PSEDYS | TECHNICAL REFERENCE MANUAL V3.0

ADX — Technical Reference Manual v1.0

PSEDYS | Complete Edition

TR · +DM/-DM · Wilder Cascade · +DI/-DI · DX · ADX · Strength vs Direction · DI Cross · Hump · Exhaustion · MTF · Feature TI · Bot vs TradingView

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1. What is ADX? — Wilder's Directional Movement System

ADX (Average Directional Index) was created by J. Welles Wilder Jr. in 1978, as part of the **Directional Movement System**. It consists of three indicators calculated simultaneously from the same dataset:

Indicator	Standard Color	What it Measures
+DI (Plus Directional Indicator)	Green	Strength of bullish (upward) movements
-DI (Minus Directional Indicator)	Red	Strength of bearish (downward) movements
ADX (Average Directional Index)	Black/White	TOTAL trend strength — regardless of direction

Fundamental distinction from all other indicators in this series:

```
EMA, SMA, MACD → indicate the DIRECTION of the trend
ADX            → indicates the STRENGTH of the trend, REGARDLESS of direction

ADX = 50 does NOT mean the price is going up or down.
ADX = 50 means there is a strong trend — +DI and -DI tell you in which direction.
```

ADX vs other indicators:

Characteristic	EMA/SMA	MACD	ADX
Type	Trend-following	Momentum	Trend strength
Values	Absolute (price)	Relative (± from zero)	0–100 (percent)
Direction	Yes — follows price	Yes — relative to zero	NO — only strength
Oscillation	No	Yes	Yes (0–100)
Calculation base	Close	Close (EMA)	High, Low, Close (OHLC)
Smoothing	Standard EMA K=2/(N+1)	Standard EMA	**Wilder RMA K=1/N**
Ideal for	Direction, entry	Momentum, timing	Trend vs sideways filter

Wilder's RMA — essential to remember:
Unlike EMA and SMA, ADX (and its components ATR, +DI, -DI) use **exclusively** Wilder's RMA with `K = 1/N`. If the bot calculates ADX with `K = 2/(N+1)` (standard EMA), the values will be completely different from TradingView. This is the most common implementation error.

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2. Calculation Formula — 6 Complete Steps

The calculation of ADX involves 6 cascading steps. Each step depends on the previous one.

2.1 Step 1 — True Range (TR)

True Range adjusts the classic OHLC limits to accurately capture real volatility, including gaps from the previous bar:

```
TR = max(
    High_current   − Low_current,      ← normal range of the bar
    |High_current  − Close_previous|, ← upward gap from previous close
    |Low_current   − Close_previous|  ← downward gap from previous close
)
```

Why the three components:

Component	Captures	Typical Situation
`H − L`	Intra-bar volatility	Any normal bar
`|H − C_prev|`	Upward gaps from previous close	Bullish news, overnight pump
`|L − C_prev|`	Downward gaps from previous close	Bearish news, overnight crash

Example:

```
Previous bar: Close = 100
Current bar:   High = 103, Low = 98

TR = max(103 − 98, |103 − 100|, |98 − 100|)
   = max(5,         3,           2)
   = 5  ← normal range of the bar dominates
```

Example with gap:

```
Previous bar: Close = 100
Current bar:   High = 104, Low = 101  (gap upward — open above previous close)

TR = max(104 − 101, |104 − 100|, |101 − 100|)
   = max(3,          4,           1)
   = 4  ← gap correctly captured
```

Crypto Note: In 24/7 crypto, classic (overnight) gaps are rare. However, macro events (FOMC, massive liquidation, exchange down) can produce a bar with an opening price significantly

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different from the previous close → TR captures them correctly, the simple H-L difference does not.

TR is calculated **starting from bar 2** (requires the previous bar for Close_prev).

