Deutsche Bank
Equities

# Autobahn Equity EMEA
## Routing Logic

## How orders are routed when sent to Autobahn's algorithmic strategies

Deutsche Bank's algorithms utilise its **Smart Order Router (SOR)** and **SOR Dark (SOR-D) Router** to access displayed and non-displayed liquidity respectively. The interactions between algorithms and routers vary depending on the algorithm being used and the client's investment objectives.

This document is intended to provide an overview only of the core operating modes of the **SOR** and **SOR-D** Router in execution of orders of European listed Equities.

### Smart Order Router (SOR)

Where client preferences permit, the **SOR** accesses displayed liquidity and private quotes from the external SI's that Deutsche Bank is connected to as well as Deutsche Bank's own SI, the **Deutsche Bank Systematic Internaliser (DBES)**. The router determines where and how to send orders based on the following principles:

1. Fulfillment of MiFID II including best execution obligations.

2. Achievement of specific execution objectives for clients. Clients have the option, by way of example, to seek to maximise liquidity, minimise implicit transaction costs (e.g. payment of the spread), help improve the probability of fill(s) or help reduce explicit transaction costs if they are cost sensitive.

The **SOR** has different Urgency settings that help to achieve these execution objectives and the logic is further configurable at the client level.

### Aims and Modes of Operation

Clients may have specific objectives when placing orders passively (orders that provide liquidity) or when placing orders aggressively (orders that take liquidity) from the market. Naturally, these objectives may conflict with each other, since optimising for one of them would typically imply the deterioration of the expected outcome with respect to the other.

In order to tailor the **SOR** to the client's specific objectives, there are a number of configurations that can be invoked by specifying (or defaulting for a particular client) the parameter called "Urgency".

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The following table provides a high level summary of the different modes supported by the SOR.

| Urgency | Trade-Off | Possible Use Cases |
|---|---|---|
| High | (+) Target Trading/Execution Venues with largest visible liquidity first when trading aggressively<br>(-) May incur higher impact | May be useful for when targeting the primary market (normally has the largest visible liquidity) or when fill probability is the primary objective. |
| Moderate | (+) Targets faster markets to reduce market impact<br>(-) Lower fill probability than High Urgency Mode when trading aggressively | May be useful when optimising fill probability vs market impact. |
| Low | (+) Lowest transaction costs<br>(-) Lower speed/probability of execution in fast markets | May be useful when sensitive to explicit transaction costs. |
| Route-Through | (+) Low latency to reach primary market<br>(-) No price improvement potential | May be useful when special order types are needed, e.g. Native Iceberg. |

By default, our algorithms utilise the SOR in the Moderate Urgency mode.

We source our European Best Bid and Offer (EBBO) by internally aggregating market data from Primary Markets, MTFs and SI's to which we connect. We consider an order as marketable in the context of the SOR if:

- the order is submitted as a 'market' order, or
- the limit price of a buy order is greater than or equal to the EBO (European Best Offer), or
- the limit price of a sell order is less than or equal to the EBB (European Best Bid)

Otherwise, the order is considered as non-marketable. An order can switch from being marketable to non-marketable and vice versa, based on changes in market data and the EBBO.

Depending on whether an order is marketable or non-marketable an order will move through various trading sequence phases (again configurable by client). Below is a description of these phases for SOR in Moderate Urgency mode, where client preferences and order types allow.

| Non-Marketable Orders | Marketable Orders |
|---|---|
| 1) Systematic Internaliser Phase – Will send an IOC (Immediate or Cancel) order to DBES at the client limit, if the order is eligible for internalisation and the client limit is at the touch or within the EBBO spread.<br><br>2) Lit Passive Phase – Orders will rest on Venues at the client limit and will be allocated based on median latency and stock or market specific average trade size data. If the price trades through the limit or Primary goes into auction this phase will be repeated. | 1) SI Phase – Will send an IOC order to DBES at EBBO.<br><br>2) Lit Aggressive Phase – Will send an IOC order to Venues based on displayed price. Will only send IOC orders to external SIs when the price offered is better than displayed Venues and the size offered is above SMS. This phase will be repeated when all submissions have returned. |

As soon as a marketable order becomes non-marketable, SOR will move to Lit Passive Phase.

