Axonetric LLC: Auto-Hedger Job Documentation (ver. 2.33)
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Overview

The Axonetric LLC: Auto-Hedger Job is a delta- and gamma-sensitive automated hedging tool that supports both passive and aggressive execution across a wide variety of operational configurations. The Auto-Hedger job also allows a configurable delta-accumulating/offsetting "pre-queue" over a rolling time window that increases hedging efficiency and precision while potentially decreasing hedging transaction costs. Various instrument subsets can be mapped in a prioritized fashion and diverse hedging needs are supported via detailed, per-future hedging parameters. Specifications are conveniently organized and edited through a grid view graphical control.

Hedging efficiency can be increased (and expenses decreased) when required hedges can be offset prior to being executed in the market. The Auto-Hedger Job is capable of offsetting deltas from incoming hedge requests in three different ways, in the following order:
- Firstly, (fractional) remainders of hedges already filled may offset incoming deltas. For example, a +50 delta from a purchased ATM call might trigger a -100 future hedge (1 lot sold of the future), leaving a balance of -50 delta. If another +50 ATM call arrives next, the prior fractional balance will automatically offset it.
- Secondly, if the user has specified a Delta Accumulation Time Window, incoming hedge request deltas less than the Delta Trigger Quantity will reside in the queue where they may be potentially offset by new incoming deltas of the opposite sign. In the other case, if enough delta of the same sign accumulates, it may also trigger a new futures hedge to be worked / executed.
- Thirdly, once a future hedge is being "worked", any triggered future hedge on the opposing side may immediately offset it. Only after a working future hedge has actually been executed does it become ineligible to be offset.

Depending on the context, the Auto-Hedger Job will attempt to execute futures in one of two different modes:
- Passive mode – A limit order is "worked" at a preferential price with hopes of the market moving "into" you. While futures are being worked, it is possible they may be offset (cancelled) by new incoming hedge requests. Parameters corresponding to this mode are usually prefixed with the word "Working".
  - Any currently "working" futures are in passive execution mode, as long as no side requirements are violated ("Minimum Side Qty Ratio" or "Require Working Side Qty") and as long as the working quantity is not greater than "Max Working Qty".

- Aggressive mode – Depending on user selection, either a market order or a limit order is produced to try to execute futures immediately at the top-of-book price. For example, an aggressive buy would try to take the current asking price, whereas an aggressive sell would try to take the current bid. A market order is guaranteed to execute, however it may incur execution slippage if the intended price moves in the meantime. A limit order is obviously more targeted, but may not execute at all if the intended price moves out of range in the meantime. Aggressive execution may be triggered by a number of factors:
    - New future hedges are requested but the maximum allowed quantity is already being worked. All new future requests will be forced into aggressive execution.
    - A side requirement ("Minimum Side Qty Ratio" or "Require Working Side Qty") is violated, which will immediately cause any working futures to be aggressively executed.
    - A working limit order has followed unfavorable market movements to the maximum extent allowed by the "Working Slippage (ticks)" parameter (and the "afterWorkingSlippageExceeded" variable is set to "Execute immediately").

Note that futures being worked in passive mode may potentially transition into immediate execution (aggressive mode) at any time due to various triggers, but the reverse transition (aggressive mode -> passive mode) will never occur—any futures than enter aggressive execution mode will either be guaranteed to execute (eg, if a market order was specified) or may possibly rest indefinitely as an unmanaged order (eg, if a limit order was specified and the market moved outside the limit price during the time the order was submitted/booked).

"Auto-Hedger Mappings" Grid Columns

"Active"
Check the checkbox in order to allow hedge requests from instruments matching the "Instrument" column of this row to flow through to the specified "Hedging Future".

"Label"
An optional, user-specified "plain English" label for the row, for convenience and readability.

"Priority"
An optional 1+ integer value that, if specified, will control the preferred row matched to a given option or strategy (if multiple rows match that instrument). Lower values have greater priority over higher values.

