



Central Counterparty (CCP) for Equities
LCH.Clearnet Ltd ERA TIP
(LCH Equity Risk Analysis Technical Information Pack)

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1. Introduction

1.1 Background

LCH.Clearnet Ltd (LCH) has developed a new algorithm, LCH ERA (Equity Risk Analysis), for the calculation of margin for cash equities and equivalent linear instruments. The LCH ERA algorithm was developed by LCH after discussions with a member advisory group late in 1999 and was subsequently approved by the LCH Risk Committee.

1.2 Purpose

This document is the Technical Information Pack (TIP) for LCH ERA. It is primarily targeted at technical developers who may be charged with the development of a system to implement LCH ERA, and is also targeted at their commissioning risk management department. Implementing LCH ERA would enable LCH members to reconcile their margins as calculated by LCH or to pass on margin to clients using the same method.

The TIP can be used as a stand-alone document. It builds on and, where necessary, clarifies the document "Description of the LCH ERA (Equity Risk Analysis) Margining Algorithm" published by LCH.

The LCH ERA algorithm provides for the calculation of both variation margin and initial margin. This technical specification provides full details of the algorithm and all the required input data to implement LCH ERA.

1.3 Document Overview

LCH ERA Margin Overview	A description of variation margin, initial margin and the steps used to calculate them.
LCH ERA Calculation Detail	A step by step guide through the calculation of variation margin and initial margin.
LCH ERA Worked Examples	Worked examples for all aspects of the margin calculations. To clarify understanding and potentially test developments against the LCH ERA algorithm.
LCH ERA Input Data	A description of each set of input data required by the LCH ERA algorithm.
Appendices	Provides implementation details for the use of LCH ERA in specific services.

1.4 References

Source Organisation	Document	Version
LCH	Description of the LCH ERA (Equity Risk Analysis) Margining Algorithm	2.0

1.5 Glossary of Terms

Account	The aggregation level to which margin is calculated. This is the financial account for LCH or an NCM account for a GCM.
Bucket	A grouping of equities for the purposes of calculating initial margin.
Cash only positions	Positions for which only cash will be settled. No transfer of equities is involved.
Central Securities Depository (CSD)	An organisation where equity settlement takes place (e.g. CRESTCo in the UK).
Consideration	Another term for settlement value.
Current value	The value of an open position using the current price not the trade price.
Eligible position	Those positions that are to be included in the margin calculations.
Equities	References to equities throughout this document are intended as generic references to all products that LCH elects to margin using LCH ERA.
Equity variation margin (EVM)	The pure mark-to-market profit and loss of eligible positions, which is the difference between the current value of these positions and their settlement value.
Financial account	An LCH member's chosen mnemonic sub-account (e.g. for member mnemonic ABC's house account).
Flat rate method	The method of calculating initial margin for individual equities, which do not have a suitable price history to use the portfolio method, by taking a flat rate of their current value.
General Clearing Member (GCM)	For the purposes of the CCP for Equities service, a GCM is an LCH member who can clear equity business for NCMs, as well as themselves and their clients.
Initial margin	Initial margin is LCH's estimate of the inherent market risk of a portfolio of open positions.
ISD	The intended settlement date of a trade.
ISIN	International Security Identification Number.
LCH ERA	LCH's Equity Risk Analysis algorithm defined by this document.
Margin run	A full execution of LCH ERA initiated at a point in time.
Member mnemonic	A three letter code used by LCH to identify an LCH member. (N.B. an LCH member can have more than

	one mnemonic.)
Non-Clearing Member (NCM)	A member of an exchange who is clearing all or part of their exchange business through a GCM.
Portfolio method	The method of calculating initial margin on a portfolio of equities in a single bucket, using historical prices as parameters.
Positions (open positions)	The term position and open position are used synonymously to mean all unsettled trades (or some netting of those trades) to which LCH is central counterparty.
PPS	Protected Payments System. An assured payments system through which LCH can call margin and other cash payments from a member's account in participating banks. It is like a direct debit facility.
Settlement value	The amount of cash to be paid for the settlement of a trade to complete.
TIP	Technical Information Pack.
Total initial margin	The total initial margin per account in the LCH base currency.
Total variation margin	The total variation margin per account in the LCH base currency.
Variation margin	Variation margin is the difference between the current value of a set of open positions and the settlement value of those positions.

2. LCH ERA Margin Overview

This section introduces the terms variation margin and initial margin in the context of LCH ERA. It also lists the steps involved in the margin calculations, the details of which are described in section 3.

2.1 Variation Margin

2.1.1 Definition

Variation margin is the difference between the current value of a set of open positions and the settlement value of those positions. The result will be either a net unrealised profit or loss.

Losses (debit variation margin) must be covered by appropriate collateral. Profits (credit variation margin) can be used to offset other debits as allowed by LCH's Risk Department. A particular restriction of the use of credit variation margin is enshrined in the LCH ERA algorithm and relates to the uncertainty LCH has on realising such assets, as it does not have control of settlement.

2.1.2 Calculation Steps

- Determine eligible positions (by ISIN by currency by ISD)
- Calculate the pure Equity Variation Margin (EVM) per equity per intended settlement date
- Separate the EVMs into two groups for the application of the credit variation margin restriction
- Aggregate the EVMs by currency within these groups
- Further aggregate by LCH base currency within these groups
- Calculate the Total Variation Margin for the position, allowing for the credit variation margin restriction

2.2 Initial Margin

2.2.1 Definition

Initial margin is LCH's estimate of the inherent market risk of a portfolio of open positions. It is designed to cover LCH for the market risk when closing out a member's position following their default.

LCH ERA uses two methods to calculate initial margin.

The 'portfolio method' is designed to take into account any inherent correlation in the prices of equities to fairly reflect the market risk. This is achieved by calculating an initial margin for a group of equities of like characteristics using their historical prices. Each such grouping of equities is referred to as a 'bucket' by LCH in relation to LCH ERA.

Where an appropriate price history for an equity is not available the initial margin for its position is calculated using the alternate 'flat rate method'.

2.2.2 Calculation Steps

2.2.2.1 Portfolio Method

- Determine eligible positions (by ISIN by currency)
- For each bucket:
 - Optionally calculate the price changes (supplied by LCH)
 - Calculate the current value of each position

- Calculate the daily portfolio value change
- Calculate the base initial margin
- Calculate the portfolio initial margin by application of the bucket risk coefficient
- Aggregate all the portfolio initial margins by currency
- Further aggregate by LCH base currency
- Apply the counterparty multiplier

2.2.2.2 Flat Rate Method

- Determine eligible positions (by ISIN by currency)
- Calculate the initial margin per position
- Aggregate all the flat rate initial margins by currency
- Further aggregate by LCH base currency
- Apply the counterparty multiplier

3. LCH ERA Calculation Detail

This section describes in detail the calculation steps required to perform the LCH ERA algorithm. Some illustrative examples are included where felt to be particularly necessary to clarify the text. Otherwise the reader should refer to the fully worked examples in section 4 which are cross-referenced back to this section.

3.1 Margin Runs

Each time LCH wants to reassess its risk position it will execute the full LCH ERA algorithm, calculating both variation margin and initial margin, in a 'margin run' using the latest available positions, prices and exchange rates.

A margin run will occur once at end-of-day and one or more times intra-day.

All the common input data used by LCH in a margin run will be made available by LCH on a per margin run basis to account for data changes between margin runs. See Appendix A for implementation details.

Member specific data, specifically open positions, may not be sourced from LCH but from a Central Securities Depository (CSD). See Appendix B for implementation details.

Margin is calculated to an aggregation level of a single account. For LCH, this is to the level of the LCH Member's chosen member mnemonic sub-account or 'financial account' (e.g. for member mnemonic ABC's house account). Alternatively, for a General Clearing Member (GCM) this could be to the level of a Non-Clearing Member (NCM) account.

The remainder of this document describes the calculation of margin for a single account. Where multiple accounts are handled, and hence positions for multiple accounts supplied, the LCH ERA algorithm is separately applied to the positions of each such account.

3.2 Data input files

Margins are calculated from three types of input data, positions, prices and parameters. Data files are provided for each of these categories as follows, with details of their contents being provided in section 5.

- Positions - 'position' - net open positions
- Prices - 'price' - current and historic equity prices
 - 'exchange rate' – current and historic exchange rates
- Parameters - 'global' – parameters defined by LCH's Risk Department for each margin run
 - 'bucket' – parameters defined by LCH's Risk Department for each bucket of equities
 - 'equity' – parameters defined by LCH's Risk Department for each equity
 - ('price' – also contains price change parameters derived from prices files)

The following conventions are used in this document when referring to the data files or their component data fields.

