# MFX Compass

## Pricing and Distribution

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# MFX Compass Pricing

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# MFX Compass Pricing Overview

## Filters

Filters remove anomalous quotes in constructing a filtered market data order book source.

A stale quote presenting itself as the best bid or offer presents latency arbitrage opportunities and results in the formation of an incorrect order book. This renders pricing vulnerable.

Crossed market quotes are also removed from the filtered market data order book. A summary of the filters can be found in pricing.filters and hovering over the tooltip (‘i’ icon)

## Signals

The signals are High Frequency Predictors that utilise available market data to predict market directions within the next few minutes.

Compass provides an adaptive signal composition, which is a method of combining multiple signals that adapt to changing market conditions and avoid the requirement to calibrate or hand tune.

The application of signals can be used in a variety of areas:

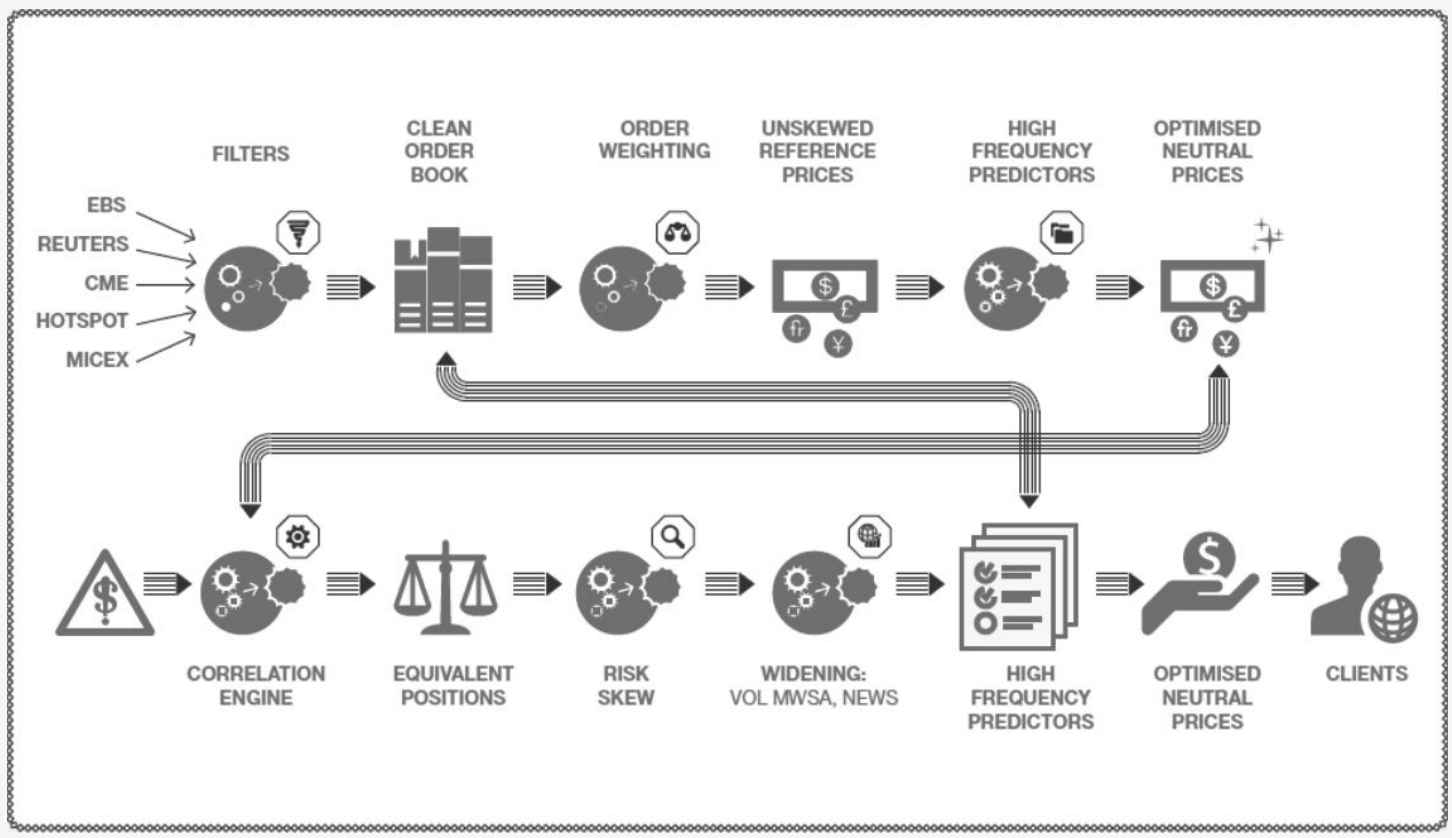
- Price Formation
- Distribution - tailoring rates to:
  - Attract liquidity in aggregated environments
  - Defend against aggressive flow
  - Internalise decision making
- Hedging - withdrawing passive hedging when the trade being filled is predicted to go against us

## MFX Compass Pricing Overview

Compasses pricing model forms its own enriched TOB price based on the information it has consumed from a number of different LPs quotes from the market. The model then runs through each of the pre defined pricing nodes and makes a decision on how the price should be adjusted based on the configuration of the node.