"Instrument"
The instrument matching string that matches 1 or more instruments (eg, option outrights, strategies, etc.) in the system. This string is selected via the Freeway Instrument Matcher Dialog which appears when the grid cell is double-clicked.

"Symbol" / "Expires" / "Strikes" / "Types"
These are output-only breakout columns that report the various individual sections of the "Instrument" column for convenience and readability. These fields should not be edited—all relevant changes must occur through the "Instrument" column.

"Quotes Also"
If this column is checked, filled options quotes generated in Metro's Quoting Center will also be auto-hedged (in addition to matching Freeway-generated options orders, which is the default). If unchecked, filled options quotes will not be auto-hedged.

"Metro Orders Also"
If this column is checked, filled options orders generated in Metro (via the order ticket or point & click in the options ladder) will also be auto-hedged (in addition to matching Freeway-generated options orders, which is the default). If unchecked, filled options orders originating in Metro will not be auto-hedged. Note that futures orders generated within Metro will always be ignored, as well as any manually entered trade corrections.

"Order Qty %"
This integer column accepts values 1-100, representing the % of the parent order's filled qty to be hedged. For example, if this was set to 50 and a hedge request arrived for a 8-contract option sale, only the deltas for 4 contracts (50%) would be hedged.

"Hedging Future"
This column allows the user to specify the exact future desired to hedge requests from instruments matching the corresponding "Instruments" column. This value must point to a single, valid non-expired future. This value is chosen through the Freeway Instrument Matcher dialog which appears when the grid cell is double-clicked.

"Delete"
If this column's checkbox is checked and then "Apply Changes" is clicked, the corresponding row will be deleted from the grid.

"Auto-Hedger Parameters" Grid Columns

"Hedging Future"

This column is a primary key that may match the value of the "Hedging Future" column of one or more rows in the "Auto-Hedger Mappings" grid. This allows future-specific hedging parameters to be mapped to any number of rows in the "Auto-Hedger Mappings" grid.

"Max Working Qty"

This column specifies the maximum aggregate futures quantity that can be passively "worked" (whether displayed to the market or not) for this future at any one time. Further incoming futures hedges (for this futures instrument) that cannot be offset will be forced to execute aggressively once this cap is reached.

"Max Show Qty"

This column specifies the maximum futures quantity that can be displayed concurrently in the market while "working" a limit order for this future. If this value is "0", the feature is deactivated and the total needed working size will be displayed. If this value is set to 1 or more, the needed hedges will effectively be "iceberged" into the market as they are worked.

"Delta Accum. Window (sec)"

This column, in conjunction with the "Accum. Delta Hedge Trigger" column, controls the configurable delta-accumulating/offsetting "pre-queue". This value sets the rolling time window over which the queue operates. Hedge request items in the queue that have not yet expired may either offset new incoming hedge requests or may accumulate with other items in the queue until the "Accum. Delta Hedge Trigger" is reached (whereupon they will be promoted to either a working or aggressively executed future hedge). If zero (0), then no queue will exist and any incoming hedge request must have a delta greater than or equal to "Accum. Delta Hedge Trigger" in order to be worked/executed (or else it will be permanently ignored because there is no queue for it to accumulate in).

"Accum. Delta Hedge Trigger"

This column specifies the level of delta (absolute value) at which point a 1-lot futures hedge would be generated (either to be worked or immediately executed, depending on the context). Some examples for reference: one ATM call = 50 delta and two ATM puts = -100 delta. If a delta-accumulating queue is specified (Delta Accum. Window column is 1 second or greater), then this value will control the accumulated delta threshold (in the queue) at which point hedge request items in the queue would be promoted to actually working or executed futures orders.

As an example, imagine a user has set "Delta Accum. Window (sec)" = 600 (ten minutes) and "Accum. Delta Hedge Trigger" = 200. Now imagine the following sequence of events occurs when the queue is originally empty:

Minute 1: 3 ATM calls were bought, bringing a delta contribution of +150 (3 x +50). Because abs(150) < 200 (Hedge Trigger), this hedgerequest

Minute 4:   will not generate an order at this time but will be placed into the queue.