2.2 Step 2 — Directional Movement (+DM and -DM)

Directional Movement captures the strength of pure directional moves, excluding overlaps and inside bars.

```
UpMove   = High_current − High_previous
DownMove = Low_previous − Low_current    ← NOTE: inverted from intuition
```

The 4 possible cases:

Condition	+DM	-DM	Interpretation
UpMove > DownMove **and** UpMove > 0	= UpMove	= 0	Dominant bullish move
DownMove > UpMove **and** DownMove > 0	= 0	= DownMove	Dominant bearish move
UpMove = DownMove (any value)	= 0	= 0	Equilibrium, inside bar
Both negative (UpMove < 0 and DownMove < 0)	= 0	= 0	Complete inside bar

Numerical Example:

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```
High_prev = 102, High_curr = 104 → UpMove   = 104 − 102 = +2
Low_prev  =  99, Low_curr  = 100 → DownMove = 99 − 100  = −1 (negative!)

UpMove (2) > DownMove (−1) and UpMove > 0
→ +DM = 2, −DM = 0

————

High_prev = 103, High_curr = 102 → UpMove   = 102 − 103 = −1 (negative)
Low_prev  = 100, Low_curr  = 98  → DownMove = 100 − 98  = +2

DownMove (2) > UpMove (−1) and DownMove > 0
→ +DM = 0, −DM = 2

————

High_prev = 102, High_curr = 103 → UpMove   = +1
Low_prev  = 100, Low_curr  = 99  → DownMove = +1

UpMove = DownMove → both canceled
→ +DM = 0, −DM = 0 (inside bar with symmetric expansion)
```

Inverted DownMove Logic: `DownMove = Low_previous − Low_current` (not `Low_current − Low_previous`) because a lower Low is a bearish move — it must be positive to be comparable with UpMove.

2.3 Step 3 — Smoothing Wilder (RMA) — 4-Level Cascade

All ADX components are smoothed with **Wilder's RMA** (K = 1/N, N = 14 standard):

```
K_wilder = 1 / 14 = 0.071428...  (7.14%)
```

Wilder's Recursive Formula:

```
Smoothed_seed = SMA(values[bar 2..N+1]) / N   ← first value = SMA of the first N values
Smoothed[i]   = Smoothed[i-1] + (Value[i] − Smoothed[i-1]) / N
              = Smoothed[i-1] × (1 − 1/N) + Value[i] × (1/N)
```

The 4 smoothed series applied simultaneously:

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```
ATR(14)   = Wilder_RMA(TR, 14)
+DM_s(14) = Wilder_RMA(+DM, 14)
-DM_s(14) = Wilder_RMA(-DM, 14)
ADX(14)   = Wilder_RMA(DX, 14)    ← DX calculated in Step 5
```

Comparison Wilder RMA vs Standard EMA for N=14:

Parameter	Wilder RMA (K=1/14)	Standard EMA (K=2/15)
K	0.071429 (7.14%)	0.133333 (13.33%)
Current bar weight	7.14%	13.33%
Half-life	9.35 bars	4.84 bars
Reactivity	Slower	86.7% faster

If the bot uses K=2/(N+1) instead of K=1/N → ATR, +DI, -DI, and ADX will be significantly different from TradingView.

2.4 Step 4 — +DI and -DI

```
+DI = 100 × (+DM_s / ATR)
-DI = 100 × (-DM_s / ATR)
```

+DI and -DI are expressed **as percentages** (0–100). Division by ATR **normalizes** Directional Movement relative to price volatility — allows comparison between assets with different prices and volatility.

Interpretation:
- +DI > -DI: bullish force dominates bearish force
- -DI > +DI: bearish force dominates bullish force
- The sum of +DI + -DI **is not** necessarily 100 (large or small values can coexist)

2.5 Step 5 — Directional Index (DX)

DX is an intermediate indicator — **not** displayed directly on the chart, but serves as input for ADX calculation:

```
DX = 100 × |+DI − -DI| / (+DI + -DI)
```

DX Interpretation:
- DX → 0: +DI ≈ -DI → bullish and bearish forces cancel each other → weak trend
- DX → 100: +DI or -DI completely dominates the other → extremely pure trend

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DX measures the **relative difference** between +DI and -DI, not their absolute values. A DX = 80 with +DI = 30 and -DI = 6 is equivalent in DX to +DI = 90 and -DI = 18 (same ratio).

2.6 Step 6 — ADX = RMA(DX, 14)

```
ADX_seed = SMA(DX[bar N+1 .. 2N])   ← arithmetic mean of the first N DX values
ADX[i]   = ADX[i-1] + (DX[i] − ADX[i-1]) / N
```

ADX is **Wilder's smoothing of DX values** — eliminates daily noise from DX and produces a smooth trend strength line.