Prices are formed in Compass by:

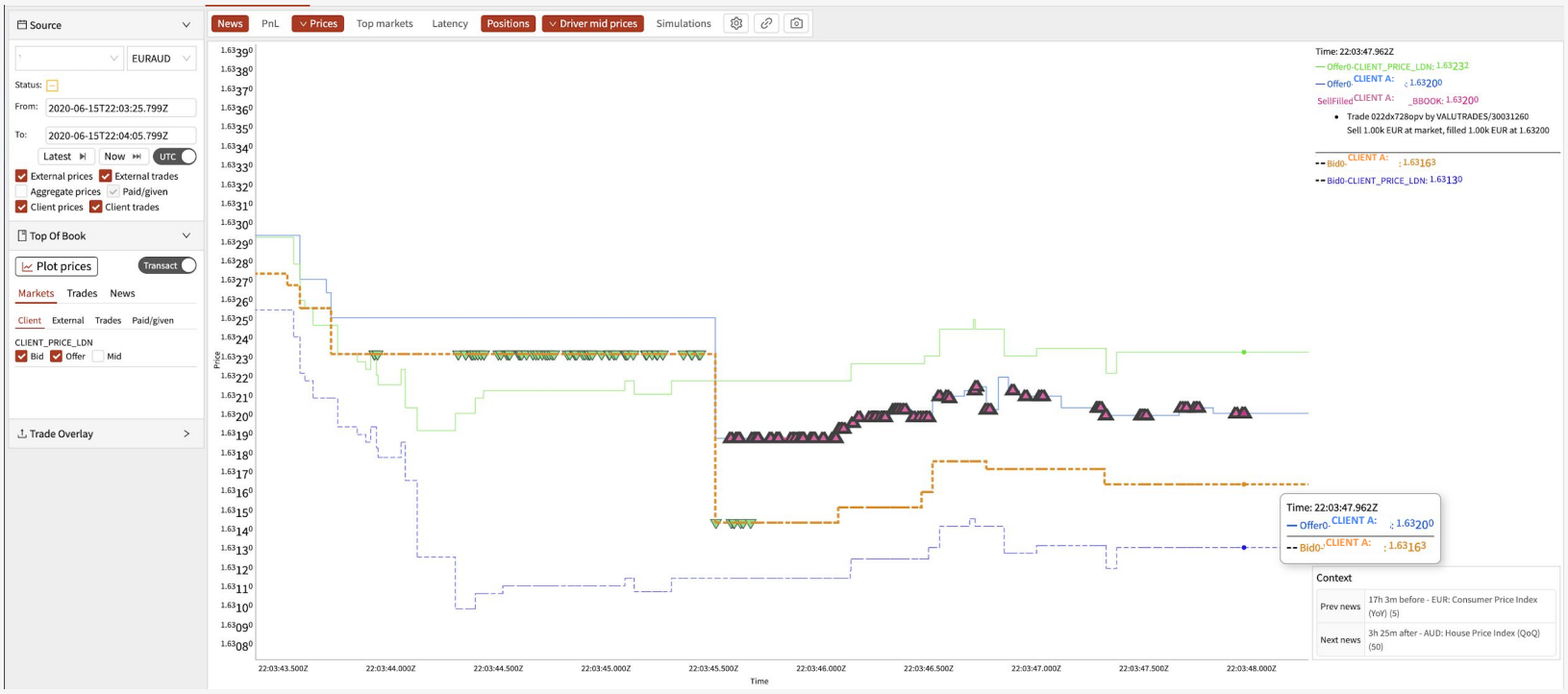
1. The pricing model takes into account a number of different LPs price quotes
2. Filters make sure anomalies or old prices are filtered out
3. It then takes the best bid and offer based on the filtered LP quotes
4. HFP signals are then used to predict changing market conditions and make decisions on how to adjust the spreads to adapt
5. It constantly feeds LP prices through each node to ensure up-to-date, competitive pricing



# Signals

If the signals indicate a market will soon rise, Compass can widen the quoted spread substantially making it less attractive to onboard toxic risk.

Below, we observe the internal pricing model widen as a signal response during a market drop protecting the Compass PNL.



## MFX Compass Pricing Nodes

Once the filtered market data order book is constructed, the order book is processed by a series of individual pricing nodes. Each node contains specific pricing logic and will update the price if the conditions within the node trigger a change.

- Base Spreads
- Market Width Minimum Spread
- Market Width Tightening Parameters
- Benchmark Minimum Spread Configuration
- Pricing Wide Spread Suppression
- Arb Protection Parameters
- Price Widening Functionality
- Skew

## Market Width Minimum Spread

Configures minimum model spreads relative to other markets.
*Configuration at pricing.marketWidthMinimumSpreadParameters*

## Market Width Tightening Parameters

Optionally configures base spread tightening relative to other markets for the given instrument. This is applied to the front of stack spread relative to the best bid/offer in the same amount on the selected benchmark markets. The remaining tiers will be widened proportionally. The resulting stack is subject to the spread minimal configured via *pricing.minimumTightenedSpreadRatioOfBase*