3 ITM puts were bought with a delta contribution of -210 (3 x -70). The +150 already in the queue will offset this -210 for a net current balance in the queue of -60 delta. No orders will be generated at this time.

Minute 6:   5 OTM calls were sold with a delta contribution of -150 (5 x -30). This will accumulate with the -60 delta balance already in the queue to create a new net balance of -210. Because abs(-210) >= 200 (Hedge Trigger), a 2-lot buy future hedge will either be worked or immediately executed depending on other parameters and the context. All items in the queue that contributed to the produced 2-lot hedge will be cleared out.

It should be noted that all deltas accumulating in the queue (during the course of the rolling time window) are reevaluated on a frequent, periodic basis. Thus, if a user has set up a queue over several hours, for example, any effects of gamma on the "present" deltas will always be considered. In other words, the deltas in the queue are not static but rather may shrink or grow over time depending on their gamma sensitivities and the movement of the underlying. If gamma causes the accumulated delta in the queue to suddenly grow larger than the "Accum. Delta Hedge Trigger", those items will be spontaneously promoted into a futures hedge.

"Min Side Qty Ratio"

This column accepts a value between 0.0 – 1.0 that controls an execution heuristic that may be applied to the currently working quantity for this future. If this value is set to zero (0), this feature is disabled. Otherwise the size showing on the top-of-book spread is evaluated using the following: SideQtyRatio = (SizeOnExecutionSide) / (SizeOnBothSides). As the SideQtyRatio begins to fall, it may indicate an impending futures tick in the unfavorable direction. Thus, if the computed SideQtyRatio at any time is less than the ratio value specified by this column's value, any currently working quantity will be immediately converted into an aggressive execution order (which may be either a market or limit order depending on other settings—see below).

For example, consider that this column's value has been set to 0.3 (equivalent to 30%) for the considered row. Using price (size) notation, imagine that the futures market is currently "3 (95) – 4 (177)" and we are working a buy order for 5 futures at the 3 price (which would imply a "Working Offset" of 1 tick—see below). The SideQtyRatio would be computed as 177 / (95+177) = 0.6507. Because this ratio is not less that the specified minimum of 0.3, no action will be taken and the buy order will continue to be worked.

Next, however, consider that size on the spread has begun to shift such that the market is now "3 (167) – 4 (52)" and we are still working the 5-lot buy order at the

3 price. Now the SideQtyRatio will be re-computed as 52 / (52+167) = 0.2374. Because this ratio is now less than the user's requirement, this could be an indication that an impending (unfavorable) up-tick in the ask to price 5 may occur soon and the user may thus lose the current opportunity to get off his 5-lot buy at price 4. Thus, this trigger event would then cancel the working order to buy 5 at price 3 and would instead attempt to aggressively execute the 5 quantity at price 4.

"Min Working Side Qty"
This column is another optional side requirement that compares the current size on the "executing side" of the spread *to the hard-coded quantity specified here*. Enter "0" to deactivate this check / requirement. If "1" or more is entered here, and the size showing on the executing side ever falls less than this value, then the currently working quantity will be immediately converted into aggressive execution.

"Req. Working Side Qty"
This column is another optional side requirement that compares the current size on the "executing side" of the spread *to the quantity currently being worked*. If this column is checked, and the size showing on the executing side ever falls less than the currently working quantity, then the currently working quantity will be immediately converted into aggressive execution.

For example, say the user has set "Min Side Qty Ratio" to 0.3 and "Require Working Side Qty" = true. Say a 30-lot buy order is being worked at price 3 when the current market is "3 (80) – 4 (52)". The SideQtyRatio (computed to be 0.39) is not in violation and neither is the "Req. Working Side Qty" check because 52 > 30 (working qty). Now, however, consider that the market becomes "3 (40) – 4 (26)". Although the SideQtyRatio has stayed exactly the same and is not in violation, the "Req. Working Side Qty" has now been violated because 26 < 30 (working qty). This would cause the 30-lot working buy order to be immediately aggressively executed at the 4 price.

