Short Description

The Eurex OptionMaster allows you to calculate

- theoretical option prices;
- option indicators such as delta and gamma (often referred to as the "Greeks"); and
- implied volatilities of options.

It also allows you to simulate the impact of various price and volatility scenarios on the calculated prices. The results of this simulation will be illustrated in the *Price/Vola Matrix*, which displays a variety of potential price developments at a glance. The enhanced transparency will give you a better idea as to how option prices change.

The Option Pricing Model

The Eurex OptionMaster uses the Black-Scholes option pricing model to calculate option prices. You can use this model to calculate theoretical prices of European-style stock options, or equity index options such as the Option on the DAX®, Deutsche Börse's benchmark index for German stocks. Although the Black-Scholes model was designed to calculate options without dividend payments on the underlying instrument during the option's lifetime, the Eurex OptionMaster allows you to approximate the impact of dividend payments.

Using the Black-Scholes model, the theoretical value of deep-in-the-money European-style put options is indicated below their intrinsic value. However, for American-style options (such as Eurex stock options) the minimum value is defined by their intrinsic value, calculated as exercise price less stock price (assuming no dividends are distributed on the underlying instrument).

The Black-Scholes model is widely used. There are, of course, alternative pricing models which may take different input factors into account – but none of the models can guarantee that the results are 100 percent accurate. Therefore, although we consider the Eurex OptionMaster to be an excellent tool, it is not intended to provide conclusive investment verdicts.

Enter Calculation Data

Once you have entered the parameters for your calculation into the entry fields in the upper part of the Eurex OptionMaster, click on the "Start Calculation" button. The calculation results (option price and implied volatility) for calls and puts will be displayed in the center part of the window, alongside the 'Greeks' – delta, gamma, rho, theta and vega. The Price/Vola Matrix in the lower part will illustrate the price data computed by the Eurex OptionMaster in a graphical display, again separately for calls and puts.

Purchase Date

Please enter the purchase date of the option into this field. The current date is set as default: to change it, just click into the date line and enter a new date, or click on the calendar icon and select the required date in the pop-up calendar.

Last Trading Day / Remaining Lifetime

In this field, you can enter the last trading day of the option, via a calendar provided. Alternatively, you can enter the option's remaining lifetime (in days – including the purchase date). In either case, the OptionMaster will display the last trading day, as a date.

For example: on April 16, you enter a remaining lifetime of 30 days. The OptionMaster will display the last trading day as May 15 (April 16 being the first day and May 15 the last day of the option's remaining lifetime). If you enter a remaining lifetime of one day, purchase date and last trading day will be identical.

Underlying Instrument Price

Enter the current price of the underlying instrument (stock, futures contract or other underlying) here – for example, a stock price of EUR 100.50.

Exercise Price

Enter the exercise price of the option into this field.

For example, enter "EUR 100" as the exercise price of a stock option. (Note that no decimal places are required for full euro amounts.)

Interest Rate

Enter the short-term domestic refinancing rate that is relevant for the option's lifetime. The interest rate most commonly used in practice is the so-called repo rate.

For example, when calculating an option with a remaining lifetime of one month, enter the short-term interest rate for one month, for instance, a "2" for a rate of 2 percent. In the same way, for an option with a remaining lifetime of one year, enter the one-year interest rate: for a rate of 2.5 percent, enter "2.5".

Volatility

Volatility is one of the most important factors in the calculation of option prices. A differentiation is made between the volatility observed in the past (historical volatility), and the future volatility implied by traded prices (implied volatility):

Historical volatility (quoted as an annualized percentage) indicates the extent and intensity of price fluctuations in the underlying instrument during a specific period of time in the past (for example, 250 days). The mathematical concept used is the standard deviation.

The suitability of historical volatility for the purpose of calculating option prices is limited, however. This is because the key factor when pricing options is the future volatility of the underlying. This, of course, can only be estimated, on the basis of historical volatility data.

The greater the estimated volatility, the higher the option price. Each traded option price, as well as bid or ask quotations, can be used to analyze – by way of iteration – the volatility which is implied by this price. Hence, the volatility corresponding to a traded option price is referred to as implied volatility.

You can use the Eurex OptionMaster to calculate implied volatility, by entering the current option price into the “Call (for implied vola)” or “Put (for implied vola)” fields.

Note: When entering expected annualized volatility rates (implied volatility) in order to calculate theoretical option prices, please enter them as a percentage – for example, enter ”25” for a volatility of 25 percent.

Start Calculation

The data entered so far is sufficient to calculate call and put prices, and option indicators. To create the Price/Vola Matrix, however, you will also need to complete the “Volatility Interval” and “Price Interval” fields.

The following sections contain details on how to complete these fields, and also to outline how dividend payments are taken into account.

Dividend

When carrying out a calculation for stock options in which dividends are distributed on the underlying during the option’s lifetime, you can enter the estimated dividend (cash dividend). For example, if you estimate a dividend distribution of EUR 2.00 enter “2” into the “Dividend” field. Further details on dividends are provided under the heading “Option Pricing Model”.

