



## User-Defined Inter-Group Strategies for Futures and Options on Futures

The user-defined strategy (UDS) functionality allows for the creation of inter-group strategies (IGS) that combine instruments from different groups in the trading engine. These strategies allow the component instruments (or legs) to trade simultaneously, and only simultaneously, in a single transaction.

IGS are disseminated through MX'S High Speed Vendor Feed via independent software vendors and data vendors who have developed for the functionality. Contact your vendor for more information.

Should you require technical assistance, or wish to carry out testing in our development environment, contact our Technical Help Desk by telephone at 1-877-588-8489 or by email at [samsupport@m-x.ca](mailto:samsupport@m-x.ca).

### Overview

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#### Benefits of IGS

- Elimination of execution risk when trading multi-legged strategies: No one leg of the strategy will be executed unless all legs are executed at the prices and ratios specified.
- Ability to trade multi-legged strategies from different instrument groups.
- Interaction of the strategy book with the regular order book through the implied pricing functionality, improving the fill rate for both outright trades and strategies.

#### Limitations of IGS

- In order to be combined in a strategy, all instruments must have identical underlying nominal values (e.g., BAX<sup>1</sup> vs. OBX<sup>2</sup>, CGB vs. CGF<sup>3</sup>).
- IGS involving BAX and OBX can have a maximum of six legs.
- All other types of IGS can have a maximum of three legs.
- Legs can have a maximum ratio of 99.
- Legs in an IGS trade with a ratio greater than 1 may have an allocation price that does not respect the tick table of the outright leg.

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<sup>1</sup> BAX: Three-Month Canadian Bankers' Acceptance Futures

<sup>2</sup> OBX: Options on Three-Month Canadian Bankers' Acceptance Futures

<sup>3</sup> CGF: Five-Year Government of Canada Bond Futures

## List of possible IGS combination (but not limited to))

Strategy	Example
LGB vs. CGB	Buy LGBU16 and sell CGBU16
LGB vs. CGF	Buy LGBU16 and sell CGFU16
CGB vs. CGF	Buy CGBU16 and sell CGFU16*
CGB vs. OGB	Buy CGBU16 and buy or sell OGB call or put
CGB vs. OGB Call Spread	Buy CGBU16, buy OGB call (X1) and sell OGB call (X2)
CGB vs. OGB Put Spread	Buy CGBU16, buy OGB put (X1) and sell OGB put (X2)
CGB vs. 1:2 Ratio Call Spread	Buy CGBU16, buy OGB call (X1) and sell two OGB calls (X2)*
CGB vs. 1:2 Ratio Put Spread	Buy CGBU16, buy OGB put (X1) and sell two OGB puts (X2)*
BAX vs. OBX	Buy BAXU16 and buy or sell OBX call or put
BAX vs. OBX Call Spread	Buy BAXU16, buy OBX call (X1) and sell OBX call (X2)
BAX vs. OBX Put Spread	Buy BAXU16, buy OBX put (X1) and sell OBX put (X2)
BAX vs 1:2 Ratio Call Spread	Buy BAXU16, buy OBX call (X1) and sell two OBX calls (X2)
BAX vs 1:2 Ratio Put Spread	Buy BAXU16, buy OBX put (X1) and sell two OBX puts (X2)
BAX vs OBX Butterfly	Buy BAXU16, buy OBX call (X1) and sell two OBX calls (X2) and buy OBX call (X3)
BAX vs OBX Condor	Buy BAXU16, buy OBX call (X1) and sell two OBX calls (X2 and X3) and buy OBX call (X4)
BAX Strategy vs OBX Strategy	buy BAXU16, sell BAXZ16, sell OBX call (X1), buy OBX call (X2), buy OBX call (X3), buy OBX call (X4)

- See item #10 of the appendix.

To execute an IGS, the strategy format must first be created, validated and accepted by the trading system. The participant must then determine the appropriate price and quantity, and enter the order for the strategy.

