COMMODITY DERIVATIVES RISK ENGINE

File set for margin replication

Content and format specifications

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1 Introduction

The present document contains the content and format specifications of the public risk data files which can be employed to replicate Euronext Agricultural derivatives EOD margins.

2 What's new

REVISION NO./ VERSION NO.	DATE	CHANGE DESCRIPTION
1.0	30/06/2023	Publication of the first version of the specifications of the public margin replication (risk data) files
2.0	23/02/2024	• Addition of file naming convention • Addition of the *und_price* field to the 'RF05C' file • Introduction of some refinements to the specifications
3.0	24/04/2024	• Refinement of the description of *sub_ptf* field in 'RF04C' file (expired instruments)
4.0	05/11/2024	• Addition of a margin replication user guide section
5.0	13/12/2024	• Addition of public risk data files to replicate margin add-ons other than *Decorrelation risk add-on* ('RF09C', 'RF010C', 'RF011C', 'RF012C', 'RF013C', 'RF014C') • Addition of a public risk data file containing unitary margins ('RF00C')

3 Scope of replicable margin components

- *Mark-to-market Margins*;
- *Variation Margins*;
- *Initial Margins* (including margins on futures positions under physical delivery process, i.e. *Delivery Margins*);
- *Decorrelation risk add-on*;
- *Liquidity risk add-on*;
- *Concentration risk add-on*;
- *Settlement risk add-on*.

4 Unitary margins ('RF00C')

4.1 Content

Initial Margins (a.k.a. 'what-if' margins - *Decorrelation risk add-on* is obviously equal to 0) on portfolios consisting of a long/short one-contract position in the instrument at the evaluation date (EOD).

Only unexpired futures available in the 'RF02C1' and 'RF04C' public risk data files published at the same evaluation date are included.
As for futures which fall into the 'SUB2' sub-portfolio according to the adopted portfolio margining methodology, figures are not adjusted by any margin or increasing percentages.

.csv file composed by a first header row + *1* value row (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
instr_id	String		Product ISIN code
instr_curcy	String		Product denomination currency code (ISO 4217, 3 chars)
mult	Float		Product multiplier
long_margin_pct	Float		Margin amount on a long position expressed as percentage of price (e.g. 10% expressed as 0.1). -1 fallback value in case of impossible/meaningless ratios (e.g. division by a price <=0)
long_margin_amount	Float		Margin amount on a long position, including multiplier, expressed in EUR
short_margin_pct	Float		Margin amount on a short position expressed as percentage of price (e.g. 10% expressed as 0.1). -1 fallback value in case of impossible/meaningless ratios (e.g. division by a price <=0)
short_margin_amount	Float		Margin amount on a short position, including multiplier, expressed in EUR

5 Model parameters ('RF01C1')

5.1 Content

Model parameters for the calculation of the *Initial Margins*, the *Decorrelation risk add-on* and *Concentration risk add-on*.

.csv file composed by a first header row + *1* value row (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
ord_cl	Float	∈ (0, 1)	Ordinary *Initial Margins* confidence level
stress_cl	Float	∈ (0, 1)	Stressed *Initial Margins* confidence level
deco	Float	∈ [0, 1]	*Decorrelation risk add-on* parameter
ord_w	Float	∈ [0, 1]	Ordinary weight
stress_w	Float	∈ [0, 1]	Stressed weight
hp	Integer	1, 2, 3, …	(Model) Holding period
sub	Integer	1, 2, 3, …	'SUB1'-'SUB2' sub-portfolio separator (number of markets days between evaluation date and expiry date of the physical delivery futures)

6 Model parameters for physical delivery (‘RF01C2’)

6.1 Content

Additional model parameters for the calculation of the *Initial Margins* for futures positions approaching and under physical delivery (‘SUB2’ and ‘SUB3’ sub-portfolios).

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
symbol_code	String		Euronext contract code
instr_curcy	String		Product denomination currency code (ISO 4217, 3 chars)
pos_sign	String	‘L’, ‘S’	‘L’: long, ‘S’: short
extra_pct	Float	∈ [0, 1]	Extra percentage
margin_pct	Float	∈ [0, 1]	Margin percentage
fee_pct	Float	∈ [0, 1]	Fee percentage

7 Instrument scenario prices ('RF02C1')

7.1 Content

Instrument scenario prices (including current scenario, which must be employed to compute instrument scenario profits/losses) for the calculation of the *Initial Margins,* the *Decorrelation risk add-on* and the *Concentration risk add-on* for positions not under physical delivery ('SUB1' and 'SUB2' sub-portfolios).

A product is represented by the **instr_id**-**instr_curcy** combination.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
scenario	String	'C', 'S', 'U'	Scenario type, current ('C' – single record per product), ordinary (scaled, 'S' – multiple records per product) or stressed (unscaled, 'U' – multiple records per product)
instr_id	String		Product ISIN code
instr_curcy	String		Product denomination currency code (ISO 4217, 3 chars)
ref_dt	Integer		Evaluation date YYYYMMDD for (current) **scenario** = 'C' (single record)/scenario date YYYYMMDD for both **scenario** = 'S' and **scenario** = 'U' (multiple records each – the number of ordinary and stressed scenarios may differ)
value	Float		Product scenario value

7.2 Minimum scope of instruments contained in the file

Options with non-0 EOD O/I (at margin account level) and all (unexpired) futures.

8 Instrument scenario prices for physical delivery ('RF02C2')

8.1 Content

Instrument scenario prices (including current scenario, which must be employed to compute instrument scenario profits/losses) for the calculation of the *Initial Margins* for futures positions under physical delivery ('SUB3' sub-portfolio).

A product is represented by the **instr_id**-**instr_curcy** combination.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
scenario	String	'C', 'S', 'U'	Scenario type, current ('C' – single record per product), ordinary (scaled, 'S' – multiple records per product) or stressed (unscaled, 'U' – multiple records per product)
instr_id	String		Product ISIN code
instr_curcy	String		Product denomination currency code (ISO 4217, 3 chars)
symbol_code	String		Euronext contract code
mult	Float		Product multiplier
hppd	Integer	1, 2, 3, …	(Physical delivery) Holding period employed to compute the scenario prices for a given product
ref_dt	Integer		Evaluation date YYYYMMDD for (current) **scenario** = 'C' (single record)/scenario date YYYYMMDD for both **scenario** = 'S' and **scenario** = 'U' (multiple records each – the number of ordinary and stressed scenarios may differ)
value	Float		Product scenario value (equal to delivery settlement price for **current** scenario = 'C')

File will be produced even if empty.

8.2 Minimum scope of instruments contained in the file

Expired futures under physical delivery.

9 FX scenario values ('RF03C1')

9.1 Content

Exchange rate scenario values (including current scenario) for the calculation of the *Initial Margins*, the *Decorrelation risk add-on* and the *Concentration risk add-on* for positions not under physical delivery ('SUB1' and 'SUB2' sub-portfolios).
Current scenario exchange rates can be employed to compute *Mark-to-market* (*Premium) Margins* and *Liquidity risk add-on*.

A FX is represented by the **base_curcy**-**counter_curcy** combination.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
scenario	String	'C', 'S', 'U'	Scenario type, current ('C' – single record per FX), ordinary (scaled, 'S' – multiple records per FX) or stressed (unscaled, 'U' – multiple records per FX)
base_curcy	String		Product currency code (ISO 4217, 3 chars, e.g. 'USD')
counter_curcy	String	'EUR'	Clearing currency code (ISO 4217, 3 chars, i.e. 'EUR')
ref_dt	Integer		Evaluation date YYYYMMDD for (current) **scenario** = 'C' (single record)/scenario date YYYYMMDD for both **scenario** = 'S' and **scenario** = 'U' (multiple records each – the number of ordinary and stressed scenarios may differ)
value	Float		FX scenario value

9.1 Minimum scope of FXs contained in the file

Based on RF02C1's **instr_curcy** list (RF03C1's **base_curcy** – RF03C1's **counter_curcy** will always equal 'EUR').