## SOR Dark (SOR-D) Router

**SOR-D Router** is used when access to dark liquidity and periodic auctions is required. It can only be accessed by an algorithm (either via "SuperX+" algorithm or another strategy). In each case the upstream algorithm is responsible for the correct pricing of the routed order, while the router is responsible for the allocation and routing logic.

**SOR-D Router** logic is determined by its client-specified Urgency parameter, Venue rankings, explicit or implicit MES* (Minimum Execution Size) instruction and the order size.

The main factors that impact the routing of orders are:

- The number of dark liquidity pools and periodic auctions that may be accessed.

- The price peg.

- MES thresholds are designed to specify the smallest individual order with which the strategy will interact. If not specified by the client, the selected Venues are based on historical trade sizes and reliant on the Urgency mode selected. The Urgency mode selected will, in general determine the MES based on the stock specific average execution size. The higher the Urgency mode selected, the smaller the MES. Depending on the size of the MES relative to the order size, the number of Venues available for allocation may change.

As with the **SOR**, the **SOR-D Router** is further controlled by explicit client instructions and configurations.

## Aims and Modes of Operation

Clients may have specific goals when placing orders through **SOR-D Router**. These goals include:

- Maximising the (expected) trading rate
- Reducing the information leakage from partial executions
- Reducing the cost of trading
- Maximising the spread capture

Naturally these objectives may conflict with each other, since optimising for one of them would typically imply the deterioration of the expected outcome with respect to the others. In order to tailor **SOR-D Router** to the specific needs of individual clients there are a number of configurations that can be invoked by specifying (or defaulting for particular client) the "Urgency" parameter.

Where client preferences permit and order types allow, **SOR-D Router** sends an Immediate Or Cancel ("IOC") order for the full size to DBES. If permitted by the client's Urgency setting, this step can be repeated for any unexecuted residuals through permissible external Venues in order of the Venue ranking logic.

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The basic characteristics, the suggested usage and the standard settings of the SOR-D Router are listed below:

| Urgency Setting | Trade-Off | Possible Use Cases | Standard Settings |
|---|---|---|---|
| Very High | (+) Maximises the expected trading rate<br>(-) Highest proportion of spread cross incurred<br>(-) Potential for highest information leakage | May be useful when liquidity demands are highest and there is a low sensitivity to information leakage. Broadest list of Trading/Execution Venues accessed at maximum of Far. | - Lowest MES Setting<br>- IOC All Trading/Execution Venues at Mid/Far, Trading/Execution Venues ordered by 'Trading/Execution Venue type' then 'Latency'<br>- Rest the unexecuted balance of the order in all of the available Venues pegged to Mid according to the SOR-D Router Allocation Phase<br>- In parallel rest qualifying conditional orders in Turquoise Plato Block Discovery and BATS LIS |
| High | (+) High expected trading rate<br>(-) Potential for high information leakage | May be useful when there is high liquidity demand while not willing to pay extra cost of transacting. Narrower list of Trading/Execution Venues and trades at Mid or better. | - Low MES Setting<br>- IOC DBES at Mid<br>- Rest the unexecuted balance of the order pegged to Mid in all of the available Venues according to the SOR-D Router Allocation Phase<br>- In parallel rest qualifying conditional orders in Turquoise Plato Block Discovery and BATS LIS |
| Moderate | (+) Moderate expected trading rate<br>(-) Moderate information leakage | May be useful when there is a balanced desire to trade (up to midpoint) versus leak information. Accesses the same Trading/Execution Venues as High but with higher MES settings. Trades at Mid or better. | - Moderate MES Setting<br>- IOC DBES at Mid<br>- Rest the unexecuted balance of the order pegged to Mid in all the available Venues according to the SOR-D Router Allocation Phase<br>- In parallel rest qualifying conditional orders in Turquoise Plato Block Discovery and BATS LIS |
| Low | (+) Low information leakage<br>(-) Low expected trading rate | Low immediacy demanded, interacts with DBES only in full size. Trades at Mid or better. | - High MES Setting<br>- IOC DBES at Mid<br>- SI at Mid according to the SOR-D Router Allocation Phase |
| Very Low | (+) Lowest information leakage<br>(+) Most Price Opportunistic<br>(-) Lowest expected trading rate | Very low liquidity demands. Only fills at Near. Only goes to DBES in full size. | - Lowest MES Setting to maximise probability of near side liquidity<br>- IOC DBES at Near |

Please note:

- For orders above SMS, DBES will be allocated at least SMS or no allocation at all
- Orders below SMS will not be sent to DBES at any Urgency.
    - For low and very low urgencies, these orders will be rejected back
    - For Urgency of Moderate and above, orders will be allocated to external Venues only
- Where Double Volume Caps ("DVCs") apply, the full quantity with a relevant MES will be allocated to the Cboe Periodic Auction.

