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Delta-Neutral Trading at Eurex

With Release 6.0, the Eurex trading system was expanded by adding a new functionality, which supports the trading of delta-neutral positions using Delta-Neutral Trading Products (DNTP). These products are a special combination where the futures leg is matched simultaneously, and automatically, creating a delta-neutral position for a traded option position. For a DNTP trade, either both the option and futures leg have the same underlying (e.g. options and futures on the DAX), or the futures product is the underlying of the option (e.g. options on the Euro Bobl Future).

The purpose of this publication is to outline the basic concepts of DNTP and mechanics of delta-neutral trading at Eurex.

Basic Concepts of Delta-Neutral Trading

What is the Delta?

The delta of an option is the rate of change in the option's price (premium) relative to a one unit change in the price of the underlying instrument. So, for example, if a call option on the Euro Bobl Future has a delta of 0.35 and the futures' price increases from 109.00 to 109.20, the option's price should increase by 0.07 (35 percent of the move in the underlying).

From a mathematical perspective, the delta factor is derived from the option pricing formula. With calls, the delta lies between zero and one. It lies between minus one and zero with puts. Applying a common simplification of the concepts involved, the delta can be interpreted as the probability of the option being in-the-money at expiration. It is worth noting that delta itself changes with price fluctuations of the underlying instrument – the impact of this so-called "gamma effect" is illustrated below.

What Does "Delta Neutral" Mean?

The term "delta-neutral" refers to any strategy where the sum of your deltas is equal to zero. In practice, managing the delta close to zero is usually accepted as delta neutral, since fractional contracts cannot be traded on an exchange. So, for instance, if you buy 10 call option contracts with a delta of 0.60 and simultaneously buy 20 put options with a delta of -0.30 you have the following:

$$(10 \times 0.60) + (20 \times -0.30) = 6.00 + -6.00 = 0$$

Your position delta (total delta) is zero, which means you are delta neutral.

Being delta neutral means your portfolio consists of positions with offsetting positive and negative deltas that balance out, bringing the net change of the position to zero or neutral. In other words, you neutralize the portfolio's response to market movements for a narrow price range.

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In practice, using the corresponding futures contract often creates delta-neutrality. A long futures position has a delta of one, whereas a short futures position has a delta of minus one. Looking at the call option referred to above (delta 0.60), a delta-neutral position can be created by selling six futures contracts:

(10 x 0.60) + (6 x -1.00) = 0

The total delta for a portfolio of related option and futures positions (for instance, a portfolio containing Euro Bobl Futures, and options on Euro Bobl Futures) is determined in the same way, by adding up the deltas of individual positions.

Motivation for Managing a Delta-Neutral Position

The primary motivation for using delta-neutral positions is to create exposure to option-specific risks without mixing it with directional risk. In other words, while the purchase of a call option will make a profit if implied volatilities rise significantly, this effect may be neutralized (or even exceeded) by the loss in time value that may be caused by a simultaneous fall in the price of the underlying instrument. In addition to using volatility itself as a traded instrument, volatility traders also attempt to exploit the impact of changes in the position delta upon market fluctuations, as illustrated by the following example.

Scenario:

May 6, 2003

Euro Bobl Future June 2003	109.95
Call Euro Bobl Future June 110.00	0.32 (delta 0.47)
Put Euro Bobl Future June 109.50	0.21 (delta -0.35)

A trader enters into these option positions:

Contract	Position
Euro Bobl Future June 2003	Long 1 contract
Call on Euro Bobl Future June 110.00	Long 20 contracts
Put on Euro Bobl Future June 109.50	Long 30 contracts

On May 7, the Euro Bobl Future rises to 110.35. The trader adjusts his position at the following conditions:

Contract	
Euro Bobl Future June 2003	110.35
Call on Euro Bobl Future June 110.00	0.53 (delta 0.58)
Put on Euro Bobl Future June 109.50	0.10 (delta -0.18)

On May 8, the Euro Bobl Future rises to 110.85. The trader closes the position at these prices:

Contract	Closing prices on May 8, 2003
Euro Bobl Future June 2003	110.85
Call on Euro Bobl Future June 110.00	0.82
Put on Euro Bobl Future June 109.50	0.04

Contract Price	Delta	Position	Futures-equivalent Position
May 6			
Call June 110.00 0.32	0.47	+ 20	+ 9.4
Put June 109.50 0.21	-0.35	+ 30	- 10.5
Net delta-weighted position			- 1.1
Number of futures contracts to be bought (+) or sold (-) 109.95			+ 1.0

