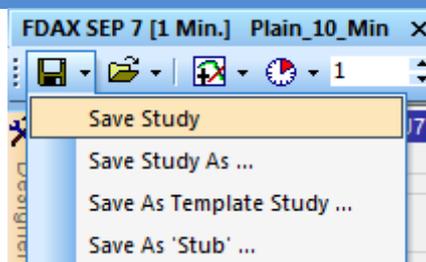
4. Saving the study

After configuring the strategy, it is advisable to permanently save the settings. This can be done in several ways.



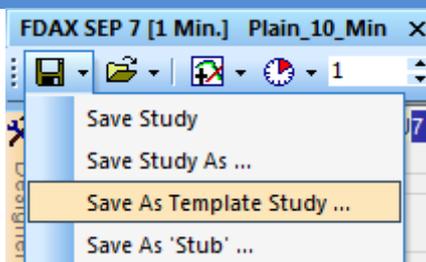
Saving as Study

- A study is only available for the contract for which it was saved.



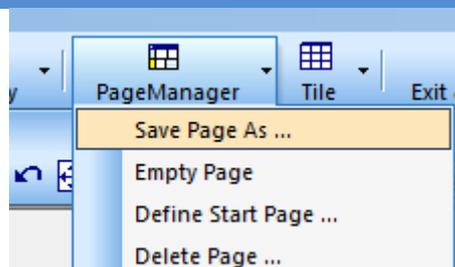
Saving as a Template Study

- A “template study” is available for every contract.



Saving as a Page

- After having given the study a name, it can, together with other studies, be saved as a page and thus be chosen as the “start page”, for example.



5. Analysing tools and Analysis of the Backtest

The strategy is now set up. The possible profits or losses for the loaded period can be shown. Furthermore, the parameters of the strategy can be optimised so as to make it more stable and more profitable.

Evaluation Period

- To be able to perform a backtest, the field “Display backtest controls” should be activated. This will open the window for the evaluation period.

In that window, the evaluation period for which the strategy’s results should be calculated, have to be entered. This can be done by using the following icons:

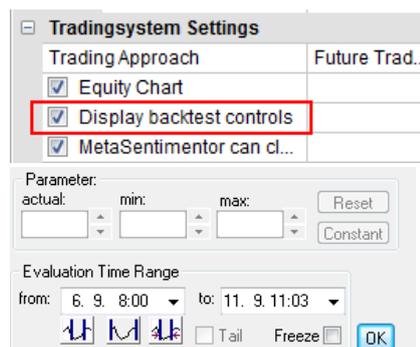
This button defines the actual zoom range as the time range to be evaluated:

After the evaluation period has been defined, the chart can zoom in on that period by means of this icon:

By using this button, the evaluation time range is set to the whole of the loaded data.

- The option “Rest” can be used to analyse the last bit of the current (or defined) period short-term. After the analysis was completed, this tick will automatically disappear.

- If you click on “Freeze”, no new ticks will be added to the analysis. Incoming ticks will then be blocked or buffered.



Note: The fields „Parameter“ are not relevant here. These will be explained in the chapter “Optimisation”.

InfoBar

→ To display the results of the strategy, the InfoBar has to be opened as follows:



The InfoBar will be displayed on the right side of the screen. Three tabs are displayed below:



Data	Sentis	Eval
If the mouse points at a candle, the specific information for that candle is shown.	This window shows the value of each sentiment and its weight in the MetaSentimentor for the candle at which the mouse points.	The result of the strategy with all its statistics is shown here: the number of winning and losing trades and the percentage rate.

Below are the results of the last 100 trading days for the strategy:

InfoBar			
Item	Optimization P...	Control Per.	T
Total net profit:	550.00	0.00	0.
Total # of trades:	138	0	
Winning trades:	74	0	
Losing trades:	64	0	
Percent profitable:	53.62%	n/a	r
Profit factor:	1.06	n/a	r
Avg win/avg loss:	0.92	n/a	r
Avg trade (win & loss):	3.99	n/a	r
Percent in the market:	56.33%	0.00%	0.00
RegCoeff*100/StdDev E...	0.0000	0.0000	0.00
Gross profit:	9110.00	0.00	0.
Gross loss:	8560.00	-0.00	-0.
Largest winning trade:	570.00	n/a	r
Avg winning trade:	123.11	n/a	r
Avg # bars in winners:	53.24	n/a	
Avg # bars in losers:	41.76	n/a	n
Max consecutive winne...	6	0	n
Max consecutive losers:	6	0	n
Std.Dev. all trades:	171.54	0.00	0.
Std.Dev. winning trades:	120.41	0.00	0.
Std.Dev. losing trades:	105.63	0.00	0.
Max # shares/contracts:	1	0	0.
Max drawdown:	2910.00	0.00	0.
Commission paid:	0.00	0.00	0.
Expectancy:	0.0304	n/a	n
Expectancy Score:	0.0004	n/a	n
Happiness Factor:	0.16	n/a	n
Performance/Drawdown...	0.20	0.00	0.
Expectation:	4.13	0.00	0.

The strategy has generated a net profit of 550€. In the defined period, there were 74 winning trades and 64 losing trades, which leads to a profit/loss ratio of 53.62%. The trade with the largest profit generated a 570.00€-profit. The average of all winning trades is 121,60€. The sum of all losses is 8560.00€ and of all profits is 9110.00€, which leads to a profit factor of 1.06 (sum of all profits/sum of all losses).