### Strategy creation

An IGS can be created electronically using the user-defined strategy (UDS) functionality or manually through MX's Market Operations Department. The information required to create a strategy is, for each leg, the instrument, the order verb (buy or sell), and the leg quantities.

### Strategy validation

Strategies created using the UDS functionality are validated by the SOLA trading engine to ensure that the format of the strategy meets IGS criteria. If necessary, the strategy will be reorganised. This will usually mean changing the order of the legs and/or reversing the signs (order verb). It can also mean reducing the ratios if they are not at their absolute minimum.

### Example of a strategy creation

Suppose a participant wishes to execute a strategy to buy 560 BAXH12 at 98.73 and simultaneously sell 1000 OBXH12C9875 at 0.02. Total leg quantities are +560 for the BAXH12 and -1000 for the OBXH12C9875.

Given the total quantity on each leg, the UDS functionality will reduce these quantities by using the highest common denominator. This breaks down to +14 BAXH12 and -25 OBXH12C9875 when each leg is divided by 40 (the highest common denominator).

This IGS will be listed in the following format: **+14 BAXH12 -25 OBXH12C9875**

This means that if the participant is buying (bid) the strategy, they are buying BAXH12 and selling OBXH12C9875 as per the listed ratios in the strategy. For every one strategy the participant buys, they will be buying 14 BAXH12 and selling 25 OBXH12C9875. To execute the total quantities (560 and 1000) on each leg, the participant will have to bid for a quantity of 40 strategies.

If the acceptable format for this type of strategy is to purchase of the futures first and sell the call option second, all of these types of strategies must conform to that format.

#### **Strategy creation limitation**

A ratio cannot be higher than 99 (or lower than -99). This means that some combinations are not possible.

Let's say Participant A wants to buy 590 BAXH12 at 98.75 and sell 1000 OBXH12C9875 at 0.05. The highest common denominator for the two quantities is 10. For the OBX leg, when -1000 is divided by 10, the result is -100. Since a sell ratio cannot be lower than -99, this strategy request will be rejected by the trading engine.

### **Examples of a strategy validation**

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#### **Scenario 1**

A participant wishes to execute a strategy to buy 560 BAXH12 at 98.73 and simultaneously sell 1000 OBXH12C9875 at 0.02. However, the strategy is sent to the trading engine as: **+25 OBXH12C9875 -14 BAXH12**.

As mentioned above, strategies created using the UDS functionality are validated by the trading engine to ensure that the format of the strategy meets the IGS criteria. In this example, the legs of the strategy have been reduced to their lowest possible terms; however the ordering of the legs is not consistent with the IGS criteria. The trading engine will re-organise the legs of the strategy so that their signs are changed and are consistent with IGS criteria.

If a strategy doesn't match the required format, the trading engine will send a message back to the participant notifying them. If possible, it will attempt to re-organise the order and, in the same message, confirm that the strategy has been listed in a format consistent with the IGS criteria. The resulting strategy will be: **+14 BAXH12 -25 OBXH12C9875**.

In the scenario described above it is important to note that since the legs of the strategy have been re-ordered (**+14 BAXH12 -25 OBXH12C9875** as opposed to **+25 OBXH12C9875 -14 BAXH12** as was originally the case), the participant must now sell the strategy in order to buy **+25 OBXH12C9875** and sell **14 BAXH12**. Therefore, in scenarios such as the one illustrated above, it is imperative that participants review the new re-ordered strategy structure to ensure that they are executing the appropriate number of contracts as well as buying and selling the appropriate legs of the strategy.

## Scenario 2

A participant wishes to execute a strategy to buy 560 BAXH12 at 98.73 and simultaneously sell 1000 OBXH12C9875 at 0.02. However, the strategy is sent as: **+50 OBXH12C9875 -28 BAXH12**.