10 FX scenario values for physical delivery ('RF03C2')

10.1 Content

Exchange rate scenario values (including current scenario) for the calculation of the *Initial Margins* for futures positions under physical delivery ('SUB3' sub-portfolio).

An FX is represented by the **base_curcy-counter_curcy** combination.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
scenario	String	'C', 'S', 'U'	Scenario type, current ('C' – single record per FX), ordinary (scaled, 'S' – multiple records per FX) or stressed (unscaled, 'U' – multiple records per FX)
base_curcy	String		Product currency code (ISO 4217, 3 chars, e.g. 'USD')
counter_curcy	String	'EUR'	Clearing currency code (ISO 4217, 3 chars, i.e. 'EUR')
hppd	Integer	1, 2, 3, …	(Physical delivery) Holding period employed to compute the scenario values for a given FX
ref_dt	Integer		Evaluation date YYYYMMDD for (current) **scenario** = 'C' (single record)/scenario date YYYYMMDD for both **scenario** = 'S' and **scenario** = 'U' (multiple records each – the number of ordinary and stressed scenarios may differ)
value	Float		FX scenario value

File will be produced even if empty.

10.1 Minimum scope of FXs contained in the file

Based on RF02C2's **instr_curcy** list (RF03C2's **base_curcy** – RF03C2's **counter_curcy** will always equal 'EUR').

11 Instrument prices & referential data ('RF04C')

11.1 Content

Instrument price and referential (static) data.

A product is represented by the **instr_id**-**instr_curcy** combination.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
instr_id	String		Product ISIN code
instr_curcy	String		Product denomination currency code (ISO 4217, 3 chars)
symbol_code	String		Euronext contract code
asset_type	String	'F', 'O'	Product type, futures ('F') or option ('O')
mat_dt	Integer		Product expiry date YYYYMMDD
mult	Float		Product multiplier
settl_type	String	'C', 'P'	Product settlement type, cash settlement ('C') or physical delivery ('P')
option_type	String	'C', 'P', 'N'	Option type, call ('C') or put ('P') ('N' for futures)
strike	Float		Option strike price (0.0 for futures)
und_instr_id	String		Underlying product ISIN code (equal to **instr_id** for futures)
und_curcy	String		Underlying product currency code (ISO 4217, 3 chars - equal to **instr_curcy** for futures)
deco_code	String		Cluster identifier for *Decorrelation risk add-on* grouping
prod_group	String		Product group for separate SUB1 sub-portfolio margining
sub_ptf	String	'SUB1', 'SUB2', 'SUB3'	Sub-portfolio the product belongs to: 'SUB1' or 'SUB2' value for unexpired instruments; as for expired instruments, 'SUB3' value in case of physical delivery futures and 'SUB1' value in all other cases
price	Float		Product settlement/closing price

11.2 Minimum scope of instruments contained in the file

Based on RF02C1's instrument list.

12 Expiry data ('RF05C')

12.1 Content

Final settlement price and underlying price (taken as reference for option exercise) of instruments expiring on evaluation date.

A product is represented by the **instr_id**-**instr_curcy** combination.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
instr_id	String		Product ISIN code
instr_curcy	String		Product denomination currency code (ISO 4217, 3 chars)
price	Float		Product final settlement price
und_price	Float		Product underlying price (taken as reference for option exercise)

File will be produced even if empty.

12.2 Minimum scope of instruments contained in the file

All instruments expired on evaluation date.

13 Option deltas ('RF07C')

13.1 Content

Delta of options.

A product is represented by the **instr_id**-**instr_curcy** combination.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
instr_id	String		Product ISIN code
instr_curcy	String		Product denomination currency code (ISO 4217, 3 chars)
delta	Float		Option delta

13.2 Minimum scope of instruments contained in the file

All (unexpired) options.

14 Market calendar (‘RF08C’)

14.1 Content

Employed market calendar (from evaluation date – included – onwards, for a sufficient number of dates equal to 250) for SUB2 sub-portfolio *Initial Margins* and *Settlement add-on* calculation purposes.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
mkt_dt	Integer		Market date YYYYMMDD

15 Liquidity risk add-on – spreads ('RF09C')

15.1 Content

Instrument bid-ask spreads for *Liquidity risk add-on* calculation purposes.

A product is represented by the **instr_id**-**instr_curcy** combination.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
instr_id	String		Product ISIN code
instr_curcy	String		Product denomination currency code (ISO 4217, 3 chars)
spread	Float		Bid-ask spread
spread_mult	Float		Bid-ask spread multiplier

15.2 Minimum scope of instruments contained in the file

Based on RF02C1's instrument list.

16 Concentration risk add-on – delta concentration bands ('RF10C')

16.1 Content

Stressed holding periods associated to the concentration ratio bands under *delta* approach for *Concentration risk add-on* calculation purposes.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
cr_down_delta	Float		Percentage representing the lower bound of the concentration ratio associated to the stressed holding period (included; the following stressed holding period's **cr_down_delta** will represent its upper bound – excluded)
hp_conc_delta	Integer	1, 2, 3, …	Stressed holding period

17 Concentration risk add-on – vega concentration bands ('RF11C')

17.1 Content

Stressed holding periods associated to the concentration ratio bands under *vega* approach for *Concentration risk add-on* calculation purposes.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
cr_down_vega	Float		Percentage representing the lower bound of the concentration ratio associated to the stressed holding period (included; the following stressed holding period's **cr_down_vega** will represent its upper bound – excluded)
hp_conc_vega	Integer	1, 2, 3, …	Stressed holding period

18 Concentration risk add-on – instrument clustering ('RF12C')

18.1 Content

Instrument clusters for *Concentration risk add-on* calculation purposes.

A product is represented by the **instr_id**-**instr_curcy** combination.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
instr_id	String		Product ISIN code
instr_curcy	String		Product denomination currency code (ISO 4217, 3 chars)
conc_code	String		Cluster identifier for *Concentration risk add-on* grouping ('NA' for options)

18.2 Minimum scope of instruments contained in the file

Based on RF02C1's instrument list.

19 Concentration risk add-on – trading volumes ('RF13C')

19.1 Content

Average daily trading volumes associated to the clusters under both *delta* and *vega* approaches for *Concentration risk add-on* calculation purposes.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
conc_code	String		Cluster identifier for *Concentration risk add-on* grouping ('NA' for options)

trade_vols_delta	Float		Cluster average daily trading volume under *delta* approach
trade_vols_vega	Float		Cluster average daily trading volume under *vega* approach

19.2 Minimum scope of clusters contained in the file

Based on RF02C1's instrument list.

20 Concentration risk add-on – option greeks ('RF14C')

20.1 Content

Delta and *vega* of options at evaluation date for *Concentration risk add-on* calculation purposes.

.csv file composed by a first header row + *n* value rows (delimiter: comma; decimal separator: dot):

Field name	Field type	Possible field values	Field description
instr_id	String		Product ISIN code
instr_curcy	String		Product denomination currency code (ISO 4217, 3 chars)
delta_conc	Float		*Delta*
vega_conc	Float		*Vega*

20.2 Scope of options contained in the file

Based on RF02C1's instrument list.

