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Kernel Regression Envelope Reversion

Expert Advisor Documentation

PLATFORM	TYPE	TIMEFRAME	WEBSITE
MetaTrader 5 (MT5)	Mean Reversion	M5 – H1	www.algobot.live

> ⚠ **Important Disclaimer** This document is for educational and informational purposes only. It does not constitute financial or investment advice. Trading forex, CFDs, and other leveraged instruments involves substantial risk of loss and is not suitable for all investors. Past backtest performance does not guarantee future results. Never trade with capital you cannot afford to lose.

Overview

Kernel Regression Envelope Reversion is a mean-reversion Expert Advisor built on **Nadaraya–Watson kernel regression** — a Gaussian-weighted local average of recent closing prices. Unlike a simple or exponential moving average (which use uniform or exponential weights), the kernel gives the most recent bars the greatest weight and tapers smoothly with a tunable bandwidth. The result is a very smooth, low-lag estimate of "fair value" — without the whipsaw of a short average or the lag of a long one.

Around that fair-value line (`nw`) the EA draws a self-scaling envelope, sized from a weighted mean-absolute-deviation (MAD) of price about the kernel. Price that over-stretches beyond the envelope tends to be pulled back toward `nw`, so the kernel line serves as both the reference and the profit target.

Crucially, the EA does **not** fade blindly. Fading only works in balanced, ranging markets, so two independent edges are stacked before any trade: a **regime gate** that measures the kernel's own slope (normalised by ATR) and stands aside when a real trend is underway, and a **reclaim trigger** that requires both the over-stretch *and* the first snap-back to occur on the same closed bar — so the EA is never knife-catching a bar that is still extending.

> **Why kernel regression?** A Nadaraya–Watson endpoint blends the responsiveness of a fast average with the smoothness of a slow one. Because only the just-closed bar and older bars feed every estimate, the line is **causal and non-repainting** — what you see in the backtester is exactly what would have been computed live.

How It Works

1. The Kernel Regression Line (Fair Value)

On each newly closed bar the EA computes a Gaussian-weighted average of the last `KernelPeriod` closes. The just-closed bar is distance `d = 0`; each older bar is weighted less by a Gaussian of bandwidth `h = Bandwidth`:

```
w_d   = exp( -(d^2) / (2 * h^2) )          (Gaussian kernel weight)
nw    = Σ( w_d * close_d ) / Σ( w_d )     (kernel line / fair value)
mad   = Σ( w_d * |close_d - nw| ) / Σ( w_d )  (weighted dispersion)
Upper = nw + BandMult * mad
Lower = nw - BandMult * mad
```

A larger `Bandwidth` makes the kernel line smoother and slower; a smaller one makes it more responsive. The envelope half-width scales automatically with volatility because it is derived from the weighted MAD of price around the kernel line.

2. Regime Gate — Only Fade in Ranges

Mean reversion loses money in strong trends. To filter these out, the EA measures the kernel line's slope over `SlopeLookback` bars and normalises it by ATR:

```
slopeAtr = |nw - nw[SlopeLookback bars ago]| / ATR
if (slopeAtr > MaxSlopeAtr)  =>  stand aside (trend too strong)
```

Only when the kernel line is relatively flat — a balanced, ranging market — is a fade permitted. The historical kernel value is reconstructed by re-anchoring the same kernel calculation `SlopeLookback` bars back, keeping the measurement fully causal.

3. Reclaim Trigger — Entry Logic

Rather than buying the instant price pierces the band, the EA waits for the stretch **and** the first snap-back on the **same closed bar**. This confirms the reversion has begun before committing.

- **Long setup:** the bar's **Low** pierced *below* the Lower band (over-stretched down), the bar **Closed back above** the Lower band (reclaimed), and the bar is **bullish** (`close > open`).

- **Short setup:** the bar's **High** pierced *above* the Upper band (over-stretched up), the bar **Closed back below** the Upper band, and the bar is **bearish** (`close < open`).

