LCH.CLEARNET

Margining Overview for London Stock Exchange Derivatives Market Indices

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Document History

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16 Oct 2009	0.1	Que Anh Trinh	First draft
05 Jan 2010	0.1	Que Anh Trinh	Updated with comments from David Randall
05 March 2010	0.2	Natalie Michalakis	Updated parameter file and SPAN print-screens on examples
01 May 2011	1.0	Dhanesh Patel	Updated with name change from EDX London to Turquoise Derivatives.
Mar 2012	1.1	Jenny Hodges	Updates and amendments
Oct 2013	1.2	Louise Searle	Updated with name change from Turquoise Derivatives to London Stock Exchange Derivatives Market.

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

Contents

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

1.Introduction

London Stock Exchange Derivatives Market Global Holdings Limited (London Stock Exchange Derivatives Market) offers members the opportunity to trade a wide range of derivatives products available on underlying from Russian and Nordic markets.

London Stock Exchange Derivatives Market Indices contracts are one set of products traded on the London Stock Exchange Derivatives Market exchange, and as such, are cleared by LCH.Clearnet Limited (LCH.C). In order to protect itself against the risks assumed as a central counterparty, LCH.C establishes margin requirements for each contract.

One of the main components in calculating the level of initial margin required by LCH.C is PC London SPAN. SPAN looks at a member's portfolio and takes into account any inter-month, inter-commodity or strategy spreads held by the member.

This document will use several examples to explain how LCH.C margins on London Stock Exchange Derivatives Market Indices products.
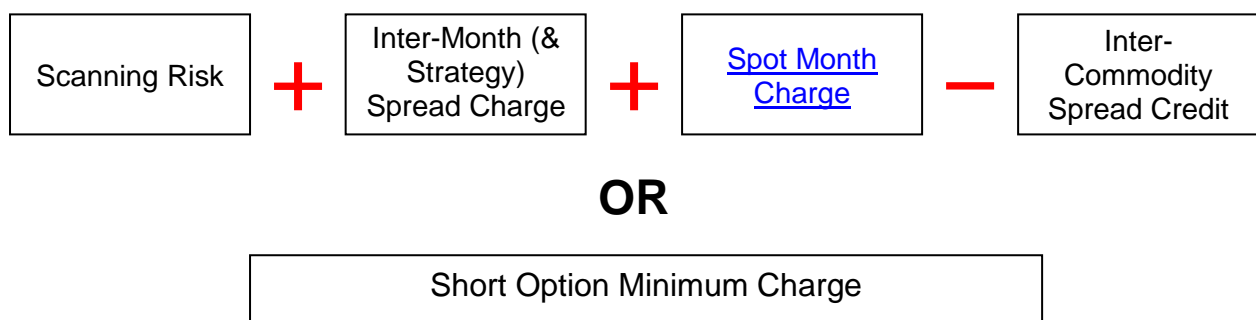
Margining

As central counterparty to its members' trades, LCH.C is at risk from the default of a member. To limit and cover such potential loss in the event of a default, LCH.C collects margin on all open positions and recalculates members' margin liabilities on a daily basis. There are two major types, **Initial Margin** (IM) is the deposit required on all net positions and is returned by LCH.Clearnet to members when positions are closed, **Variation Margin** (VM) is members' profits or losses that are calculated daily from the market-to-market close value of their open position.

PC London SPAN

PC London SPAN is a portfolio based margining system that incorporates both futures and options, and calculates the net initial margin requirement. There are three major inputs to the London SPAN margin calculation - Positions, Prices and Parameters (determined by LCH.Clearnet and reviewed on a continual basis). A change to any one of these will result in a change to the margin requirement.

Initial Margin Calculation

London SPAN uses the following calculation to work out the initial margin requirements, it is the maximum of:

Scanning Risk	**+**	Inter-Month (& Strategy) Spread Charge	**+**	Spot Month Charge	**−**	Inter-Commodity Spread Credit