- 'filename: Fieldname', e.g. 'position: net quantity'
- 'fieldname', e.g. 'net quantity'
- 'filename', e.g. 'position'

3.3 Positions

3.3.1 Converting trades to net positions

LCH ERA assumes net open positions as primary input as described in section 5.1. These net positions are an aggregation of all the individual open settlement instructions to which LCH is the counterparty. The aggregation consists of summing across settlement instructions the quantities into a net quantity and the considerations into a net consideration where the settlement ISIN, currency and ISD are equal. (Note that consideration, trade value and gross settlement value are synonymous and equal).

It should be noted that the same ISIN can have considerations in different currencies. This can arise from a change in listing currency, a takeover with a change in listing currency, dual currency listing or bilateral agreed settlement not in the listing currency.

As an example the following open settlement instructions ...

Trade	ISIN	Currency	ISD	Quantity	Price	Consideration
1	XG0000000001	GBP	25/5/2001	-100	0.10	+10.00
2	XG0000000001	GBP	25/5/2001	+50	0.11	-5.50
3	XG0000000001	GBP	29/5/2001	-40	1.00	+40.00
4	XE0000000001	EUR	29/5/2001	+200	1.30	-260.00
5	XE0000000001	GBP	29/5/2001	-20	1.00	+20.00

...become the following net positions ...

From trades	ISIN	Currency	ISD	Net quantity	Net consideration
1 & 2	XG0000000001	GBP	25/5/2001	[-100 + +50 =] -50	[10.00 + -5.50 =] +4.50
3	XG0000000001	GBP	29/5/2001	-40	+40.00
4	XE0000000001	EUR	29/5/2001	+200	-260.00
5	XE0000000001	GBP	29/5/2001	-20	+20.00

A key point to note is that each trade price is used to calculate net consideration, thus allowing variation margin to be calculated.

3.3.2 Cash only positions

Cash only positions arise from cash claims such as interest or dividend payments. They will have a net quantity of zero and net consideration of the cash amount.

LCH will provide "equity" and "price" data relating to cash only positions with a dummy ISIN of 'CASH'. Given this, cash only positions can be treated exactly the same as equity positions throughout the LCH ERA calculations.

Alternatively, cash only positions can be identified as a special case and handled appropriately. The variation margin of cash only positions is the full amount of the net consideration, being a debit to the payer and a credit to the payee. No initial margin is paid on cash only positions.

3.3.3 Preparing the positions input

The assumed position input to LCH ERA is the aggregate of all unsettled trades by ISIN, currency and ISD, as defined by the file 'position'. LCH ERA applies filtering and further netting on these positions to provide the basic input for various of the calculations as described below. The modified set of positions for each calculation is termed the 'eligible positions'.

3.3.3.1 Preparing eligible positions for variation margin calculation

For intra-day variation margin calculations, the eligible positions are all the original positions in the 'position' file with no filtering or netting applied.

For end-of-day variation margin calculations, LCH ERA assumes settlement of positions that can or probably will settle early on the next LCH business day and removes them from the margin calculation. This includes cash only positions.

Whether settlement of an equity position should be assumed is determined by the 'assume settlement' flag for each equity (see 5.4). The flag would be set to not assume settlement (value = 'FALSE') if the next LCH business day was a currency holiday for the settlement currency of the equity, or if there were market reasons why settlement of the equity was not likely. The flag is set to assume settlement otherwise (value = 'TRUE').

Therefore, the positions assumed to settle are those for which

'equity: ISIN' = 'position: ISIN'
and 'equity: Currency' = 'position: Currency'
and 'equity: Assume settlement' = 'TRUE'
and 'position: ISD' <= 'global: Next LCH business day'.

The eligible end-of-day positions are therefore the starting position set, less those positions assumed to settle.

This data set will continue to be referenced as 'position: <fieldname>' as it has the same structure and values as 'position', but note carefully the exclusion of the assumed settled records.

3.3.3.2 Preparing eligible positions for initial margin calculation

The eligible positions used for initial margin calculation are simply the eligible positions used for variation margin calculation netted across ISDs. That is, the 'net quantities' are summed within 'ISIN' and 'currency'.

This data set will be referenced as 'im position: <fieldname>' and is of the same structure as the 'position' file, but with 'ISD' and 'net consideration' excluded.

3.4 Variation Margin

The calculation of variation margin is a two stage process.

- The first stage calculates 'equity variation margin' which is the pure mark-to-market profit and loss of eligible positions. This is the difference between the current value of the position and its settlement value.
- The second stage calculates a single 'total credit variation margin' for the account. This is the sum of the 'equity variation margin' less any credit variation margin that is restricted from use as an offsetting asset by LCH's Risk Department. This restriction is rule based and described below.

3.4.1 Calculation of Equity Variation Margin (EVM)

The 'price' input data file is used for both variation and initial margin calculation. For the variation margin calculation, only prices dated for the current business date are relevant. That is, where

'price: Date' = 'global: Current business date'.

The price used will be for the ISIN and currency specified in the position record. That is, where

'price: ISIN' = 'position: ISIN'

and 'price: Currency' = 'position: Currency'.

Further, the price used to determine the mark-to-market value of an equity position is determined from 'equity: VM price' and the direction of the position (buy or sell). LCH's Risk Department will set the 'equity: VM price' parameter to specify whether mid prices or bid/ask prices are to be used to calculate variation margin for each equity.

Where the 'equity: VM price' = MID, the 'price: Price type' = 'MID' is used.

Where the 'equity: VM price' = B/A,

the 'price: Price type' = 'BID' is used for a long/buy position ('position: Net quantity' is a credit (+ve)),

the 'price: Price type' = 'ASK' is used for a short/sell position ('position: Net quantity' is a debit (-ve)).

For each eligible position record, using the appropriate price, the 'equity variation margin' is calculated as:

$(\text{'position: Net quantity'} * \text{'price: Price'}) + (\text{'position: Net consideration'})$

Please note, this is the difference between the current value and the settlement value even though an addition appears to be being carried out. Please see the signing conventions of 'position: Net quantity' and 'position: Net consideration' defined in section 5.1.

Equity variation margin could be similarly calculated on a trade-by-trade basis using this method. In order for the sum of the equity variation margin for each trade to match the net position value, the use of bid or ask prices must be based on the sign of the net quantity of the position and not the sign of the quantity of each trade.

3.4.2 Calculation of Total Variation Margin

'Restricted credit variation margin' is defined as the net credit variation margin arising from trades that may settle before the margin call PPS (Protected Payments System) confirmation cut-off time (9:00 am) following the next end-of-day margin run. It is restricted from use as

credit variation margin because the asset value is not guaranteed to LCH as it ceases to be a realisable asset on settlement.

Whilst the concept of 'restricted credit variation margin' seems complex, its calculation within LCH ERA is simply executed, as described below, through the use of the 'global: CVM date' parameter supplied by LCH.

The 'total variation margin' is the sum of the 'equity variation margins' less any 'restricted credit variation margin'.

3.4.2.1 Separating EVMs for Credit Offset Restriction

The calculation of total variation margin is performed by first summing the 'equity variation margin' for two distinct groups; the group of 'restricted credit variation margin' positions, being those that may settle before PPS confirmation following the next end-of-day margin call, and the group of 'unrestricted credit variation margin' positions, being the rest.

LCH will define the date 'global: CVM date' to distinguish the two groups as follows.

The restricted credit variation margin positions are those where

'position: ISD' <= 'global: CVM date'

and the unrestricted credit variation margin positions are those where

'position: ISD' > 'global: CVM date'.

3.4.2.2 Aggregation by Currency

The sum of the equity variation margins for each group is then calculated within currency as the 'currency total'.

3.4.2.3 Aggregation in LCH Base Currency

Any 'currency total' not in the 'global: LCH base currency' is then converted to this currency, using the current exchange rate, as

'currency total' * 'exchange rate: Multi exchange rate'

where

'exchange rate: From currency' = 'currency total' currency

and 'exchange rate: To currency' = 'global: LCH base currency'

and 'exchange rate: Date' = 'global: Current business date'.

The total for each group is then calculated in the LCH base currency.

3.4.2.4 Final Calculation of Total Variation Margin

If the total for the 'restricted credit variation margin group' is negative (i.e. a debit) then no credit variation margin exists for this group, no restriction applies and hence

total variation margin = the sum of the two group totals.

If the total for the 'restricted credit variation margin group' is positive (i.e. a credit) then a restricted credit variation margin exists and

total variation margin = the 'unrestricted credit variation margin' group total.

Please note that this is the same as the total variation margin, less any restricted credit variation margin.

The total variation margin is rounded to a settleable amount in the LCH base currency. For example, a total variation margin of £456.35507 would be rounded to £456.36.