2.7 Complete Numerical Example — ADX 14 (50 bars)

OHLC data generated with realistic trend (up / retracement / up):

First 20 bars — TR, +DM, -DM (selection):

Bar	High	Low	Close	TR	+DM	-DM
2	100.60	99.55	99.91	1.0500	0.2700	0.0000
3	100.37	99.56	99.69	0.8100	0.0000	0.0000
5	100.88	99.76	100.20	1.1200	0.7800	0.0000
6	100.74	99.43	100.19	1.3100	0.0000	0.3300
10	101.28	99.78	101.05	1.5000	0.7000	0.0000
15	103.72	102.13	103.13	1.5900	0.9000	0.0000

ATR seed at bar 15 (SMA of the first 14 TR):

```
TR[bar 2..15] = [1.05, 0.81, 0.57, 1.12, 1.31, 1.61, 1.24, 0.61, 1.50, 1.37, 0.60, 1.30, 1.19, 1.
Sum = 15.87
ATR_seed(bar 15) = 15.87 / 14 = 1.1336

+DM_s_seed = sum(+DM[bar 2..15]) / 14 = 5.01 / 14 = 0.3579
-DM_s_seed = sum(-DM[bar 2..15]) / 14 = 0.49 / 14 = 0.0350
```

Verification bar 15:

```
+DI(15) = 100 × 0.3579 / 1.1336 = 31.57
-DI(15) = 100 × 0.0350 / 1.1336 =  3.09
DX(15)  = 100 × |31.57 − 3.09| / (31.57 + 3.09) = 100 × 28.48 / 34.66 = 82.18
```

Complete Table — bars 14 to 45 (+DI, -DI, DX, ADX):

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Bar	Close	+DI	-DI	DX	ADX	Regime
14	102.40	N/A	N/A	N/A	N/A	—
15	103.13	**31.57**	**3.09**	**82.18**	N/A	—
16	102.88	28.78	2.81	82.18	N/A	—
17	102.83	26.75	3.42	77.32	N/A	—
18	101.98	23.78	7.13	53.86	N/A	—
19	101.18	21.87	8.32	44.88	N/A	—
20	101.05	20.24	10.63	31.15	N/A	—
25	100.75	18.50	8.89	35.10	N/A	—
28	100.74	15.87	10.32	21.17	**44.24**	very strong
29	100.72	15.77	9.89	22.93	42.72	very strong
30	101.74	19.72	8.92	37.73	42.36	very strong
31	102.31	24.10	7.89	50.68	42.96	very strong
32	103.32	25.09	7.12	55.77	43.87	very strong
33	103.62	26.65	6.42	61.19	45.11	very strong
35	103.76	26.30	5.84	63.67	47.50	very strong
37	104.25	27.13	5.08	68.47	50.07	very strong
40	106.66	32.74	3.65	79.92	55.20	very strong
45	107.60	30.67	2.98	82.29	63.36	very strong

Observations from data:

- Bar 15: First +DI/−DI/DX. Strong bullish trend (+DI=31.57 >> −DI=3.09)
- Bars 15–27: DX decreases (retracement in progress) but remains solid (31–82)
- **Bar 28: First ADX value = 44.24** — ADX seed = SMA(DX[bar 15..28])
- Bars 28–45: ADX consistently increases → trend intensifies on the uptrend again
- +DI always remains >> −DI → consistent bullish direction

2.8 Warm-up, Cold Start, and Limitations

Bars required at startup:

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Component	First valid value	Condition
TR	Bar 2	Requires previous Close
+DM, -DM	Bar 2	Requires previous High/Low
ATR_seed, +DM_s_seed, -DM_s_seed	**Bar N+1 = 15**	SMA of the first N=14 values
+DI, -DI	Bar 15	Requires ATR_seed, +DM_s_seed, -DM_s_seed
DX	Bar 15	Requires +DI and -DI
ADX_seed	**Bar 2N = 28**	SMA of the first N=14 DX values
Recursive ADX	**Bar 2N+1 = 29**	First value calculated with Wilder

```
Absolute minimum warm-up:      29 bars (first recursive ADX value)
Recommended warm-up:           42 bars (3×N — more stable seed)
Production standard:          100 bars minimum
```