OR

Short Option Minimum Charge

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

This can be seen on the following SPAN screen:
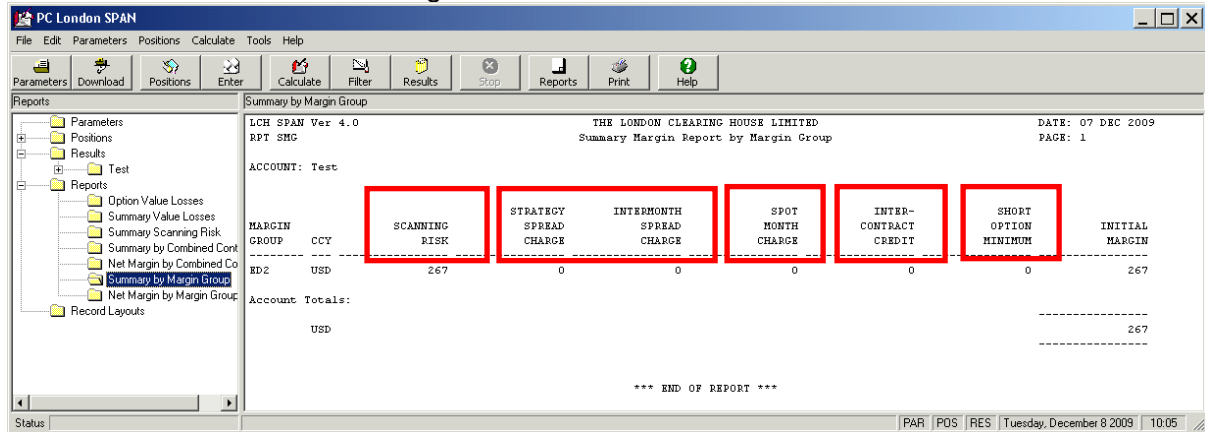
This document will provide more detail about the various sections of the initial margin calculation, with examples to help explain how SPAN evaluates portfolios to establish the required margin amount.

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

2. Margin for London Stock Exchange Derivatives Market Indices

SPAN margining methodology for London Stock Exchange Derivatives Market Indices mainly consists of three components:

- Scanning risk, which is the initial margin required for individual position (per lot) calculated based upon the scanning range parameter set for each index.

- Inter-month Spread charge, which is the additional margin applied to a portfolio with long and short positions in the same contract but different expiries.

The following section will explain how these three components are calculated by London SPAN.

2.1. Scanning Risk

SPAN divides contracts into groups of futures and options relating to a single underlying asset (e.g. OMXS30 index futures and options). At the first stage of calculation, PC London SPAN simulates how the value of a 'Portfolio' would react to the changing market conditions defined in the initial margin parameters. This is done by adopting a series of market scenarios and evaluating the portfolio under these conditions.
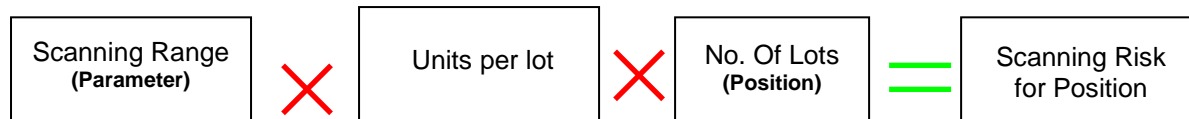
By valuing each net position (future or option) with the appropriate array (sixteen scenarios consisting of implied volatilities increasing or decreasing by 2.5% (i.e. 10% shift of 25% implied volatility will give an up and down volatility of 27.5% and 22.5%) and futures prices increasing or decreasing by proportions of the futures scanning range) and then combining the arrays, PC London SPAN determines which is the worst loss scenario for the portfolio. This is referred to as the scanning risk.

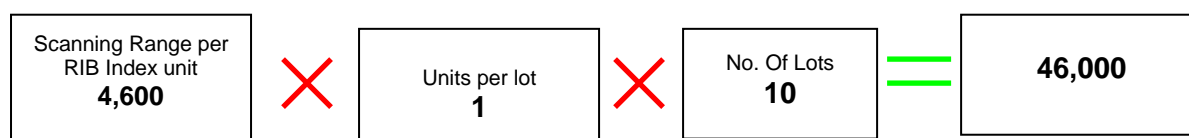**Example 1: Scanning Risk of Simple Futures Position**

For this example 10 Long FTSE Russia IOB Index (RIB) positions will be used. The following parameters for this position need to be entered into SPAN.

Note: *Lot size for London Stock Exchange Derivatives Market Indices in USD is 1 unit.*

Calculating the initial margin for a single futures position is relatively straightforward, the Scanning Risk (set by LCH.C) is multiplied by the number of lots:

Scanning Range **(Parameter)**	✕	Units per lot	✕	No. Of Lots **(Position)**	═	Scanning Risk for Position

So:

Scanning Range per RIB Index unit **4,600**	✕	Units per lot **1**	✕	No. Of Lots **10**	═	**46,000**

These figures can be found on the *Summary Value Losses* report (below), where the scanning risk for the position (46,000) is the worst possible scenario from the risk array. This means that in the worst possible scenario, this is the furthest the contract price is expected to move under normal market conditions.