In this scenario, the legs of the strategy have not been reduced to their lowest possible terms, and the order of the legs in the strategy is not in a format that is consistent with IGS. The trading engine will therefore re-organise the legs in a manner that is consistent with IGS. The result will be: **+28 BAXH12 -50 OBXH12C9875**.

It will also reduce the legs to their lowest possible terms by dividing each leg of the strategy by the highest possible common denominator. The participant, in this case, used 20 as the common denominator; however, the ratios can be reduced further by using a common denominator of 40. The resulting acceptable strategy will be listed as: **+14 BAXH12 -25 OBXH12C9875**

The participant who originally submitted the strategy for acceptance will receive a message informing them that the strategy as submitted was not in an acceptable format and that it was re-organised to meet the IGS criteria.

## Post strategy creation

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Once a strategy has been created, participants will be able to trade it like any other instrument. Inter-group strategies are implied eligible. This means that once the strategy is created, posted markets on the individual instrument legs will generate a displayed market for the strategy. This implied strategy price can be used by the participant as a verification of the price to be entered.

The participant must fix a price for the strategy to execute the order they wish to enter.

It is important to note that the structure of the listed strategy represents what the buyer of the strategy will execute. The seller will execute the opposite.

Example:

+5	BAXH12
-17	OBXH12C9850
+30	OBXH12C9875

Here, buyers of the strategy will buy 5 BAXH12, sell 17 OBXH12C9850 and buy 30 OBXH12C9875. Sellers of the strategy will do the opposite.

## Strategy price determination

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In this section, the calculation of bid and ask prices for listed IGS are illustrated. In order to calculate strategy prices, participants have to familiarize themselves with the following formulas:

$(\text{Listed leg1 ratio} \cdot \text{Leg1 price}) + (\text{Listed leg2 ratio} \cdot \text{Leg2 price})$

### Scenario 1

A participant wishes to execute a strategy where they buy 560 BAXH12 at 98.73 and simultaneously sell 1000 OBXH12C9875 at 0.02. As illustrated in the strategy creation section, this IGS will be listed as: **+14 BAXH12 -25 OBXH12C9875**.

The bid price of the strategy is calculated as follows:

$$\begin{aligned} &\text{Bid price of the strategy} \\ &= (\text{Listed leg1 ratio} \cdot \text{Leg1 price}) + (\text{Listed leg2 ratio} \cdot \text{Leg2 price}) \\ &= (+14 \cdot 98.73) + (-25 \cdot 0.02) \\ &= \mathbf{1381.72} \end{aligned}$$

In the example, the bid price is **1381.72**.

If this IGS order gets executed for a quantity of one strategy, it will represent a purchase of 14 BAXH12 at 98.73 and a sale of 25 OBXH12C9875 at 0.02 for the participant BIDDING on the strategy. Therefore, the participant will enter a bid of +1381.72 for a quantity of 40 to obtain the original quantities (+560 BAXH12 at 98.73 and -1000 OBXH12C9875 at 0.02) in the scenario.

### Scenario 2

A participant wishes to post a competing ask price on the same strategy as in Scenario 1 where they sell 560 BAXH12 at **98.74** and simultaneously buy 1000 OBXH12C9875 at 0.02.

The ask price of the strategy is calculated as follows:

$$\begin{aligned} &\text{Ask price of the strategy} \\ &= (\text{Listed leg1 ratio} \cdot \text{Leg1 price}) + (\text{Listed leg2 ratio} \cdot \text{Leg2 price}) \\ &= (+14 \cdot 98.74) + (-25 \cdot 0.02) \\ &= \mathbf{1381.86} \end{aligned}$$

If this IGS order gets executed for a quantity of one, it will represent a sale of 14 BAXH12 at 98.74 and a purchase of 25 OBXH12C9875 at 0.02 for the participant SELLING the strategy. Therefore, the participant will enter an ask of +1381.86 for a quantity of 40.