EURONEXT CLEARING

21 File naming convention

Archive file: 'COMDER_<yyyymmddhhmmss>.zip'

Data files: 'COMDER_<yyyymmdd>_rf<id>_<subtype>.csv', with:

- <id> ∈ ['00', '01', '02', '03', '04', '05', '07', '08', '09', '10', '11', '12', '13', '14'];
- <subtype> ∈ ['STD', 'PD'] so that:
    - 'RF00C': 'rf00_STD';
    - 'RF01C1': 'rf01_STD';
    - 'RF01C2': 'rf01_PD';
    - 'RF02C1': 'rf02_STD';
    - 'RF02C2': 'rf02_PD';
    - 'RF03C1': 'rf03_STD';
    - 'RF03C2': 'rf03_PD';
    - 'RF04C': 'rf04_STD';
    - 'RF05C': 'rf05_STD';
    - 'RF07C': 'rf07_STD';
    - 'RF08C': 'rf08_STD';
    - 'RF09C': 'rf09_STD';
    - 'RF10C': 'rf10_STD';
    - 'RF11C': 'rf11_STD';
    - 'RF12C': 'rf12_STD';
    - 'RF13C': 'rf13_STD';
    - 'RF14C': 'rf14_STD'.

Example:
'COMDER_20240223233015.zip'\'COMDER_20240223_rf02_STD.csv'

22 Margin replication user guide

In the following we assume that those willing to replicate the various replicable margin components possess an input file containing portfolios of open positions in (unexpired) instruments with net numbers of contracts expressed as positive if the net quantity is long and as negative if the net quantity is short. We will call such portfolios e.g. *ptf* and numbers of contracts e.g. *n_contracts*.

The same applies to the delivery instructions in expired futures for *Delivery Margins* (i.e. 'SUB3' sub-portfolio *Initial Margins*) calculation purposes, the only difference being that such delivery instructions must not be netted if both long and short delivery instructions in a given instrument are associated to the same portfolio. We will call such delivery instructions e.g. *di*.

22.1 Mark-to-market Margins and Variation Margins

22.1.1 Mark-to-market Margins

Mark-to-market Margins on open option positions are computed leveraging on *price* and *mult* fields of the 'RF04C' file. The computation is the following:

$$-n\_contracts * price * mult,$$

to express credits (long options) as negative amounts and debts (short options) as positive amounts.

The total *Mark-to-market Margins* amount (hereinafter called e.g. *MtmM*) is equal to the algebraic sum of the *Mark-to-market Margins* computed at single position level (in turn corresponding to the current value of the option).

22.1.2 Variation Margins

We assume that those willing to replicate the *Variation Margins* on open futures positions/trades have available either the previous EOD price or the trade price of the futures, depending on the fact that the *Variation Margins* must be computed on a previous EOD position or on a new (daily) trade, respectively. We will generically call such price e.g. *prev_price*.

In case of futures positions 'generated' by the exercise/assignment of an option the first *prev_price* is the strike price of the option.

Variation Margins are computed leveraging on *price* and *mult* fields of the 'RF04C' file. The computation is the following:

$$-n\_contracts * (price - prev\_price) * mult,$$

to express credits as negative amounts and debts as positive amounts.

The total *Variation Margins* amount (hereinafter called e.g. *VM*) is equal to the algebraic sum of the *Variation Margins* computed at single position/trade level.

22.2 Initial Margins and Decorrelation risk add-on

22.2.1 'SUB1' sub-portfolio

22.2.1.1 Initial Margins

22.2.1.1.1 Data preparation

'RF03C1' file must be filtered for *counter_curcy* field equal to 'EUR'.
The *base_curcy* field will have to be matched against *instr_curcy* field of 'RF02C1' file, hence it may be useful to rename it *instr_curcy* itself.
It may also be useful to rename the *value* field as e.g. *fx*, so that when joining 'RF03C1' and 'RF02C1' files there are no multiple *value* fields.

Instrument current prices can be found in the 'RF02C1' file, filtering *scenario* field equal to 'C'.
It may be useful to create a dataframe with current prices only, renaming its *value* field as e.g. *current_value*.

Exchange rate current values can be found in the 'RF03C1' file, filtering *scenario* field equal to 'C'.
It may be useful to create a dataframe with current values only, renaming its *value* (*fx* if renamed) field as e.g. *current_fx*.

Instrument scenario prices can be found in the 'RF02C1' file, filtering *scenario* field equal to 'S' (Scaled, ordinary) or 'U' (Unscaled, stressed).
It may be useful to create a dataframe with such prices.

Exchange rate scenario values can be found in the 'RF03C1' file, filtering *scenario* field equal to 'S' (Scaled, ordinary) or 'U' (Unscaled, stressed).
It may be useful to create a dataframe with such values.

The dataframe with instrument scenario prices can be (left) joined to the dataframe with instrument current prices (on *instr_id* and *instr_curcy* fields), to the dataframe with exchange rate scenario values (on *scenario*, *instr_curcy* and *ref_dt* fields) and to the dataframe with exchange rate current values (on *instr_curcy* field).

The resulting dataframe has the following shape (focusing on a given sample instrument and assuming that there are just 3 'S' *scenario*s and 2 'U' *scenarios*):

scenario	instr_id	instr_curcy	ref_dt	value	current_value	fx	current_fx
'S'	'FR0000000001'	'USD'	20240620	105.0	100.0	0.98	0.99
'S'	'FR0000000001'	'USD'	20240619	95.0	100.0	1.00	0.99
'S'	'FR0000000001'	'USD'	20240618	100.0	100.0	0.99	0.99
'U'	'FR0000000001'	'USD'	20220304	110.0	100.0	0.97	0.99
'U'	'FR0000000001'	'USD'	20220303	90.0	100.0	1.01	0.99

There is then the need for (at least) the *asset_type*, *mult*, *deco_code*, *prod_group* and *sub_ptf* fields of the 'RF04C' file (again, left joining on *instr_id* and *instr_curcy* fields).

Instruments with *sub_ptf* field equal to 'SUB2' must be margined instrument-wise, while 'SUB1' instruments must be margined portfolio-wise. It may be then useful to label the former as e.g. 'SUB2_instr_id_instr_curcy', so that they can form a single-instrument sub-portfolio ready to be margined individually.

22.2.1.1.2 Instrument P&L calculation

An instrument profit/loss (hereinafter called e.g. *pnl*) can be computed this way:

$(value - current\_value) * fx * mult$ if its *asset_type* is equal to 'F' and

$(value * fx - current\_value * current\_fx) * mult$ if its *asset_type* is equal to 'O'.

Example

Focusing on the same sample instrument with 3 'S' *scenario*s and 2 'U' *scenario*s:

…	value	current_value	fx	current_fx	asset_type	mult	…	pnl
…	105.0	100.0	0.98	0.99	'F'	50.0	…	245.0
…	95.0	100.0	1.00	0.99	'F'	50.0	…	-250.0
…	100.0	100.0	0.99	0.99	'F'	50.0	…	0.0
…	110.0	100.0	0.97	0.99	'F'	50.0	…	485.0
…	90.0	100.0	1.01	0.99	'F'	50.0	…	-505.0

22.2.1.1.3 Portfolio P&L calculation

The dataframe containing instrument *pnl*s obtained as described above can be (left) joined to the dataframe containing the portfolios *ptf*s. The fields on which the dataframes will have to be joined depend on how instruments are identified in the dataframe containing the portfolios *ptf*s (instrument referential data being retrievable in the 'RF04C' file).

Every *pnl* must be multiplied by the number of contracts *n_contracts* associated to the instrument, obtaining a portfolio profit/loss for the instrument, this way:

$-n\_contracts * pnl,$

to express profits as negative amounts and losses as positive amounts.