As this example uses only one simple future position, the initial margin required is the scanning risk for the position, in this case 46,000.

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

```
PC London SPAN                                                                                    _ □ ×
File  Edit  Parameters  Positions  Calculate  Tools  Help
 📁        🔧        🔍       📝       📝       📑       📄       ⊗        📄       🖨       ❓
Parameters Download  Positions  Enter   Calculate  Filter  Results   Stop     Reports   Print    Help
Reports                          Summary Value Losses
  ├─ 📁 Parameters              LCH SPAN Ver 4.0                  THE LONDON CLEARING HOUSE LIMITED          DATE: 24 FEB 2012
  ├─ 📁 Positions               RPT SVL                           Summary Value Losses Report                PAGE: 1
  ├─ 📁 Results
  │   └─ 📁 Example             ACCOUNT: Example
  ├─ 📁 Reports
  │   ├─ 📁 Summary Value Losses   MARGIN GROUP:      EDX PRODUCTS ("ED2")
  │   ├─ 📁 Summary by Margin Group  COMBINED CONTRACT: RIB  MARGIN CURRENCY: USD   FTSE Russia IOB Inde
  │   └─ 📁 Net Margin by Margin Group
  └─ 📁 Record Layouts          CONTRACT: RIK  CONTRACT CURRENCY: USD        SCANNING RANGE: 4600 / LOT

                                           G       NET                 F-3/3    F-2/3    F-1/3    F+0      F+1/3    F+2/3    F+3/3
                              EXPIRY DATE  T       POS       DELTA  F-EXTREME VOL UP/DN VOL UP/DN VOL UP/DN VOL UP/DN VOL UP/DN VOL UP/DN VOL UP/DN F+EXTREME
                              -----------  -   --------- --------- --------- -------- -------- -------- -------- -------- -------- -------- ---------

                              16 MAR 2012  F      10      10.0000   32200    46000    30665    15335      0     -15335   -30665   -46000   -32200
                                                                            46000    30665    15335      0     -15335   -30665   -46000

                              Totals for RIK
                                                         --------- --------- -------- -------- -------- -------- -------- -------- -------- ---------
                                                         10.0000   32200    46000    30665    15335      0     -15335   -30665   -46000   -32200
                                                                            46000    30665    15335      0     -15335   -30665   -46000
                                                         --------- --------- -------- -------- -------- -------- -------- -------- -------- ---------


                                                         *** END OF REPORT ***

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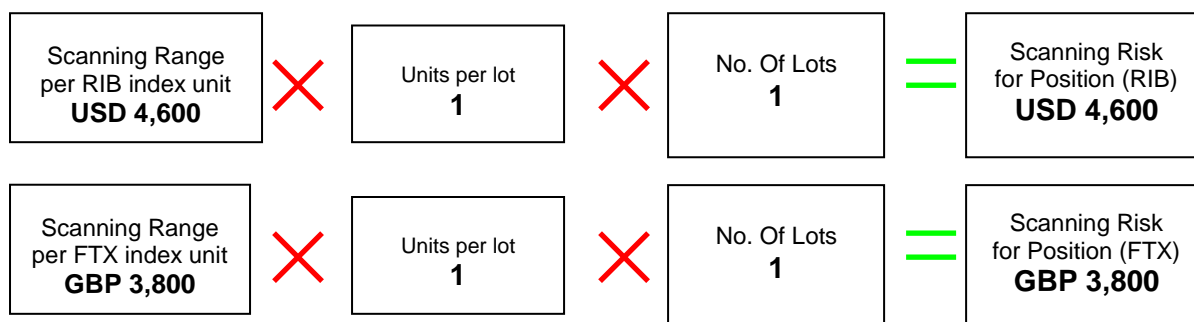
Example 2: Scanning Risk of Multiple Futures Positions in Different Currencies

In this example two positions in different currencies are now held, 1 long FTSE Russia IOB Index (RIB) positions traded in USD and 1 long FTSE 100 Index (FTX) Futures traded in GBP.

However, as the contracts trade in different currencies, SPAN is unable to produce the scanning risk for the entire portfolio, instead two figures are produced, the scanning risk for contracts traded in USD, and the scanning risk for the contracts traded in EUR. The user should convert one of the figures into the other currency to produce the total initial margin requirement.

The calculations for this example are as follows:

Scanning Range per RIB index unit **USD 4,600**	✕	Units per lot **1**	✕	No. Of Lots **1**	═	Scanning Risk for Position (RIB) **USD 4,600**
Scanning Range per FTX index unit **GBP 3,800**	✕	Units per lot **1**	✕	No. Of Lots **1**	═	Scanning Risk for Position (FTX) **GBP 3,800**

These resultant figures can be seen on the *Summary by Value Losses* SPAN report, and the initial margin requirements in their specific currencies, can be found on the *Summary by Margin Group report,* both below.

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

PC London SPAN

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Positions

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```
LCH SPAN Ver 4.0                    THE LONDON CLEARING HOUSE LIMITED              DATE: 24 FEB 2012
RPT SVL                                Summary Value Losses Report                 PAGE: 1

ACCOUNT: Example

MARGIN GROUP:      EDX PRODUCTS  ("ED2")
COMBINED CONTRACT: FTX    MARGIN CURRENCY: GBP    FTSE100 Index

CONTRACT: FTF    CONTRACT CURRENCY: GBP        SCANNING RANGE: 3800 / LOT    FTSE100 Ind Stnd Fut

              G       NET                        F-3/3     F-2/3     F-1/3    F+0    F+1/3    F+2/3    F+3/3
EXPIRY DATE   T       POS      DELTA F-EXTREME  VOL UP/DN VOL UP/DN VOL UP/DN VOL UP/DN VOL UP/DN VOL UP/DN VOL UP/DN F+EXTREME
-----------  ---   --------- --------- --------- --------- --------- --------- --------- --------- --------- --------- ---------
   MAR 2012  F        1        1.0000      2660     3800     2533     1267       0    -1267    -2533    -3800    -2660
                                                    3800     2533     1267       0    -1267    -2533    -3800

Totals for FTF
                                                 --------- --------- --------- --------- --------- --------- --------- ---------
                              1.0000      2660     3800     2533     1267       0    -1267    -2533    -3800    -2660
                                                    3800     2533     1267       0    -1267    -2533    -3800
                                                 --------- --------- --------- --------- --------- --------- --------- ---------

MARGIN GROUP:      EDX PRODUCTS  ("ED2")
COMBINED CONTRACT: RIB   MARGIN CURRENCY: USD    FTSE Russia IOB Inde

CONTRACT: RIK    CONTRACT CURRENCY: USD        SCANNING RANGE: 4600 / LOT

16 MAR 2012   F        1        1.0000      3220     4600     3067     1534       0    -1534    -3067    -4600    -3220
                                                    4600     3067     1534       0    -1534    -3067    -4600

Totals for RIK
                                                 --------- --------- --------- --------- --------- --------- --------- ---------
                              1.0000      3220     4600     3067     1534       0    -1534    -3067    -4600    -3220
                                                    4600     3067     1534       0    -1534    -3067    -4600
                                                 --------- --------- --------- --------- --------- --------- --------- ---------

                                *** END OF REPORT ***
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PC London SPAN

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Reports / Summary by Margin Group

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- Record Layouts