3.5 Initial Margin

3.5.1 Portfolio Method

The portfolio method is used for all positions where the equity is defined as being margined by the portfolio method in the 'bucket' data. That is, where

'im position: ISIN' = 'equity: ISIN'
 and 'im position: Currency' = 'equity: Currency'
 and 'equity: Bucket code' = 'bucket: Bucket code'
 and 'bucket: Bucket type' = 'P'.

3.5.1.1 Calculation by Bucket

3.5.1.1.1 Calculation of the Price Change Parameters

Portfolio initial margins are calculated using historic price changes. LCH calculates and provides the required price change parameters in the 'price' file as 'price: Price change', **therefore they do not need to be recalculated.**

The price change parameters are calculated by LCH as described below.

The method can be used where prices or exchange rates that are different from those supplied by LCH are used. The days offset parameters are provided as 'price: Days offset' to assist in the calculation, particularly if SQL is used.

The price changes are required for each equity for a range of historic dates. The length of the price history, in days, is specified as parameter 'bucket: Price history days'. The number of days over which each price change is to be measured is specified as parameter 'bucket: Time horizon'. Therefore, the number of price changes calculated per equity in the bucket is

'bucket: Price history days' - 'bucket: Time horizon'.

To allow equities settled in different currencies to be margined together all price changes are calculated in the bucket base currency specified as parameter 'bucket: Currency'.

Only mid prices are used to calculate the price changes.

Prices not in the bucket base currency are converted to that currency, using the exchange rate from the same date as the price, as

'price: Mid' * 'exchange rate: Multi exchange rate'

where

'price: ISIN' = 'equity: ISIN'
 and 'price: Currency' = 'equity: Currency'
 and 'equity: Bucket code' = 'bucket: Bucket code'
 and 'exchange rate: From currency' = 'price: Currency'
 and 'exchange rate: To currency' = 'bucket: Currency'
 and 'exchange rate: Date' = 'price: Date'.

For each equity in the bucket, the price change for each day is calculated as

$$(P_{D-T} - P_D) / P_D$$

where

P_x is the mid price (in bucket base currency) appropriate to 'x' = 'Days offset'

D is the 'price: Days offset' of the earlier date

T is the 'bucket: Time horizon' of the bucket.

For example, for an equity in a bucket with a 'Time horizon' of 2 days and a 'Currency' of GBP, where today is 22/5/2001 and the price of the equity on 'Days offset = 5' (15/5/2001) is £10 and its price on 'Days offset = 3' (17/5/2001) is £12 then the price change for 'Days offset = 5' is $(12-10)/10 = 0.2$.

LCH rounds the price changes to six decimal places.

3.5.1.1.2 Calculation of the Position Current Value

Portfolio initial margins are calculated using the current value of each equity position in the bucket base currency. The current value for each equity position is calculated as the product of the net quantity, the current mid price and the current exchange rate from the equity currency to the bucket base currency. That is,

'im position: Net quantity' * 'price: Mid' * 'exchange rate: Multi exchange rate'

where

'equity: ISIN'	= 'im position: ISIN'
and 'equity: Currency'	= 'im position: Currency'
and 'equity: ISIN'	= 'price: ISIN'
and 'equity: Currency'	= 'price: Currency'
and 'equity: Bucket code'	= 'bucket: Bucket code'
and 'exchange rate: To currency'	= 'bucket: Currency'
and 'exchange rate: From currency'	= 'price: Currency'
and 'exchange rate: Date'	= 'price: Date'
and 'global: Current business date'	= 'price: Date'.

This value will be henceforth referenced as 'im position: Current value'.

3.5.1.1.3 Calculation of the Daily Portfolio Value Changes

For each day in the price change history calculate the daily portfolio value change. This is the absolute value of the sum of the product of the price changes and position current values for each equity in the bucket. That is,

$$\text{Daily portfolio value change} = \text{abs} \left(\sum_{\text{for 'price: Days offset'}} \left(\sum_{\text{for all ISINs in the bucket}} \left(\text{'im position: Current value'} * \text{'price: Price change'} \right) \right) \right)$$

where

'im position: ISIN'	= 'price: ISIN'
and 'im position: Currency'	= 'price: Currency'.

The "abs()" operation, applied after the sum of the products, ensures that the price change results are all absolute magnitudes (i.e. all positive).

3.5.1.1.4 Calculation of the Base Initial Margin

The daily portfolio value changes are then in effect ranked in descending order, the largest 'N' are discarded and the next 'M' are averaged where

'N'	= 'bucket: Discarded portfolio losses' and
'M'	= 'bucket: Averaged portfolio losses'.

The result is then made negative to give the 'base initial margin'. This is because all initial margins are debits against the account being margined.

For example, if five daily value changes of 100, 300, 200, 500, 400 were calculated and N=1 and M=2, then calculation of the base initial margin would discard the largest change, 500, and average the next two largest changes, $(400+300)/2=350$, and then make the result negative as -350.

3.5.1.1.5 Application of the Risk Coefficient

The 'base initial margin' is then multiplied by the 'bucket: Risk coefficient' to give the 'portfolio initial margin'.

3.5.1.2 Aggregation by Currency

All 'portfolio initial margins' with the same currency are then added together to give a single 'portfolio initial margin' per currency or 'currency total'.

3.5.1.3 Aggregation in LCH Base Currency

Any 'currency total' not in the 'global: LCH base currency' is then converted to this currency as

$$\text{'currency total'} * \text{'exchange rate: Multi exchange rate'}$$

where

$$\text{'exchange rate: From currency'} = \text{'currency total'} \text{ currency}$$

$$\text{and 'exchange rate: To currency'} = \text{'global: LCH base currency'}$$

$$\text{and 'exchange rate: Date'} = \text{'global: Current business date'}$$

The total is then calculated as the sum of these results in the LCH base currency.

3.5.1.4 Application of Counterparty Multiplier

The 'global: Counterparty multiplier' will be pre-set as 1. For LCH members it should be left at this value, unless LCH's Risk Department contact the member to advise of a different value to be used. In this case the value should be amended by the member prior to the margin calculation.

The total margin in LCH base currency is multiplied by the 'global: Counterparty multiplier' and rounded to a settleable amount to give the total portfolio initial margin.

For example, if the total margin in LCH base currency (GBP) is -123.45668 and the counterparty multiplier is 1.5, the product is -185.18502, which rounded to the nearest penny is £-185.19.

3.5.2 Flat Rate Method

The flat rate method is used for all positions where the equity is defined as being margined by the flat rate method in the 'bucket' data. That is, where

'im position: ISIN' = 'equity: ISIN'
 and 'im position: Currency' = 'equity: Currency'
 and 'equity: Bucket code' = 'bucket: Bucket code'
 and 'bucket: Bucket type' = 'F'.

3.5.2.1 Calculation by Position

The initial margin for each appropriate position is calculated as an LCH Risk defined fraction, the 'bucket: Risk rate', of the current value of the position in the currency of the equity. That is,

- abs('im position: Net quantity' * 'price: Mid' * 'bucket: Risk rate')

where

'equity: ISIN' = 'im position: ISIN'
 and 'equity: Currency' = 'im position: Currency'
 and 'equity: ISIN' = 'price: ISIN'
 and 'equity: Currency' = 'price: Currency'
 and 'equity: Bucket code' = 'bucket: Bucket code'
 and 'global: Current business date' = 'price: Date'.

The "- abs()" operation ensures the result is always a member debit (i.e. negative).

3.5.2.2 Aggregation by Currency

The sum of the flat rate margins is then calculated within currency as the 'currency total'.

3.5.2.3 Aggregation in LCH Base Currency

Any 'currency total' not in the 'global: LCH base currency' is then converted to this currency as

'currency total' * 'exchange rate: Multi exchange rate'

where

'exchange rate: From currency' = 'currency total' currency
 and 'exchange rate: To currency' = 'global: LCH base currency'
 and 'exchange rate: Date' = 'global: Current business date'.

The total is then calculated as the sum of these results in the LCH base currency.

3.5.2.4 Application of Counterparty Multiplier

The 'global: Counterparty multiplier' will be pre-set as 1. For LCH members it should be left at this value, unless LCH's Risk Department contact the member to advise of a different value to be used. In this case, the value should be amended by the member prior to the margin calculation.

The total margin in LCH base currency is multiplied by the 'global: Counterparty multiplier' and rounded to a settleable amount to give the total flat rate initial margin.

3.5.3 Total Initial Margin

The total initial margin is the sum of the total portfolio margin and the total flat rate margin.