Cold Start — cascade of errors:

ADX has the most complex seed cascade of all common indicators:

```
Level 1 — Seed TR, +DM, -DM:
→ Error if the first N bars are not representative of normal volatility
→ Impact: Initial ATR and DM_s incorrect

Level 2 — Seed +DI/-DI/DX:
→ Error propagated from Level 1
→ Impact: first N DX values incorrect

Level 3 — Seed ADX:
→ Error propagated from Levels 1+2 (average of the first N incorrect DX values)
→ Impact: Initial ADX may deviate by 5–15 points from TradingView over 100 bars

Recovery: ~3×N bars after cold start for complete convergence
```

Correct cold start procedure:

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```
# 1. Download at least 100 OHLC bars from GM API
# 2. Calculate TR, +DM, -DM for bars 2..N (i=1..N-1 in 0-indexed)
# 3. ATR_seed = SMA(TR[1:N]), +DM_s_seed = SMA(+DM[1:N]), -DM_s_seed = SMA(-DM[1:N])
# 4. Calculate Wilder recursively for ATR, +DM_s, -DM_s from bar N+1
# 5. Calculate +DI, -DI, DX from bar N onward
# 6. DX_seed = SMA(DX[N:2N])
# 7. Calculate ADX Wilder recursively from bar 2N+1
# 8. First 2N+1 bars → invalid (no signal)
# 9. Bars 2N+1 .. 3N → possible signal but with reduced accuracy
# 10. From bar 3N+ → production signal
```

---

3. ADX Lag — Quantified at Each Level of the Cascade

ADX is the slowest indicator in the PSEDYS series — it has **two levels of Wilder smoothing** applied in cascade.

3.1 Lag per Level

```
Level 1 — Wilder RMA14 of TR, +DM, -DM:
  Center of mass lag = (14 − 1) / 2 = 6.5 bars
  Half-life = 9.35 bars (compared to 4.84 for EMA14)

Level 2 — Wilder RMA14 of DX:
  Additional lag = 6.5 bars
  (DX depends on ATR and DM_s → already lagged by 6.5 bars)

Total ADX lag ≈ 6.5 + 6.5 = 13.0 bars behind the current price
```

3.2 Lag Comparison with Other Indicators

Indicator	Lag (bars)
EMA 9	4.0
MACD Signal Cross	~16.5
EMA 20	9.5
ATR 14 (+DI/-DI)	6.5
ADX 14	**~13.0**
EMA 50	24.5

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Practical consequence: ADX confirms a trend with ~13 bars delay compared to reality. On 5M → ADX reflects the trend state from ~65 minutes ago. On 15M → ~3.25 hours ago. ADX is not an entry timing tool — it is a **regime filter**.

3.3 ADX Rising as a Faster Proxy

Since ADX has a large lag, the **ADX direction** (rising vs falling) is sometimes more useful than the absolute value:

```
ADX rising (increases compared to the previous bar) → trend is intensifying NOW
ADX falling (decreases compared to the previous bar) → trend is decelerating NOW

Detection: adx_slope = adx[-1] - adx[-3]  (similar to EMA slope)
```

---

4. ADX Measures TREND STRENGTH, Not DIRECTION

This is the most important conceptual distinction about ADX.

4.1 Fundamental Principle

```
ADX = 30, +DI = 25, -DI = 8  → STRONG BULLISH TREND
ADX = 30, +DI = 8,  -DI = 25 → STRONG BEARISH TREND
ADX = 30, +DI = 18, -DI = 16 → Misleading ADX — nearly equal forces
```

ADX alone never tells you:
- Whether the price is going up or down
- Whether you should go Long or Short

ADX combined with +DI and -DI tells you:
- How strong the trend is (ADX)
- Which direction dominates (+DI > -DI = bullish, or vice versa)

4.2 ADX Rises in Bearish Trends as in Bullish

This surprises many traders:

```
Scenario 1: BTC drops 20% in 3 days — ADX rises to 50+
Scenario 2: BTC rises 20% in 3 days — ADX rises to 50+