```
LCH SPAN Ver 4.0                    THE LONDON CLEARING HOUSE LIMITED              DATE: 24 FEB 2012
RPT SMG                            Summary Margin Report by Margin Group           PAGE: 1

ACCOUNT: Example

                              STRATEGY    INTERMONTH      SPOT      INTER-       SHORT
MARGIN          SCANNING       SPREAD       SPREAD       MONTH     CONTRACT     OPTION      INITIAL
GROUP    CCY      RISK         CHARGE       CHARGE       CHARGE     CREDIT      MINIMUM      MARGIN
------   ---  ----------   ------------   -----------  ---------  ----------  ----------  -----------
ED2      GBP     3800           0            0            0           0           0          3800
ED2      USD     4600           0            0            0           0           0          4600

Account Totals:

         GBP                                                                               3800
         USD                                                                               4600

                                *** END OF REPORT ***
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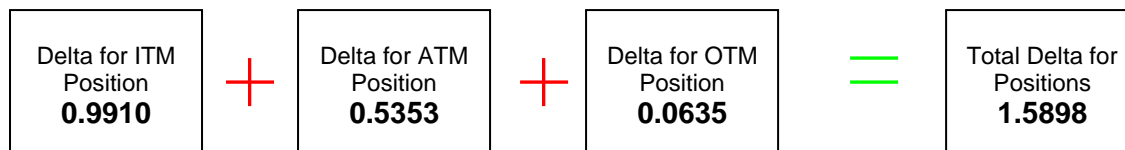
NB: If the positions are traded in the same currency, the initial margin will be the total initial margin required for the portfolio in that currency.
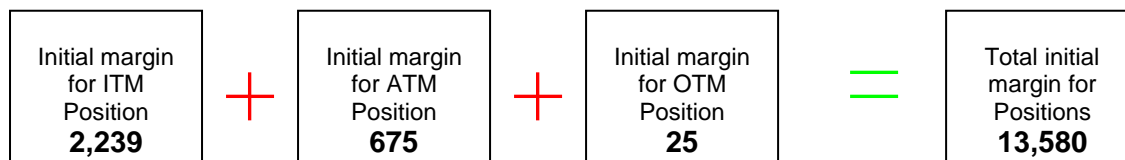
Example 3: Scanning Risk of Options Positions