The resulting market for strategy **+14 BAXH12 -25 OBXH12C9875** would be:

Bid Size	Bid	Ask	Ask Size
40	1381.72	1381.86	40

### Scenario 3

Another participant also wishes to post a competing ask price on the same strategy as in Scenario 1 but where they sell **280** BAXH12 at **98.76** and simultaneously buy **500** OBXH12C9875 at 0.02.

In this scenario, the participant changes the leg price of the futures contract and only wishes to execute half the original volume illustrated in Scenario 2.

$$\begin{aligned} &= (+14 \cdot 98.76) + (-25 \cdot 0.02) \\ &= \mathbf{+1382.14} \end{aligned}$$

The resulting market for strategy **+14 BAXH12 -25 OBXH12C9875** would be:

Bid Size	Bid	Ask	Ask Size
40	1381.72	1381.86	40
		1382.14	20

**Scenario 4: IGS with 3 legs “CGB vs. 1:2 ratio call spread”**

Participant A wants to buy 300 CGBH12 at 132.66, sell 600 OGBH12C13100 at 3.98 and buy 1200 OGBH12C13150 at 3.745.

Participant Z wants to sell 225 CGBH12 at 132.67, buy 450 OGBH12C13100 at 3.96 and sell 900 OGBH12C13150 at 3.745.

Participant	Parameters	Leg1	Leg2	Leg3
		CGBH12	OGBH12C13100	OGBH12C13150
A	Quantity	300	-600	1200
A	Ratio	1	-2	4
A	Price	132.66	3.98	3.745
Z	Price	132.67	3.96	3.745
Z	Ratio	-1	2	-4
Z	Quantity	-225	450	-900

The resulting strategy will be listed as: **+1 CGBH12 -2 OGBH12C13100 +4 OGBH12C13150**

Strategy bid price and quantity

$$= (+1 \cdot 132.66) + (-2 \cdot 3.98) + (+4 \cdot 3.745) = \mathbf{139.68}$$

Quantities on the three legs (300, -600 and 1200) have 300 as the highest common denominator to reach their lowest terms (1, -2, 4, respectively).

Therefore, Participant A will bid **139.68** for a quantity of **300**.

Strategy ask price and quantity

$$= (+1 \cdot 132.67) + (-2 \cdot 3.96) + (+4 \cdot 3.745) = \mathbf{139.73}$$

Quantities on the three legs (-225, 450, and -900) have 225 as the highest common divisor to reach their lowest terms (1, -2, 4, respectively).

Therefore, Participant Z will offer **139.73** for a quantity of **225**.

The resulting market for strategy **+1 CGBH12 -2 OGBH12C13100 +4 OGBH12C13150** would be:

Bid Size	Bid	Ask	Ask Size
300	139.68	139.73	225

## APPENDIX A

1. Participants are strongly encouraged to confirm the format and leg ratios of the strategy after it has been listed by MX. Confirming the format and leg ratios is the most certain way to validate the pricing and the quantity of the strategy order.
2. Implied orders can only be created from regular orders. They cannot be created from other implied orders.
3. Implied orders can trade against either only regular orders or only implied orders, with priority given to qualifying regular orders; under no circumstances are regular and implied orders combined.
4. An implied order on an instrument can trade through limit orders if the collective size of the qualifying regular orders is not sufficient to fill the quantity of the instrument required by the strategy structure, and the quantity can be filled by the implied market on the instrument.
5. In the case of crossed implied orders (implied bid > implied ask), the traded price is the price of the most recent order.