Example

Always sticking to the above example and introducing a *ptf* 'ptf01' having a single position of *n_contracts* 2 in the instrument:

…	ptf	n_contracts	pnl
…	'ptf01'	2	-2 * 245.0 = -490.0
…	'ptf01'	2	-2 * -250.0 = 500.0
…	'ptf01'	2	-2 * 0.0 = 0.0
…	'ptf01'	2	-2 * 485.0 = -970.0
…	'ptf01'	2	-2 * -505.0 = 1010.0

22.2.1.1.3.1 Initial Margins ('diversified') approach

It's then possible to group *pnl*s by *ptf*, *sub_ptf*, *prod_group*, *scenario* and *ref_dt* fields (all other fields can be disregarded), summing to obtain a ('diversified') portfolio P&L distribution. This distribution will be used to compute the portfolio risk measure (i.e. *Initial Margins*).

Example

Let's assume now we have three *ptf*s ('ptf01', 'ptf02' and 'ptf03'). The dataframe resulting from the above described step would look like the below. Please notice that two *ptf*s ('ptf01', taken from the previous example, and 'ptf02') only have positions in 'SUB1'-'PG1' instruments (as for 'ptf01' *ptf* actually 1 instrument), while the other ('ptf03') has positions in 'SUB1'-'PG1', 'SUB1'-'PG2' and 'SUB2'-'PG1' instruments. The assumption that there are just 3 'S' *scenario*s and 2 'U' *scenario*s for all instruments still holds.

ptf	sub_ptf	prod_group	scenario	ref_dt	pnl
'ptf01'	'SUB1'	'PG1'	'S'	20240620	-490.0
'ptf01'	'SUB1'	'PG1'	'S'	20240619	500.0
'ptf01'	'SUB1'	'PG1'	'S'	20240618	0.0
'ptf01'	'SUB1'	'PG1'	'U'	20220304	-970.0
'ptf01'	'SUB1'	'PG1'	'U'	20220303	1010.0
'ptf02'	'SUB1'	'PG1'	'S'	20240620	150.0
'ptf02'	'SUB1'	'PG1'	'S'	20240619	-150.0
'ptf02'	'SUB1'	'PG1'	'S'	20240618	0.0
'ptf02'	'SUB1'	'PG1'	'U'	20220304	25.0
'ptf02'	'SUB1'	'PG1'	'U'	20220303	-25.0
'ptf03'	'SUB1'	'PG1'	'S'	20240620	75.0
'ptf03'	'SUB1'	'PG1'	'S'	20240619	-75.0
'ptf03'	'SUB1'	'PG1'	'S'	20240618	0.0
'ptf03'	'SUB1'	'PG1'	'U'	20220304	-5.0
'ptf03'	'SUB1'	'PG1'	'U'	20220303	0.0
'ptf03'	'SUB1'	'PG2'	'S'	20240620	50.0
'ptf03'	'SUB1'	'PG2'	'S'	20240619	100.0
'ptf03'	'SUB1'	'PG2'	'S'	20240618	-100.0
'ptf03'	'SUB1'	'PG2'	'U'	20220304	0.0
'ptf03'	'SUB1'	'PG2'	'U'	20220303	0.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'S'	20240620	1.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'S'	20240619	2.0

'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'S'	20240618	3.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'U'	20220304	-2.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'U'	20220303	-1.0

22.2.1.1.3.2 'Undiversified' approach for Decorrelation risk add-on

It's also possible to group *pnl*s by *ptf*, *sub_ptf*, *prod_group*, *deco_code*, *scenario* and *ref_dt* (all other fields can be disregarded), again summing. The obtained portfolio P&L distributions will be used to compute the *Decorrelation risk add-on* (in conjunction with the *Initial Margins*, once calculated).
Please note that 'SUB2_instr_id_instr_curcy' *sub_ptf*s cannot have more than 1 *deco_code*, by construction.

Example

Sticking to the above example and assuming that 'ptf02' *ptf* has instruments belonging to two different *deco_code*s ('EBM' and 'ECO'), the resulting dataframe would look like the below:

ptf	sub_ptf	prod_group	deco_code	scenario	ref_dt	pnl
'ptf01'	'SUB1'	'PG1'	'EMA'	'S'	20240620	-490.0
'ptf01'	'SUB1'	'PG1'	'EMA'	'S'	20240619	500.0
'ptf01'	'SUB1'	'PG1'	'EMA'	'S'	20240618	0.0
'ptf01'	'SUB1'	'PG1'	'EMA'	'U'	20220304	-970.0
'ptf01'	'SUB1'	'PG1'	'EMA'	'U'	20220303	1010.0
'ptf02'	'SUB1'	'PG1'	'EBM'	'S'	20240620	-50.0
'ptf02'	'SUB1'	'PG1'	'EBM'	'S'	20240619	-25.0
'ptf02'	'SUB1'	'PG1'	'EBM'	'S'	20240618	200.0
'ptf02'	'SUB1'	'PG1'	'EBM'	'U'	20220304	20.0
'ptf02'	'SUB1'	'PG1'	'EBM'	'U'	20220303	-20.0
'ptf02'	'SUB1'	'PG1'	'ECO'	'S'	20240620	-100.0
'ptf02'	'SUB1'	'PG1'	'ECO'	'S'	20240619	-25.0
'ptf02'	'SUB1'	'PG1'	'ECO'	'S'	20240618	-25.0
'ptf02'	'SUB1'	'PG1'	'ECO'	'U'	20220304	10.0
'ptf02'	'SUB1'	'PG1'	'ECO'	'U'	20220303	-10.0
'ptf03'	'SUB1'	'PG1'	'EBM'	'S'	20240620	75.0
'ptf03'	'SUB1'	'PG1'	'EBM'	'S'	20240619	-75.0
'ptf03'	'SUB1'	'PG1'	'EBM'	'S'	20240618	0.0
'ptf03'	'SUB1'	'PG1'	'EBM'	'U'	20220304	-5.0
'ptf03'	'SUB1'	'PG1'	'EBM'	'U'	20220303	0.0
'ptf03'	'SUB1'	'PG2'	'ESF'	'S'	20240620	50.0
'ptf03'	'SUB1'	'PG2'	'ESF'	'S'	20240619	100.0
'ptf03'	'SUB1'	'PG2'	'ESF'	'S'	20240618	-100.0
'ptf03'	'SUB1'	'PG2'	'ESF'	'U'	20220304	0.0
'ptf03'	'SUB1'	'PG2'	'ESF'	'U'	20220303	0.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'EMA'	'S'	20240620	1.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'EMA'	'S'	20240619	2.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'EMA'	'S'	20240618	3.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'EMA'	'U'	20220304	-2.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'EMA'	'U'	20220303	-1.0

22.2.1.1.4 Portfolio risk measure (i.e. *Initial Margins*) calculation

In order to compute any portfolio risk measure, the number of Ordinary/Stressed tail observations *n_tail_observations* of the P&L distribution is needed.
In order to do so, Ordinary and Stressed Confidence Level α and Lookback Period *LP* model parameters must be retrieved.

Ordinary and Stressed Confidence Level α model parameters can be retrieved under *ord_cl* and *stress_cl* (respectively) fields of 'RF01C1' file.

Ordinary and Stressed Lookback Period *LP* model parameters can instead be retrieved counting the number of 'S' and 'U' (respectively) *scenario* field records for any instrument in the 'RF02C1' file.