Options margining involves more calculations. In this example we will hold three long OBX STOCK INDEX options (OBX) positions:

- One in-the-money (ITM) call
- One at-the-money (ATM) call
- One out-of-the-money (OTM) call

The total delta for these option positions is seen in the calculation below:

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

Delta for ITM Position **0.9910**	**+**	Delta for ATM Position **0.5353**	**+**	Delta for OTM Position **0.0635**	**=**	Total Delta for Positions **1.5898**

The initial margin for each position will then vary depending on how 'in' or 'out' of the money it is.

Initial margin for ITM Position **2,239**	**+**	Initial margin for ATM Position **675**	**+**	Initial margin for OTM Position **25**	**=**	Total initial margin for Positions **13,580**

In this example, the more the option is in the money, the more the position will behave as a future and this is reflected in the delta being close to 1, with the initial margin requirement being the same as that for a future position, 2239. The 'out of the money' position has a delta of 0.0635, and a very small initial margin requirement of 25. The 'at the money' position has a delta close to 0.5, indicating it will move by 0.5p for every 1p move of the underlying asset and as such, attracts a margin requirement of approximately half the scanning risk.

NB: The Delta is drawn from the theoretical options pricing model and it shows the rate of change in an option premium, with respect to a change in the underlying asset or security.

The initial margin requirement then is the sum of initial margins for each position. This can be seen on the *Option Value Losses* report, where the initial margin for each position is the worst-case scenario indicated, and the sum of these is the total initial margin.

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

Example 4: Scanning Risk of Offsetting Options Positions

When two offsetting options are held, SPAN calculates the overall delta and the total initial margin requirement. If 10 OBX Stock Index long Calls and 5 OBX stock Index long Puts are held, the delta is 2.624: 5.520 for the call, and – 2.896 for the put (which can be seen in the green box on the diagram below)

Delta for ATM Call		Delta for ATM Put			Total Delta Positions		Initial margin for Total Position
5.3530	—	**-2.9075**	=		**2.4455**		**2,755**

The initial margin required for holding the two positions is the worst-case loss when the two risk arrays are combined, which in this case is 360. This can be seen below on the O*ption Value Losses* report.

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

2.2. Intermonth Spread Charge

When calculating the scanning risk, PC London SPAN assumes that the futures prices move by exactly the same amount across all contracts months. Therefore, a long position in one month exactly offsets a short position in another month.

Since futures prices do not correlate exactly across contract months, long and short positions in the same contract with different expiries cannot completely offset each other. LCH.C requires additional margin, called inter-month spread charge, to cover this differential in prices.

Example of Inter-month Spread Charge calculation

In this example two positions are now held, 10 Long FTSE 100 Index Futures (FTX) positions expiring on March 2012, and 15 Short FTSE 100 Index Futures (FTX) positions expiring June 2012.

SPAN will consider 10 long positions offsetting 10 shorts positions and the inter-month spread charge will be calculated as below:

Inter-Month charge FTX index **GBP 35**	✕	Units per lot **1**	✕	No. Of Lots **10**	=	Inter-Month charge FTX index **GBP 350**
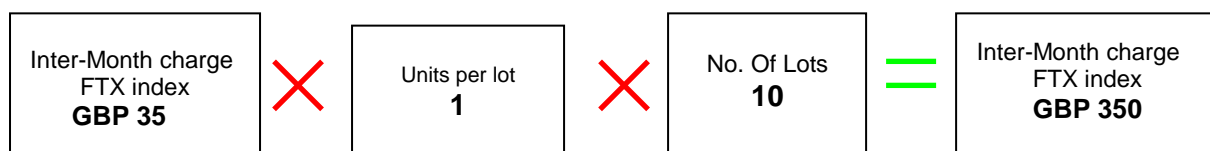
There will be no inter-month charge for the remaining 5 short positions FTX expiring June 2012and they will be charged at full scanning risk.

