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Mahalanobis Flow Breakout

Expert Advisor Documentation

PLATFORM	TYPE	TIMEFRAME	WEBSITE
MetaTrader 5 (MT5)	Statistical Anomaly Breakout	M5 – H1	www.algobot.live

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Overview

Mahalanobis Flow Breakout is an "information-event" breakout system. Most jump or surge strategies test a big **return** and a big **volume** separately, firing only when each is individually extreme. That double-threshold ignores the *joint* behaviour of the two — and because price and tick-volume are correlated, what looks "big" on each axis alone is often just ordinary co-movement.

Instead, this strategy measures how abnormal each bar is in the **two-dimensional (return, volume) space** using the **squared Mahalanobis distance**, which folds in the full covariance — both variances *and* the return/volume correlation — of the recent regime. A bar only qualifies when its combined coordinate is a genuine statistical outlier versus how that market has actually been behaving lately.

An outlier bar does not trigger a trade by itself; its edge may already be spent. It merely **arms a direction**. Entry then requires **breakout confirmation** on the very next closed bar — evidence the information move is being accepted rather than faded. Every exit is managed by a volatility-adaptive ATR stop and a reward:risk take-profit.

> **Natural home:** liquid FX majors, metals, or indices (EURUSD, XAUUSD, US500) on the M5–H1 range, where tick-volume is a decent order-flow proxy and news / ignition events leave a clear joint price–volume footprint. The EA runs on whatever timeframe the chart is set to — nothing is hard-coded to a higher timeframe.

How It Works

1. The feature vector

Every time a primary-timeframe bar closes, the EA records two features for it:

```
r = ln(Close / PrevClose)     // directional log return
u = ln(1 + TickVolume)        // activity / participation
```

The log transforms keep both features on a stable, comparable scale and tame the heavy tails typical of raw returns and volume.

2. Learning the recent regime

Over the last `StatPeriod` bars (ending at the candidate "anomaly" bar), the EA computes the mean of each feature and the full 2×2 covariance matrix:

```
mean:        (mr, mu)
covariance:  C = [[Srr, Sru],
                  [Sru, Suu]]
det(C) = Srr·Suu − Sru²
```

If the regime is degenerate (a variance is zero, or the determinant collapses below `1e-18`), the bar is skipped — the covariance cannot be inverted safely.

3. Scoring the candidate bar

The candidate bar's squared Mahalanobis distance is computed from its deviations `dr = r − mr` and `du = u − mu`:

```
d² = (Suu·dr² − 2·Sru·dr·du + Srr·du²) / det(C)
```

Under a two-feature Gaussian, `d²` is approximately **chi-square distributed with 2 degrees of freedom**, so a threshold near **9** corresponds to a joint ~3-sigma event (roughly the 99th percentile). Higher thresholds isolate rarer, more information-rich bars.

4. Qualifying the anomaly

A bar must clear three gates to become a valid, direction-arming outlier:

- **Joint outlier:** `d² ≥ MahalThreshold`.
- **Volume-elevated:** `du > 0` — the participation must be *above* the regime mean, so the EA catches conviction moves rather than thin, low-volume spikes.

- **Real thrust:** the candle must close at least `ClosePushPct`% of the way toward its own extreme (a decisive close, not a two-sided doji).

5. Entry — breakout confirmation

The outlier bar only arms a direction. Entry is taken on the **very next closed bar** only if the information move is being accepted:

- **LONG** — a bullish outlier (`r > 0`, close pushed up toward the high) *and* the next bar **closes above the outlier bar's High**.
- **SHORT** — a bearish outlier (`r < 0`, close pushed down toward the low) *and* the next bar **closes below the outlier bar's Low**.

6. Exits — ATR stop & reward:risk target

There is no discretionary exit logic; the protective orders manage every trade:

```
stopDist = AtrStopMult · ATR(AtrPeriod)
LONG :  SL = entry − stopDist,  TP = entry + RewardRisk · stopDist
SHORT:  SL = entry + stopDist,  TP = entry − RewardRisk · stopDist
```