→ ADX does not distinguish. Both are strong trends.
→ +DI >> -DI in scenario 2, -DI >> +DI in scenario 1
```

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4.3 Low ADX Does NOT Mean Price is Not Moving

```
ADX < 20 means: there is no dominant directional trend
It does NOT mean: the price is static or volatility is zero

Crypto can be volatile (high ATR) with low ADX (chaotic movement without direction)
→ ADX < 20 + high ATR = volatility without trend = most dangerous context for entry
```

---

5. ADX Values — Interpretation, Thresholds, and Regimes

5.1 Universal Interpretation Scale

ADX Range	Regime	PSEDYS Action
0 – 18	**No Trend / Sideways**	SKIP on 5M — PSEDYS rule
18 – 20	**Emerging or Weak Trend**	SKIP on 5M; possible on 15M with other confirmations
20 – 25	**Weak-Medium Trend**	Valid on 15M with EMA + MACD confirmation
25 – 40	**Solid Trend**	Valid signal on any TF
40 – 50	**Strong Trend**	Quality signal — aggressive trailing
50 – 60	**Very Strong Trend**	Rare — active monitoring + possible reversal signal on horizon
> 60	**Extreme Trend**	Watch for exhaustion — reduce sizing new positions

PSEDYS specific thresholds:
- **ADX > 18 on 5M** — minimum condition for valid entry
- **ADX > 20 on 15M** — minimum condition for trend confirmation on MTF filter

5.2 ADX and Trend Phase

ADX does not measure the absolute tension field — it measures where it is **in the trend's life cycle**:

```
ADX at 15 and RISING   → emerging trend, possibly at the start
ADX at 25 and RISING   → confirmed trend and accelerating → optimal entry
ADX at 40 and RISING   → strong trend, likely continuation but near peak
ADX at 50 and FALLING  → trend at peak or decelerating → reduce positions, do not add
ADX at 30 and FALLING  → weakened trend, possible consolidation or reversal
ADX at 15 and FALLING  → trend completely exhausted → imminent sideways market
```

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6. Trading Signals with the DI System

6.1 +DI and -DI — Directional Strength

+DI (green) = how strong bullish movements are over the last N bars, normalized against volatility.
-DI (red) = how strong bearish movements are over the last N bars, normalized against volatility.

Interpretation of +DI vs -DI ratio:

Configuration	Interpretation	Action
+DI >> -DI (e.g., 30 vs 8)	Clear dominant bullish strength	LONG Bias
-DI >> +DI (e.g., 30 vs 8)	Clear dominant bearish strength	SHORT Bias
+DI ≈ -DI (e.g., 20 vs 18)	Nearly equal forces, struggle	DO NOT enter — uncertainty
Both < 15	Small directional movements in both directions	Confirmed Sideways
Both > 25	High volatility in both directions	Potential reversal or breakdown

BULLISH Signals — Long

- ADX > 18/20 + +DI > -DI + ADX rising → active bullish trend with acceleration
- +DI crosses above -DI from below (DI bullish cross) with ADX > 20 → bullish direction change
- +DI far from -DI (spread > 10 points) + ADX > 25 → confirmed strong bullish trend
- Low ADX (< 20) + +DI > -DI → emerging bullish trend, anticipatory positioning

BEARISH Signals — Short

- ADX > 18/20 + -DI > +DI + ADX rising → active bearish trend with acceleration
- -DI crosses above +DI from below (DI bearish cross) with ADX > 20 → bearish direction change
- -DI far from +DI (spread > 10 points) + ADX > 25 → confirmed strong bearish trend

NEUTRAL / To Avoid

- ADX < 18 on 5M → Mandatory SKIP PSEDYS
- +DI ≈ -DI (spread < 5) → balanced forces → high risk of false signal
- ADX falling with DI cross → cross in weakening trend → high probability of fake cross

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6.2 DI Crossover — Directional Signals

Bullish DI Cross:

```
+DI crosses above -DI from below, on closed candle
→ Direction change: bullish strength surpasses bearish strength
→ Valid signal if ADX > 20 at the time of the cross or immediately after
```

Bearish DI Cross:

```
-DI crosses above +DI from above, on closed candle
→ Direction change: bearish strength surpasses bullish strength
→ Valid signal if ADX > 20 at the time of the cross or immediately after
```

Strength of DI Cross Signal:

Context at cross	Signal Strength
ADX > 25 and rising	Strong
ADX 20–25 and rising	Medium
ADX < 20	Weak — high probability of false signal
ADX falling	Weak — trend is already weakening
ADX < 15	Completely ignored — pure sideways

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6.3 Filters for False DI Crossover

```
Filter 1 — CLOSED CANDLE CONFIRMATION:
+DI has crossed above -DI on closed candle[-1]. Intra-bar crossing → DOES NOT count.