Example of SPAN Inter-month spread Charge Calculation

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)
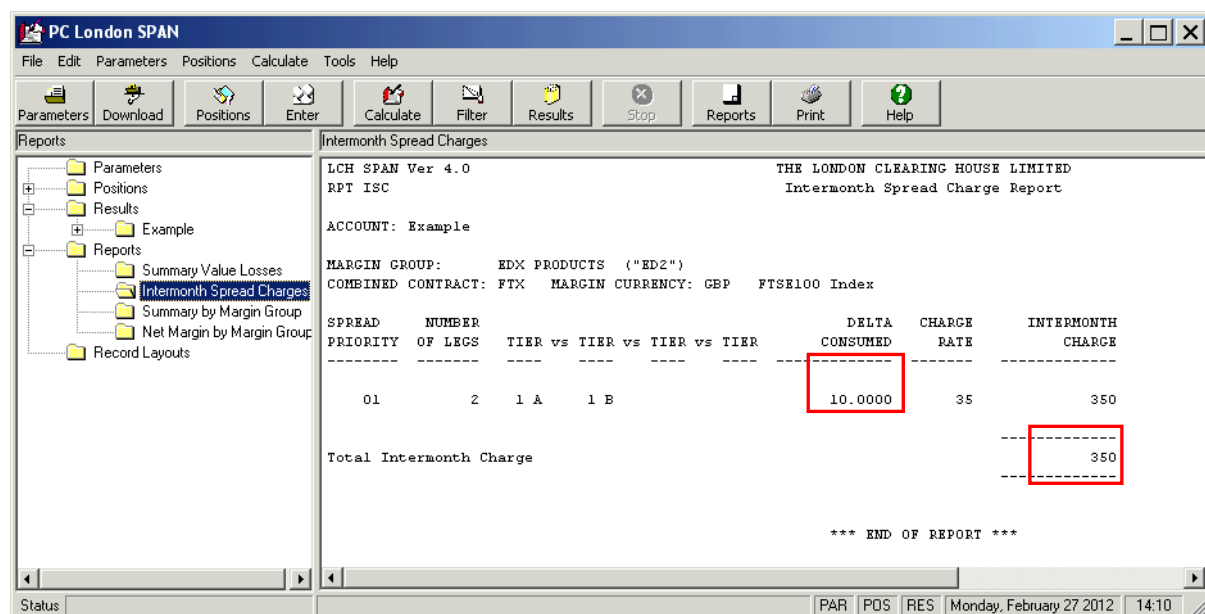
3. Short Option Minimum Charge

Certain option 'portfolios' may show zero or minimal risk when assessed using SPAN. In these cases, SPAN requires a minimum charge for each net short option. The charge sets an absolute minimum margin for the portfolio. If the short option minimum charge is lower than the total initial margin calculated, it is ignored.

Short option minimum charge = | Net short position | ✕ | Short option minimum charge |

Short Option Minimum Charge Example

In this example 20 deep out of the money Short puts are held. The delta value for the position is 0.00:

When looking at the *Summary Value losses* report, the total delta is 0.0, with the worst-case loss being 0. So, Initial Margin of 0 required on this position, as there appears to be very little risk. However, SPAN levies the short option minimum charge of 10 for each option held (10 X 20 short options held = Scanning risk 200) to cover any potential losses. This can be seen below in the *Summary by Margin Group* report.

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

As can be seen, the Scanning Risk is less than the Short Option Minimum charge, so, SPAN charges 200 for the 20 short options held.

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

4. PC London SPAN Parameter File

Accessing the Parameter File

This file contains all the prices for Futures and Strike for Options needed to enter positions in PC London SPAN. It is available on the (LCH.C) website at http://www.lchclearnet.com/data_downloads/ltd/span.asp