The Ordinary/Stressed *n_tail_observations* can be finally obtained according to the following formula:

$$LP * (1 - \alpha).$$

The rounding of the above multiplication is at the nearest integer.
If the decimal part of the result is exactly equal to 0.5 the rounding is prudentially down.
The (rounded) result is floored at 1.

22.2.1.1.4.1 Initial Margins ('diversified') approach

For a given *ptf-sub_ptf-prod_group-scenario* combination, as losses are expressed as positive quantities, the largest *n_tail_observations pnl*s are averaged to get the risk measure (Expected Shortfall, hereinafter called e.g. *IM*) related to that combination (*n_tail_observations* may be different depending on the *scenario* type, i.e. 'S' or 'U').

In the remote case a smaller number of losses (in our example, strictly positive *pnl*s) than *n_tail_observations* is available the average of the available losses must be computed.
In the even more remote case no losses are available at all, the risk measure must be set to 0.0.

Example

The following table (continuation of the example above) is heavily affected by the unrealistically low number of 'S'/'U' scenarios (i.e. *ref_dt*s) – the *n_tail_observations* (both Ordinary and Stressed) are equal to 1 and the abovementioned corner cases are often triggered.

ptf	**sub_ptf**	**prod_group**	**scenario**	**IM**
'ptf01'	'SUB1'	'PG1'	'S'	500.0
'ptf01'	'SUB1'	'PG1'	'U'	1010.0
'ptf02'	'SUB1'	'PG1'	'S'	150.0
'ptf02'	'SUB1'	'PG1'	'U'	25.0
'ptf03'	'SUB1'	'PG1'	'S'	75.0

'ptf03'	'SUB1'	'PG1'	'U'	0.0
'ptf03'	'SUB1'	'PG2'	'S'	100.0
'ptf03'	'SUB1'	'PG2'	'U'	0.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'S'	3.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'U'	0.0

The so obtained *IM*s are the ('diversified') *Initial Margins*, hence available at *ptf-sub_ptf-prod_group-scenario* combination level.

22.2.1.1.4.2 Undiversified approach for Decorrelation risk add-on

For a given *ptf-sub_ptf-prod_group-deco_code-scenario* combination, as losses are expressed as positive quantities, the largest *n_tail_observations pnl*s are averaged to get the risk measure (Expected Shortfall, hereinafter called e.g. *uIM*) related to that combination (again, *n_tail_observations* may be different depending on the *scenario* type, i.e. 'S' or 'U').

Again, in the remote case a smaller number of losses (in our example, strictly positive *pnl*s) than *n_tail_observations* is available the average of the available losses must be computed. In the even more remote case no losses are available at all, the risk measure must be set to 0.0.

Example

Also in this case, the table below (continuation of the example above) is heavily affected by the unrealistically low number of 'S'/'U' scenarios (i.e. *ref_dt*s) – the *n_tail_observations* (both Ordinary and Stressed) are equal to 1 and the abovementioned corner cases are often triggered.

ptf	**sub_ptf**	**prod_group**	**deco_code**	**scenario**	**uIM**
'ptf01'	'SUB1'	'PG1'	'EMA'	'S'	500.0
'ptf01'	'SUB1'	'PG1'	'EMA'	'U'	1010.0
'ptf02'	'SUB1'	'PG1'	'EBM'	'S'	200.0
'ptf02'	'SUB1'	'PG1'	'EBM'	'U'	20.0
'ptf02'	'SUB1'	'PG1'	'ECO'	'S'	0.0
'ptf02'	'SUB1'	'PG1'	'ECO'	'U'	10.0
'ptf03'	'SUB1'	'PG1'	'EBM'	'S'	75.0
'ptf03'	'SUB1'	'PG1'	'EBM'	'U'	0.0
'ptf03'	'SUB1'	'PG2'	'ESF'	'S'	100.0
'ptf03'	'SUB1'	'PG2'	'ESF'	'U'	0.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'EMA'	'S'	3.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'EMA'	'U'	0.0

The so obtained *uIM*s, available at *ptf-sub_ptf-prod_group-deco_code-scenario* combination level, are employed to compute 'undiversified' *Initial Margins*, in turn used to compute the *Decorrelation risk add-on*.

22.2.1.2 Decorrelation risk add-on

'Undiversified' *Initial Margins* are obtained grouping *uIMs* computed at *ptf-sub_ptf-prod_group-deco_code-scenario* level by *ptf, sub_ptf, prod_group* and *scenario* (all other fields can be disregarded), summing.
Such 'undiversified' *Initial Margins* can only be greater than or equal to ('diversified') *Initial Margins*, by construction.

Example

Sticking to the above example:

ptf	sub_ptf	prod_group	scenario	uIM
'ptf01'	'SUB1'	'PG1'	'S'	500.0
'ptf01'	'SUB1'	'PG1'	'U'	1010.0
'ptf02'	'SUB1'	'PG1'	'S'	200.0
'ptf02'	'SUB1'	'PG1'	'U'	30.0
'ptf03'	'SUB1'	'PG1'	'S'	75.0
'ptf03'	'SUB1'	'PG1'	'U'	0.0
'ptf03'	'SUB1'	'PG2'	'S'	100.0
'ptf03'	'SUB1'	'PG2'	'U'	0.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'S'	3.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'U'	0.0

In order to compute the *Decorrelation risk add-on*, the *decorrelation_parameter* model parameter must be retrieved under *deco* field of 'RF01C1' file.

The formula to compute the *Decorrelation risk add-on* (hereinafter called e.g. *DECO*) is the following:

$$(1 - decorrelation\_parameter) * (uIM - IM)$$

Example

Sticking to the above example:

ptf	sub_ptf	prod_group	scenario	IM	uIM	DECO
'ptf01'	'SUB1'	'PG1'	'S'	500.0	500.0	0.0
'ptf01'	'SUB1'	'PG1'	'U'	1010.0	1010.0	0.0
'ptf02'	'SUB1'	'PG1'	'S'	150.0	200.0	10.0
'ptf02'	'SUB1'	'PG1'	'U'	25.0	30.0	1.0
'ptf03'	'SUB1'	'PG1'	'S'	75.0	75.0	0.0
'ptf03'	'SUB1'	'PG1'	'U'	0.0	0.0	0.0
'ptf03'	'SUB1'	'PG2'	'S'	100.0	100.0	0.0
'ptf03'	'SUB1'	'PG2'	'U'	0.0	0.0	0.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'S'	3.0	3.0	0.0
'ptf03'	'SUB2_FR0000000002_EUR'	'PG1'	'U'	0.0	0.0	0.0

As highlighted above, 'SUB2_instr_id_instr_curcy' *sub_ptf*s are not subject to any *Decorrelation risk add-on*, by construction. This is also the case of 'SUB1' sub-portfolios having a single *deco_code* (for a given *prod_group*), as e.g. 'ptf01' *ptf* in our example.

22.2.2 'SUB2' sub-portfolio

22.2.2.1 Initial Margins

22.2.2.1.1 Initial Margins calculation

Please refer to what outlined in 22.2.1.1.

22.2.2.1.2 Initial Margins adjustment

Once computed the *Initial Margins IM*s for every 'SUB2' single-instrument sub-portfolio 'SUB2_instr_id_instr_curcy' *sub_ptf*, such *IM*s must be first combined in their Ordinary and Stressed components, then floored.

Ordinary and Stressed weight *ordinary_weight* and *stress_weight* model parameters can be retrieved under *ord_w* and *stress_w* (respectively) fields of 'RF01C1' file.

