



Autobahn Equity Americas US Routing Logic

Smarter Liquidity – Innovation with Integrity

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This document describes the routing logic used for orders sent to the Autobahn desk.

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How Orders are Routed When Sent to Autobahn’s Algorithmic Strategies

The algorithms utilize the **Smart Order Router** and **SuperX+ Router** to access displayed and non-displayed liquidity, respectively. The interaction between algorithms and routers varies as a function of client objective and the intended behavior of the strategy.

Smart Order Router (SOR)

SOR accesses displayed liquidity and DB’s ATS, SuperX. The router determines where to send orders based on the following principles:

1. Fulfill Reg. NMS obligations.
2. Achieve execution objectives for clients, which vary as a function of client strategy. Clients may seek to maximize liquidity, minimize implicit transaction costs (i.e., payment of spread), or minimize explicit transaction costs if they are cost-sensitive. The SOR has various modes that work to achieve these execution objectives and are configurable by client and algorithmic strategy.
3. All else being equal, DB will attempt to minimize explicit transaction costs, subject to that not being in conflict with #1 and #2 above.

The logic employed to realize these principles varies by client trading strategy and instruction. By default, our algorithms utilize a router mode (“SOR Aggressive” with SuperX ATS ping) that will cross the spread when taking liquidity and prefer venues with lowest latency and highest fill probability. This feature is called the Taker Tactic. When posting, our algorithms use a router mode (“SOR Neutral” with no SuperX ATS Ping) where passive orders are posted on one or more venues to reduce expected time to fill. This feature is called the Supplier Tactic.

Steps when taking liquidity or posting orders in lit exchanges for algorithmic strategies

Taker Tactic	Supplier Tactic
<ul style="list-style-type: none"> – Sweeps SuperX-ATS with an aggressive limit – Sweeps top of book on all eligible venues – Prefers lowest latency venues – May allocate a multiple of display size 	<ul style="list-style-type: none"> – Posts with a passive limit – Shares allocated on expected time to fill – Display size of posted orders is equal to the average trade size

Please see [SOR Routing Modes](#) on page 3 for more information on the smart order router.

SuperX+ (Dark Router)

SuperX+ accesses non-displayed liquidity. The logic employed to realize execution objectives varies by client trading strategy and instruction. By default, our algorithms utilize an urgency ("SX+ Neutral") with dynamic order parameters to interact with non-displayed liquidity.

Based on the order's execution progress and the signals generated within the algorithm, one or more of the following tactics may be used:

Pounce Tactic	Supplier Tactic	Dark Tactic
<ul style="list-style-type: none"> – Used to sweep non-displayed liquidity resting within the NBBO – Periodically sweeps multiple venues – Shares allocated based on urgency, order size, and dark pool ranking 	<ul style="list-style-type: none"> – Used to post orders passively – Posts with a passive limit – Shares allocated based on urgency, order size, and dark pool ranking 	<ul style="list-style-type: none"> – Used to post orders within the NBBO with a dynamic minimum quantity – Posts within the NBBO with a dynamic minimum quantity – Shares allocated based on urgency, order size, and dark pool ranking

A number of factors may affect the pools to which an order is allocated:

- A lower urgency may result in allocation to fewer dark pools and more passive placement (generally at near touch or midpoint), whereas higher urgencies will result in more aggressive order placement and allocation to a broader number of pools.
- Minimum acceptable quantity (MAQ) thresholds are designed to specify the smallest individual order with which the strategy will interact. Depending on the size of the MAQ, the number of pools selected for allocation may change.
- Order type (IOC vs. Day) may also affect the number of pools selected.
- Non-actionable orders will rest in SuperX ATS until they become actionable. Please see [SuperX+ Routing Urgencies](#) on page 4 for more information.
- Odd lot orders may be handled separately for clean-up.

How Orders are Routed When Sent Directly to the Smart Order Router

SOR Routing Modes

Execution price is the primary routing factor in the SOR. Where multiple venues quote at the same price, the SOR uses a number of “modes” to allow the user to balance explicit transaction costs and fill probability. The following table describes the behavior for each of the major SOR modes.

By default, the **Neutral** mode (with SuperX ATS Ping) is used when clients send marketable and non-marketable orders directly to the SOR. Any client may opt-in to another mode or combination of modes. For example, the **Cost-Neutral** mode uses **Neutral** logic on non-marketable orders and **Cost-Saver** logic on marketable orders.

For the non-marketable behavior of each mode, if client specifies a display quantity (MaxFloor), this display quantity is used on each venue submission.

By default, the SOR attempts to internalize the order by sending an Immediate Or Cancel (IOC) order to SuperX ATS before sending to external venues. This feature is called **SuperX ATS Ping**. This feature may be disabled on request.