The other parameters give more detailed information about the strategy's statistical analysis.

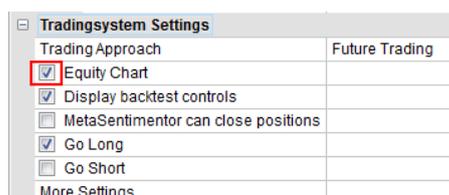
More information, as well as a more detailed explanation of the single items is to be found in the manual [NanoTrader Manual „Trading Systems“](#).

Equity window (Equity Chart)

The equity window (Equity Chart) shows the development of your cash balance, starting from the first signal. The more irregular the curve, the less stable the strategy. At best, the curve climbs constantly and regularly. When the image remains unchanged over a representative number of data, the strategy can be considered as “reliable”.



To open the Equity Chart: open the DesignerBar and tick the option “Equity Chart”.



This is what the equity window of the strategy looks like. It shows the account balance’s evolution if the strategy had run, based upon the cumulated net profit the strategy has generated, as well as the total net profit (which are shown in the upper left-hand corner of the chart).

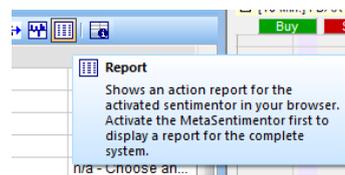


Detailed Report

The NanoTrader makes it possible to draw a detailed report of all signals generated during backtesting.



Open the DesignerBar. In the tool bar, click on the following icon:



The detailed report will be shown in the internet browser. It consists of three parts.

Note: Before clicking on the symbol „Report“, check if the MetaSentimentor is ticked in the DesignerBar. Only then will a report be made on the basis of the complete strategy.

Header *Main part* *Conclusion*

Date and time of the report, name of the study, sentimentor for which the report is shown, trading approach and rating.

All trades with date and time of execution. Furthermore, the reason for closing the position is shown, as well as the corresponding profit and loss. The last column shows the cumulated profit and loss.

All information, which is also included in the platform’s „InfoBar“, is listed here

Date	Action	Size	Quote	Comm.	Trade Profit	Account
10.03.17						0.00
10.03.17 Fri 21:40	Long	1	3417	0.00		
13.03.17 Mon 21:10	close Long (Flat)	1	3423	0.00	60.00	60.00
14.03.17 Tue 14:30	Long	1	3406	0.00		
14.03.17 Tue 21:10	close Long (Flat)	1	3403	0.00	-30.00	30.00
15.03.17 Wed 14:50	Long	1	3409	0.00		
15.03.17 Wed 21:10	close Long (Flat)	1	3423	0.00	140.00	170.00
16.03.17 Thu 17:50	Long	1	3442	0.00		

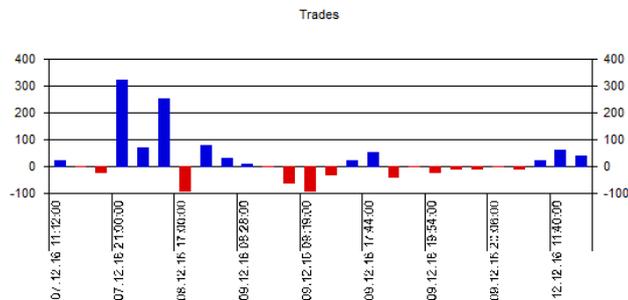
Performance Histogram

The losses and profits of the chosen period can be shown as a histogram. To do so, click on the following symbol in the DesignerBar:



The histogram can also be exported to Excel.

Different units are visible: trade, day, week etc.



Evaluator settings

→ In the DesignerBar under “Trading Approach”, select “Future Trading”.



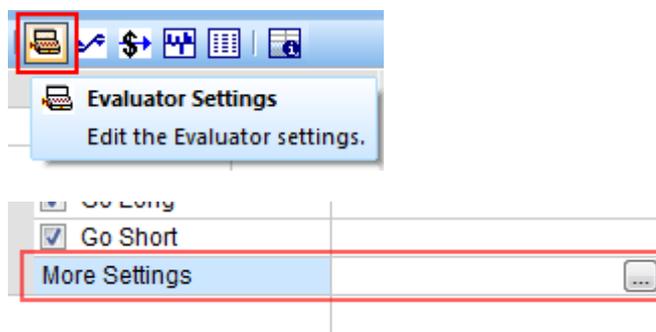
„Future Trading“ = The generated signals form a series of buy /sell transactions. The transaction costs and slippage affect the performance. A trade’s profit is calculated by multiplying the difference between the entry and exit price with the point value of the future. The number of traded contracts is fixed.



NanoTrader Full – Manual Backtesting

Each trading approach is linked to a so-called “Evaluator”. The relevant parameters, e.g. when a signal has to be turned into an order; what slippage the backtest should take into account, etc., can be set in the “Evaluator settings”. In the window “Evaluator settings”, three options are displayed: **Future trading, Trading constraints and Control period.** To adjust the settings, click on this icon in the DesignerBar:

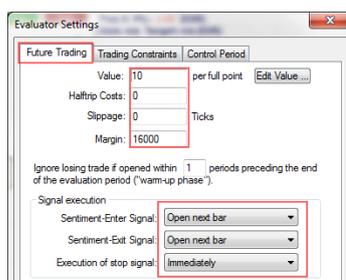
Alternatively, the evaluator settings can be opened by double-clicking on “More Settings” in the DesignerBar.