Filter 2 — MINIMUM ADX AT CROSS:
ADX > 20 at the time of the crossover.
ADX < 20 at cross → fake signal → skip.

Filter 3 — ADX RISING:
ADX[cross bar] > ADX[cross bar - 2]
If ADX falling at the time of cross → trend is exhausting just as DIs cross → risk of fake.

Filter 4 — MINIMUM DI SPREAD:
|+DI − -DI| > 5 points at the bar immediately after cross
Small spread → DIs are too close → probability of immediate re-cross.

Filter 5 — MTF CONFIRMATION:
DI Cross on 5M confirmed by EMA 200 bias on 4H.
Bullish DI Cross on 5M with price below EMA 200 4H → skip or reduced sizing.
```

7. ADX Rising vs ADX Falling — Acceleration vs Deceleration

7.1 ADX Rising (increases compared to previous bars)

ADX rising = trend is INTENSIFYING, regardless of whether it is bullish or bearish.

```
ADX at 20 rising to 30 → trend consolidates and gains strength
ADX at 30 rising to 40 → strong trend and accelerating
ADX at 45 rising to 55 → extreme trend — watch for exhaustion

→ Ideal context for: riding the trend, adding to positions, trailing SL
→ NOT an entry signal in itself — direction comes from +DI vs -DI
```

ADX slope formula:

```
adx_slope = adx[-1] - adx[-3]    # absolute variation over 2 bars
# > +0.5  → ADX accelerates (trend intensifies rapidly)
# 0 – +0.5 → ADX rises slowly (trend consolidates steadily)
# ≈ 0      → ADX flat (trend in equilibrium)
# < 0      → ADX falling (trend decelerates)
```

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7.2 ADX Falling (decreases compared to previous bars)

ADX falling = trend is DECELERATING, NOT that it has reversed.

```
COMMON MISTAKE: ADX falling = Short signal
CORRECT: ADX falling = existing trend weakens (may continue in the same direction but slower)

Example:
BTC rises for 3 days, ADX = 45 and starts to fall to 35
→ Does not mean BTC will fall
→ Means the rate of rise is decreasing (likely consolidation or pullback before continuation)

If at the same time +DI >> -DI and MACD > 0 → bullish trend continues, but slower
```

Actions on ADX falling on existing position:

```
ADX falling 50 → 40: Tighten trailing SL, reduce sizing at TP3
ADX falling 40 → 30: Secure TP1/TP2, move SL close
ADX falling 30 → 20: Prepare exit — trend loses structural strength
ADX falling below 20: Exit or hold with very tight SL
```

---

8. ADX Hump Pattern — Trend Exhaustion

8.1 Definition

An ADX Hump occurs when ADX rises to a significant peak (> 40 or > 50) and subsequently **declines steadily** without recovery:

```
ADX: 20 → 25 → 32 → 40 → 47 → 52 → 48 → 43 → 38 → 32 → 25 → 20
              ↑ trend            ↑ peak      ↓ decline
```

Significance: The trend that generated the high ADX is gradually exhausting. The price may make a final push to extremes, but the directional strength is systematically decreasing.

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8.2 ADX Hump in Long Context

```
Typical scenario:
1. ADX rises from 15 to 50 on a strong bullish trend
2. ADX peaks at 50 and begins to decline (but +DI > -DI continues)
3. Price may continue to rise, but more slowly and with larger pullbacks
4. At ADX < 30 declining: likely major consolidation or reversal

Correct action:
→ At ADX peak (50+): reduce position by 50%, tighten SL
→ At ADX < 40 falling: secure profit, SL at breakeven
→ At ADX < 25 falling: complete exit or extremely tight SL
```

8.3 How to Recognize ADX Hump (algorithmically)