SOR Modes	Intended <u>Marketable</u> Behavior	Intended <u>Non-Marketable</u> Behavior
Aggressive	<ul style="list-style-type: none"> Orders are sent to multiple venues, one price level at a time. Where there are multiple venues displaying the same price, fill probability/latency is used to select the venues. The order is sent to venues ordered by expected fill probability/latency. 	<ul style="list-style-type: none"> Order is split among venues to reduce expected fill time. This calculation considers, among other factors, each venue’s expected fill rate and queue size. Display quantity is equal to 200% of average fill size, unless client specifies MaxFloor.
Neutral	<ul style="list-style-type: none"> Orders are sent to multiple venues, one price level at a time. Where there are multiple venues displaying the same price, both exchange fee and fill probability/latency are used to select the venues. Half of the order is sent to venues ordered by expected fill rate, half is sent to venues, ordered by exchange fee. 	<ul style="list-style-type: none"> Order is split among venues to reduce expected fill time. This calculation considers, among other factors, each venue’s expected fill rate and queue size. Display quantity is equal to 100% of average fill size, unless client specifies MaxFloor.
Cost-Saver	<ul style="list-style-type: none"> Orders are sent to multiple venues, one price level at a time. Where there are multiple venues displaying the same price, exchange fee is used to select the venues. The order is sent to venues ordered by exchange fee. 	<ul style="list-style-type: none"> A short-list of venues is created for each order. Only venues with an expected symbol-specific fill rate higher than the threshold are included in the short-list. Of those venues, the whole order is sent to the venue with the highest rebate. Display quantity is equal to 100% of average fill size, unless client specifies MaxFloor.

Dynamic SAS

For all Marketable Modes: When sending to multiple venues, orders are sent simultaneously with the aim of minimizing quote fade. As of August 2014, the ultra SOR instance uses a feature called **Dynamic Submission Arrival Synchronization (SAS)**, described below.

- Order-acknowledgement latencies for each exchange are monitored in real-time throughout the day
- The SOR uses historical latencies for initialization and calculates a moving average of order-acknowledgement latency for each exchange
- When the SOR receives a marketable order that takes liquidity from multiple venues, the venue submissions are staggered by the real-time, expected latency offset
- The aim is to have all submissions arrive at all exchanges at the same time, after taking into account current network conditions
- By default, the SOR will send an IOC order to SuperX ATS before sending orders to exchanges. This feature is called the **SuperX ATS ping** and it may be disabled on request.

How Orders are Routed When Sent Directly to SuperX+

SuperX+ accesses non-displayed liquidity. The router is driven by historical and real-time pool performance information, and uses the following algorithmic models to achieve the varying execution objectives for clients.

1. Fair Price Model: determines when to trade based on the real-time return relative to an ETF and the historical volatility of the stock. This is combined with order parameters to establish a theoretical “fair price” to trade. Note that the “fair price” is dynamic and will change over time with the change in relative return.
2. Anti-Adverse Selection Model: briefly pauses trading when there are several simultaneous fills from multiple destinations.
3. Dark Pool Ranking Model: measures historical liquidity quality and quantity based on reversion metrics and fill rates to establish a rank by value. This is combined with order parameters to select the appropriate number of dark pools to which the order will initially be sent. Clients have the ability to exclude any venue or venues.

SuperX+ Routing Urgencies

The following table describes the behavior for each of the major SuperX+ urgencies.

SuperX+ Urgencies	Intended Behavior
Aggressive	<ul style="list-style-type: none"> – Sends orders to all venues. – Dark venues: Peg to market where available, otherwise, peg to midpoint. – Hidden orders send to exchanges: Peg to midpoint. – No delays between fills and new submissions. – Sweeps multiple venues starting from highest ranked venues. – Unallocated remaining shares are sent to SuperX ATS.
Neutral	<ul style="list-style-type: none"> – Sends orders to the top 80% of eligible dark pools from ranking model. – Peg to midpoint. – Shorter delays between fills and new submissions. – Sweeps multiple venues starting from highest ranked venues. – Unallocated remaining shares are sent to SuperX ATS.
Passive	<ul style="list-style-type: none"> – Sends orders to the top 60% of eligible dark pools from ranking model. – Peg to midpoint or near touch. – Longer delays between fills and submissions. – Sweeps multiple venues starting from highest ranked venues. – Unallocated remaining shares are sent to SuperX ATS.
Custom-Venue	<ul style="list-style-type: none"> – Rests in a single venue – Please contact your Autobahn coverage for more information

If the order is considered non-actionable, the whole order will rest in the SuperX ATS. An order is considered non-actionable if the limit price of the order is very passive relative to the NBBO and considered to have a negligible chance of execution. Note that an order’s marketability can change over time depending on the movement of the current market bid and offer. SuperX+ will change its behavior accordingly.



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