This situation also ideally illustrates the impact of the "Execution Slippage (ticks)" setting below. If an "Exec. Order Type" of LIMIT was specified, and "Execution Slippage (ticks)" = 0 ticks, then our 30-lot working buy order would become an aggressively execute buy 30 limit order at price 4. However, since only 26 size is currently showing on the book, there is a good possibility we will not get fully filled. However, if "Execution Slippage (ticks)" had been 1 tick, then the new LIMIT order would have been placed at price 5 (current ask of 4 + 1 tick), thus allowing the exchange's matching engine to partially fill you with whatever was available at price 4 and then fill the remainder with size available at price 5.

"Working Offset (ticks)"
This column must be 1 or greater and specifies how many ticks more favorable the working price level will be compared to the current price showing at the executing price of the spread. For example, if the market is "2 – 4" and we are

working a buy order with a "Working Offset" = 1 tick, then our working limit order would be placed in initially at price 3. If the spread then up-ticked to "3 – 5" (and assume no side requirements were enabled or triggered), then our working order would follow the unfavorable movement and be modified to work at new price 4 (assuming the "Working Slippage" value was least 1 tick—see below). If, on the other hand, the spread had down-ticked to "1 – 3" then our working buy order at 3 would have been filled at that preferred price.

"Working Slippage (ticks)"
This column must be zero or more and controls the maximum number of ticks a working order is allowed to follow an unfavorably moving market from it's initial position. Note that in order for a working order to follow an unfavorably moving market (and stay working), no side requirements can be triggered (otherwise the working order would be converted directly into an aggressive execution order).

To use the prior example, if the market is "2 – 4" and we our working a buy order (with a "Working Offset" = 1 tick) is initially placed at price 3 and our "Working Slippage" is set to 2 ticks, then we could modify our working order as high as price 5 (eg, if the ask up-ticked 2 consecutive times) and still be working. However, if the ask up-ticked yet again to price 7, we have reached the end of our "leash" and the order will no longer be actively worked. Depending on the "afterExceedingWorkingSlippage" parameter setting (see below), this working order would either sit at its last location (and no longer be actively managed by the job) or would have its quantity immediately converted into an aggressive execution order to try to get filled at price 7 (where the current ask would be in this hypothetical situation).

"Max Working Duration (sec)"
This column controls the maximum duration any futures lot is allowed to work before it is converted into aggressive execution. If set to zero (0), this feature is disabled and any working quantity may work indefinitely (assuming no other criteria or triggers are violated). Note that, working quantity components are tracked independently. For example, if this parameter was set to 300 (5 minutes) and at minute 1, three futures lots being working on a buy order, and at minute 5, an additional four futures lots join the working buy order (for a total working quantity of 7), then (assuming no fills have taken place) at minute 6, only three lots will be removed from the working buy order to be aggressively executed. The remaining 4 lots will continue to work as long as minute 10. Durations are tracked on a first-in first-out (FIFO) basis.

"Exec. Order Type"
This column must be either "MARKET" or "LIMIT" and describes the type of order used to aggressively execute quantity for this future.

"Exec. Slippage (ticks)"
This column must be zero ticks or more and is only relevant when "Exec. Order Type" = LIMIT. It provides the level of additional padding added to the desired

execution price when an aggressive limit order is produced. The exchange's matching engine will always match at the most advantageous available price, so this padding is only for the worst-case scenario. Please see the final paragraph of the "Req. Working Side Qty" example given above for a practical illustration.

"FastFutures Symbol"

This column allows for an artificial symbol mapping to be specified that leverages Scott Morris' "FastFutures" algo. More details to be provided in the future.

"Account Override"

This optional column allows the user to override the trade account attached to orders generated for this future. If not specified, the overall job's default assignment will be used.

"Delete"

If this column's checkbox is checked and then "Apply Changes" is clicked, the corresponding row will be deleted from the grid.