The combination is performed according to the following formula:

$$\max\{ord\_w * IM_{scenario=S} + stress\_w * IM_{scenario=U}; IM_{scenario=S}\}.$$

Example

Assuming that the *ord_w* is equal to 0.75 (and the *stress_w* is equal to 0.25), continuing the example above we end up having the following combined *IM* figures:

ptf	sub_ptf	IM
'ptf02'	'SUB2_FR0000000002_EUR'	max(0.75 * 3.0 + 0.25 * 0.0; 3.0) = 3.0

Please notice that the *prod_group* variable is not relevant in the 'SUB2' sub-portfolio case, hence it was removed from the example.

In order the *IM*s to be floored, it's first necessary to retrieve some information on the instruments underlying the 'SUB2_instr_id_instr_curcy' sub-portfolios.
Such information are all retrievable from the 'RF04C' file (joining is again to be performed leveraging on *instr_id* and *instr_curcy* fields), and are *symbol_code*, *mat_dt*, *mult* and *price*.
The size and sign of the positions *n_contracts* in the instruments are also needed.

Example

Assuming that the *n_contracts* in the instrument *instr_id*: 'FR0000000002', *instr_curcy*: 'EUR' is long 2:

…	instr_id	instr_curcy	symbol_code	mat_dt	mult	price	n_contracts

…	'FR0000000002'	'EUR'	'EMA'	20240624	50.0	75.0	2

The *margin_pct* model parameters contained in the 'RF01C2' file are then needed, as well as the value under *hp* field of the 'RF01C1' file and the market calendar contained in the 'RF08C' file.

If a *n_contracts* is positive (the position is long) the record can be enriched with a *pos_sign* field with value equal to 'L', if negative (short) with 'S'. Then, (left) joining the above table to the 'RF01C2' file (on *symbol_code*, *instr_curcy* and *pos_sign* fields) enables to retrieve the *margin_pct* values (*extra_pct* and *fee_pct* fields can be discarded).

Example

Assuming a *margin_pct* value for the instrument *instr_id*: 'FR0000000002', *instr_curcy*: 'EUR' (actually, for a long position – *pos_sign* = 'L' – in a 'EMA' *symbol_code* instrument with 'EUR' *instr_curcy*) equal to 1.0:

…	instr_id	instr_curcy	symbol_code	mat_dt	mult	price	n_contracts	margin_pct
…	'FR0000000002'	'EUR'	'EMA'	20240624	50.0	75.0	2	1.0

After the retrieval of the *margin_pct* values, it is necessary to compute *increasing_pct* values. Such values are function of the *hp* model parameter ('RF01C1' file), the margin computation date *t* and the *mat_dt*s of the instruments.
The *increasing pct* values are computed according to the following formula:

$$\frac{hp-(mat\_dt-t)}{hp+1},$$

where the distance between *mat_dt* and *t* (in business days) can be computed employing the market calendar contained in the 'RF08C' file.

Example

Assuming *t* is equal to 20240621 and the market calendar is the following:

mkt_dt
20240621
20240624
20240625
…

the *increasing_pct* in the above example is equal to $\frac{2-1}{2+1} = 0.\bar{3}$.

…	instr_id	instr_curcy	symbol_code	mat_dt	mult	price	n_contracts	margin_pct	increasing_pct
…	'FR0000000002'	'EUR'	'EMA'	20240624	50.0	75.0	2	1.0	0.333

A floor to the *Initial Margins IM* (hereinafter called e.g. *IMfloor*) must be computed this way:

$$price * |n\_contracts| * mult * margin\_pct * increasing\_pct.$$

Example

Sticking to the above example:

…	instr_id	instr_curcy	symbol_code	mat_dt	mult	price	n_contracts	margin_pct	increasing_pct	IMfloor
…	'FR0000000002'	'EUR'	'EMA'	20240624	50.0	75.0	2	1.0	0.333	2500.0

Finally, *Initial Margins IM*s must be 'adjusted' to take into account their floor this way:

$$\max\{IM; IMfloor\}.$$

Example

Sticking to the above example:

ptf	sub_ptf	IM
'ptf02'	'SUB2_FR0000000002_EUR'	max(3.0; 2500.0) = 2500.0

22.2.2.2 Decorrelation risk add-on

No *Decorrelation risk add-on* can be computed by construction. Please refer to what outlined in 22.2.1.1.

22.2.3 'SUB3' sub-portfolio (i.e. Delivery Margins)

22.2.3.1 Initial Margins

22.2.3.1.1 Data preparation

'RF03C2' file must be filtered for *counter_curcy* field equal to 'EUR'.
The *base_curcy* field will have to be matched against *instr_curcy* field of 'RF02C2' file, hence it may be useful to rename it *instr_curcy* itself.
It may also be useful to rename the *value* field as e.g. *fx*, so that when joining 'RF03C2' and 'RF02C2' files there are no multiple *value* fields.

Instrument current prices can be found in the 'RF02C2' file, filtering *scenario* field equal to 'C'.[1]

[1] Here and in the following we will refer to the instrument under physical delivery process as if it was not expired yet, hence having a current price which can be subject to changes. In reality, this is just an 'artificial' way to compute the margins on the expired instrument, in turn due to the potential volatility of the spot price of the underlying commodity during the physical delivery process.

It may be useful to create a dataframe with current prices only, renaming its *value* field as e.g. *current_value*.

Exchange rate current values can be found in the 'RF03C2' file, filtering *scenario* field equal to 'C'.
It may be useful to create a dataframe with current values only, renaming its *value* (*fx* if renamed) field as e.g. *current_fx*.

Instrument scenario prices can be found in the 'RF02C2' file, filtering *scenario* field equal to 'S' (Scaled, ordinary) or 'U' (Unscaled, stressed).
It may be useful to create a dataframe with such prices.

Exchange rate scenario values can be found in the 'RF03C2' file, filtering *scenario* field equal to 'S' (Scaled, ordinary) or 'U' (Unscaled, stressed).
It may be useful to create a dataframe with such values.

The dataframe with instrument scenario prices can be (left) joined to the dataframe with instrument current prices (on *instr_id*, *instr_curcy*, *symbol code*, *mult* and *hppd* fields), to the dataframe with exchange rate scenario values (on *scenario*, *instr_curcy*, *hppd* and *ref_dt* fields) and to the dataframe with exchange rate current values (on *instr_curcy* and *hppd* fields).

The resulting dataframe has the following shape (focusing on a given sample instrument and assuming that there are just 3 'S' *scenario*s and 2 'U' *scenario*s):

scenario	instr_id	instr_curcy	symbol_code	mult	hppd	ref_dt	value	current_value	fx	current_fx
'S'	'FR0000000003'	'EUR'	'EBM'	50.0	12	20240620	225.0	200.0	0.98	0.99
'S'	'FR0000000003'	'EUR'	'EBM'	50.0	12	20240619	175.0	200.0	1.00	0.99
'S'	'FR0000000003'	'EUR'	'EBM'	50.0	12	20240618	200.0	200.0	0.99	0.99
'U'	'FR0000000003'	'EUR'	'EBM'	50.0	12	20220304	250.0	200.0	0.97	0.99
'U'	'FR0000000003'	'EUR'	'EBM'	50.0	12	20220303	150.0	200.0	1.01	0.99

22.2.3.1.2 Instrument P&L calculation

An instrument profit/loss (hereinafter called e.g. *pnl*) can be computed this way:

$$(value * fx - current\_value * current\_fx) * mult.$$

Example

Focusing on the same sample instrument with 3 'S' *scenario*s and 2 'U' *scenario*s:

…	mult	…	value	current_value	fx	current_fx	…	pnl
…	50.0	…	225.0	200.0	0.98	0.99	…	1125.0
…	50.0	…	175.0	200.0	1.00	0.99	…	-1150.0
…	50.0	…	200.0	200.0	0.99	0.99	…	0.0
…	50.0	…	250.0	200.0	0.97	0.99	…	2225.0
…	50.0	…	150.0	200.0	1.01	0.99	…	-2325.0

22.2.3.1.3 Portfolio P&L calculation

The dataframe containing instrument *pnl*s obtained as described above can be (left) joined to the dataframe containing the portfolios *ptf*s of delivery instructions *di*s.