### Example for points 2, 3, 4 and 5

Suppose the following markets on an IGS and on the instruments that compose it (implied orders are in brackets):

#### 14 BAXH12 – 25 OBXH12C9875

Bid Size	Bid	Ask	Ask Size
40	1381.08		
7	(1380.69)		

#### BAXH12

Bid Size	Bid	Ask	Ask Size
100	98.71	98.72	560
50	98.70	98.73	50
50	98.69	98.74	50

#### OBXH12C9875

Bid Size	Bid	Ask	Ask Size
1000	(0.035)	(0.04)	1000
5	0.03	0.05	1000
10	0.025		

The bid price of the regular IGS order is generated using 98.72 for the BAXH12 leg and 0.04 for the OBXH12C9875 leg.

$$= (+14 \cdot 98.72) + (-25 \cdot 0.04) = 1381.08$$

The bid price of the implied IGS order is generated using 98.71 for the BAXH12 leg and 0.05 for the OBXH12C9875 leg.

$$= (+14 \cdot 98.71) + (-25 \cdot 0.05) = 1380.69$$

The 0.035 bid in brackets for the OBXH12C9875 is implied from another strategy.

The 0.04 ask in brackets for the OBXH12C9875 is implied from the 1381.08 bid on the IGS and the 98.72 ask on the BAXH12 leg.

Even though there are 1015 contracts (1000 from implied orders and 15 from regular orders) on the OBXH12C9875 bid, an implied ask order cannot be generated on the IGS since:

- the strategy needs to trade the OBXH12C9875 leg in lots of 25 contracts;
- regular orders only make up 15 contracts; and
- the implied functionality only implies off of regular orders.

If another participant enters a 1381.58 bid for a quantity of one on the IGS, this will represent buying 14 BAXH12 at 98.72 and selling 25 OBXH12C9875 at 0.02.

The functionality will first verify if it can imply prices on an instrument by using qualifying regular orders on the related instrument. To qualify, the collective size of the regular orders must meet the minimum quantity ratio for the instrument in question.

In the instant before the trade resulting from the 1381.58 bid, here are the markets on the IGS and on the instruments that compose it:

**14 BAXH12 -25 OBXH12C9875**

Bid Size	Bid	Ask	Ask Size
1	1381.58		
40	1381.08		
7	(1380.69)		

**BAXH12**

Bid Size	Bid	Ask	Ask Size
14	(98.72)	98.72	560
100	98.71	98.73	50
50	98.70	98.74	50
50	98.69		

**OBXH12C9875**

Bid Size	Bid	Ask	Ask Size
1000	(0.035)	(0.02)	25
5	0.03	0.05	1000
10	0.025		

Once the implied orders are generated, trades against qualifying orders will result where possible.

In the example above, the implied ask on OBXH12C9875 generated from the IGS bid will seek to trade against regular orders first and then implied orders. Since the collective size of the regular orders on the bid is not the required 25 contracts, the functionality will trade against the implied bid (where both the price and quantity qualify).

The resulting trade between the implied orders will be at 0.02 for 25 contracts. The trade price is the price of the more recent implied order.



The functionality will also buy 14 contracts of BAXH12 at 98.72 to fill the other leg of the IGS order.

6. Implied pricing may lead to crossed markets on an instrument if the incoming implied order has a required ratio (within the strategy structure) that is incompatible with the opposing quantity on the bid or ask (whether they are implied or not).

**Example**

Continuing with the example above, if the implied bid on OBXH12C9875 is from another IGS and has a ratio of 50, the two implied orders cannot trade. The implied bid must trade in lots of 50 while the incoming implied ask must trade in lots of 25.

If this was the case, the market on OBXH12C9875 would remain:

**OBXH12C9875**

Bid Size	Bid	Ask	Ask Size
1000	(0.035)	(0.02)	25
5	0.03	0.05	1000
10	0.025		

7. Implied pricing may lead to crossed markets on an instrument if the quantity on the bid or ask is insufficient to fill the minimum quantity ratio for the instrument (within the strategy structure).

**Example**

Again, continuing with the example above, if there was no implied bid on OBXH12C9875, the market on OBXH12C9875 would be:

**OBXH12C9875**

Bid Size	Bid	Ask	Ask Size
5	0.03	(0.02)	25
10	0.025	0.05	1000

The market would also be crossed if the implied bid of 0.035 remained but was for 24 contracts or less.