Tab „Futures Trading“

The parameters in this window refer to the backtests. The following parameters can be set:

- Value per point
- Commission per contract
- Slippage
- Margin

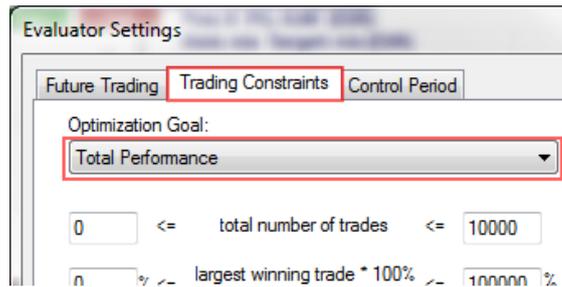


In addition, the trader can determine when the entry, exit and stop signals should be turned into orders. The example on the left shows a few examples.

Note: Since, during backtesting, different scenarios and situations should be taken into account, the NanoTrader platform will always choose the most pessimistic scenario. When, e.g. the historical data indicate that both the limit and the stop loss could have been hit, NanoTrader will always choose the scenario in which the stop loss was reached.

Tab „Trading Constraints“

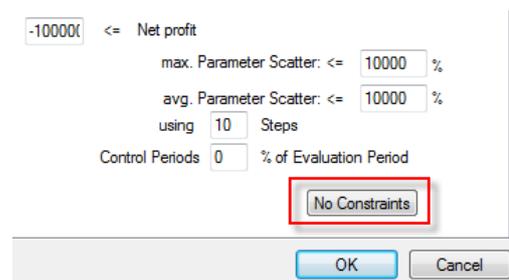
This tab is meant to configure the valuation method of the strategy. Several valuation methods can be chosen, e.g. “total performance” (total profit/total loss), percentage of winning trades, average profit, Fröhlich factor and so on.



When the valuation method is chosen, NanoTrader will automatically select the best parameters. By choosing « Total Performance », e.g. the parameters which positively influence a strategy’s performance are chosen.

It is also possible to set restrictions (“constraints”) to the backtest. The trader can choose not to accept more than x-number of trades in total, or can decide that the consecutive number of losing trades should not be higher than Y.

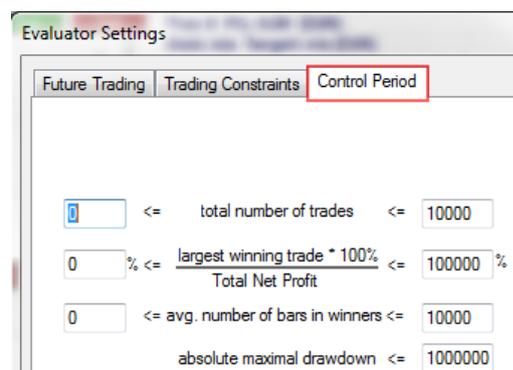
At the same time, the option “no constraints” can also be chosen, simply by clicking on the “no constraints”- button.



Tab „Control Period“

With this tab, the length of the control period can be determined. The value to be chosen is a percentage of the total evaluation period. If, e.g. the evaluation period is 100 days of which 25% was indicated as the control period, two results will be obtained : one for the first 75 days and one for the 25 days of the control period.

Constraints are also possible and correspond largely to the ones underneath Trading constraints



6. Optimising a strategy

When all the building blocks of a strategy have been configured, it could be interesting to check if they can be optimised. Since the number of possible parameter combinations is innumerable, it would be impossible to find the most profitable setting manually.

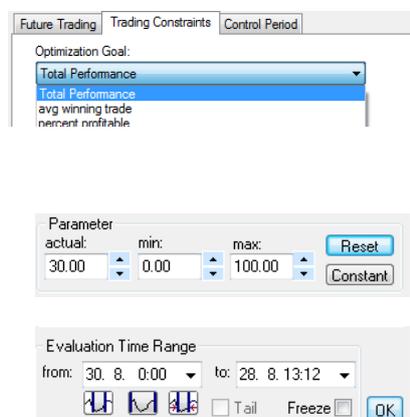


NanoTrader can do this automatically, thanks to its unique optimisation technology. One of its features is the most efficient and flexible in the market: an algorithm called “Tabu Search”, which makes it possible for the trader to adjust and improve the strategy in a simple but highly effective way, even if the optimisation is complex and very detailed. Stability and reliability should always be the trader’s main focus.

Basic Information

Optimising a strategy is done:

- based upon the optimisation goal (e.g. total performance).
- within the bounds of the min.-max. settings of the individual parameters in the DesignerBar (e.g. 0 to 100 for a long stop; ticks for a trailing stop)
- based upon the evaluation time range (e.g. 30.8.-28.8. for 100 loaded historical days).



(Further restrictions and other influences will not be taken into account here.)

The optimisation goal (or “objective function”) that was chosen in the following explanation is “Total performance”. It is also the standard setting in the NanoTrader “evaluator settings”-window.

NanoTrader allows an optimisation on 3 levels:

- Parameter (e.g. stop long within the trailing stops)
- Sentimentor (e.g. trailing stop)
- The trading system as a whole

There are no restrictions on the number of parameters a trading system can include. Due to the large amount of possible combinations on each level, NanoTrader offers different options during the optimisation.