Then select London Stock Exchange Derivatives Market, change the date to the previous working day, change the drop down from compressed to standard and click next. The following screen should appear.
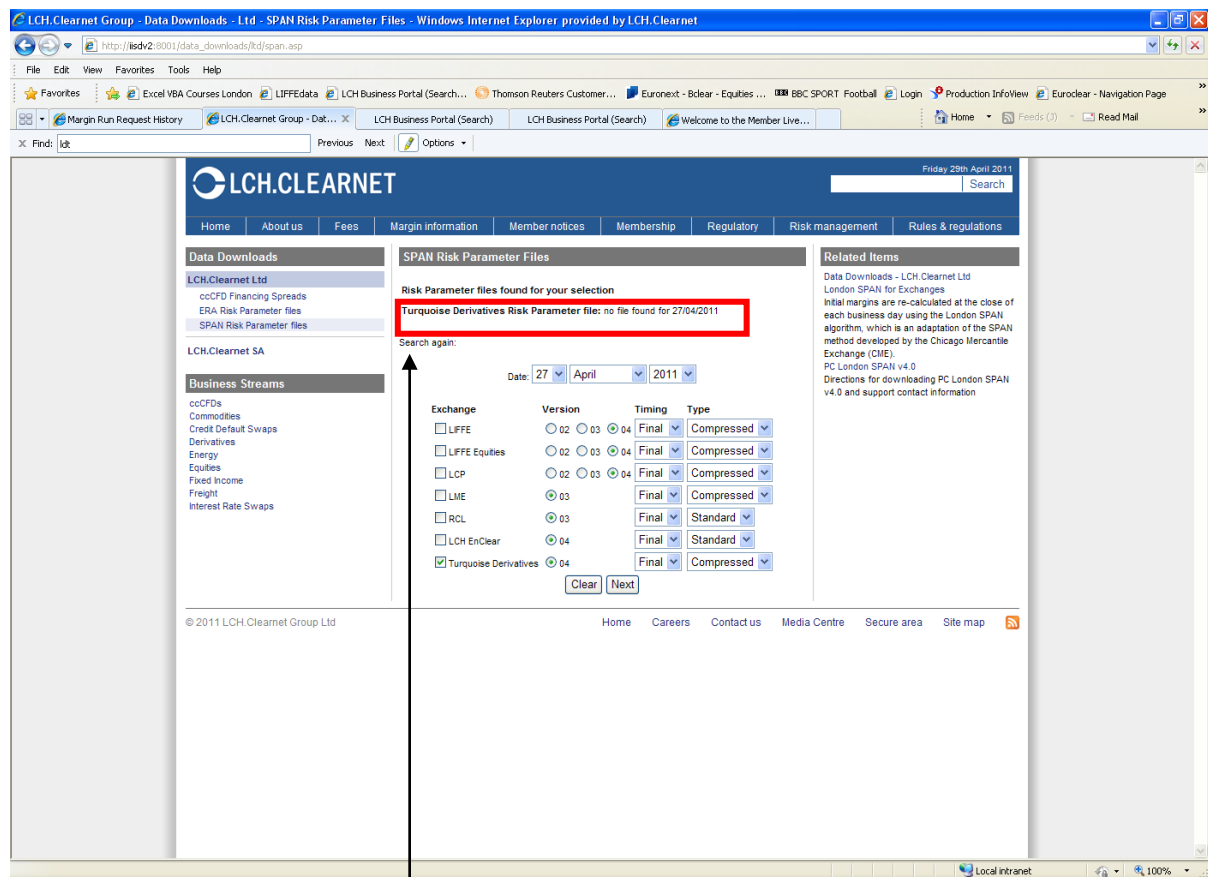
Clicking on the .DAT file link will display the parameter file.

Navigating the Parameter File

Above is an example of the Parameter File. The contract code and name are displayed at the top. The expiry, price and number of lots of each future are displayed below this.

The future highlighted would be entered into PC London Span the following way

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

If you wish to construct your own SPAN parameter file, please see the below link for details.
http://www.lchclearnet.com/risk_management/ltd/margining/london_span_for_exchanges/technical_specifications/default.asp

Below is an example of how Options are displayed in the Parameter file:

The contract code and name are again displayed at the top on the futures example. The date of the expiry of the option is also shown at the top. The lists of strike prices for this expiry are shown below this. The P or C represents whether the option is a Put or a Call.
The highlighted example above would be entered into PC London Span the following way:

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

NB: All positions entered into PC London Span have to be genuine futures prices or option strike prices otherwise PC London Span will not be able to calculate the Initial Margin requirement.

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

5. Glossary of Terms

At-the-money

An option or warrant where the exercise price is equal to the current market price of the asset subject to the option. For example, a call option with an exercise price of 100p on a share with a share price of 100p is at-the-money.