3.6 Rounding Rules

LCH rounds the historic price changes to six decimal places (6dp) for inclusion in the 'price' file (section 3.5.1.1.1). If the price change figures are recalculated they should similarly be rounded to ensure reconciliation.

Otherwise, rounding of values only takes place as the final action in generating the total variation margin (section 3.4.2.4), the total portfolio initial margin (section 3.5.1.4) and the total flat rate initial margin (section 3.5.2.4).

Rounding takes place to the nearest settleable unit (e.g. for sterling (GBP) this is the nearest penny).

When rounding, 'halves' round up in absolute terms. That is

0.005 rounds to 0.01 (e.g. £1.555 rounds to £1.56) and

-0.005 rounds to -0.01 (e.g. £-1.555 rounds to £-1.56).

4. LCH ERA Worked Examples

Two worked examples are shown. The first is for the end-of-day margin run of 22 May 2001 and the second is for the subsequent formal intra-day margin run on 23 May 2001. The full input data set is shown for each margin run in table form here and as sample files in section 5. Please note that some of the intermediate results shown have been rounded for presentation purposes only, with calculation accuracy being used as defined by the algorithm.

4.1 End-of-day 22/5/2001

Global

Current business date	Margin run type	Next LCH business date	CVM date	Counterparty multiplier	LCH base currency
22/5/2001	EOD	23/5/2001	24/5/2001	1.5	GBP

Bucket

Bucket code	Price history days	Time horizon	Currency	Discarded portfolio losses	Averaged portfolio losses	Risk coefficient	Bucket type	Risk rate
LIQUID1	6	2	GBP	1	2	1.25	P	
LIQUID2	6	2	EUR	2	1	1.3	P	
FLAT5							F	0.05
FLAT10							F	0.10
FLAT0							F	0.00

Equity

ISIN	Name	Currency	Assume settlement	VM price	Bucket code
XE111111111	IRL BANK	EUR	TRUE	MID	LIQUID1
XE222222222	IRL TELECOM	EUR	FALSE	B/A	LIQUID2
XE333333333	COMPANIE	EUR	TRUE	MID	FLAT5
XG000000001	ABC PLC	GBP	FALSE	MID	LIQUID1
XG000000002	DEF PLC	GBP	TRUE	B/A	FLAT5
XG000000003	GHI PLC	GBP	TRUE	MID	FLAT10
CASH	EUR cash only	EUR	TRUE	MID	FLAT0
CASH	GBP cash only	GBP	TRUE	MID	FLAT0

Exchange rate

From currency	To currency	Date	Mult exchange rate
EUR	GBP	15/5/2001	0.728916
EUR	GBP	16/5/2001	0.719424
EUR	GBP	17/5/2001	0.714235
EUR	GBP	18/5/2001	0.714286
EUR	GBP	21/5/2001	0.716846
EUR	GBP	22/5/2001	0.735294
GBP	EUR	15/5/2001	1.371900
GBP	EUR	16/5/2001	1.390000
GBP	EUR	17/5/2001	1.400100
GBP	EUR	18/5/2001	1.400000
GBP	EUR	21/5/2001	1.395000
GBP	EUR	22/5/2001	1.360000
EUR	EUR	15/5/2001	1.000000
EUR	EUR	16/5/2001	1.000000
EUR	EUR	17/5/2001	1.000000
EUR	EUR	18/5/2001	1.000000
EUR	EUR	21/5/2001	1.000000
EUR	EUR	22/5/2001	1.000000
GBP	GBP	15/5/2001	1.000000
GBP	GBP	16/5/2001	1.000000
GBP	GBP	17/5/2001	1.000000
GBP	GBP	18/5/2001	1.000000
GBP	GBP	21/5/2001	1.000000
GBP	GBP	22/5/2001	1.000000

Price

ISIN	Currency	Date	Bid	Mid	Ask	Price change	Days offset
XE1111111111	EUR	15/5/2001		12.5		-0.043657	5
XE1111111111	EUR	16/5/2001		12.495		-0.021842	4
XE1111111111	EUR	17/5/2001		12.2		0.013528	3
XE1111111111	EUR	18/5/2001		12.31		0.063697	2
XE1111111111	EUR	21/5/2001		12.32			1
XE1111111111	EUR	22/5/2001		12.72			0
XE2222222222	EUR	15/5/2001	0.21	0.23	0.25	0.021739	5
XE2222222222	EUR	16/5/2001	0.22	0.2275	0.235	0.252747	4
XE2222222222	EUR	17/5/2001	0.225	0.235	0.245	0.180851	3
XE2222222222	EUR	18/5/2001	0.27	0.285	0.3	-0.157895	2
XE2222222222	EUR	21/5/2001	0.26	0.2775	0.295		1
XE2222222222	EUR	22/5/2001	0.235	0.24	0.245		0
XE3333333333	EUR	22/5/2001		123.45			0
XG0000000001	GBP	15/5/2001		4.6		-0.086957	5
XG0000000001	GBP	16/5/2001		4.57		-0.083151	4
XG0000000001	GBP	17/5/2001		4.2		0.042857	3
XG0000000001	GBP	18/5/2001		4.19		0.050119	2
XG0000000001	GBP	21/5/2001		4.38			1
XG0000000001	GBP	22/5/2001		4.4			0
XG0000000002	GBP	22/5/2001	12.96	12.99	13.02		0
XG0000000003	GBP	22/5/2001		0.5			0
CASH	EUR	22/5/2001		0			0
CASH	GBP	22/5/2001		0			0

Position (NB Field 'Account' is not shown as this example is for a single account)

ISIN	ISD	Currency	Net quantity	Net consideration
XG0000000002	18/5/2001	GBP	-500	+6000.00
XE1111111111	23/5/2001	EUR	+123	-1512.90
XE2222222222	22/5/2001	EUR	-200	+46.00
XE1111111111	24/5/2001	EUR	+1000	-12300.00
XE2222222222	24/5/2001	EUR	+1000	-280.00
XE3333333333	24/5/2001	EUR	-300	+36900.40
XG0000000001	23/5/2001	GBP	+100	-419.25
XG0000000001	24/5/2001	GBP	-700	+3067.25
XG0000000002	24/5/2001	GBP	-240	+3024.30
XG0000000001	25/5/2001	GBP	+200	-881.40
XG0000000002	25/5/2001	GBP	+400	-5400.00
XG0000000003	25/5/2001	GBP	-600	+299.90
CASH	29/5/2001	GBP	0	-199.99
XE1111111111	25/5/2001	EUR	+1000	-12719.30
XE2222222222	25/5/2001	EUR	+1000	-233.60
CASH	4/6/2001	EUR	0	+12.34

im position (derived for initial margin see section 3.3.3.2)

ISIN	Currency	Net quantity
XE1111111111	EUR	+2000
XE2222222222	EUR	+1800
XE3333333333	EUR	-300
XG0000000001	GBP	-400
XG0000000002	GBP	+160
XG0000000003	GBP	-600
CASH	GBP	0
CASH	EUR	0

Variation Margin Calculation

Date boundary functions	ISIN	ISD	Assume settlement	Currency	Net quantity (Q)	Net consideration (C)	VM price	Price 3.4.1 (P)	Equity VM 3.4.1 (Q*P + C)	By position currency 3.4.2.2	In LCH base currency 3.4.2.3	Total VM 3.4.2.4
Assumed settled 3.3.3	XG0000000002	18/5/2001	TRUE	GBP	-500	+6000.00						
	XE1111111111	23/5/2001	TRUE	EUR	+123	-1512.90						
	XE2222222222	22/5/2001	FALSE	EUR	-200	+46.00	B/A	0.245	-3.00	237.40	82.0587956	-406.87
	XE1111111111	24/5/2001	TRUE	EUR	+1000	-12300.00	MID	12.72	420.00			
	XE2222222222	24/5/2001	FALSE	EUR	+1000	-280.00	B/A	0.235	-45.00			
	XE3333333333	24/5/2001	TRUE	EUR	-300	+36900.40	MID	123.45	-134.60	-92.50		
	XG0000000001	23/5/2001	FALSE	GBP	+100	-419.25	MID	4.4	20.75			
	XG0000000001	24/5/2001	FALSE	GBP	-700	+3067.25	MID	4.4	-12.75			
Credit VM restriction	XG0000000002	24/5/2001	TRUE	GBP	-240	+3024.30	B/A	13.02	-100.50			
3.4.2.1	XG0000000001	25/5/2001	TRUE	GBP	+200	-881.40	MID	4.4	-1.40	-417.49	-406.87235464	
	XG0000000002	25/5/2001	TRUE	GBP	+400	-5400.00	B/A	12.96	-216.00			
	XG0000000003	25/5/2001	TRUE	GBP	-600	+299.90	MID	0.5	-0.10			
	CASH	29/5/2001	TRUE	GBP	0	-199.99	MID	0	-199.99			
	XE1111111111	25/5/2001	TRUE	EUR	+1000	-12719.30	MID	12.72	0.70	14.44		
	XE2222222222	25/5/2001	FALSE	EUR	+1000	-233.60	B/A	0.235	1.40			
	CASH	4/6/2001	TRUE	EUR	0	+12.34	MID	0	12.34			