Parameter:

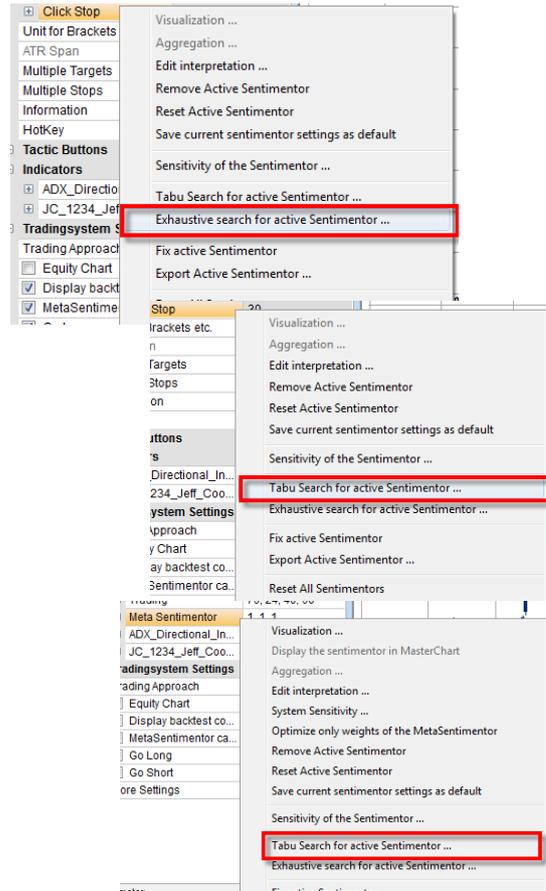
An individual parameter can be optimised by selecting “Exhaustive search for parameter”.

Sentimentor:

The platform can also do an “exhaustive search for a particular sentimentor”. However, the trader can equally choose the so-called Tabu Search: based on a highly performing algorithm, the platform will choose the best settings.

Complete trading system:

The optimisation is done by means of a Tabu Search on the MetaSentimentor. However, this can only be done on parameters that have not been set in the Designer Bar!



Optimising a Parameter

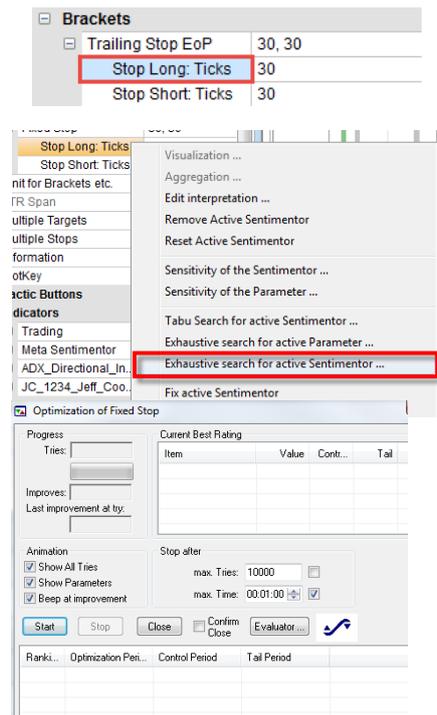
The optimisation of a single parameter will be explained based on the “trailing stop”. The trailing stop includes two parameters, the “long stop” and the “short stop”, which can both be optimised separately.

To optimise the “long stop”, click on the parameter “long stop” in the DesignerBar. The values can then be overwritten or changed by using the arrow keys.

Subsequently, right click on the parameter “long stop” and choose “Exhaustive search for active parameter”.

An optimisation window will open. The header shows for which parameter the optimisation will be performed. It consists of the following essential areas:

- Start/Stop
- Conditions for aborting the optimisation
- Animation
- Progress control
- Optimisation history



Start / Stop:

These buttons are used to start and stop/cancel the optimisation process. The header of the optimisation window shows the starting point while the optimisation is running. When it ends, the running time is shown.

Abortion criteria:

To stop the optimisation, several criteria are possible: stop after a maximum number of attempts; after a specific time, or a combination of both. These criteria can be chosen by ticking the corresponding box. If no boxes were ticked, the process will be stopped as soon as all possible combinations have been tested or after the “stop” button was hit.

Animation:

The animation window offers 3 options, which can be combined:

“Show All Tries” : the curve will constantly be redrawn during optimisation.

“Show Parameters” : all changes to the parameters will be shown in the DesignerBar.

“Beep at improvement” : when this tick box is activated, the NanoTrader platform will make a sound as soon as an improvement was found.

The animation settings can be changed even while the optimisation is running!

However, they use quite some computer capacity. To avoid this, all three check boxes should be unticked.

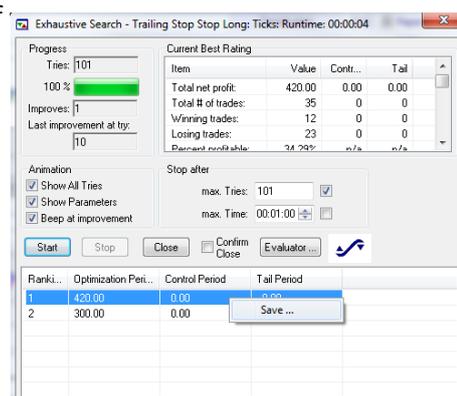
Progress control:

The left side of the window shows the backtesting’s progress. The field “tries” shows the number of attempts that have been made since the start. The bar and percentage display show the time/effort already consumed. The field “Improves” shows the total number of improvements since the initial situation. The “Last improvement at try”-field shows at which attempt the NanoTrader found the latest improvement.