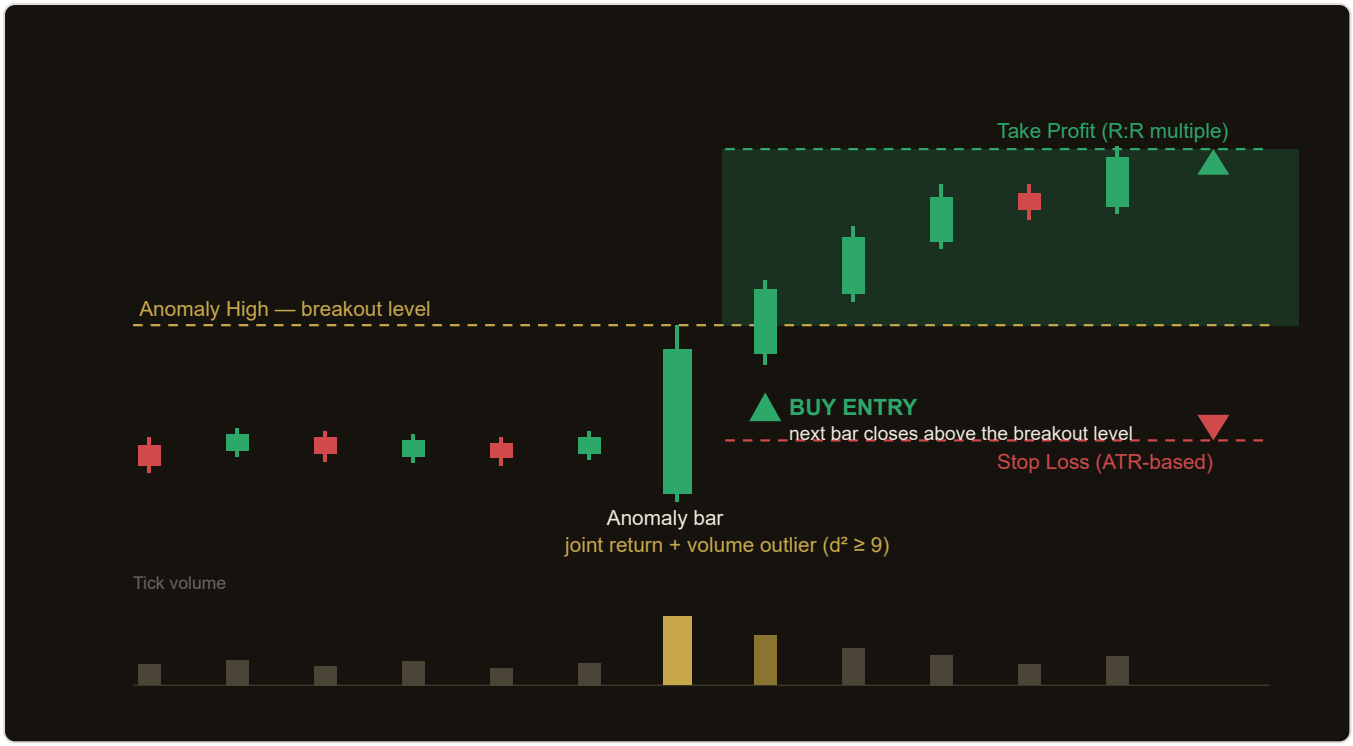
The stop scales with current volatility, and the target is a fixed multiple of the risk taken.

7. Trade & execution filters

- **One position per magic number** — no pyramiding; a new setup is ignored while a trade is open.
- **Spread guard** — new entries are skipped when the current spread exceeds `MaxSpreadPoints`.
- **Bar-close driven** — logic runs once per newly closed bar, so signals never repaint intrabar.

Strategy in Action

The illustration below shows an example of how the strategy identifies a setup and triggers its entry and exit. This is a simplified, illustrative example for educational purposes — not real market data.



Illustrative example only. Actual market behaviour varies.

Parameters

Parameter	Default	Description
StatPeriod	`60`	Rolling window (bars) used to learn the (return, volume) mean & covariance regime. Range 20–250, step 5.
MahalThreshold	`9.0`	Squared-Mahalanobis cutoff. ~$chi^2(2)$: 9 ≈ 3σ (99%), 6 ≈ 2.45σ (95%); higher = rarer signals. Range 4.0–25.0, step 0.5.
ClosePushPct	`60.0`	The outlier close must sit at least this % of the way toward its extreme (thrust filter). Range 0–100, step 5.0.
AtrPeriod	`14`	ATR lookback used for the volatility-adaptive stop. Range 5–40, step 1.
AtrStopMult	`1.5`	Stop distance as a multiple of ATR (`stopDist = AtrStopMult · ATR`). Range 0.5–4.0, step 0.1.
RewardRisk	`1.8`	Take-profit as a reward:risk multiple of the stop distance. Range 0.5–5.0, step 0.1.
MaxSpreadPoints	`80`	Skip new entries when the current spread (points) is wider than this. Range 5–300, step 5.
Lots	`0.10`	Fixed order volume in lots. Range 0.01–1.0, step 0.05.
Magic	`8842`	Magic number identifying this EA's positions. Range 0–9,999,999, step 1.

Recommended Settings

The defaults are a balanced starting point for liquid FX majors on M15. Adjust to the instrument's character and your risk tolerance:

- **Symbols & timeframe:** EURUSD, XAUUSD, or US500 on M5–H1. Lower timeframes generate more signals but demand a tighter spread filter.
- **Signal rarity:** raise `MahalThreshold` toward 12–16 for fewer, higher-conviction events; lower it toward 6 for more frequent but noisier setups.
- **Thrust strictness:** a higher `ClosePushPct` (70–80) demands cleaner, more decisive outlier candles.
- **Stop & target:** widen `AtrStopMult` on volatile instruments like XAUUSD; keep `RewardRisk` in the 1.5–2.5 band for a realistic hit-rate versus payoff balance.
- **Spread guard:** set `MaxSpreadPoints` to reflect your broker's typical spread on the chosen symbol so you never enter into an unusually wide market.

Example — XAUUSD on M15

Because gold moves in larger, more volatile swings, a trader might use `AtrStopMult = 2.0`, `RewardRisk = 2.0`, `MahalThreshold = 11`, and a wider `MaxSpreadPoints` to accommodate the instrument's spread — keeping `StatPeriod = 60` so the regime window still spans roughly a full trading day.

Tip: always validate any parameter change in the MT5 Strategy Tester across several years and multiple symbols before trading it live. Optimise on one period and confirm on an unseen out-of-sample period to avoid curve-fitting.

How to Install on MetaTrader 5

1. Copy `MahalanobisFlowBreakout.ex5` to your MT5 `MQL5\Experts\` folder
2. Restart MetaTrader 5 and refresh the Navigator panel
3. Drag the EA onto a chart matching the recommended symbol and timeframe
4. Configure the input parameters and click **OK**
5. Enable **Algo Trading** in the MT5 toolbar

Risk Warning

Trading foreign exchange, CFDs, and other leveraged financial instruments involves substantial risk of loss and is not suitable for all investors. The strategies and tools described in this document are provided for **educational purposes only** and do not constitute financial advice, investment recommendations, or solicitation to trade. Always consult a qualified financial adviser before making trading decisions. Past backtest performance is not indicative of future results.