Every *pnl* must be multiplied by the number of contracts *n_contracts* associated to the delivery instruction in the instrument, obtaining a portfolio-delivery instruction profit/loss, this way:

$$-n\_contracts * pnl,$$

to express profits as negative amounts and losses as positive amounts.

Example

Always sticking to the above example and assuming the *ptf* 'ptf03' having the following *di*s:

ptf	di	instr_id	instr_curcy	n_contracts
'ptf03'	1	'FR0000000003'	'EUR'	5
'ptf03'	2	'FR0000000003'	'EUR'	-3

we end up having the following *pnl* distributions at *ptf-di* combination level:

…	ptf	di	n_contracts	pnl
…	'ptf03'	1	5	-5 * 1125.0 = -5625.0
…	'ptf03'	1	5	-5 * -1150.0 = 5750.0
…	'ptf03'	1	5	-5 * 0.0 = 0.0
…	'ptf03'	1	5	-5 * 2225.0 = -11125.0
…	'ptf03'	1	5	-5 * -2325.0 = 11625.0
…	'ptf03'	2	-3	-(-3) * 1125.0 = 3375.0
…	'ptf03'	2	-3	-(-3) * -1150.0 = -3450.0
…	'ptf03'	2	-3	-(-3) * 0.0 = 0.0
…	'ptf03'	2	-3	-(-3) * 2225.0 = 6675.0
…	'ptf03'	2	-3	-(-3) * -2325.0 = -6975.0

22.2.3.1.4 Portfolio risk measure (i.e. Initial Margins) calculation

*pnl*s at *ptf-di-scenario-ref_dt* combination level must not be further grouped (summed), as a delivery instruction is always associated to a single instrument, and represent a portfolio-delivery instruction P&L distribution. This distribution will be used to compute the portfolio-delivery instruction risk measure (i.e. *Initial Margins*).

Example

Continuing the example above, the previous dataframe can be simply represented this way:

ptf	di	scenario	ref_dt	pnl
'ptf03'	1	'S'	20240620	-5625.0
'ptf03'	1	'S'	20240619	5750.0
'ptf03'	1	'S'	20240618	0.0
'ptf03'	1	'U'	20220304	-11125.0

'ptf03'	1	'U'	20220303	11625.0
'ptf03'	2	'S'	20240620	3375.0
'ptf03'	2	'S'	20240619	-3450.0
'ptf03'	2	'S'	20240618	0.0
'ptf03'	2	'U'	20220304	6675.0
'ptf03'	2	'U'	20220303	-6975.0

In order to compute any portfolio-delivery instruction risk measure, the number of Ordinary/Stressed tail observations *n_tail_observations* of the P&L distribution is needed. In order to do so, Ordinary and Stressed Confidence Level α and Lookback Period *LP* model parameters must be retrieved.

Ordinary and Stressed Confidence Level α model parameters can be retrieved under *ord_cl* and *stress_cl* (respectively) fields of 'RF01C1' file.

Ordinary and Stressed Lookback Period *LP* model parameters can instead be retrieved counting the number of 'S' and 'U' (respectively) *scenario* field records for any instrument in the 'RF02C2' file.

The Ordinary/Stressed *n_tail_observations* can be finally obtained according to the following formula:

$$LP * (1 - \alpha).$$

The rounding of the above multiplication is at the nearest integer.
If the decimal part of the result is exactly equal to 0.5 the rounding is prudentially down.
The (rounded) result is floored at 1.

For a given *ptf-di-scenario* combination, as losses are expressed as positive quantities, the largest *n_tail_observations pnl*s are averaged to get the risk measure (Expected Shortfall, hereinafter called e.g. *IM*) related to that combination (*n_tail_observations* may be different depending on the *scenario* type, i.e. 'S' or 'U').

In the remote case a smaller number of losses (in our example, strictly positive *pnl*s) than *n_tail_observations* is available the average of the available losses must be computed.
In the even more remote case no losses are available at all, the risk measure must be set to 0.0.

Example

The following table (continuation of the example above) is heavily affected by the unrealistically low number of 'S'/'U' scenarios (i.e. *ref_dt*s) – the *n_tail_observations* (both Ordinary and Stressed) are equal to 1 and the abovementioned corner cases are often triggered.

ptf	di	scenario	IM
'ptf03'	1	'S'	5750.0
'ptf03'	1	'U'	11625.0
'ptf03'	2	'S'	3375.0
'ptf03'	2	'U'	6675.0

The so obtained *IM*s are the *Initial Margins*, hence available at *ptf-di-scenario* combination level.

22.2.3.1.5 Initial Margins adjustment

Once computed the *Initial Margins IM*s for every delivery instruction *di* in the portfolio *ptf*, such *IM*s must be first combined in their Ordinary and Stressed components, then floored and multiplied by an increasing factor.

Ordinary and Stressed weight *ordinary_weight* and *stress_weight* model parameters can be retrieved under *ord_w* and *stress_w* (respectively) fields of 'RF01C1' file.

The combination is performed according to the following formula:

$$\max\{ord\_w * IM_{scenario=S} + stress\_w * IM_{scenario=U}; IM_{scenario=S}\}.$$

Example

Assuming that the *ord_w* is equal to 0.75 (and the *stress_w* is equal to 0.25), continuing the example above we end up having the following combined *IM* figures:

ptf	di	IM
'ptf03'	1	max(0.75 * 5750.0 + 0.25 * 11625.0; 5750.0) = 7218.75
'ptf03'	2	max(0.75 * 3375.0 + 0.25 * 6675.0; 3375.0) = 4200.0

In order the *IM*s to be floored and multiplied by the increasing factor, it's first necessary to retrieve some information on the instruments associated to the delivery instructions.
Such information are all retrievable from the 'RF02C2' file.
One must first (left) join the above dataframe to the delivery instructions dataframe on *ptf* and *di* fields.

Example

Sticking to the above example:

ptf	di	IM	instr_id	instr_curcy	n_contracts
'ptf03'	1	7218.75	'FR0000000003'	'EUR'	5
'ptf03'	2	4200.0	'FR0000000003'	'EUR'	-3

Then, one must (left) join the resulting dataframe to the dataframe containing instrument current prices on *instr_id* and *instr_curcy* fields, ignoring *hppd* field.

Example

Always sticking to the above example:

ptf	di	IM	instr_id	instr_curcy	n_contracts	symbol_code	mult	current_value
'ptf03'	1	7218.75	'FR0000000003'	'EUR'	5	'EBM'	50.0	200.0
'ptf03'	2	4200.0	'FR0000000003'	'EUR'	-3	'EBM'	50.0	200.0

The *margin_pct*, *extra_pct* and *fee_pct* model parameters contained in the 'RF01C2' file are then needed.

If a *n_contracts* is positive (the position is long) the record can be enriched with a *pos_sign* field with value equal to 'L', if negative (short) with 'S'. Then, (left) joining the above table to the 'RF01C2' file (on *symbol_code*, *instr_curcy* and *pos_sign* fields) enables to retrieve the *margin_pct*, *extra_pct* and *fee_pct* fields.