Contract Price	Delta	Position	Futures-equivalent Position
May 7			
Call June 110.00 0.53	0.58	+ 20	+ 11.6
Put June 109.50 0.10	-0.18	+ 30	- 5.4
Euro Bobl Future June 110.35	1.00	+ 1	+ 1.0
Net delta-weighted position			+ 7.2
Number of futures contracts to be bought (+) or sold (-) 110.35			- 7.0

May 8 closeout: Total profit/loss on the aggregate position:

Contract Trade date Opening price	Closeout price	Position	Profit/Loss (Ticks) Profit/Loss (EUR)
May 8			
Call June 110.00 May 6, 2003 0.32	0.82	+ 20	+ 1,000 + 10,000
Put June 109.50 May 6, 2003 0.21	0.04	+ 30	- 510 - 5,100
Euro Bobl Future June 2003 May 6, 2003 109.95	110.85	+1	+ 90 + 900
Euro Bobl Future June 2003 May 7, 2003 110.35	110.85	-7	- 350 - 3,500
Total profit (Ticks)			**+ 230**
Total profit (EUR)			**+ 2,300**

As demonstrated in the example, the change in delta could be exploited to generate a profit – this is characteristic for delta-neutral positions based on long option positions, whereas market fluctuation is negative for a delta-neutral portfolio based on short option exposure. Option pricing models attempt to quantify this impact using a set of assumptions. In theory, the options premium received by the seller should equalize the losses sustained by hedging operations throughout the position's lifetime.

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Mechanics of Delta-Neutral Trading at Eurex

How Does Delta-Neutral Trading Work at Eurex?

DNTP at Eurex are set up as independent products without relation to the order books of their component futures and option legs. The matching of DNTP orders works the same way as for 'ordinary' option orders. DNTPs are defined as standardized option products. Therefore, a DNTP has the same series as its related option product – in other words, a DNTP contract is equivalent to the corresponding option series, with the difference that the delta hedge is automatically attached. Generally, the DNTP futures leg is always the front month contract, i.e. the contract with the shortest time to maturity. Several business days before its last trading day, the future used in the DNTP is switched automatically to the next maturity by the Eurex system. The execution of a DNTP order results in two different trades in the component legs. These trades form part of the overall position in the respective leg, and can be closed out by another DNTP or by trades in the component legs.

With the delta being positive for call options and negative for put options, there are four different delta-neutral trading schemes, depending on the original DNTP order:

Original DNTP order	Resulting options position	Resulting futures position
Buy call	long call	short future
Sell call	short call	long future
Buy put	long put	long future
Sell put	short put	short future

For DNTP orders or quotes, the associated option series has to be selected. A price, as well as the requested amount of option contracts must be entered – very much the same as for a straight options trade. The futures leg of the DNTP trade is then determined accordingly by the Eurex system. The price of the futures leg is fixed by the Eurex system for a certain period of time and cannot be influenced by the trader. It is therefore called the "Futures Fixed Price". On the basis of the Futures Fixed Price and the option order limit/execution price, the system calculates the option delta using the 'Black-76' option pricing model. The option's delta is then used to calculate the "Futures Size". This is the quantity of futures contracts required for a delta-neutral position. The option's delta and Futures Size are shown separately for every market price and every price in the order book on the "Market Overview" and "Contract Overview" windows, respectively. For market orders this information is calculated after the order has been matched, since the execution price is required for the calculation.

The Futures Fixed Price depends either on the current market price of the futures leg itself, or on the price of the underlying product. It is always fixed at a valid exercise price of the related option. If the market price of the futures leg moves out of a predefined price range, the Futures Fixed Price is recalculated. This process is indicated to traders by a product state change of the DNTP and causes the deletion of all existing orders and quotes for the DNTP.

DNTP may only be traded in integer multiples of a predefined round lot size. All other order quantities are rejected by the Eurex system with an error message. The Futures Size is calculated for the minimum round lot size and then rounded to the nearest integer. The Futures Size displayed by the system is that for the overall option quantity available in the order book at a given price. (For instance, a calculated Futures Size of 33.434 for 100 options is rounded to 33. If 1,000 options are traded, then the Futures Size is 330 and not 334.) If the calculated Futures Size is zero (for out-of-the-

money options) or the Futures Size exceeds the limit of 9,999, the order is rejected by the system with an error message.

What Order Types are Possible in Eurex DNTP?