Optimisation history:

The lower part of the optimisation dialog shows a history of all improvements, starting with the best performing one. The illustration on the right shows one improvement on 101 tries, resulting in a net profit of 2620€, as opposed to the initial 2140€.

By clicking on a row, the settings become visible and, consequently, the parameters active. This means that they appear in the DesignerBar and are updated accordingly. Right-clicking on a row opens a menu that allows the trader to save the corresponding settings as a study.



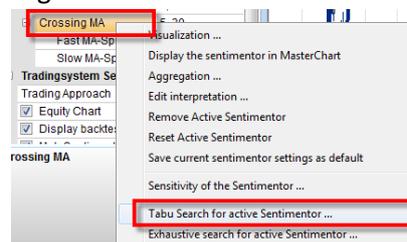
The new, optimised parameter settings for the long stop will be shown in the Designerbar.

Brackets	
Trailing Stop EoP	26, 30
Stop Long: Ticks	26
Stop Short: Ticks	30

Optimising a Sentimentor

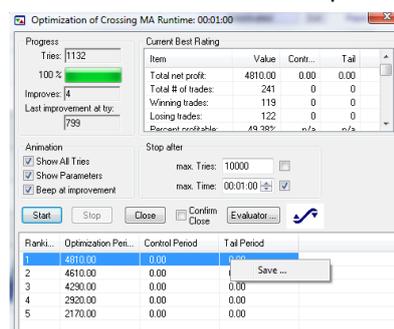
In this example, only one sentimentor will be optimised, the Crossing MA. Other components of the strategy will be configured as explained above.

- Right click on the Crossing MA in the DesignerBar, and click on „Tabu search for active sentimentor...“.



The optimisation window appears. Its structure and functions are the same as the ones to optimise a single parameter (see above).

The picture on the right shows 4 improvements based on the “net profit” of 2170€. The best result (4810 €) was found after 1132 tries (after 60 seconds).



By clicking on a row, the settings become visible and, consequently, the parameters active. This means that they appear in the DesignerBar and are updated accordingly. Right-clicking on a row opens a menu that allows the trader to save the corresponding settings as a study.

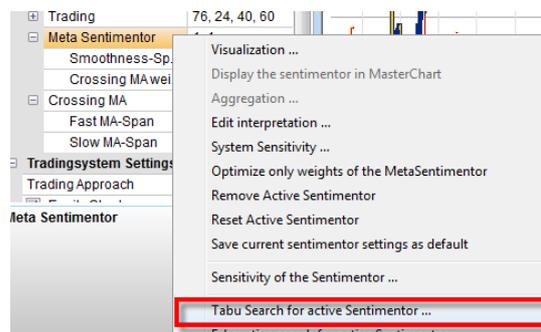
[-] Crossing MA	27, 128
Fast MA-Span	27
Slow MA-Span	128

The new optimised parameter settings for the “Crossing MA” will be shown in the DesignerBar.

Optimising a Trading Strategy

By selecting the MetaSentimentor for optimisation, the whole trading system will be optimised.

- Right click on the MetaSentimentor in the Designerbar and click on „Tabu search for active Sentimentor...“



The Tabu Search finds a better setting in less time than would be possible with a manual search.

By clicking on the Tabo Search-row, the optimisation window opens and all parameters become active. Its structure and functions are the same as the ones to optimise a single parameter (see above). By clicking on a row, the corresponding settings become active and the charts, signals, statistics, and DesignerBar are updated accordingly.

Right-clicking on a row opens a context menu that makes it possible for the trader to save the corresponding setting as a study.

Attention: The optimisation function in NanoTrader is a very valuable help when looking for the ideal parameter settings in a trading strategy.

NanoTrader offers many possibilities, while, at the same time, the trader keeps an overview of all settings and thus manages their own trading system.

Resetting a Parameter, Sentimentor or Trading System

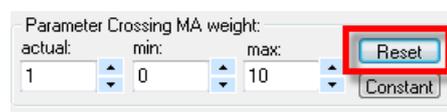
If, for some reason, the optimised settings should not be saved in the trading strategy, all values can be reset.

This can be done on different levels:

- Parameter (e.g. stop long within a trailing stop)
- Sentimentor (e.g. the trailing stop)
- Total trading system

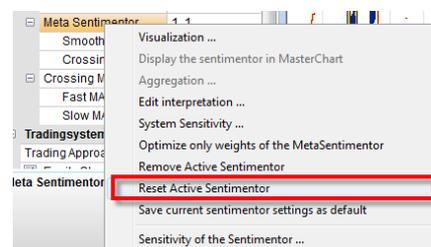
Parameter:

By clicking on the reset-button, all three parameter values are reset to their default values. Mark the parameter in the DesignerBar and then click on „Reset“.



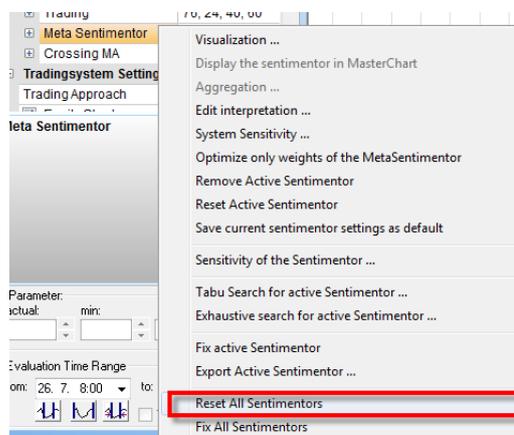
Sentimentor:

To reset all parameters of a sentimentor right-click on it and choose “Reset Active Sentimentor”.