Example

Assuming *margin_pct*, *extra_pct* and *fee_pct* values for the instrument *instr_id*: 'FR0000000003', *instr_curcy*: 'EUR' are equal to 1.0, 0.1 and 0.0 (respectively) for a long position (*pos_sign* = 'L' in a 'EBM' *symbol_code* instrument with 'EUR' *instr_curcy*) and 0.6, 0.1 and 0.0 (respectively) for a short position (*pos_sign* = 'S' in a 'EBM' *symbol_code* instrument with 'EUR' *instr_curcy*):

…	instr_id	instr_curcy	n_contracts	symbol_code	mult	current_value	margin_pct	extra_pct	fee_pct
…	'FR0000000003'	'EUR'	5	'EBM'	50.0	200.0	1.0	0.1	0.0
…	'FR0000000003'	'EUR'	-3	'EBM'	50.0	200.0	0.6	0.1	0.0

The floor to the *Initial Margins IM* (hereinafter called e.g. *IMfloor*) must be computed this way:

$$current\_value * |n\_contracts| * mult * (margin\_pct + fee\_pct).$$

Example

Sticking to the above example:

…	n_contracts	symbol_code	mult	current_value	margin_pct	extra_pct	fee_pct	IMfloor
…	5	'EBM'	50.0	200.0	1.0	0.1	0.0	50000.0
…	-3	'EBM'	50.0	200.0	0.6	0.1	0.0	18000.0

Finally, *Initial Margins IMs* must be 'adjusted' to take into account their floor and the increasing factor this way:

$$\max\{IM * (1 + extra\_pct); IMfloor\}.$$

Example

Sticking to the above example:

ptf	di	IM
'ptf03'	1	max(7218.75 * (1 + 0.1); 50000.0) = 50000.0
'ptf03'	2	max(4200.0 * (1 + 0.1); 18000.0) = 18000.0

22.2.3.2 Decorrelation risk add-on

No *Decorrelation risk add-on* can be computed by construction.

22.3 Total Margins

Total Margins represent the aggregation of the margin components.
All the related figures must hence be retrieved.

In the following we will assume non-replicable margin components:

- *Concentration risk add-on* – hereinafter called e.g. *CONC*,
- *Liquidity risk add-on* – hereinafter called e.g. *LIQ*,
- *Settlement risk add-on* – hereinafter called e.g. *SETTL* and
- add-ons linked to stress testing, i.e. *Monthly Stress add-on* – hereinafter called e.g. *MSA* – and *Daily Stress add-on* – hereinafter called e.g. *DSA*, being these non-replicable by construction

are set equal to 0. In reality, these margin components will likely be greater than 0, hence the replicated *Total Margins* will be lower than the *Total Margins* actually called on the portfolio.

Example

Mark-to-market Margins (*MtmM*):
being all the sample portfolios composed by futures instruments only, *Mark-to-market Margins* for all such portfolios are equal to 0.0 (as *Mark-to-market Margins* are only computed on open option net positions).

'SUB1' sub-portfolio *Initial Margins* (*IM*) and *Decorrelation risk add-on* (*DECO*):

ptf	sub_ptf	prod_group	scenario	IM	DECO
'ptf01'	'SUB1'	'PG1'	'S'	500.0	0.0
'ptf01'	'SUB1'	'PG1'	'U'	1010.0	0.0
'ptf02'	'SUB1'	'PG1'	'S'	150.0	10.0
'ptf02'	'SUB1'	'PG1'	'U'	25.0	1.0
'ptf03'	'SUB1'	'PG1'	'S'	75.0	0.0
'ptf03'	'SUB1'	'PG1'	'U'	0.0	0.0
'ptf03'	'SUB1'	'PG2'	'S'	100.0	0.0
'ptf03'	'SUB1'	'PG2'	'U'	0.0	0.0

'SUB2' sub-portfolio *Initial Margins* (*IM*):

ptf	sub_ptf	IM
'ptf02'	'SUB2_FR0000000002_EUR'	2500.0

'SUB3' sub-portfolio *Initial Margins* (*IM* – i.e. *Delivery Margins*):

ptf	di	IM
'ptf03'	1	50000.0
'ptf03'	2	18000.0

Ordinary and Stressed weight *ordinary_weight* and *stress_weight* model parameters must then be retrieved under *ord_w* and *stress_w* (respectively) fields of 'RF01C1' file.

The *Total Margins* (hereinafter called e.g. *TM*) computed on a given portfolio *ptf* are equal to:

$\max\{TM_{SUB1} + TM_{SUB2} + LIQ + CONC; 0\} + SETTL + TM_{SUB3} + MSA + DSA$,

with:

$TM_{SUB1} = \sum_{prod\_group} \max\{ord\_w * \left(IM_{sub\_ptf=SUB1,prod\_group,scenario=S} + DECO_{sub\_ptf=SUB1,prod\_group,scenario=S}\right) + stress\_w * \left(IM_{sub\_ptf=SUB1,prod\_group,scenario=U} + DECO_{sub\_ptf=SUB1,prod\_group,scenario=U}\right); IM_{sub\_ptf=SUB1,prod\_group,scenario=S} + DECO_{sub\_ptf=SUB1,prod\_group,scenario=S}\} + MtmM,$

$TM_{SUB2} = \sum_{sub\_ptf} IM_{sub\_ptf},$

$TM_{SUB3} = \sum_{di} IM_{di}.$

Always employing the convention of expressing margin debts as positive quantities and margin credits as negative quantities, all margin components in the above formulas represent a debt (+) except for *MtmM*, which can represent a credit (-) or a debt (+).

Example

Total Margins for *ptf* 'ptf01':

$TM_{SUB1} = \max\{0.75 * (500.0 + 0.0) + 0.25 * (1010.0 + 0.0); 500.0 + 0.0\} + 0.0 = 627.5,$

$TM_{SUB2} = 0.0,$

$TM_{SUB3} = 0.0,$

$LIQ = 0.0,$

$CONC = 0.0,$

$SETTL = 0.0,$

$MSA = 0.0,$

$DSA = 0.0,$

$TM = \max\{627.5 + 0.0 + 0.0 + 0.0; 0\} + 0.0 + 0.0 + 0.0 + 0.0 = 627.5.$

Total Margins for *ptf* 'ptf02':

$TM_{SUB1} = \max\{0.75 * (150.0 + 10.0) + 0.25 * (25.0 + 1.0); 150.0 + 10.0\} + 0.0 = 160.0,$

$TM_{SUB2} = 2500.0,$

$TM_{SUB3} = 0.0,$

$LIQ = 0.0,$

$CONC = 0.0,$

$SETTL = 0.0,$

$MSA = 0.0,$

$DSA = 0.0,$

$TM = \max\{160.0 + 2500.0 + 0.0 + 0.0; 0\} + 0.0 + 0.0 + 0.0 + 0.0 = 2660.0.$

Total Margins for *ptf* 'ptf03':

$TM_{SUB1} = \max\{0.75 * (75.0 + 0.0) + 0.25 * (0.0 + 0.0); 75.0 + 0.0\} + \max\{0.75 * (100.0 + 0.0) + 0.25 * (0.0 + 0.0); 100.0 + 0.0\} + 0.0 = 175.0,$

$TM_{SUB2} = 0.0,$

$TM_{SUB3} = 50000.0 + 18000.0 = 68000.0,$

$LIQ = 0.0,$

$CONC = 0.0,$

$SETTL = 0.0,$

$MSA = 0.0,$

$DSA = 0.0,$

$TM = \max\{175.0 + 0.0 + 0.0 + 0.0; 0\} + 0.0 + 68000.0 + 0.0 + 0.0 = 68175.0.$