*Configuration at pricing.marketWidthTighteningParameters*

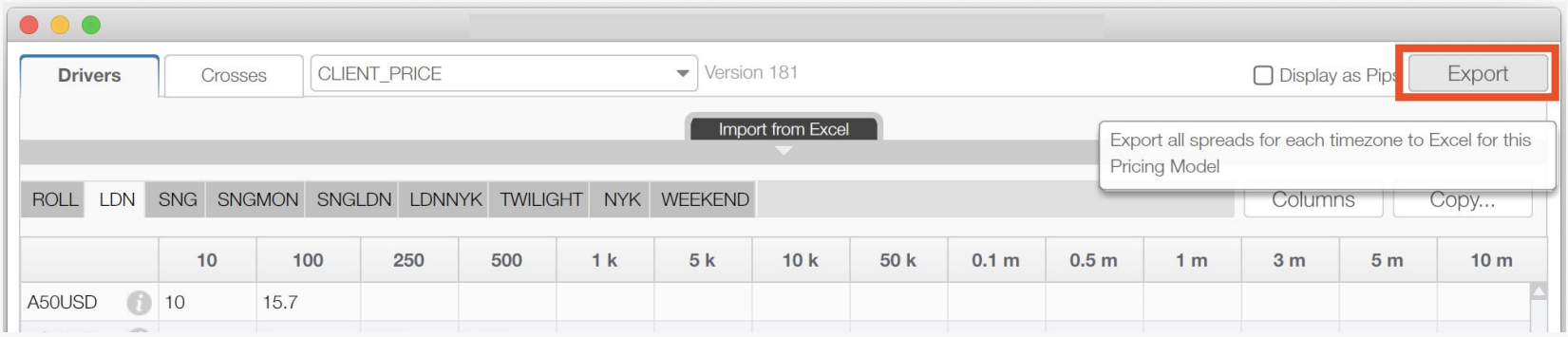
## Base Spreads

These are the minimum allowed spreads per instrument and configured via Excel import in the Spread Configuration key under Configuration. Base spreads can modulated by the following factors:

- Volatility
- Liquidity
- Exceptionally high risk
- Market directional movement
- Scheduled news
- Benchmarking

**Configuring base spreads:**

Navigate to the Spread Configuration found under Configuration in the toolbar in MFX Compass. Export the current configuration and open in Excel. Here the current spreads can be edited and new currencies can be added by adding rows.




Once adjustments have been made to the spread, ensure to save the file in the Excel (97-2003) format. Return to the spread config window and click ‘Import from Excel’. Once imported, the spread config window should update automatically and the specified adjustments will be in place.

## Benchmark Minimum Spread Configuration

Widens part or all of the order book if tighter than reference spreads

*Configuration at pricing.benchmarkMinimumSpreadLogicParameters*

## Wide Spread Suppression

This is a critical protective measure in preventing the stopping out of clients. Suppresses publication of wide spreads in one of 3 ways:

- **Turn pricing indicative**
  - Will not send out a new price update if the quote is more than a specified multiple of the base spread; instead it will wait until the spreads are back within the acceptable range
  - *Note: not all bridge providers can cope with this.*
- **Spread Cap**
  - A spread ceiling beyond which limits the maximum spread value

*Configuration at pricing.wideSpreadSuppression*

## Arb Protection Parameters

This allows the model to maintain a minimum distance from the opposing side of a specified LP by widening the published bid/offer, thus preventing it from being closer to the VWAP (Value Weighted Average Price) than the configured amount. It increases the protection applied to the price, as new qualifying bids or offers are introduced into the external stack, it avoids presenting an arb to market based on the resulting prices.

*Configuration at pricing.arbProtectionParameters*

## Price Widening Functionality

There are multiple sources of widening in the system:

- **Benchmark Widening**
  - As liquidity changes in the external stack, this feature allows for the different elements of the stack to widen independently of each other. This is very important to strike the right balance between being competitive and still making profit in the different sizes being shown to customers. Each size needs to be managed directly as average widening applied across the whole stack will not strike the right balance.
- **Market Width Spread Adjustment**
  - This takes a weighted average of recent spreads from or near the top of book and allows us to apply as a multiplier to the whole stack. This provides protection in the event of unanticipated market changes.
- **Anti Spoof Moving Average Widening**
  - This is to combat spoofing of the source rates, which is particularly important in illiquid conditions. If a bid or offer is abruptly moved by more than the configured threshold, the system will wait until that bid or offer is confirmed (by a configured number of ticks) before incorporating that price into the stack for rate formation.
- **Marginal Risk Widening**
  - The system can be configured to widen the risk increasing side of all prices when the VaR or equivalent position exceeds the specified limits.
- **Signal Widening**
  - Each signal used in the system can apply skew and/or widening in a configurable way. For example, the short term trend signal can be used to either skew the price up one market step size, or just widen the offer one market step size.
  - All of this is fully automated and deterministic. Mahi has the ability to back test alternative configurations before applying to the active pricing model.
- **Volatility Widening**
  - This shows a ladder of volatility quantiles to widening factors and how they decay.
  - Widens the published bid/offer to prevent it from being closer than the configured amount to the VWAP offer/bid in the regular amount across the configured markets (or all reference price markets if markets is null)
    *Configuration at pricing.widening.volatility.factors.X*