Trading system:

To reset all the parameters of the sentimentors, right-click on any sentimentor and choose “Reset All Sentimentors”.



Attention: The tools introduced herewith are meant to control the results of the optimisation

7. Sensitivity analysis

After the optimisation's objective is decided, e.g. maximising the total profitability, a sensitivity analysis of each parameter is highly advisable.

Such an analysis checks to what extent a change in an individual parameter influences the strategy's total profitability.

The analysis is based upon the idea that the more sensitive a parameter is, the higher the risk of unstable results after the backtesting period.

NanoTrader can measure and visualise this sensitivity.



Basics

The sensitivity analysis, as the name already indicates, is an analysis of a parameter's sensitivity and the stability of the strategy's profitability as a result of this. Based on the outcome of the analysis, the trader can decide whether a particular optimisation should be included in the strategy and which one had better be left out. The more sensitive a parameter is, the less the backtesting results can be projected in the future. Only parameters, sentimentors and trading systems that generate stable results may be suitable for implementation.

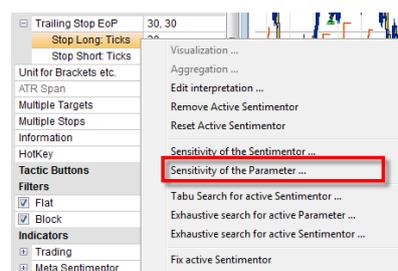
NanoTrader allows a sensitivity analysis on three levels:

- Parameter (e.g. stop long within a trailing stop)
- Sentimentor (e.g. trailing stop)
- Total trading system

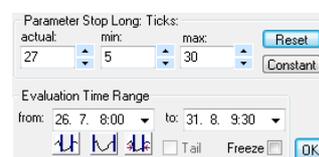
Sensitivity Analysis of a Single Parameter

Only the active parameter with its complete value range is examined.

→ Right-click on the chosen parameter and click on "Sensitivity of the parameter...".



At the bottom of the DesignerBar, the current settings, as well as the minimum and maximum values are shown.

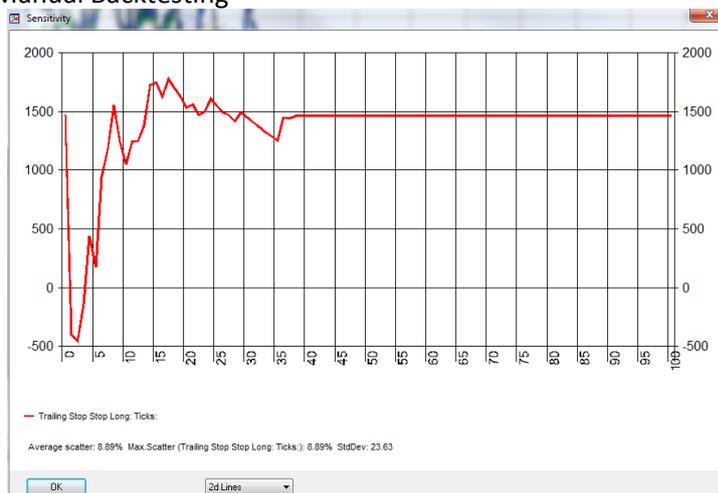


NanoTrader Full – Manual Backtesting

Underneath this display, the sensitivity analysis for this parameter opens.

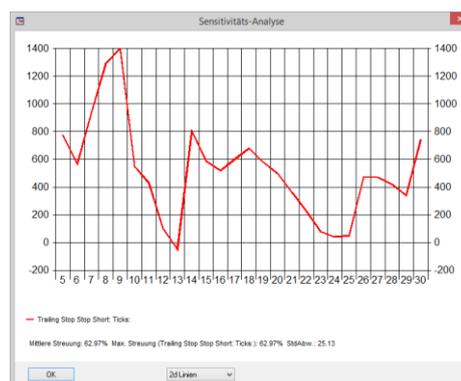
The Y-Axis shows the net profit, which is the result of different parameter settings. (The Y-Axis changes depending on the optimisation goal.)

The X-Axis shows the values the parameter can take. Its values correspond to the ones from the backtesting control in the DesignerBar. They can also be changed in the DesignerBar, which will automatically adjust the sensitivity analysis.



In this screenshot, the highest net profit is reached at 17. When the value of the parameter was low (from 5 till 15), the net profit (i.e. the optimisation goal) showed an irregular pattern with spikes and drops. Between 15 and 40, the pattern becomes more regular, which shows that the parameter has become more stable and therefore more reliable in the strategy.

As a counterexample, this is an illustration of a high-sensitive parameter, no matter at what value. The net profit e.g. increases dramatically between 13 and 14, after which it drops back, after which it climbs again. The smallest modification in value causes serious changes in the net profit. This shows that the parameter is too sensitive for the test to be reliable.

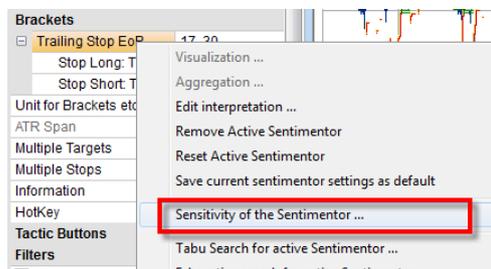


Attention: The sensitivity of a parameter depends on the context, i.e. all the strategy's elements. Modifications of one single parameter will change the results of the sensitivity analysis.