Price changes calculation for equity of ISIN 'XE1111111111' (3.5.1.1.1)

Days offset [D]	5	4	3	2	1	0
Date	15/5/2001	16/5/2001	17/5/2001	18/5/2001	21/5/2001	22/5/2001
Mid price (EUR)	12.5	12.495	12.2	12.31	12.32	12.72
Mult exchange rate (EUR to GBP)	0.728916	0.719424	0.714235	0.714286	0.716846	0.735294
Mid price (GBP) [P]	9.11145	8.98920288	8.713667	8.79286066	8.83154272	9.35293968
Δ Price (over 2 days) [(P _{D-2} - P _D)/P _D] (to 6 d.p.)	-0.043657	-0.021842	0.013528	0.063697		

Base initial margin calculation for bucket 'LIQUID1'

Days offset	5		4		3		2		0
ISIN	Δ Price [AP]	Δ Value [Δ P*V] 3.5.1.1.3	Δ Price [AP]	Δ Value [Δ P*V] 3.5.1.1.3	Δ Price [AP]	Δ Value [Δ P*V] 3.5.1.1.3	Δ Price [AP]	Δ Value [Δ P*V] 3.5.1.1.3	Current Value [V] 3.5.1.1.2
XE1111111111	-0.043657	-816.642575	-0.021842	-408.573817	0.013528	253.053136	0.063697	1191.508398	18705.87936 =2000*12.72*0.735294
XG0000000001	-0.086957	153.044320	-0.083151	146.345760	0.042857	-75.428320	0.050119	-88.209440	-1760 =-400*4.4*1
Daily portfolio value change 3.5.1.1.3 Ranking 3.5.1.1.4		663.598255 2		262.228057 3		177.624816 4		1103.298958 1	
Base initial margin 3.5.1.1.4	Drop ranking (1), average rankings (2) and (3), and make the result negative = $-(663.598255 + 262.228057)/2 = -462.913156$								
Portfolio initial margin 3.5.1.1.5	Multiply base initial margin by bucket risk coefficient of 1.25 = $-462.913156 * 1.25 = -578.641445$								

Final initial margin calculations

Portfolio bucket	Currency	Portfolio initial margin 3.5.1.1	By currency 3.5.1.2	In LCH base currency 3.5.1.3	Total portfolio initial margin 3.5.1.4	Total initial margin 3.5.3
LIQUID1	GBP	-578.641445	-578.641445	-643.842782	-965.76	-3209.01
LIQUID2	EUR	-88.673832	-88.673832			
Flat rate ISIN	Currency	Flat rate initial margin 3.5.2.1	By currency 3.5.2.2	In LCH base currency 3.5.2.3	Total flat rate initial margin 3.5.2.4	
XG0000000002	GBP	-103.92	-133.92	-1495.500665	-2243.25	
XG0000000003	GBP	-30.00				
XE3333333333	EUR	-1851.75	-1851.75			

4.2 Intra-day 23/5/2001

Global

Current business date	Margin run type	Next LCH business date	CVM date	Counterparty multiplier	LCH base currency
23/5/2001	ITD	24/5/2001	24/5/2001	1.5	GBP

Bucket

Bucket code	Price history days	Time horizon	Currency	Discarded portfolio losses	Averaged portfolio losses	Risk coefficient	Bucket type	Risk rate
LIQUID1	6	2	GBP	1	2	1.25	P	
LIQUID2	6	2	EUR	2	1	1.3	P	
FLAT5							F	0.05
FLAT10							F	0.10
FLAT0							F	0.00

Equity

ISIN	Name	Currency	Assume settlement	VM price	Bucket code
XE1111111111	IRL BANK	EUR	TRUE	MID	LIQUID1
XE1111111111	IRL BANK	GBP	TRUE	MID	LIQUID1
XE2222222222	IRL TELECOM	EUR	FALSE	B/A	LIQUID2
XE3333333333	COMPANIE	EUR	TRUE	MID	FLAT5
XG0000000001	ABC PLC	GBP	FALSE	MID	LIQUID1
XG0000000002	DEF PLC	EUR	TRUE	B/A	FLAT5
XG0000000002	DEF PLC	GBP	TRUE	B/A	FLAT5
XG0000000003	GHI PLC	GBP	TRUE	MID	FLAT10
CASH	EUR cash only	EUR	TRUE	MID	FLAT0
CASH	GBP cash only	GBP	TRUE	MID	FLAT0

Exchange rate

From currency	To currency	Date	Multi exchange rate
EUR	GBP	16/5/2001	0.719424
EUR	GBP	17/5/2001	0.714235
EUR	GBP	18/5/2001	0.714286
EUR	GBP	21/5/2001	0.716846
EUR	GBP	22/5/2001	0.735294
EUR	GBP	23/5/2001	0.729820
GBP	EUR	16/5/2001	1.390000
GBP	EUR	17/5/2001	1.400100
GBP	EUR	18/5/2001	1.400000
GBP	EUR	21/5/2001	1.395000
GBP	EUR	22/5/2001	1.360000
GBP	EUR	23/5/2001	1.370200
EUR	EUR	16/5/2001	1.000000
EUR	EUR	17/5/2001	1.000000
EUR	EUR	18/5/2001	1.000000
EUR	EUR	21/5/2001	1.000000
EUR	EUR	22/5/2001	1.000000
EUR	EUR	23/5/2001	1.000000
GBP	GBP	16/5/2001	1.000000
GBP	GBP	17/5/2001	1.000000
GBP	GBP	18/5/2001	1.000000
GBP	GBP	21/5/2001	1.000000
GBP	GBP	22/5/2001	1.000000
GBP	GBP	23/5/2001	1.000000

Price

ISIN	Currency	Date	Bid	Mid	Ask	Price change	Days offset
XE1111111111	EUR	16/5/2001		12.495		-0.021842	5
XE1111111111	EUR	17/5/2001		12.2		0.013528	4
XE1111111111	EUR	18/5/2001		12.31		0.063697	3
XE1111111111	EUR	21/5/2001		12.32		0.066029	2
XE1111111111	EUR	22/5/2001		12.72			1
XE1111111111	EUR	23/5/2001		12.90			0
XE1111111111	GBP	16/5/2001		8.989203		-0.021842	5
XE1111111111	GBP	17/5/2001		8.713667		0.013528	4
XE1111111111	GBP	18/5/2001		8.792861		0.063697	3
XE1111111111	GBP	21/5/2001		8.831543		0.066029	2
XE1111111111	GBP	22/5/2001		9.35294			1
XE1111111111	GBP	23/5/2001		9.414678			0
XE2222222222	EUR	16/5/2001	0.22	0.2275	0.235	0.252747	5
XE2222222222	EUR	17/5/2001	0.225	0.235	0.245	0.180851	4
XE2222222222	EUR	18/5/2001	0.27	0.285	0.3	-0.157895	3
XE2222222222	EUR	21/5/2001	0.26	0.2775	0.295	-0.279279	2
XE2222222222	EUR	22/5/2001	0.235	0.24	0.245		1
XE2222222222	EUR	23/5/2001	0.18	0.2	0.22		0
XE3333333333	EUR	23/5/2001		124.85			0
XG0000000001	GBP	16/5/2001		4.57		-0.083151	5
XG0000000001	GBP	17/5/2001		4.2		0.042857	4
XG0000000001	GBP	18/5/2001		4.19		0.050119	3
XG0000000001	GBP	21/5/2001		4.38		0.050228	2
XG0000000001	GBP	22/5/2001		4.4			1
XG0000000001	GBP	23/5/2001		4.6			0
XG0000000002	EUR	23/5/2001	17.017884	17.072692	17.1275		0
XG0000000002	GBP	23/5/2001	12.42	12.46	12.5		0
XG0000000003	GBP	23/5/2001		0.52			0
CASH	EUR	23/5/2001		0			0
CASH	GBP	23/5/2001		0			0

Position (NB Field 'Account' is not shown as this example is for a single account)

