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# Z Score Mean Reversion

Expert Advisor Documentation

| PLATFORM | TYPE | TIMEFRAME | WEBSITE |
| --- | --- | --- | --- |
| MetaTrader 5 (MT5) | Mean Reversion (Counter-Trend Fade) | Any (H1 recommended) | www.algobot.live |

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## Overview

**Z Score Mean Reversion** is a statistically-grounded counter-trend strategy. Rather than chasing momentum, it assumes that price tends to oscillate around a moving-average "fair value" and that unusually large deviations from that value are likely to snap back. The strategy measures exactly how far price has stretched from its mean — expressed in standard deviations, the *z-score* — and fades the move only when the stretch is statistically extreme.

Because blindly fading extremes is dangerous during strong trends, Z Score Mean Reversion never acts on the z-score alone. Three independent robustness filters must all agree before an entry is taken: an **RSI exhaustion** check, a **flat-regime gate** that keeps the strategy out of trending markets, and a **reversal tick** that requires price to already be turning back toward the mean. Risk on every trade is fixed with ATR-based stops and targets, protected with an ATR break-even, and bounded by a time-stop. The long and short rules are fully symmetric.

> **Design intent.** This EA is built to trade ranges, not trends. The flat-regime gate deliberately stands the strategy aside when the mean is sloping strongly — the exact conditions under which naive mean-reversion systems tend to lose the most.

## How It Works

### The Core Idea: the Z-Score

On each completed bar the EA computes a simple moving average (SMA) of closing prices over `MaPeriod` bars — this is the "fair value" mean. It then computes the population standard deviation of those same closes. The z-score expresses the current close as a distance from the mean, measured in standard deviations:

```
z = (close - mean) / standardDeviation
```

A z-score of `-2.0` means price is two standard deviations *below* its mean — a statistically unusual stretch to the downside. A z-score of `+2.0` is the mirror image to the upside. The `ZThreshold` input sets how extreme the stretch must be before the strategy is willing to fade it.

### Entry Conditions

A long (buy) signal fades a downside stretch. All of the following must be true on the last closed bar:

- **Statistical extreme:** `z ≤ -ZThreshold` — price is stretched well below the mean.
- **RSI exhaustion:** `RSI < RsiLevel` — the move is oversold and losing steam.
- **Flat-regime gate:** the mean's own change over the last `SlopeLookback` bars must be smaller than `ATR × SlopeAtrFactor` — i.e. the market is ranging, not trending.
- **Reversal tick:** `close > previousClose` — price is already turning back up, so the EA never catches a falling knife on the same bar it is still accelerating down.

A short (sell) signal is the exact symmetric mirror: `z ≥ +ZThreshold`, `RSI > (100 - RsiLevel)` (overbought), the same flat-regime gate, and `close < previousClose` (turning back down).

> **Worked example (long)**
>
> With defaults, suppose the SMA(20) mean sits at 1.10000, standard deviation is 0.00120, and price has fallen to 1.09730. The z-score is (1.09730 − 1.10000) / 0.00120 = `-2.25`, beyond the `-2.0` threshold. RSI reads 26 (below 30), the 20-period mean has barely moved over the last 10 bars (flat regime), and the current close ticked up above the prior close. All four conditions agree — the EA buys, expecting a snap back toward the mean.

### Exit Management

Only one position per magic number is ever open at a time. Every trade carries a fixed risk frame set at entry, then three protective mechanisms:

- **Stop loss / take profit:** set immediately from ATR. For a long, `SL = entry - ATR × SlAtrMult` and `TP = entry + ATR × TpAtrMult` (mirrored for shorts). The default 1.5× / 2.0× frame targets a return toward the