Orders and quotes for DNTP can only be entered when the product and its component legs are in continuous trading during the trading period. The window is disabled during pre-trading, pre-opening and post-trading phases. DNTP orders are only valid for the current trading day. Combination orders and combination quotes are not supported for DNTP. Market orders are supported, as are the restrictions IOC (Immediate-or-Cancel) and FOK (Fill-or-Kill). Stop orders are not possible.

Market Making in DNTP

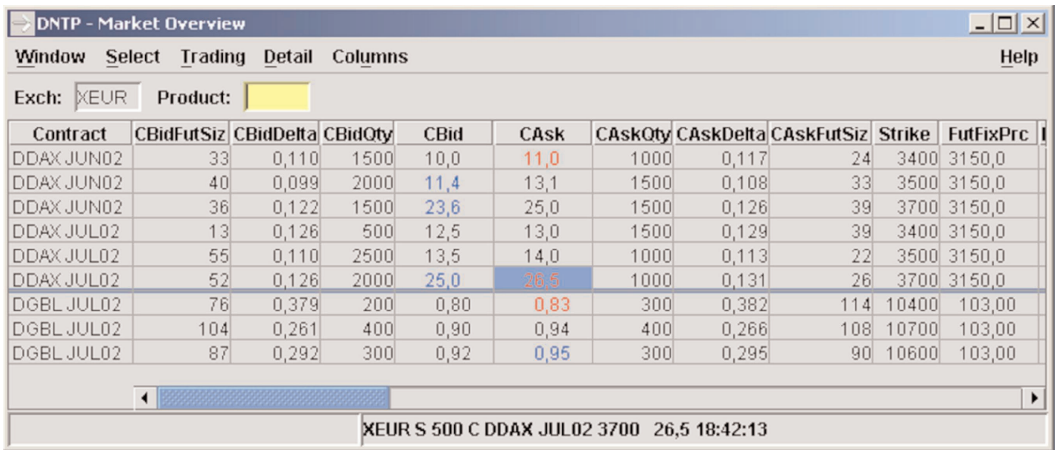
Just like regular option contracts, DNTPs are supported by Market Makers. Prospective Market Makers in DNTPs need to have a Market Maker license for the relevant option product.
Any participant may enter quote requests for options or DNTPs. However, quote requests are not allowed to be made by Market Makers in their licensed products.

Which Eurex @X-ceed Windows are Used for DNTP Trading?

The windows used for DNTP trading are the same as for straight option trades. Some additional columns have been added to these windows to reflect information specific to DNTP. The following description assumes that readers are familiar with the Eurex @X-ceed front end application.
The product code for DNTP is identical to the corresponding option, except for the first letter that is a "D".

Market Overview / Contract Overview

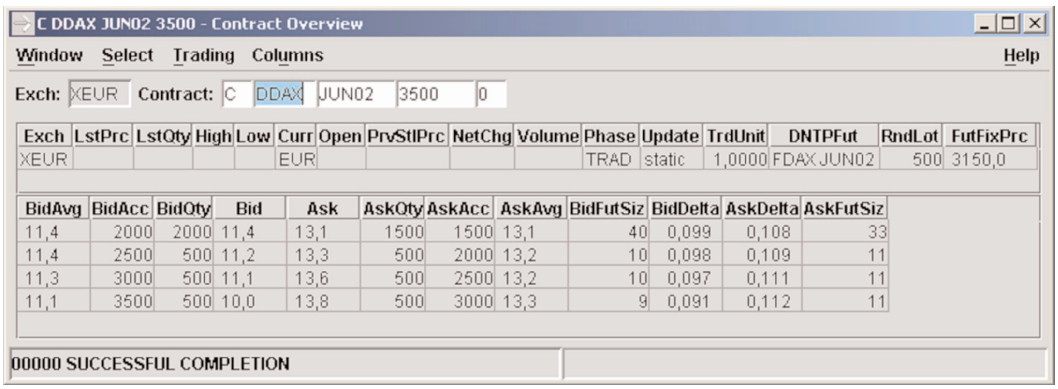
The "DNTPFut" column displays the futures leg for DNTP contracts and the "FutFixPrc" column the respective Futures Fixed Price. Additionally, the option's delta and the corresponding Futures Size for the best bid, best ask and the last executions are displayed for these contracts.



Note that the "Contract Overview" window is used to display the details of DNTP contracts, not the "Combination Overview" window. For DNTP, the "Market Overview" additionally provides the option's delta and corresponding Futures Size for each limit price.