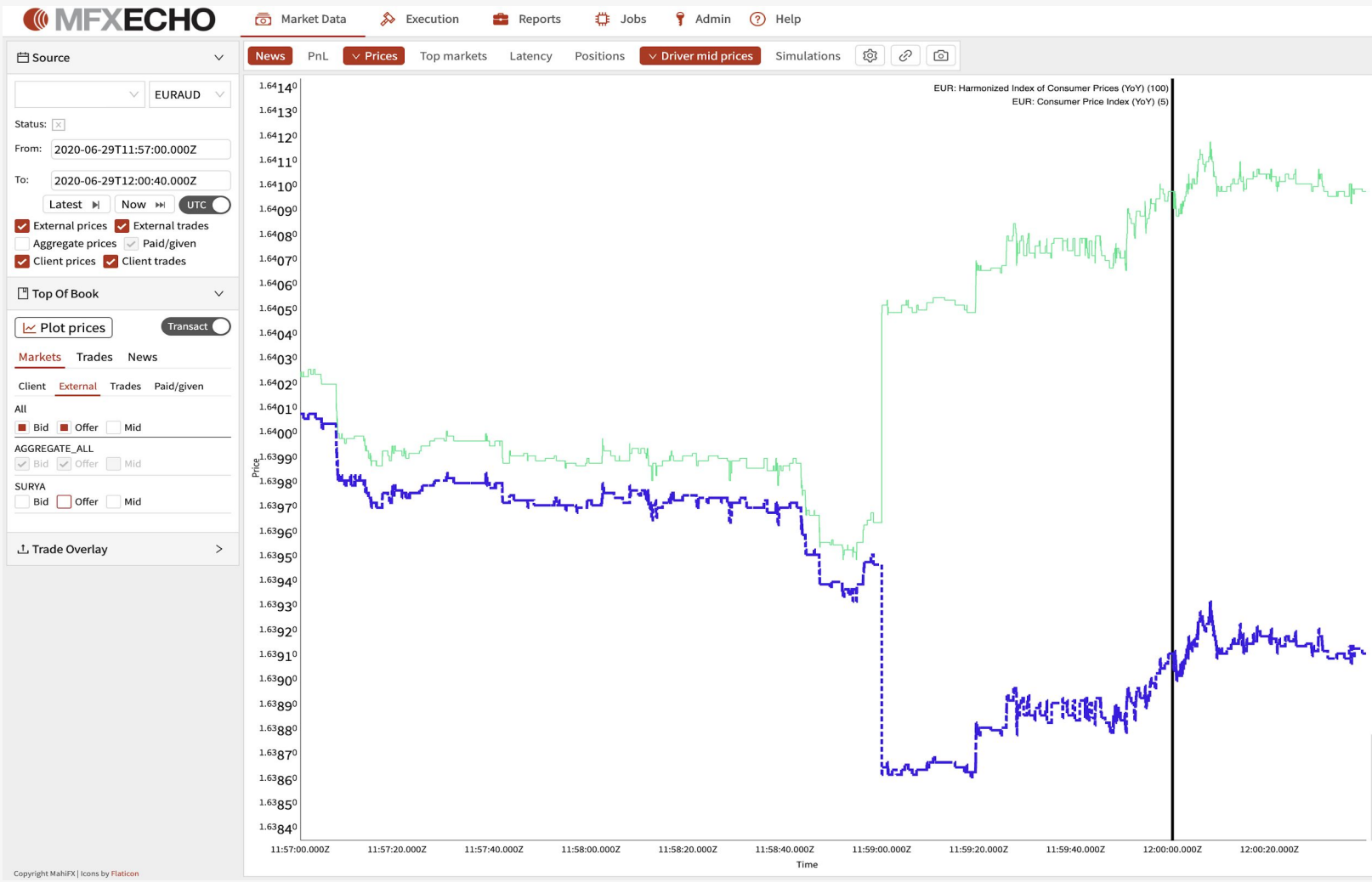
# Pricing Nodes

- **News Widening**
  - The news widening node widens the spreads prior to scheduled news events. Once the news event kicks in, volatility widening maintains width. There are 3 configurations that control the News Widening node:

    1. *pricing.econNewsTightMillisAfter*
       Maps the news event weight to the length of time the widening should persist for. The value equal to or otherwise below the news event's weight is selected.

    2. *pricing.econNewsWideMillisBefore*
       Maps the news event weight to how soon to before an event takes place to begin widening. The value equal to or otherwise below the news event's weight is selected.

    3. *pricing.econNewsWideningFactors*
       Retrieves the mapping between news event weight and news widening factor. The value equal to or otherwise below the highest active news event's weight is selected.



# Pricing Nodes

## Reference Price

- reference price is generated from markets configured at *reference.referencePriceMarketSelectors*
- further reference pricing is configured via *reference.referencePrice.* Here prioritisePrimaryMarkets and topOfbook.normalQtyMultiplier can be adjusted (defaults are flase and 1 respectively)

## Skew

- From the calculated mid price, the broker's pricing is changed slightly to make it more competitive.
- Skewed price makes it possible to:
  - Make the spread, that would normally be passed through, profitable
  - Make prices more appealing to remove risk quicker

There are two main sources of skew:

a) A bank's inventory
   - This is defined per pricing model. This gives a bank the ability to have greater or lesser amounts of skew for different categories of clients, should this be required. The skew is simply parameterised. For example Compass can be programmed for: 'when the risk is X, apply the maximum skew where the maximum skew is Y% of the base spread.'

b) Pricing models that enhance the price formation with information that is not in the book
   - This is specified per predictor, these are then combined to create optimal signal ratios.

A third skew parameter, again available per model, limits how much total skew will be applied.