ISIN	ISD	Currency	Net quantity	Net consideration
XE1111111111	23/5/2001	EUR	+123	-1512.90
XE1111111111	24/5/2001	EUR	+1000	-12300.00
XE2222222222	24/5/2001	EUR	+1000	-280.00
XE3333333333	24/5/2001	EUR	-300	+36900.40
XG0000000001	23/5/2001	GBP	+100	-419.25
XG0000000001	24/5/2001	GBP	-700	+3067.25
XG0000000002	24/5/2001	GBP	-240	+3024.30
XG0000000001	25/5/2001	GBP	+200	-881.40
XG0000000002	25/5/2001	GBP	+400	-5400.00
XG0000000003	25/5/2001	GBP	-600	+299.90
CASH	29/5/2001	GBP	0	-199.99
XE1111111111	25/5/2001	EUR	+1000	-12719.30
XE2222222222	25/5/2001	EUR	+1000	-233.60
XE1111111111	29/5/2001	GBP	-2000	18700.00
XE2222222222	29/5/2001	EUR	+500	-90.00
XG0000000002	29/5/2001	EUR	-1000	17300.00
CASH	4/6/2001	EUR	0	+12.34

im position (derived for initial margin see section 3.3.3.2)

ISIN	Currency	Net quantity
XE1111111111	EUR	+2123
XE1111111111	GBP	-2000
XE2222222222	EUR	+2500
XE3333333333	EUR	-300
XG0000000001	GBP	-400
XG0000000002	EUR	-1000
XG0000000002	GBP	+160
XG0000000003	GBP	-600
CASH	GBP	0
CASH	EUR	0

Variation Margin Calculation

Date boundary functions	ISIN	ISD	Assume settlement [not applicable]	Currency	Net quantity [Q]	Net consideration [C]	VM price	Price 3.4.1 [P]	Equity VM 3.4.1 [Q*P + C]	By position currency 3.4.2.2	In LCH base currency 3.4.2.3	Total VM 3.4.2.4
	XE1111111111	23/5/2001		EUR	+123	-1512.90	MID	12.90	73.80	19.20	-73.687456	-580.87
	XE1111111111	24/5/2001		EUR	+1000	-12300.00	MID	12.90	600.00			
	XE2222222222	24/5/2001		EUR	+1000	-280.00	B/A	0.18	-100.00			
	XE3333333333	24/5/2001		EUR	-300	+36900.40	MID	124.85	-554.60	-87.70		
	XG0000000001	23/5/2001		GBP	+100	-419.25	MID	4.60	40.75			
	XG0000000001	24/5/2001		GBP	-700	+3067.25	MID	4.60	-152.75			
Credit VM restriction	XG0000000002	24/5/2001		GBP	-240	+3024.30	B/A	12.50	24.30			
3.4.2.1	XE1111111111	29/5/2001		GBP	-2000	18700.00	MID	9.414678	-129.356	-734.846	-507.185949	
	XG0000000001	25/5/2001		GBP	+200	-881.40	MID	4.60	38.60			
	XG0000000002	25/5/2001		GBP	+400	-5400.00	B/A	12.42	-432.00			
	XG0000000003	25/5/2001		GBP	-600	+299.90	MID	0.52	-12.10			
	CASH	29/5/2001		GBP	0	-199.99	MID	0	-199.99			
	XE1111111111	25/5/2001		EUR	+1000	-12719.30	MID	12.90	180.70	311.94		
	XE2222222222	25/5/2001		EUR	+1000	-233.60	B/A	0.18	-53.60			
	XE2222222222	29/5/2001		EUR	+500	-90.00	B/A	0.18	0.00			
	XG0000000002	29/5/2001		EUR	-1000	+17300.00	B/A	17.1275	172.5			
	CASH	4/6/2001		EUR	0	+12.34	MID	0	12.34			

Price changes calculation for equity of ISIN 'XE1111111111' [3.5.1.1.1]

Days offset [D]	5	4	3	2	1	0
Date	16/5/2001	17/5/2001	18/5/2001	21/5/2001	22/5/2001	23/5/2001
Mid price (EUR)	12.495	12.2	12.31	12.32	12.72	12.9
Mult exchange rate (EUR to GBP)	0.719424	0.714235	0.714286	0.716846	0.735294	0.729820
Mid price (GBP) [P]	8.98920288	8.713667	8.79286066	8.83154272	9.35293968	9.414678
Δ Price (over 2 days) [(P _{D-2} - P _D)/P _D] (to 6 d.p.)	-0.021842	0.013528	0.063697	0.066029		

Base initial margin calculation for bucket 'LIQUID1'

Days offset	5		4		3		2		0
ISIN (Settlement ccy)	Δ Price [Δ P]	Δ Value [Δ P*V] 3.5.1.1.3	Δ Price [Δ P]	Δ Value [Δ P*V] 3.5.1.1.3	Δ Price [Δ P]	Δ Value [Δ P*V] 3.5.1.1.3	Δ Price [Δ P]	Δ Value [Δ P*V] 3.5.1.1.3	Current Value [V] 3.5.1.1.2
XE1111111111 (EUR)	-0.021842	-436.5639476	0.013528	270.3890249	0.063697	1273.134959	0.066029	1319.745485	19987.361394 =2123*12.9*0.72982
XE1111111111 (GBP)	-0.021842	411.270900	0.013528	-254.717548	0.063697	-1199.373863	0.066029	-1243.277888	-18829.356 =-2000*9.414678*1
XG0000000001 (GBP)	-0.083151	152.99784	0.042857	-78.85688	0.050119	-92.21896	0.050228	-92.41952	-1840 =-400*4.6*1
Daily portfolio value change 3.5.1.1.3 Ranking 3.5.1.1.4		127.704686 1		63.191383 2		18.457490 3		15.957582 4	
Base initial margin 3.5.1.1.4	Drop ranking (1), average rankings (2) and (3), and make the result negative = $-(63.191383 + 18.457490)/2 = -40.824437$								
Portfolio initial margin 3.5.1.1.5	Multiply base initial margin by bucket risk coefficient of 1.25 = $-40.824437 * 1.25 = -51.030546$								

Final initial margin calculations

Portfolio bucket	Currency	Portfolio initial margin 3.5.1.1	By currency 3.5.1.2	In LCH base currency 3.5.1.3	Total portfolio initial margin 3.5.1.4	Total initial margin 3.5.3
LIQUID1	GBP	-51.030546	-51.030546	-136.823186	-205.23	-3386.21
LIQUID2	EUR	-117.55315	-117.55315			
Flat rate ISIN	Currency	Flat rate initial margin 3.5.2.1	By currency 3.5.2.2	In LCH base currency 3.5.2.3	Total flat rate initial margin 3.5.2.4	
XG0000000002	GBP	-99.68	-130.88	-2120.650009	-3180.98	
XG0000000003	GBP	-31.20				
XE3333333333	EUR	-1872.75	-2726.3846			
XG0000000002	EUR	-853.6346				

5. LCH ERA Input Data

The table below describes the data types used in the input data definitions that follow.

Data Type	String Length	Description	Example
Char(n)	n characters	Exactly 'n' text characters.	GBP
Varchar(n)	0 to n characters	From 0 to 'n' characters.	LIQUID1 FLAT5
Date	8 to 10 characters	UK date format (d/m/yyyy). No leading zero for day or month.	4/3/2001 30/11/2001
Integer	1 to 10 characters for positive numbers 1 to 11 characters for negative numbers	Leading sign used for negative numbers. Range -2147483648 to 2147483647.	1234567 -1234567890
Numeric(n dp)	1 to 18 characters including decimal point and sign for negative numbers	Leading '-' sign used for negative numbers. All numeric values will be rounded to the specified number of decimal places (n dp). Trailing zeros to the right of the decimal point are dropped.	1.35 210 -13.456 -23456.900001
Boolean	4 or 5 characters	Will be either TRUE or FALSE.	TRUE FALSE

5.1 Position

Field	Data Type	Description
Account	Varchar(11)	For LCH or an LCH member's position, this is the concatenation of the member mnemonic and the House-Client Indicator. For a GCM this can be the NCM identifier.
ISIN	Varchar(12)	This is the ISIN code of the equity. Set to CASH for cash only deliveries.
Currency	Char(3)	This is the ISO code of the currency.
Net quantity	Integer	This is the unsettled position of the equity and may be zero if there is the same quantity of buys and sells. A debit (-ve value) quantity is a net sell by the member and a credit quantity (+ve value) is a net buy by the member.
Net consideration	Numeric(2*) (* is currency dependent - 2 for GBP and EUR)	This is the sum of the considerations of the trades. A debit consideration (-ve value) is a net payment by the member and a credit consideration (+ve value) is a net receipt by the member. All considerations are for settleable amounts (i.e. no smaller than pennies or cents) and therefore no rounding difficulties arise.
ISD	Date	This is the Intended Settlement Date of the position.