Sensitivity Analysis of a Sentimentor

Apart from the sensitivity of a single parameter, it is also possible to measure the sensitivity of an indicator, stop etc. This means, that you can check to what extent the total result changes when all the sentimentor's parameters are modified.

→ Right-click on the chosen sentimentor and choose "Sensitivity of the sentimentor...".



All the parameters of that sentimentor appear.

The X-Axis shows the values between -10 and 10.

1 stands for the impact on the result, when the parameter's value is increased by 1.

-1 shows the result, when the parameter's value is reduced by 1.

0 shows the current result (i.e. based on the initial settings).

At this place, both parameters are the most equal and show no peaks or drops. This is where the settings are the most stable.



Attention: A sentimentor's sensitivity measures its stability. When a curve peaks at one specific value, this is considered to be an exception and the result should not be taken into account.

If, however, the curve is relatively flat with no peaks or drops, it shows that the sentimentor as a whole generates stable results. As a result of this, the backtest is more reliable and its results more relevant for the future

Sensitivity Analysis of a Complete Trading System

→ Right-click on the MetaSentimentor in the DesignerBar and choose “System sensitivity”.

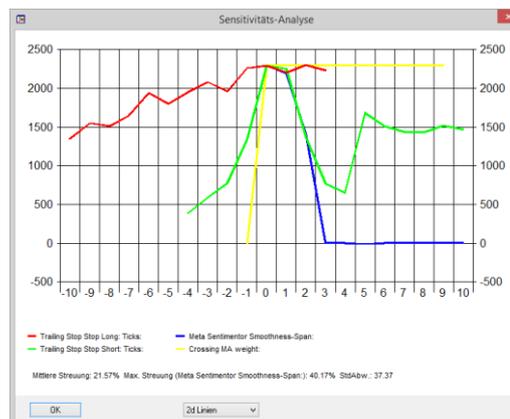
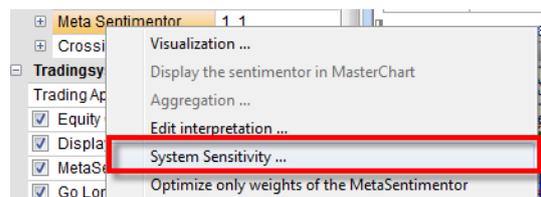
All the curves in this chart correspond to the adjustable parameters from the DesignerBar.

The X-Axis shows values between -10 and 10. 1 stands for the impact on the result, when the parameter’s value is increased by 1.

-1 shows the result, when the parameter’s value is reduced by 1.

0 shows the current result (i.e. based on the initial settings).

The same rule applies here: the flatter the curves and the lower the number of peaks, the more stable the settings.



8. Tips and tricks

The following tips & tricks are based on the most frequently asked questions about backtesting.

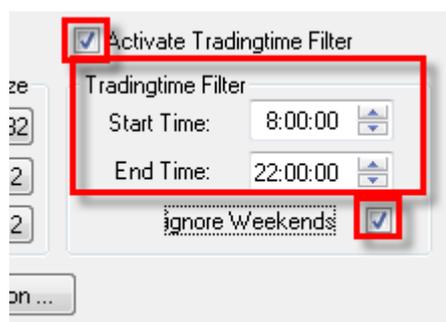
Stops and Targets in the Same Candle...

Whilst loading the historical data for a certain aggregation, the system loads 5 different elements for each interval: open, close, high, low, and volume. When a study contains both a stop and a limit, which happen to occur in the same candle (interval), NanoTrader automatically chooses the losing scenario.

The same rule applies to exit signals.

Defining the Data Filter

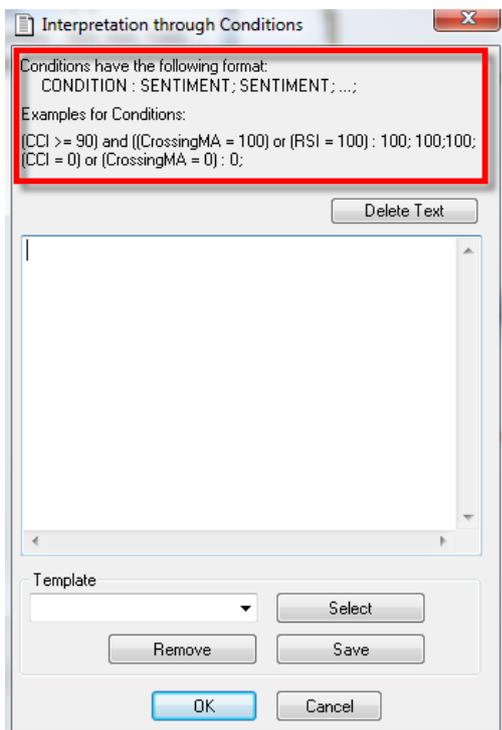
In some cases, when the platform was started before the market opening e.g., the pre-opening quotes are loaded in the chart. These data very often deviate from the ones after market opening. Therefore, it is unadvisable to use them for the strategy. They can be excluded from it by means of the “tradingtime filter” :



Right-click in your account bar on the contract name and choose „Symbol Details...”.

Check the field „Activate Tradingtime Filter“ and define the time frame during which the data should be shown in the chart.