**Skew by Net Open Position (NOP)**

- This is skew to encourage limiting LP margin exposure.
- This retrieves the mapping between the proportion of NOP limit consumed and the resulting additional skew (as a proportion of base spread) to be added to prices.
- The value equal to or otherwise below the current NOP limit proportion is selected i.e. 0.0 would add no additional skew, 0.5 would skew the bid/offer to mid.

  *Configured at pricing.netOpenPositionToSkewMapping*

# Pricing Firewalls

## MFX Compass Pricing Firewalls

Firewalls are defined to render pricing indicative either temporarily or permanently if tripped.

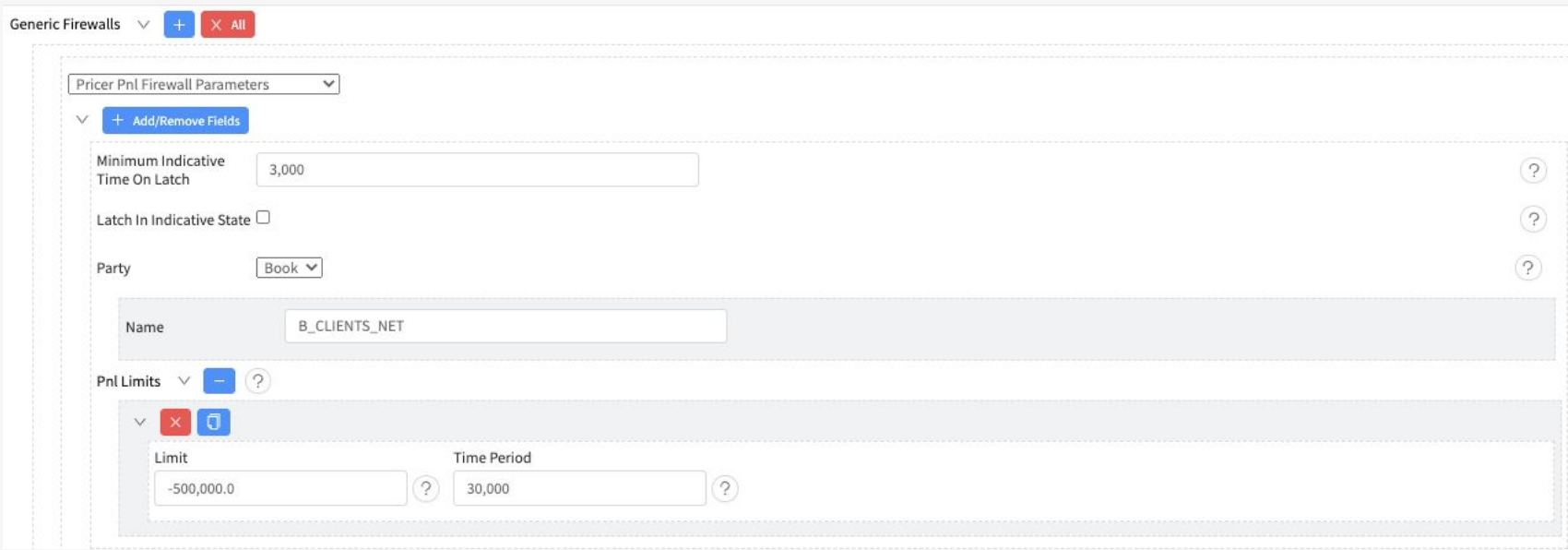
They take into account:

- Volume or PnL limits
- Price spikes
- Price barriers

## Generic Firewalls

*Configured at pricing.genericFirewalls*

When triggered, generic firewalls will turn pricing indicative, which in turn brokers flow if there is a PnL loss over a period of time.




In the above example, the firewall will be tripped if PnL drops by -$500,000 or more in 30s. The Minimum Indicative Time On Latch will ensure prices are indicative for at least 3 seconds if the conditions that tripped the firewall no longer apply..

## Instrument Specific Firewalls

*Configured at pricing.instrumentSpecificFirewalls*

Instrument specific firewalls will turn individual instruments or all instruments to indicative if a spike in an instrument's mid price is seen.

# MFX Compass Distribution

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## MFX Compass Distribution Overview

The distribution configuration enables personalisation and control of the pricing and liquidity sent out to defined sets of clients. Prices are distributed to clients per connection through channels set up in the html cockpit window.

**Channels** allow the creation of numerous defined sets of criteria for which prices, pools, visibility and throttle limits can be applied and managed. Channels can be defined for a combination of the following:

- Counterparties
- Instruments
- Timezones
- Risk increasing/decreasing

Once a channel has been set up, the config allows specification of how each subset of flow is managed through various execution styles, each modifiable to the particular subset:

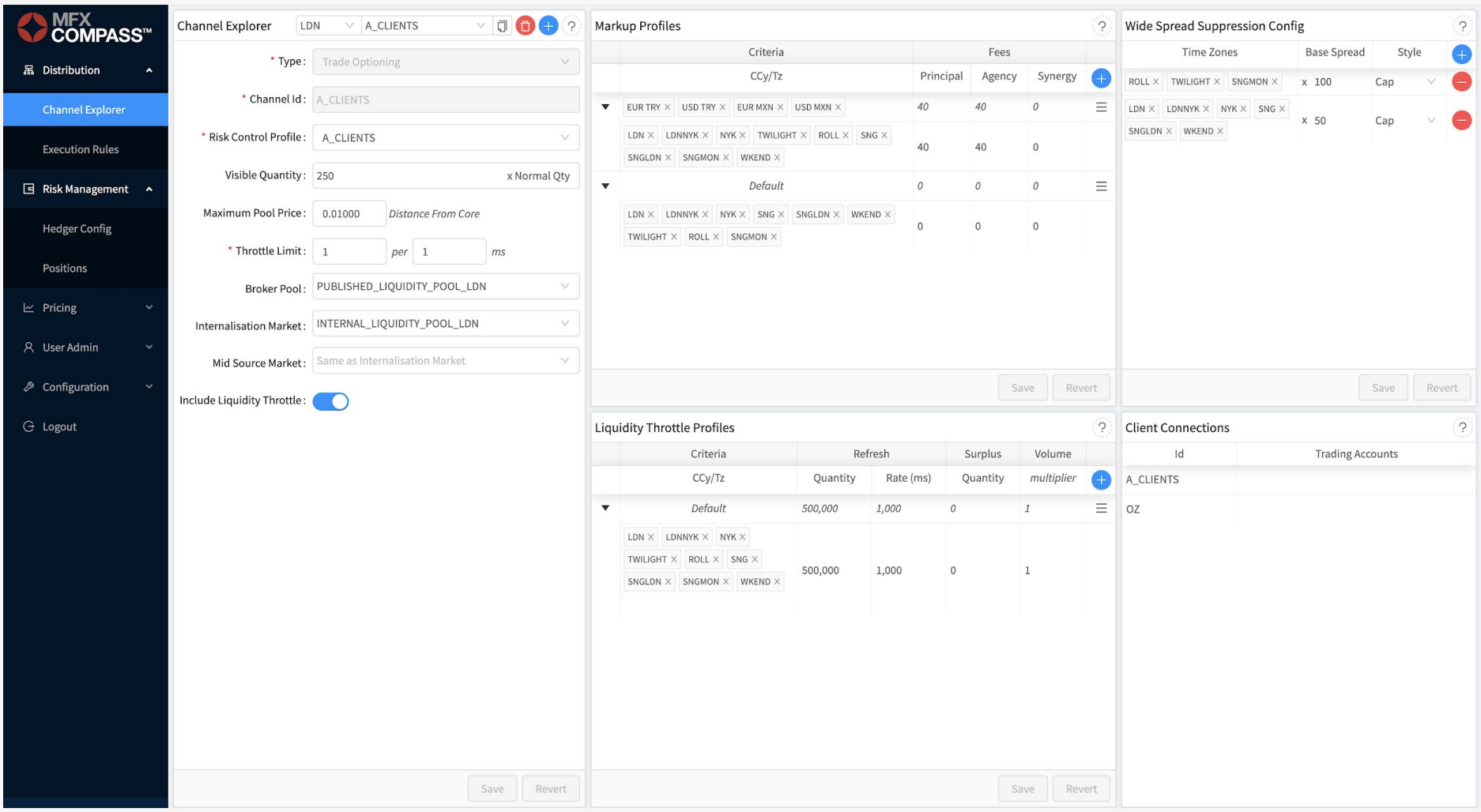
- First look
- TOB wins
- Internalise only
- Broker
- Reject

# Channels

The **Channels** are a specification of price distribution characteristics and order acceptance criteria. They allow for the definition of criteria for particular sets of flow.

The channel configuration is accessed via the html cockpit window, navigate to Distribution -> Channel Explorer. Channels are made up of the following 5 controls:

- **Risk Control Profiles**
- **Markup Profiles**
- **Wide Spread Suppression**
- **Liquidity Throttle Profiles**
- **Client Connections**



## Risk Control Profile

The risk control profiles utilises a similar firewall protection to the pricing models. When a firewall trips, if the option to broker liquidity is applied to the channel, all orders will be brokered until the firewall is reset. If no brokered workflows are enabled then the orders will be rejected at source. This may result in them being rerouted by the connectivity provider.

In the risk control profile the following controls manage each subset of flow:

- **Risk control profile** - the group of clients for which the distribution channel configuration is being applied to.
- **Visible quantity** - this will apply a limit to how much of the available quantity in an instrument is visible to the client.
    - Expressed as a multiplier for normal quantity
      E.g. if set to 250, where the normal quantity has been set at 200,000. Clients will only be able to see the prices for the first $50,000,000 available of the defined instruments .
- **Max pool price** - is the maximum distance the pool price can move from the core models TOB price, expressed in basis points.
- **Throttle limit** - defines how many times a price is updated per ms.
- **Broker pool** - specifies which pool an order is to be sent if it cannot be internalised.
- **Internalisation market** - the core price market to base prices on and where internalised trades will be sent.
- **Mid source market** - the market from which mid will be sourced for mid price checks during internalisation.

| Price Selectors | Include Price | | |
|---|---|---|---|
| Instruments | Pool | Core | + |
| *Default* | ☐ | ☑ | |

The price selectors enable a choice of whether pool, core or both prices are published to clients.

## Markup Profiles

The markup profiles allow fees to be applied to principal prices or Liquidity Providers pool prices according to instrument or timezone.