**OBXH12C9875**

Bid Size	Bid	Ask	Ask Size
24	(0.035)	(0.02)	25
5	0.03	0.05	1000
10	0.025		

8. Strategies can only be constructed with two or three legs, and their ratio must be between 99 and -99 (inclusively).
9. The minimum tick increment of a strategy will be the same as the minimum tick increment of the strategy components. This can lead to fill prices being in between usual tick increments for certain instruments.

**Example**

A strategy involving BAXU12 (tick = 0.01) and OBXU12C98625 (tick = 0.001 when below 0.01) will trade in 0.001 tick increments.

10. A Strategy trade with any legs having a ratio greater than 1 may have the leg prices for allocation with a minimum tick smaller than each outright leg minimum tick.

**Example**

A strategy involving 2 CGFH20 (tick = 0.01) and 1 CGBH20 (tick = 0.01) may have a 0.005 (half tick) assigned to the CGF leg for fair leg price algorithm assignment:

Current Market		
Product	Bid Price	Ask Price
CGFH20	120.90	120.91
CGBH20	138.97	138.98
2CGFH20 – 1CGBH20 (spread)	102.84 (real order)	102.85 (implied order)

Now, assume that someone comes in the outright market offering 120.90 in CGFH20, the 2CGF-1CGB spread will be triggered because of an implied bid price of 120.905 in CGF (see below).

$$\text{Spread Price} = +2 * \text{CGFH20} - 1 * \text{CGBH20}$$

$$\begin{aligned} \text{CGB Bid Price} &= 138.97 \\ \text{Spread Bid Price} &= 102.84 \\ X &= \text{CGF implied bid price} \end{aligned}$$

$$\begin{aligned} 102.84 &= 2*X - 1*138.97 \\ X &= 120.905 \end{aligned}$$

The seller in CGF will get an allocation of 120.905 (wanted to sell 120.90) and the buyer of the spread will get an allocation of 120.905 in CGF (buy) and 138.97 in CGB (sell) resulting from his spread price of 102.84.

11. Maximum order sizes for strategies will be dependent on the highest component ratio.

**Example**

If the structure of a strategy is **+14 BAXH12 -25 OBXH12C9875**, 25 is the highest component ratio. The maximum order size for this strategy will be:

$$9999 / 25 = 399.96$$

This will be rounded down to 399.

12. Since the HSVF market dissemination is limited to six numbers and an IGS price can have more than six numbers, price rounding is necessary for display purposes only. The price must still be entered in its entirety by the participant. Bid prices that need to be rounded will be rounded down while ask prices will be rounded up. The price entered by a participant is not rounded and will be the price traded if there is an execution.

**Example**

A participant wishes to buy 290 BAXM12 at 98.72, sell 500 OBXM12C9850 at 0.25 and buy 990 OBXM12C9900 at 0.005. The bid price of this strategy works out to 2850.875 for a quantity of 10.

The structure will be: +29 BAXM12 -50 OBXM12C9850 +99 OBXM12C9900. The bid price the participant must enter is 2850.875. The display will look like this:

BAXOBXOBX#####

Bid Size	Bid	Ask	Ask Size
10	2850.87		

If another participant tries to sell that price by entering a sell order at 2850.87, the trade will take place at 2850.875.

Conversely, a participant wishes to sell 290 BAXM12 at 98.72, buy 500 OBXM12C9850 at 0.25 and sell 990 OBXM12C9900 at 0.005. The ask price of this strategy again works out to 2850.875 for a quantity of 10.

The structure will again be: +29 BAXM12 -50 OBXM12C9850 +99 OBXM12C9900. The ask price the participant must enter is 2850.875. However, the display will look like this:

BAXOBXOBX#####

Bid Size	Bid	Ask	Ask Size
		2850.88	10

12. Even though participants will generate an IGS price using set leg prices, filled legs prices can differ upon execution of the IGS with no effect on the overall IGS price.