Programming the MetaSentimentor



It is possible to add a personal interpretation to the MetaSentimentor so that specific conditions can be set at certain values.

Example:

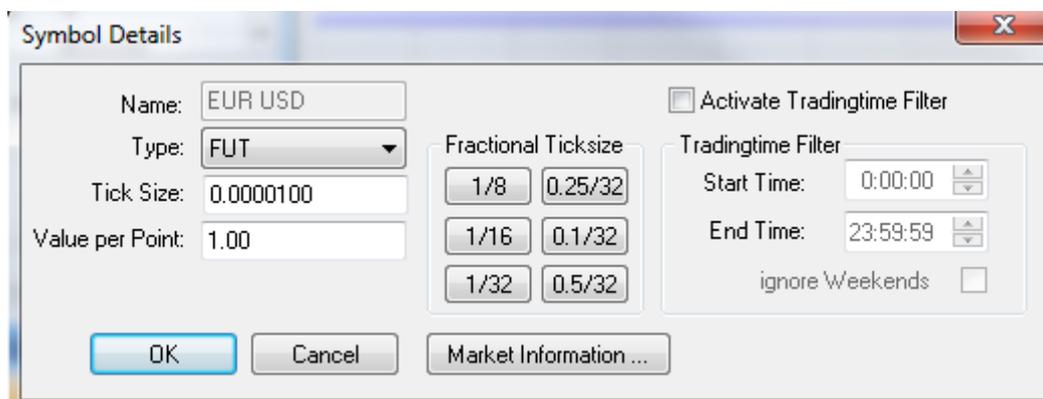
- The trader would like the MetaSentimentor to take the value 100 when the Crossing MA is higher than 90 OR when the Moving Average is higher or equals 75.
- The trader would like the MetaSentimentor to take the value 0 when the Crossing MA is lower than 30 AND when the Moving Average is lower or equals 0.

By a double click on the MetaSentimentor in the DesignerBar, the window to the left of this page opens. In this window, the trader can programme his own conditions. The example shows the syntax for that.

Peculiarities when Backtesting Forex

Backtesting only allows a tick value of 1. Even if the order volume was changed somewhere else, this setting will be maintained.

To obtain realistic results from the backtesting, the value per point should be changed to 1000 for a micro-lot; 10 000 for a mini lot or 100 000 for a standard lot in the "Symbol Details" (which you can access by right-clicking on the Forex contract in the account bar).



Attention: The change of the interpretation is an **expert function**. Remember to switch the value per point back to 1 before trading in live modus. The P/L of a position is calculated based on this setting!

For example, if a position generates a 10€-profit, but the point value is still set on 1000, the platform will show a 10 000 €-profit.

Peculiarities Span/Renko and Heikin Ashi

In these charts, the candles are not built according to a specific time aggregation, but based on certain (time-independent) conditions (see more in our manual “Charting & Trading”). In backtesting, however, specific date and time information is relevant. Span/renko charts are therefore unsuitable for backtesting.

The Heikin Ashi chart and the indicators are calculated with the real Open, High, Close, Low of the unsmoothed candle.

Stops which can be used for Backtesting

Many stops are meant to be used in real-time because they are calculated on the basis of incoming ticks (Tick-by-Tick-Implementation). Backtesting, however, is done on the basis of candles that consist of 4 values (Open, High, Low, Close), so that a Tick-by-Tick-Fill is impossible. The following stops can be used in backtesting, because they are calculated on the period close:

- BreakEven Stop EoP
- Fixed Stop
- KaseDev Stop
- Linear Stop
- Parabolic Stop
- PeriodsHighLow Stop
- Time Stop
- Profit Target
- Trailing Stop EoP

Specific Information on Spreads and Fills in Backtesting

It is impossible to consider the spread in backtesting. This is because the only available information is the bid price. Also long positions will be closed at the bid price, instead of the ask price.

The screenshot shows the 'Trading Constraints' tab in the NanoTrader interface. It contains three input fields: 'Value' with a value of 1 and the unit 'per full point', 'Halftrip Costs' with a value of 0, and 'Slippage' with a value of 2 and the unit 'Ticks'. There is also an 'Edit Value ...' button next to the 'Value' field.

It is however possible to simulate the current spread and to take it into account during backtesting. To do this, add a slippage in the Evaluator Settings that more or less corresponds to the current spread the spread.

Historical Data vs. Live Data

Incoming real-time data have the time stamp of the trader's PC. Historical data, however, have the time stamp of the exchange servers. When the PC deviates from the correct time, ticks may be loaded in the wrong candles. This can result in different signals in live modus compared to the ones in backtest. To avoid this, the PC clock should be synchronised with the atomic clock.

Evaluator Settings: Open next Bar vs. Close Same Bar

When, in the evaluator settings, "Open next bar" is chosen in the "Sentiment-Enter Signal"-field, the signal will be filled at the next bar in backtest.

The screenshot shows the 'Signal execution' settings in the NanoTrader interface. It contains three dropdown menus: 'Sentiment-Enter Signal' set to 'Open next bar', 'Sentiment-Exit Signal' set to 'Close same bar', and 'Execution of stop signal' set to 'Immediately'.

This option will lead to more realistic backtest results. The reason is, that in live trading, it takes several milliseconds before the signal reaches the order server to fill the order. "Open next bar" is therefore more realistic than the option "Close same bar", which would cause the signal to fill the order immediately.