- Prices are defined by US$/million traded

Markup Profiles

| | Criteria | Fees | | | |
|---|---|---|---|---|---|
| | CCy/Tz | Principal | Agency | Synergy | + |
| ▼ | EUR TRY × USD TRY × EUR MXN × USD MXN × | *40* | *40* | *0* | ☰ |
| | LDN × LDNNYK × NYK × TWILIGHT × ROLL × SNG × SNGLDN × SNGMON × WKEND × | 40 | 40 | 0 | |
| ▼ | *Default* | *0* | *0* | *0* | ☰ |
| | LDN × LDNNYK × NYK × SNG × SNGLDN × WKEND × TWILIGHT × ROLL × SNGMON × | 0 | 0 | 0 | |

- Principal fees include any trades that were made in house from market making.
- Agency fees include where trades have been brokered.

## Wide Spread Suppression

Wide spread suppression can be very important as it can impact pricing SLAs which can damage relationships with recipients using the price feed. This is particularly true for distribution to retail clients that have resting orders, a severely wide spread can result in stop orders being triggered. In this case, it may be better to bound the spreads with a published price.

The Wide Spread Suppression config allows tailoring of the systems behaviour when wide spreads are generated, for example around unexpected market behaviour. The spreads clients receive can also be capped or made indicative.

The way this is configured in the cockpit is as a multiplier of the distribution market's base spread. The inputted value represents the maximum the front of stack spread can be before pricing is suppressed.

## Liquidity Throttle Profiles

This is used to make the rate worse for the client once they have consumed beyond a normal level of liquidity. It can act globally, giving protection against on-boarding acute levels of risk, from EAs for example, or can be applied at a more tailored level on a counterparty, channel, instrument or timezone specific.

Liquidity Throttle Profiles

| | Criteria | Refresh | | Surplus | Volume | |
|---|---|---|---|---|---|---|
| | CCy/Tz | Quantity | Rate (ms) | Quantity | *multiplier* | + |
| ▼ | *Default* | *500,000* | *1,000* | *0* | *1* | ☰ |
| | LDN × LDNNYK × NYK × TWILIGHT × ROLL × SNG × SNGLDN × SNGMON × WKEND × | 500,000 | 1,000 | 0 | 1 | |

- **Refresh** - Refresh Quantity Tokens are bucket limiter parameters that apply to a profile. The bucket begins full and trading is allowed freely, emptying by one token for every unit of base currency traded. When the balance becomes negative, the units are carved out of the price stack, worsening the rate at which the customer gets filled until the negative token balance exceeds available liquidity. Buckets apply per currency and side, e.g. buy EURGBP consumes both LONG EUR tokens and SHORT GBP tokens.
  - Quantity - Number of tokens returned to the bucket per Refresh Rate.
  - Rate (ms) - interval after which Refresh Quantity tokens are returned to the bucket.
- **Surplus** - The bucket refills at the rate of Surplus Quantity per refresh rate until maximum capacity (defined at Refresh Quantity) is reached.
  Maximum quantity that the throttle will allow if no activity has occurred recently.
- **Volume** - defined as a multiplier - volume traded will be multiplied by this value, e.g. 2 will deduct 200% of each trades volume from the token bucket.