5.2 Price

Field	Data Type	Description
ISIN	Varchar(12)	ISIN code of the equity. Set to CASH for cash only deliveries.
Currency	Char(3)	ISO code of the currency of denomination of the ISIN.
Date	Date	Date of the price.
Bid	Numeric(6)	Latest bid price for the current business day. Will be zero for all historic dates. Represented in major denomination unit (e.g. GBP = pounds, EUR = euros.)
Mid	Numeric(6)	Latest mid price for the date, hence the closing price for all historic dates. Represented in major denomination unit (e.g. GBP = pounds, EUR = euros.)
Ask	Numeric(6)	Latest ask price for the current business day. Will be zero for all historic dates. Represented in major denomination unit (e.g. GBP = pounds, EUR = euros.)
Price change	Numeric(6)	For ISINs margined in a portfolio method bucket, this will be the fractional price change using its bucket parameters.
Days offset	Integer	This gives the number of valid price business days back relative to the current business day (e.g. the current business day = 0, for the previous price date = 1, and so on.)

5.3 Exchange rate

Exchange rates of one between a currency and itself will be provided for all dates.

Field	Data Type	Description
From currency	Char(3)	ISO code of the currency to which the exchange rate is to be applied.
To currency	Char(3)	ISO code of the currency of the result of the exchange rate application.
Date	Date	Date of the price.
Mult exchange rate	Numeric(6)	The value which the 'From' amount should be multiplied by to get the 'To' amount.

5.4 Equity

Field	Data Type	Description
ISIN	Varchar(12)	This is the ISIN code of the equity. Set to CASH for cash only deliveries.
Name	Varchar(255)	Name of the equity.
Currency	Char(3)	This is the ISO code of the currency of denomination of the ISIN.
Assume settlement	Boolean	TRUE = settlement assumed. FALSE = settlement not assumed.
VM price	Char(3)	MID = use MID price for credit & debit position. B/A = use BID price for credit (+ve) position and ASK price for debit (-ve) position.
Bucket code	Varchar(20)	The initial margin bucket appropriate to this equity.

5.5 Bucket

Field	Data Type	Description
Bucket code	Varchar(20)	The bucket code used to reference the following parameters.
Price history days	Integer	For portfolio: the number of historic days prices to be used (including the current day).
Time horizon	Integer	For portfolio: the number of contiguous prices across which price changes are calculated.
Currency	Char(3)	For portfolio: the currency in which all values are calculated.
Discarded portfolio losses	Integer	For portfolio: the number of largest portfolio value changes to be discarded for the purpose of margin calculation.
Averaged portfolio losses	Integer	For portfolio: the number of subsequent largest portfolio value changes to be averaged to calculate the base margin.
Risk coefficient	Numeric(2)	For portfolio: the factor by which the base margin is multiplied.
Bucket type	Char(1)	P = portfolio, F = flat rate.
Risk rate	Numeric(3)	For flat rate: the fraction of the current position value to be collected as margin.

5.6 Global

There will only be one data record per global file.

Field	Data Type	Description
Current business date	Date	Business date for the current margin run.
Margin run type	Char(3)	EOD = end-of-day, ITD = intra-day.
Next LCH business date	Date	The next date on which margins will be calculated.
CVM date	Date	A date used in the calculation of variation margin.
Counterparty multiplier	Numeric(2)	An initial margin multiplier specific to the counterparty. This will be defaulted to one. On rare occasions, LCH's Risk Department may notify the member that this multiplier has been increased. This value should be amended accordingly by the member for reconciliation purposes.
LCH base currency	Char(3)	This is the currency in which the final initial and variation margins will be calculated, reported and posted as liabilities/assets to the members account within LCH for cover purposes.

Appendix A LCH Implementation Details for 'CCP for Equities'

LCH will provide price and parameter data files for the calculation of LCH ERA margins via its public internet website (www.lch.co.uk).

A.1 File descriptions

The data files provided will be 'price', 'exchange rate', 'equity', 'bucket' and 'global' as detailed in section 5.

The files will be comma separated ASCII text. They will contain a header record of the field names as shown in section 5 as 'column headings', and then zero, one or more detail records corresponding in sequence with those headings. No order of records in the files should be implied unless specifically stated below.

Null fields will be represented by a single space.

A.2 Example files

The example files below are those that would be provided by LCH, corresponding with the data sets used in the two worked examples in section 4. (Please note that the counterparty multiplier in the files below is accordingly set to one, whereas the section 4 examples have this parameter set to 1.5. The user will need to change the value to 1.5 in the global file to match the results given in section 4.)

A.2.1 End-of-day 22/5/2001.

A.2.1.1 Price

The price file is ordered by 'ISIN' ascending, 'Currency' ascending, 'Date' descending.

ISIN, Currency, Date, Bid, Mid, Ask, Price change, Days offset

```
CASH, EUR, 22/5/2001, , 0, , , 0
CASH, GBP, 22/5/2001, , 0, , , 0
XE1111111111, EUR, 22/5/2001, , 12.72, , , 0
XE1111111111, EUR, 21/5/2001, , 12.32, , , 1
XE1111111111, EUR, 18/5/2001, , 12.31, , 0.063697, 2
XE1111111111, EUR, 17/5/2001, , 12.2, , 0.013528, 3
XE1111111111, EUR, 16/5/2001, , 12.495, , -0.021842, 4
XE1111111111, EUR, 15/5/2001, , 12.5, , -0.043657, 5
XE2222222222, EUR, 22/5/2001, 0.235, 0.24, 0.245, , 0
XE2222222222, EUR, 21/5/2001, 0.26, 0.2775, 0.295, , 1
XE2222222222, EUR, 18/5/2001, 0.27, 0.285, 0.3, -0.157895, 2
XE2222222222, EUR, 17/5/2001, 0.225, 0.235, 0.245, 0.180851, 3
XE2222222222, EUR, 16/5/2001, 0.22, 0.2275, 0.235, 0.252747, 4
XE2222222222, EUR, 15/5/2001, 0.21, 0.23, 0.25, 0.021739, 5
XE3333333333, EUR, 22/5/2001, , 123.45, , , 0
XG0000000001, GBP, 22/5/2001, , 4.4, , , 0
XG0000000001, GBP, 21/5/2001, , 4.38, , , 1
XG0000000001, GBP, 18/5/2001, , 4.19, , 0.050119, 2
XG0000000001, GBP, 17/5/2001, , 4.2, , 0.042857, 3
XG0000000001, GBP, 16/5/2001, , 4.57, , -0.083151, 4
XG0000000001, GBP, 15/5/2001, , 4.6, , -0.086957, 5
XG0000000002, GBP, 22/5/2001, 12.96, 12.99, 13.02, , 0
```

XG0000000003, GBP, 22/5/2001, , 0.5, , , 0

A.2.1.2 Exchange rate

From currency, To currency, Date, Multi exchange rate

EUR, GBP, 15/5/2001, 0.728916
 EUR, GBP, 16/5/2001, 0.719424
 EUR, GBP, 17/5/2001, 0.714235
 EUR, GBP, 18/5/2001, 0.714286
 EUR, GBP, 21/5/2001, 0.716846
 EUR, GBP, 22/5/2001, 0.735294
 GBP, EUR, 15/5/2001, 1.371900
 GBP, EUR, 16/5/2001, 1.390000
 GBP, EUR, 17/5/2001, 1.400100
 GBP, EUR, 18/5/2001, 1.400000
 GBP, EUR, 21/5/2001, 1.395000
 GBP, EUR, 22/5/2001, 1.360000
 EUR, EUR, 15/5/2001, 1
 EUR, EUR, 16/5/2001, 1
 EUR, EUR, 17/5/2001, 1
 EUR, EUR, 18/5/2001, 1
 EUR, EUR, 21/5/2001, 1
 EUR, EUR, 22/5/2001, 1
 GBP, GBP, 15/5/2001, 1
 GBP, GBP, 16/5/2001, 1
 GBP, GBP, 17/5/2001, 1
 GBP, GBP, 18/5/2001, 1
 GBP, GBP, 21/5/2001, 1
 GBP, GBP, 22/5/2001, 1

A.2.1.3 Equity

ISIN, Name, Currency, Assume settlement, VM price, Bucket code

XE1111111111, IRL BANK, EUR, TRUE, MID, LIQUID1
 XE2222222222, IRL TELECOM, EUR, FALSE, B/A, LIQUID2
 XE3333333333, COMPANIE, EUR, TRUE, MID, FLAT5
 XG0000000001, ABC PLC, GBP, FALSE, MID, LIQUID1
 XG0000000002, DEF PLC, GBP, TRUE, B/A, FLAT5
 XG0000000003, GHI PLC, GBP, TRUE, MID, FLAT10
 CASH, EUR cash only, EUR, TRUE, MID, FLAT0
 CASH, GBP cash only, GBP, TRUE, MID, FLAT0

A.2.1.4 Bucket

Bucket code, Price history days, Time horizon, Currency, Discarded portfolio losses, Averaged portfolio losses, Risk coefficient, Bucket type, Risk rate

LIQUID1, 6, 2, GBP, 1, 2, 1.25, P,
 LIQUID2, 6, 2, EUR, 2, 1, 1.3, P,
 FLAT5, , , , , , F, 0.05
 FLAT10, , , , , , F, 0.1

FLAT0, , , , , F, 0

A.2.1.5 Global

Current business date, Margin run type, Next LCH business date, CVM date, Counterparty multiplier, LCH base currency

22/5/2001, EOD, 23/5/2001, 24/5/2001, 1, GBP

A.2.2 Intra-day 23/5/2001.