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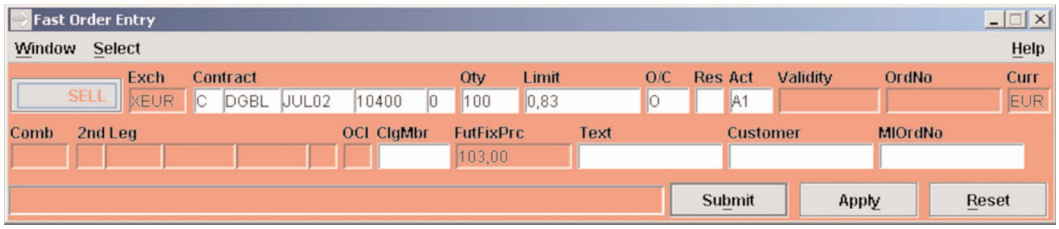


Fast Order Entry/Order Entry Window

Just like for straight option orders, the mandatory order attributes for DNTP are call/put, underlying instrument or product, exercise price, expiration month and year.

The "Comb" field is not used for the entry of DNTP orders as from a technical point of view these are set up as seperate non-combination products.

The "FutFixPrc" field is only enabled when a DNTP order is selected, and specifies the fixed price for the futures leg. The Futures Fixed Price is a mandatory order attribute for DNTP orders. This field is pre-filled if the order entry window has been activated by clicking on a price cell in an overview window, otherwise it has to be filled manually.

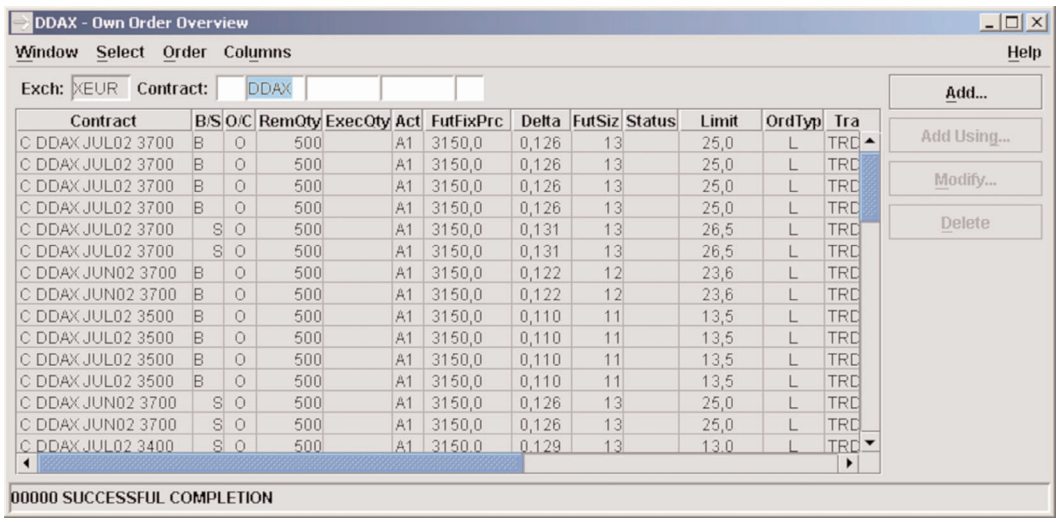


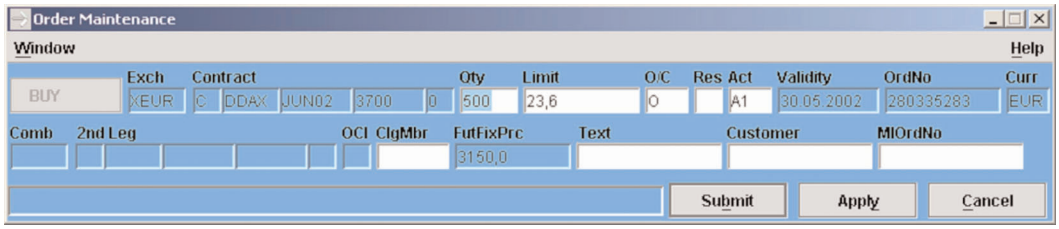
Rapid Order Entry

The "Rapid Order Entry" window does not support DNTP.

Own Order Overview/Order Maintenance

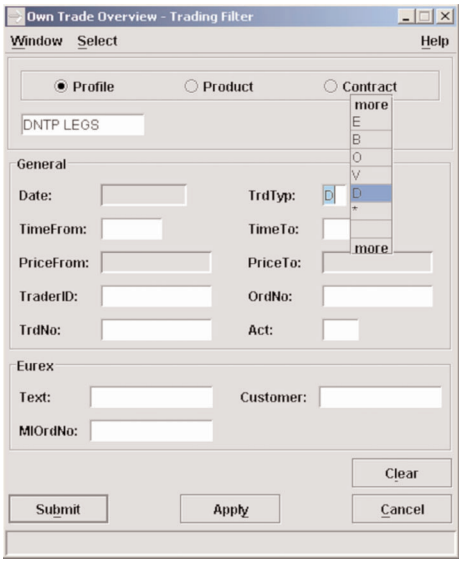
Modifying or deleting unexecuted DNTP orders works the same way as for option orders.