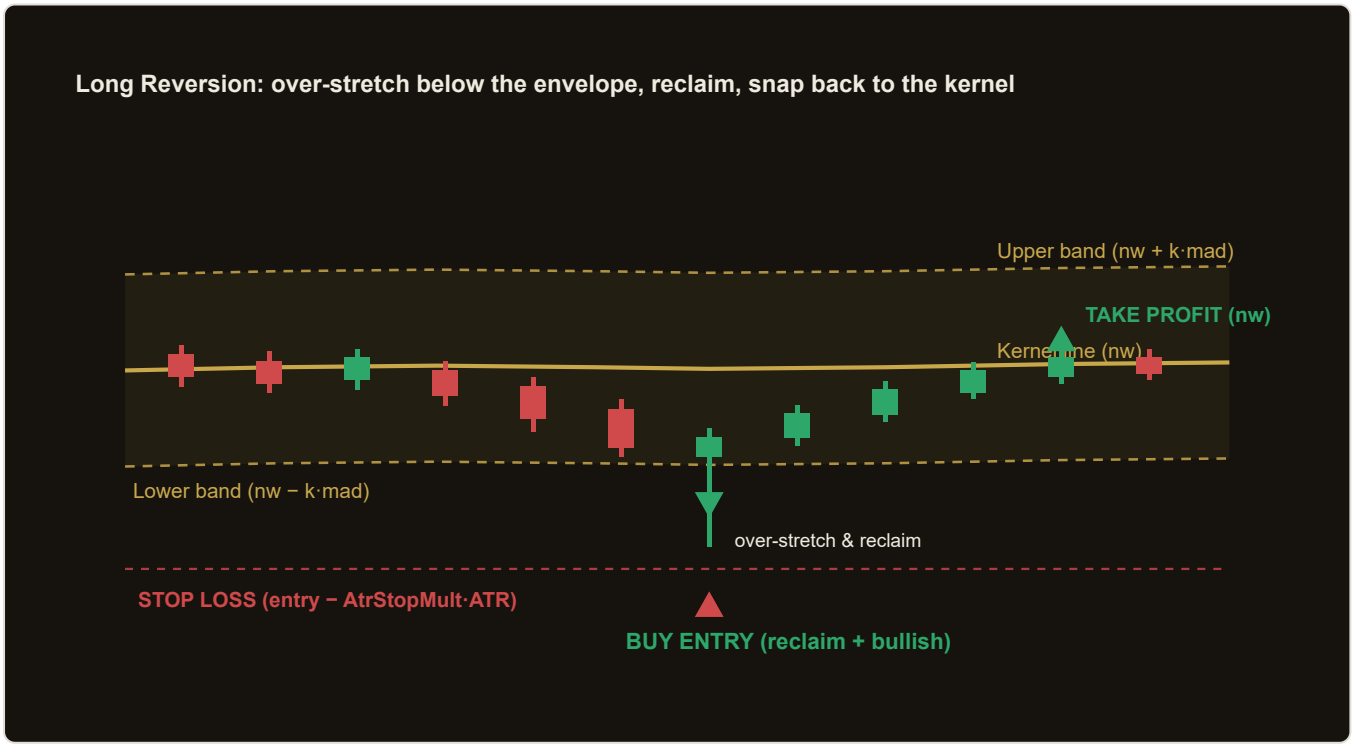
4. Stops, Targets and Trade Management

- **Take Profit:** the kernel mean `nw` — the structural "magnet" price is being pulled toward.
- **Stop Loss:** one ATR-multiple beyond entry — `AtrStopMult × ATR` below a long entry, or above a short entry.
- **Reward:Risk filter:** setups where `nw` is already too close to justify the ATR stop are rejected via `MinRewardRisk`.
- **Spread filter:** new entries are skipped when the current spread exceeds `MaxSpreadPoints`.
- **One position per magic:** only a single position is held at a time, so the ATR stop / kernel target manage every exit — there is no averaging in.

> **Everything self-scales.** The envelope adapts to volatility via the weighted MAD, the stop adapts via ATR, and the target is a genuine structural magnet (`nw`) rather than a fixed distance. The EA runs on whatever timeframe is selected at backtest time — it never hardcodes a frame.

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
KernelPeriod	`25`	Number of closed bars feeding the Nadaraya–Watson kernel regression. Range 10–100, step 5.
Bandwidth	`8.0`	Gaussian bandwidth *h* — larger values produce a smoother, slower kernel line. Range 3.0–20.0, step 0.5.
BandMult	`2.0`	Envelope width as a multiple of the weighted mean-absolute-deviation. Range 1.0–4.0, step 0.1.
SlopeLookback	`5`	Number of bars over which the kernel slope (regime gauge) is measured. Range 2–20, step 1.
MaxSlopeAtr	`1.0`	Maximum |kernel slope| (in ATRs over SlopeLookback) still allowed to fade — the range gate. Range 0.2–3.0, step 0.1.
AtrPeriod	`14`	ATR lookback used for the stop distance and the slope regime normalisation. Range 5–30, step 1.
AtrStopMult	`1.5`	Stop-loss distance in ATR multiples beyond the entry price. Range 0.5–4.0, step 0.1.
MinRewardRisk	`0.7`	Reject setups whose `nw` target is closer than this multiple of the ATR stop distance. Range 0.3–3.0, step 0.1.
MaxSpreadPoints	`80`	Skip new entries when the current spread (in points) is wider than this. Range 5–300, step 5.
Lots	`0.10`	Fixed trade volume in lots. Range 0.01–1.0, step 0.05.
Magic	`5417`	Magic number identifying the EA's orders (one position held per magic). Range 0–9,999,999, step 1.

Recommended Settings

The strategy is designed for liquid instruments where balanced intraday ranges dominate. Its natural home is FX majors or a major index.

- **Symbols:** EURUSD, GBPUSD, or an index such as US500.
- **Timeframes:** M5 to H1, where mean-reverting ranges are most common.

- **Bandwidth & KernelPeriod:** the defaults (8.0 / 25) give a smooth, low-lag fair-value line. Increase `Bandwidth` for a slower line on higher timeframes.
- **Regime gate:** lower `MaxSlopeAtr` toward 0.5–0.7 to be stricter about only fading truly flat markets; raise it to trade more often in mildly trending conditions.

Example configuration — EURUSD M15

KernelPeriod = 25, Bandwidth = 8.0, BandMult = 2.0, SlopeLookback = 5, MaxSlopeAtr = 0.8, AtrPeriod = 14, AtrStopMult = 1.5, MinRewardRisk = 0.8, MaxSpreadPoints = 30, Lots = 0.10. This tightens the range gate and the spread filter for a lower-timeframe, cost-sensitive setup.

> **Tip:** Always run a backtest and a period of forward testing on a demo account with your broker's exact spreads before deploying any configuration live. Because the target is the kernel mean, the average reward is modest — keep `MaxSpreadPoints` tight so transaction costs do not erode the edge.

How to Install on MetaTrader 5

1. Copy `KernelRegressionEnvelopeReversion.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

> **Note:** The EA acts once per newly closed bar and holds only one position per magic number. Ensure the chart timeframe is the one you intend to trade — every calculation uses the chart's current period, never a hardcoded frame.

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.