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*SOR-D Dark Router uses Minimum Execution Size (MES) except when interacting with ITG POSIT who only support MAQ (Minimum Acceptable Quantity)

## SOR-D Router Allocation Phase

For each order SOR-D will determine appropriate MES and MaxQTY (maximum quantity) values taking into account the market characteristics for that stock, order size and specified Urgency.

A list of eligible Trading/Execution Venues will be created for each order taking into account the following factors:

- Order size (where eligible for SI interaction and LIS Venues);

- Order Urgency;

- Listing Venues; and

- Client preferences with respect to individual Venues or types of Venues.

The order will be rejected if there are no eligible Venues available at this stage.

| Trading / Execution Venue Type | Venues | Phase 1 | Phase 2 |
|---|---|---|---|
| Systematic internalisers | DBES | 100% | 80% |
| Primary market mid-point order book | DCSE, DHEL, DSTO | 100% | 0% |
| Dark Venues | BATD, CHID, TRQM, XPOS | 100% | 20% |
| Periodic auction Venues | BATP | 0% | |
| Venues with conditional orders | LISX, TRQM | 0% | 100% |

There are two phases in the SOR-D router interaction:

In Phase 1 SOR-D would send the unexecuted part of the order sequentially to all Trading/Execution Venues supporting IOC orders (see the table above) using the MES as defined above. The sequence of Venues to which orders are sent is defined by the latency to access the market.

In Phase 2, SOR-D Router will run an iterative algorithm to define the final allocation to be sent to each eligible Venue, as follows:

1. Each of the Venue categories will initially be allocated a part of the order as defined in the table;

2. When executing firm orders, the subsequent allocation is determined in accordance with historical liquidity for a given MES value;

3. The resulting allocation is verified against MES and, if the relevant order size is below the MES, the Venue with the lowest allocation is removed from the list of possible Venues;

4. If the allocation is greater than MaxQTY, it is replaced with a random value between MES and MaxQTY;

5. The sequence starting from step 2 is repeated until all the orders for each Venue meets both MES and MaxQTY requirements;

6. Venues that support conditional orders will be sent the full order size if greater than LIS.

NB: Where client orders cannot rest at a given venue, the SOR-D Router will periodically IOC the Venue with the allocated quantity

If there is no known historic liquidity the allocation across all available Venues in a category will be based on an equal split.

Non-conditional orders are sent simultaneously to all eligible Venue types while conditional orders are delayed and submitted in randomised order.

If a partial or full execution is received from one of the non-conditional orders the allocation cycle is re-run and the orders are amended/re-sent accordingly

If a firm-up request is received from a conditional Venue, all active orders are cancelled and on completion of the cancellation cycle the firm-up order is sent for the remaining order quantity. If multiple firm-up requests are received the first Venue that responds will get a un-conditional order and get a priority and subsequent firm-up requests will be excluded.

If the firm-up order is not fully executed, the standard allocation cycle is run once again and all orders are submitted as per the allocation model explained above.

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# Deutsche Bank
## Equities

# Autobahn

## Contacts:

**European Execution Desk:**
+44 (0)207 547 2022
autobahnequity.emea@list.db.com

**US Execution Desk:**
+1 212 250 3988
autobahnequity.us@list.db.com

**Asia Pacific Execution Desk:**
+852 2203 6028
autobahnequity.apac@list.db.com

**Japan Execution Desk:**
+813 5156 6642

**Australia Execution Desk:**
+61 2 8258 2862

## Autobahn

Autobahn Equity is part of Deutsche Bank's electronic trading platform, providing you with access to execution solutions in all major equities markets. Autobahn trading is available in both lit and alternative destinations via our flexible suite of algorithms or direct market access (DMA) and both are supported by robust risk controls. Detailed market knowledge and algorithmic trading expertise are provided by our dedicated coverage team.

## Further information:

**Support:**
Europe: +44 207 545 3448

US: +1 212 250 7034

**Website:**
autobahn.db.com/equity

Asia (ex Japan): +852 2203 7700

Japan: +813 5156 6642