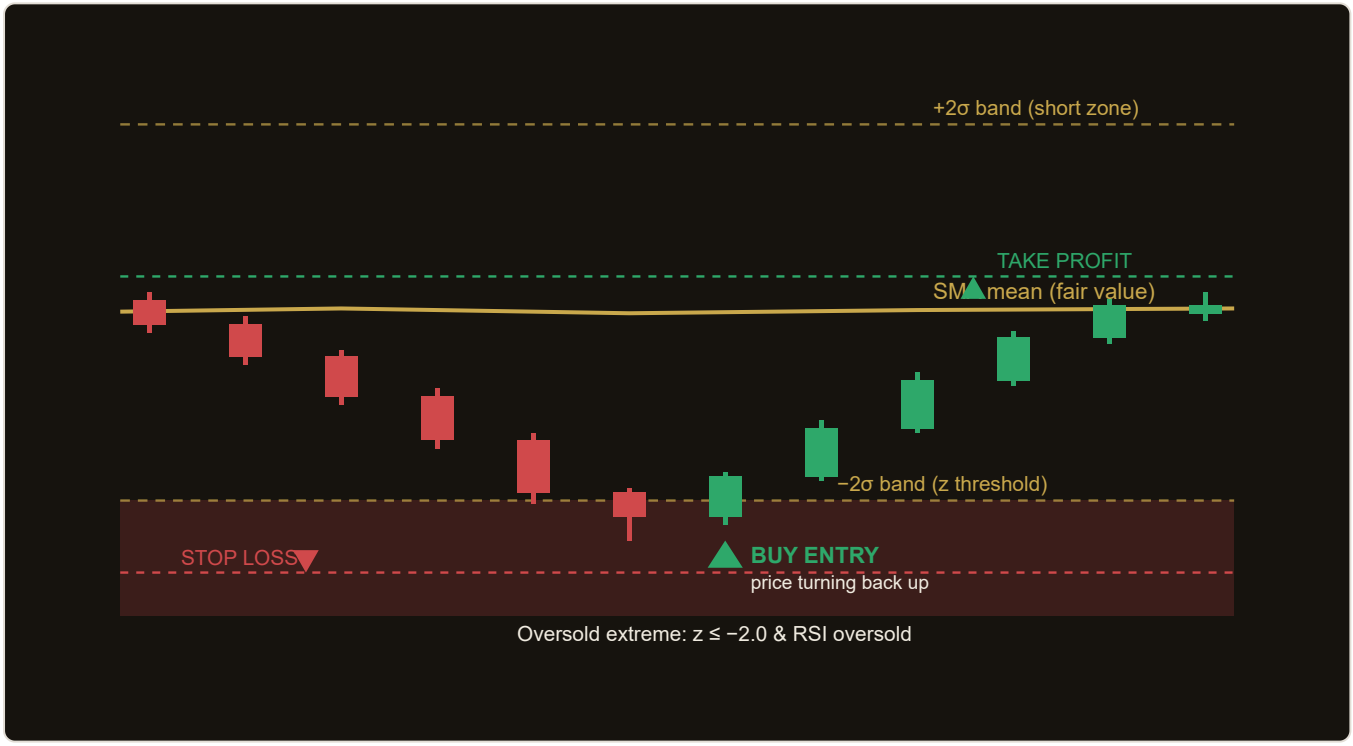
mean.

- **ATR break-even:** once price moves in the trade's favour by `ATR × BeTriggerAtr`, the stop is moved to the entry price, removing downside risk while the reversion plays out.
- **Time-stop:** if the position has been open for `MaxBarsInTrade` bars without resolving, it is closed. A reversion that fails to happen is released rather than left to drift into a developing trend.

> **Why a time-stop matters here.** Mean reversion works when price returns to fair value quickly. The longer a fade lingers, the more likely the "extreme" was actually the start of a genuine trend. The time-stop caps that exposure.

## 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 |
|---|---|---|
| **MaPeriod** | `20` | Period of the SMA “fair value” mean and its standard deviation. Range 10–60, step 5. |
| **ZThreshold** | `2.0` | Absolute z-score required to fade the move. Higher = rarer, more extreme entries. Range 1.0–3.5, step 0.1. |
| **RsiPeriod** | `14` | Period of the RSI exhaustion filter. Range 7–30, step 1. |
| **RsiLevel** | `30.0` | Oversold level for longs; overbought level is derived as 100 − RsiLevel. Range 15–45, step 5. |
| **AtrPeriod** | `14` | ATR period driving stop, target, break-even and the flat-regime tolerance. Range 7–30, step 1. |
| **SlopeLookback** | `10` | Bars back used to measure the mean’s slope for the flat-regime gate. Range 3–30, step 1. |
| **SlopeAtrFactor** | `1.0` | Flat-regime tolerance: the mean’s move must stay under ATR × this factor. Range 0.2–3.0, step 0.1. |
| **SlAtrMult** | `1.5` | Stop-loss distance as a multiple of ATR. Range 0.5–4.0, step 0.1. |
| **TpAtrMult** | `2.0` | Take-profit distance as a multiple of ATR. Range 0.5–5.0, step 0.1. |
| **BeTriggerAtr** | `1.0` | Favourable move (× ATR) required before the stop is pulled to break-even. Range 0.3–3.0, step 0.1. |
| **MaxBarsInTrade** | `30` | Time-stop: a position open this many bars is closed. Range 5–120, step 5. |
| **Lots** | `0.10` | Fixed trade volume in lots. Range 0.01–1.0, step 0.05. |
| **Magic** | `2027` | Magic number identifying this EA’s positions, so it manages only its own trades. |

## Recommended Settings

Z Score Mean Reversion is designed for **ranging, mean-reverting markets**. It performs best on instruments and sessions that oscillate around a stable value rather than those in strong directional trends.

- **Symbols:** range-prone major FX pairs (e.g. EUR/USD, EUR/GBP, USD/CHF) and metals during quiet sessions.

- **Timeframe:** H1 is a sensible default. Lower timeframes (M15–M30) generate more signals but more noise; higher timeframes produce fewer, cleaner setups.
- **Threshold tuning:** raise `ZThreshold` toward 2.5–3.0 for stricter, higher-conviction fades; lower it toward 1.5 for more frequent (but noisier) trades.
- **Regime discipline:** if you find too many entries occurring in trending conditions, tighten `SlopeAtrFactor` (e.g. toward 0.5) so the flat-regime gate is more selective.

> **Tip.** Always validate a configuration in the MT5 Strategy Tester across several years and multiple symbols before considering live use. Optimise the z-threshold, RSI level and ATR multipliers together — they interact.

> **Counter-trend risk.** Fading extremes means occasionally standing against a market that keeps running. The flat-regime gate, RSI filter, reversal tick, ATR stop and time-stop exist to limit this, but no filter set is perfect. Size positions conservatively.

## How to Install on MetaTrader 5

1. Copy `ZScoreMeanReversion.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.