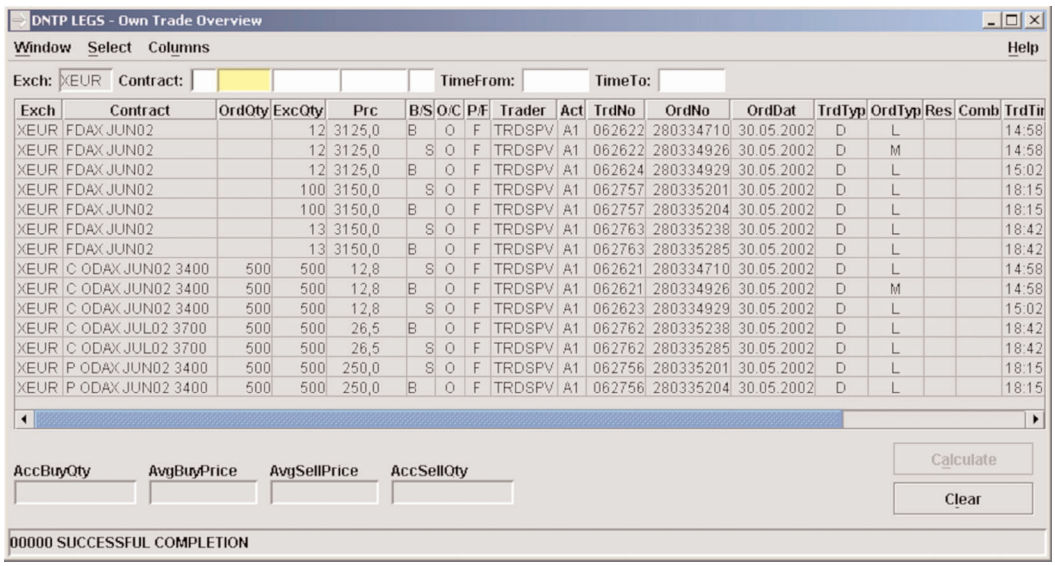
Trading Filter

When called from the "Own Trade Overview" or "Online Time and Sales Sheet" windows, the "TrdTyp" field allows filtering for specific trade types. With a blank "TrdTyp" field, only exchange trades (excluding DNTP) are displayed. Trade type "D" specifies DNTP.



Own Trade Overview/Trade Ticker Log

DNTP trades are displayed as two separate trades with different trade number but the same order number. Note that the execution of a DNTP order results in two trade confirmations in the "Own Trade Overview" window: one for the option leg and one for the futures leg (assuming that the filter settings have been defined to include both). The execution confirmation for the DNTP is not displayed here, but in the "Trade Ticker Log" window and the right-hand message box in "Overview" windows.



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In contrast to the "Own Trade Overview" window, the "Trade Ticker Log" shows a single execution confirmation for each execution of a DNTP order.

Contract Statistics Overview

The volume of DNTP trades is shown in the "IPS" (Inter-Product Spreads) column.

How are DNTP Positions Margined?

The straightforward answer is not at all. As soon as a DNTP trade takes place, the DNTP execution is separated into (for example) an option on the Euro Bund Future (OGBL) trade and an Euro Bund Future (FGBL) trade. Margin offset arrangements for these positions are, of course, already in place with the Eurex Risk Based Margining. No further offset or special arrangement is therefore necessary.

"Audio Configuration" Window and DNTP

The "Audio Configuration" window allows the user to configure audio files to be played when certain supported events occur. The WAV audio file format is supported.
This is particularly important for DNTP users, since this will allow them to set alerts for product state changes (remember that changes in the Futures Fixed Price result in the deletion of all orders and quote in the DNTP concerned).

Additional background information on trading options and futures at Eurex is available in the Eurex strategy brochure Fixed Income Products and the Quick Reference Guide Trading. Both publications can be downloaded from the Eurex website **www.eurexchange.com**.

For more information on DNTP at Eurex, please contact Michael Durica, T +49 (0)69-21 01-59 23, e-mail: Michael.Durica@eurexchange.com.

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