More generally, however, an at-the-money option is an option whose exercise price is nearest to that of the underlying asset. For example, where an option has strike prices at intervals of 10p, e.g. 90p, 100p, 110p etc, if the underlying asset has a price of 97p, the at-the-money option is the 100p strike, which is the nearest strike price to the underlying price. See also In-the-Money.
Back

Call Option

An option that gives the holder the right, but not the obligation, to buy an asset at a given price on or before a given date. See also Option.
Back

Delta

Drawn from the theoretical options pricing model (see Black Scholes), the delta of an option shows the rate of change in an option premium with respect to a change in price of the underlying asset or security. For example, the premium on an option with a delta of 0.5 will move by 0.5p for every 1p move in the price of the underlying. Delta can also be defined as either (i) the probability that the option will expire in-the-money, or (ii) the theoretical number of futures contracts of which the holder is either long (with a call option) or short (put option).
Back

Futures Contract

A legal agreement to buy or sell a standard quantity of a specified asset for delivery at a fixed future date at a price agreed today. Futures are traded on futures exchanges, such as NYSE Liffe (London market), London Stock Exchange Derivatives Market or the London Metal Exchange. They are available in a range of assets, such as wheat and copper and also on indices, such as the FTSE 100.
Back

In-the-Money

A call option where the exercise price is below the asset price is in-the-money. For example, a call option on a share with an exercise price of 100p when the share price is 110p is in-the-money. A put option is in-the-money when the asset price is below the exercise price. For example, a put option on a share with an exercise price of 100p when the share price is 90p is in-the-money. See also out-of-the-money and at-the-money.
Back

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

Initial Margin

The returnable deposit paid to the LCH.C by the clearing member when entering into transactions on the cleared markets. The purpose of initial margin allows the LCH.C to hold sufficient funds on behalf of each clearing member to offset any losses incurred between the last payment of margin and the close out of clearing member's positions should the clearing member default. Initial margin is usually calculated by taking the worst probable loss that the position could sustain over a fixed amount of time, and can be paid in either cash or non-cash collateral.
Back

Initial Margin Requirement

The size of deposit a member must lodge with the LCH.C to cover potential losses to the LCH.C in closing out the open positions in the event of a member defaulting.
Back

Intermonth Spread Charge

A charge to cover the basis risk that prices of contracts (with the same underlying asset) in different delivery (prompt) months will move independently of one another.
Back

Inter Commodity Spread Saving

In certain cases, offsets or margin liabilities in respect of different contracts are allowed across "portfolios". The inter-commodity spread credits recognize cases where offsetting positions in price-related but discrete contracts reduce overall portfolio risk. The offset reduces the amount of margin required on the spread position.

Details of spreads allowed are available from the LCH.C Risk Management department or from frequently distributed LCH.C and exchange circulars. The LCH.C and the exchanges decide where it is justifiable, on risk assessment criteria, to allow inter-contract margin offsets and set the corresponding spread credit rates. Delta spreads are calculated and then used with these parameters to calculate the inter-commodity spread credits. The calculation of inter-commodity spread credits is explained in detail in the PC London SPAN Technical Information Package (TIP).
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London SPAN

Standard Portfolio Analysis of Risk, a margining system used by the LCH.C to calculate initial margins due from and to its clearing members for NYSE Liffe (London market), LME, London Stock Exchange Derivatives Market, LCH EnClear and RepoClear positions. SPAN is a computerised system which calculates the effect of a range of possible changes in price and volatility on portfolios of derivatives. The worst probable loss calculated by the system is then used as the initial margin requirement.
Back

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

Long Position

Any position which has been purchased. For example, a long futures position means that you have bought a future. Contrast with Short.
Back

Lot

Another term for a contract.
Back

Option

A contract which gives the holder the right, but not the obligation to buy or sell a specified asset at an agreed price on or before an agreed date in the future. The right to buy an asset is referred to as a call option. The right to sell is referred to as a put option.
Back

Out-of-the-Money

A call option or warrant where the exercise price exceeds the asset price is out-of-the-money. For example, a call option on a share with an exercise price of 100p when the share price is 90p is out-of-the-money. A put option is out-of-the-money when the asset price exceeds the exercise price. For example, a put option on a share with an exercise price of 100p when the share price is 110p is out-of-the-money. See also In-The-Money and At-The-Money.
Back

Portfolio

The current open positions held in any futures or options contracts. If all the contracts held are based on the same underlying asset then the portfolio is more correctly known as a contract family.
Back

Position

A long or short market commitment, an obligation, or right, to make or take delivery.
Back

Put Option

A contract which confers upon the holder the right, but not the obligation, to sell an asset at a given price on or before a given date.
Back

(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)

Short Position

A term used to describe an open sold futures or options position. Also used to describe someone who sells a cash asset not previously owned. Contrast with Long (Position).
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Spot Month Charge

Volatility can increase when a contract approaches the last day of trading or the day of delivery of the underlying instrument. The LCH.C covers this risk by building an additional spot month charge into PC London SPAN.
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(For more information on downloading and using SPAN, please see the user guides on the LCH Clearnet website.)