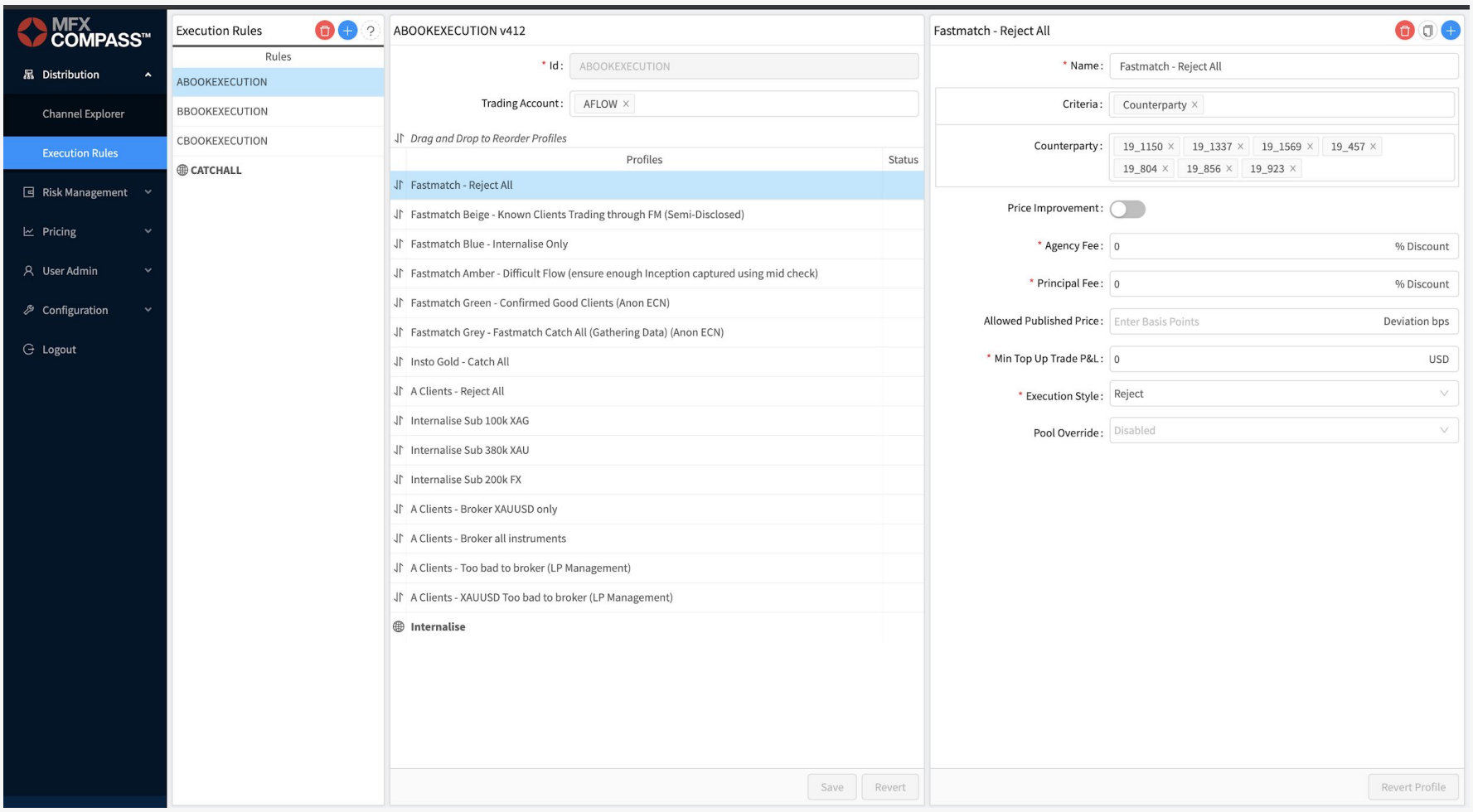
## Client Connections

The client connections panel allows mapping of connections to distribution Channels. We provide our own internal FIX API support for on-boarding clients directly, or there is the option to utilise Mahi's custom adapters to various platforms.

# Execution

The **Execution Rules** also live in the html config cockpit. This is the core engine for managing flow through the different distribution channels. The config applies particular trading behaviours to each set of order criteria defined in the channels.

Profiles can be added to each rule allowing full personalisation for each distribution channel. When an order is placed, Compass will run through each profile from top to bottom checking if any of the information contained within the order matches the criteria, if the criteria matches up, the profile will be applied and the process stopped.




In the example above, if one of the counterparties tagged in the ‘reject all’ profile was to make a trade, Compass would match up the counterparty to the first profile, reject it immediately and halt the process.

Another counterparty making the same trade but not tagged anywhere, would continue to be run through each profile checking against the rules before reaching the global internalisation rule, ensuring the right pricing and liquidity is sent out for each order.

# Execution

The parameters the execution profiles run each trade through are:

- **Criteria** - what the order must match up to for the profile to be applied, can be a combination of:
  - Risk Increasing
  - Signal Alias
  - Dynamic Counterparty
  - Instrument
  - Asset
  - Trading Account
  - Timezone
  - Counterparty
  - Base notional
- **Price Improvement** - toggles on/off to allow price improvement to be applied to fills compared to the published price, when switched off, orders will never be filled at a better rate than the inception price.
- **Agency fee** - for limit orders, agency executions will be allowed to work with a reduced fee, given as a percentage reduction, this may increase fill rates but reduce profits.

  E.g. 100% indicates no bank commission. 0% indicates all agency executions must have enough buffer to cover the fee payable to the bank.
- **Principal fee** - percentage reduction on principle execution for limit orders.
- **Allowed Published Price** - allows trades to be accepted up to the specified distance from the benchmark price, expressed in basis points.

  E.g. Set at 1bps will allow trades up to 1 basis point worse than the current benchmark to be accepted.
- **Min Top Up Trade PnL** - where attempts to broker the full amount of a trade results in a partial fill, the house will cover the rest. This parameter sets a minimum PnL required for a top up deal to be provided, calculated in USD/million

  E.g. set at 20 means a 1m top up deal needs to have at least $20 edge in it.
- **Execution style**
  - First look - the order will be sent for internalisation first and then brokered if internalisation fails.
  - TOB wins - orders will be internalised or brokered based on which price is best for the client. If to be brokered, the order will be sent to the external pool defined in the distribution channel.
  - Internalise only
  - Broker
  - Reject

# Execution

- **Pool override** - only applies to client orders with tight limit prices. When enabled, brokered orders can be sent to a selected pool instead of the pool configured in the distribution channel.
  - If there is no pool defined in the channel, brokering will not happen regardless of the override.
  - Care needs to be taken with orders that are marketable on the original market but not on the override, in this case a reject will be sent to the client.

If the execution style selected is first look, TOB wins or internalise only, there are further options for tailoring flow:

**Internalisation options**

- **Last look delay** - how many ms an order will be held for before Compass makes the decision to fill or cancel.
- **Price check** - the maximum the price can move away from the mid to the customers advantage, before the order is rejected.
- **Mid distance** - the minimum distance allowed between the mid price of the principal stream and the price the order was filled at.

Last look holds an order for a given timeframe after it has been received, if the price hasn't moved more than a specified amount in that time, the trade will fill.


In the example above, if after 50ms (200ms during a news event), if the price has moved 3bps in favour of the customer the order will be filled. Any more, Compass will broker or cancel the order (in this case broker).

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# Thank you

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