A.2.2.1 Price

The price file is ordered by 'ISIN' ascending, 'Currency' ascending, 'Date' descending.

ISIN, Currency, Date, Bid, Mid, Ask, Price change, Days offset

CASH, EUR, 23/5/2001, , 0, , , 0
 CASH, GBP, 23/5/2001, , 0, , , 0
 XE1111111111, EUR, 23/5/2001, , 12.90, , , 0
 XE1111111111, EUR, 22/5/2001, , 12.72, , , 1
 XE1111111111, EUR, 21/5/2001, , 12.32, , 0.066029, 2
 XE1111111111, EUR, 18/5/2001, , 12.31, , 0.063697, 3
 XE1111111111, EUR, 17/5/2001, , 12.2, , 0.013528, 4
 XE1111111111, EUR, 16/5/2001, , 12.495, , -0.021842, 5
 XE1111111111, GBP, 23/5/2001, , 9.414678, , , 0
 XE1111111111, GBP, 22/5/2001, , 9.35294, , , 1
 XE1111111111, GBP, 21/5/2001, , 8.831543, , 0.066029, 2
 XE1111111111, GBP, 18/5/2001, , 8.792861, , 0.063697, 3
 XE1111111111, GBP, 17/5/2001, , 8.713667, , 0.013528, 4
 XE1111111111, GBP, 16/5/2001, , 8.989203, , -0.021842, 5
 XE2222222222, EUR, 23/5/2001, 0.18, 0.2, 0.22, , 0
 XE2222222222, EUR, 22/5/2001, 0.235, 0.24, 0.245, , 1
 XE2222222222, EUR, 21/5/2001, 0.26, 0.2775, 0.295, -0.279279, 2
 XE2222222222, EUR, 18/5/2001, 0.27, 0.285, 0.3, -0.157895, 3
 XE2222222222, EUR, 17/5/2001, 0.225, 0.235, 0.245, 0.180851, 4
 XE2222222222, EUR, 16/5/2001, 0.22, 0.2275, 0.235, 0.252747, 5
 XE3333333333, EUR, 23/5/2001, , 124.85, , , 0
 XG0000000001, GBP, 23/5/2001, , 4.6, , , 0
 XG0000000001, GBP, 22/5/2001, , 4.4, , , 1
 XG0000000001, GBP, 21/5/2001, , 4.38, , 0.050228, 2
 XG0000000001, GBP, 18/5/2001, , 4.19, , 0.050119, 3
 XG0000000001, GBP, 17/5/2001, , 4.2, , 0.042857, 4
 XG0000000001, GBP, 16/5/2001, , 4.57, , -0.083151, 5
 XG0000000002, EUR, 23/5/2001, 17.017884, 17.072692, 17.1275, , 0
 XG0000000002, GBP, 23/5/2001, 12.42, 12.46, 12.5, , 0
 XG0000000003, GBP, 23/5/2001, , 0.52, , , 0

A.2.2.2 Exchange rate

From currency, To currency, Date, Multi exchange rate

EUR, GBP, 16/5/2001, 0.719424
 EUR, GBP, 17/5/2001, 0.714235
 EUR, GBP, 18/5/2001, 0.714286
 EUR, GBP, 21/5/2001, 0.716846
 EUR, GBP, 22/5/2001, 0.735294
 EUR, GBP, 23/5/2001, 0.729820
 GBP, EUR, 16/5/2001, 1.390000

GBP, EUR, 17/5/2001, 1.400100
 GBP, EUR, 18/5/2001, 1.400000
 GBP, EUR, 21/5/2001, 1.395000
 GBP, EUR, 22/5/2001, 1.360000
 GBP, EUR, 23/5/2001, 1.370200
 EUR, EUR, 16/5/2001, 1
 EUR, EUR, 17/5/2001, 1
 EUR, EUR, 18/5/2001, 1
 EUR, EUR, 21/5/2001, 1
 EUR, EUR, 22/5/2001, 1
 EUR, EUR, 23/5/2001, 1
 GBP, GBP, 16/5/2001, 1
 GBP, GBP, 17/5/2001, 1
 GBP, GBP, 18/5/2001, 1
 GBP, GBP, 21/5/2001, 1
 GBP, GBP, 22/5/2001, 1
 GBP, GBP, 23/5/2001, 1

A.2.2.3 Equity

ISIN, Name, Currency, Assume settlement, VM price, Bucket code

XE1111111111, IRL BANK, EUR, TRUE, MID, LIQUID1
 XE1111111111, IRL BANK, GBP, TRUE, MID, LIQUID1
 XE2222222222, IRL TELECOM, EUR, FALSE, B/A, LIQUID2
 XE3333333333, COMPANIE, EUR, TRUE, MID, FLAT5
 XG0000000001, ABC PLC, GBP, FALSE, MID, LIQUID1
 XG0000000002, DEF PLC, EUR, TRUE, B/A, FLAT5
 XG0000000002, DEF PLC, GBP, TRUE, B/A, FLAT5
 XG0000000003, GHI PLC, GBP, TRUE, MID, FLAT10
 CASH, EUR cash only, EUR, TRUE, MID, FLAT0
 CASH, GBP cash only, GBP, TRUE, MID, FLAT0

A.2.2.4 Bucket

Bucket code, Price history days, Time horizon, Currency, Discarded portfolio losses, Averaged portfolio losses, Risk coefficient, Bucket type, Risk rate

LIQUID1, 6, 2, GBP, 1, 2, 1.25, P,
 LIQUID2, 6, 2, EUR, 2, 1, 1.3, P,
 FLAT5, , , , , , F, 0.05
 FLAT10, , , , , , F, 0.1
 FLAT0, , , , , , F, 0

A.2.2.5 Global

Current business date, Margin run type, Next LCH business date, CVM date, Counterparty multiplier, LCH base currency

23/5/2001, ITD, 24/5/2001, 24/5/2001, 1, GBP

Appendix B CREST Implementation Details for ‘CCP for Equities’

For the ‘CCP for Equities’ service applicable to London Stock Exchange SETS and SEAQ auctions trades, CREST is the source of net positions to both LCH and the market. CREST is also providing other data as described in outline below. For full details of CREST interfaces, please refer to the CREST Data Exchange Manual (DEX), CREST technical newsletters and CREST whitebooks relating to the ‘CCP for Equities’ service.

B.1 Input data

CREST is providing net positions in a format similar to the ‘position’ file described in this document.¹ Note that no ISIN will be supplied for cash only positions, rather than the dummy ISIN of “CASH” used in LCH reference data.

CREST is providing prices in a format similar to the ‘price’ file described in this document, but without the ‘Price change’ and ‘Days offset’ fields. These can be derived from the price data as described in this document. Also, CREST will not be providing price records of zero for cash. These records are required by PC ERA and potentially by third party implementations of LCH ERA. (Please note that the full ‘price’ file is available from LCH as described in Appendix A).

B.2 Results enquiries

Two margin results enquiries are being provided by CREST.

The ‘Variation Margin Details Enquiry’ will provide the ‘equity variation margins’ as calculated in section 3.4.1. Note that no ISIN will be supplied for cash only positions, rather than the dummy ISIN of “CASH” used in LCH reference data.

The ‘Margin Summary Enquiry’ will provide the ‘total variation margin’ as finally calculated in section 3.4.2.4, the ‘total portfolio initial margin’ as finally calculated in section 3.5.1.4, and the ‘total flat rate initial margin’ as finally calculated in section 3.5.2.4.

These results will only be those calculated by LCH for their members’ ‘financial account(s)’.

¹ It should be noted that any corporate action residual outturn will be assumed by CREST to settle on its ISD and hence will not be included in the net positions available from CREST from then on. LCH will keep its own records of any residual that does not settle on its ISD and will margin these open positions, but separately from those positions available from CREST.