Dividend Date

You can enter the date of a possible dividend payment using a calendar, as described with the procedure for the entry of the purchase date and the last trading day. Alternatively, you can click into the date line, to enter the dividend payment date, or the number of days until that date.

Call (for implied vola)

If you want to calculate the implied volatility of a call option traded in the market, in addition to its theoretical price (given identical specifications), enter the current call price into the “Call (for implied vola)” field.

Example:

Purchase Date	16.09.2004
Last Trading Day	17.12.2004

Underlying Instrument Price	EUR 100.50
Exercise Price	EUR 100
Interest Rate	3%
Volatility	25%

Call price	EUR 5.6805

If an option price of EUR 7 is entered under “Call (for implied vola)”, the OptionMaster will automatically calculate the associated volatility, and will display it under “Implied Volatility”, alongside the call results: 31.60%.

Put (for implied vola)

If you want to calculate the implied volatility of a put option traded in the market, in addition to its theoretical price (given identical specifications), enter the current put price into the “Put (for implied vola)” field.

Volatility Interval

The “Volatility Interval” field is used to define how the Eurex OptionMaster will generate the Price/Vola Matrix for calls and puts. Let us assume that you entered a 30 percent volatility for the calculation of theoretical options prices. If you enter a “Volatility Interval” of “2” (for 2 percent), the Eurex OptionMaster will generate a Price/Vola Matrix with option prices based on different volatilities with a 2-percent interval: starting from 22 percent up to a level of 38 percent.

Price Interval

The “Price Interval” field is used to define the price gradations for the underlying prices used by Eurex OptionMaster to generate the Price/Vola Matrix. Again, let us assume that you entered a share price of EUR 100 for the calculation of theoretical options prices. If you enter a “Price Interval” of “5” (for EUR 5), the Eurex OptionMaster will generate a Price/Vola Matrix with option prices using underlying prices with a 5-euro interval: starting from EUR 80 up to EUR 120.

Call Results/Put Results

After clicking on the “Start Calculation” button, option prices for calls and puts will be displayed in the upper fields “Call Price” and “Put Price”. If you have also entered a traded call and/or put price on the right-hand side, the implied volatility of these options will also be displayed.

Call Price

This refers to the theoretical call option price, calculated using the Black-Scholes option pricing model and the calculation parameters you specified.

Put Price

This refers to the theoretical put option price, calculated using the Black-Scholes option pricing model and the calculation parameters you specified.

Implied Volatility

If an option price is entered under “Call (for implied vola)” or “Put (for implied vola)”, implied volatility will be displayed here.

Call and Put Option Indicators

Delta

The delta factor expresses the expected absolute change in the theoretical option price, given a one-unit change in the underlying instrument price. From a mathematical perspective, the delta factor is the first derivative of the option price by the price of the underlying instrument.

A call delta of 0.53 indicates that the call price will rise by 0.53 units if the price of the underlying instrument increases by one unit. In this event, however, the put price will fall (the delta factor of put options is negative – for example, -0.45). The delta factor is not constant: for a call, it ranges between zero and +1, while a put delta is between -1 and zero. Change in the delta is measured by the gamma factor, which is also calculated by the Eurex OptionMaster.

Gamma

The gamma factor expresses the expected change in the delta factor, given a one-unit change in the underlying instrument price.

For example, the price of an underlying share rises from EUR 100 to EUR 101. At the initial underlying share price of EUR 100, the call has a delta of 0.50, which changes to 0.55 due to the rise in the share price to EUR 101 – the gamma factor is therefore 0.05. In other words, any subsequent changes in the price of the underlying in the same direction will have a stronger impact on the option price (in absolute terms). Gamma is positive for both calls and puts. This is because the call delta moves from zero to +1, while the put delta also increases, from -1 to zero (assuming a constant increase in the underlying price in both cases).

Rho

Rho measures the expected change in the option price, given a one percent change in the interest rate. The impact of rho is generally lower for options with a shorter

remaining lifetime, compared to options with a longer remaining lifetime. The rule of thumb is that the longer the remaining lifetime of an option, the greater the impact of a change on interest rates.

Theta

The theta factor expresses the expected absolute change in the theoretical option price, given a one-day reduction in the option's remaining lifetime. Since option prices tend to fall with a shorter remaining lifetime, theta is usually negative – in contrast to delta or vega, which may be positive).

Vega

The vega factor expresses the expected absolute change in the theoretical option price, given a one percentage point change in volatility (Vega is also frequently referred to as *kappa*). Calls and puts both become more expensive with rising volatility – vega is thus positive. After delta and gamma, this is the most important option indicator.

Price/Vola Matrix for Call and Put Prices

The Price/Vola Matrix allows the calculation of a large number of options prices in a single process. In this way, you will obtain an overview of different price/volatility scenarios in a single display.

You can customize the intervals for which the Eurex OptionMaster should calculate individual option prices. The matrices will be calculated automatically if values have been entered under "Volatility Interval" and "Price Interval", in addition to the other details required for the calculation of option prices.

Clicking on one of the prices in the matrix will automatically center the matrix around that price – displaying new prices for more comparisons.