```
# Detect hump (ADX peak followed by consistent decline):
adx_peak = max(adx[-10:])
adx_current = adx[-1]
hump_confirmed = (
    adx_peak > 40 and
    adx_current < adx_peak * 0.85 and  # declined by >15% from peak
    adx[-1] < adx[-2] < adx[-4]        # consistent downward trend
)
if hump_confirmed:
    reduce_position = True  # do not add to position
```

8.4 Extreme ADX Values (> 50) — Special Attention

ADX > 50 on any significant timeframe (15M+) is an unusual event indicating an extreme trend:

```
ADX 50–60: Exceptionally strong trend — typically after major news (FOMC, ETF approval)
ADX > 60:  Extremely rare — explosive trend, likely spike or capitulation
ADX > 70:  Almost never on large TF — "once per cycle" event

Risk at extreme ADX:
→ Imminent aggressive mean reversion when the trend exhausts
→ Do not enter NEW at ADX > 50 without confirmation of continuously rising volume
→ Existing positions: tight trailing SL, progressive TP
```

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9. Spikes and ADX Behavior

9.1 Unique ADX Behavior at Spikes

ADX behaves differently from EMA/MACD during extreme spikes:

Bullish spike (extreme upper wick):

```
+DM spike: Large UpMove → +DM_s increases with K × spike_dm
ATR spike: Large TR (High - Low or |High - Close_prev|) → ATR increases similarly

If small body and large wick: ATR increases more than +DM
→ +DI = +DM_s / ATR may DECREASE or remain stable
→ But DX jumps if +DI remains > -DI

ADX ALWAYS RISES after a strong spike (whether bull or bear)
→ Any extreme spike produces a high DX (difference |+DI - -DI| / sum increases)
→ ADX can rise to 40+ after a single large spike even if there is no real trend
```

Practical implication:

```
Extreme spike → ADX jumps to 30-40+ → ADX > 18 signal → bot may consider trend valid
BUT: the signal is false — the spike artificially created a high ADX

Filter: check that ADX > 18 is NOT exclusively generated by a recent spike:
spike_bar = (H - L) > 3 * atr14
if spike_bar or recent_spike:
    discount_adx_signal = True  # ADX may be artificially inflated
```

9.2 ADX Recovery After Spike

Unlike EMA (which gradually attenuates), ADX has a more complex recovery:

```
Immediately after spike:
- +DM_s or -DM_s may remain elevated for several bars (Wilder smoothing is slow)
- ATR remains similarly elevated
- DX and ADX may remain artificially high 5-10 bars after spike

Complete recovery: ~N/2 = ~7 bars for Wilder RMA14
→ ADX generated by spike completely attenuates in ~7-10 bars
```

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10. Multi-Timeframe Analysis (MTF)

10.1 MTF PSEDYS Hierarchy — ADX

Level	Timeframe	ADX Usage	Threshold	Role
1 (Macro)	4H	ADX + DI direction	ADX > 20	Confirms macro trend existence
2 (Meso)	1H	ADX + trend strength	ADX > 20	Confirms medium trend is active
3 (Micro)	15M	ADX ≥ 20 + rising	ADX ≥ 20	Mandatory PSEDYS filter
4 (Entry)	5M	ADX ≥ 18 + rising	ADX ≥ 18	Minimum entry condition

10.2 MTF Alignment Score — ADX

ADX 4H	ADX 1H	ADX 15M	ADX 5M	Score	Action
> 20 ✅	> 20 ✅	≥ 20 ✅	≥ 18 ✅	4/4	Entry with full sizing
> 20 ✅	> 20 ✅	≥ 20 ✅	15–18 ⚠	3/4	Entry with reduced sizing 50–75%
> 20 ✅	> 20 ✅	15–20 ⚠	≥ 18 ✅	3/4	Wait for ADX 15M ≥ 20
> 20 ✅	< 20 ❌	any	any	2/4	DO NOT enter — weak 1H trend
< 20 ❌	any	any	≥ 18 ✅	conflict	DO NOT enter — macro trend absent

10.3 ADX + EMA + MACD — Complete Combination

ADX is most powerful as a **validation filter**, not as a primary indicator. Ideal combination:

```
High probability bullish setup:
1. EMA 200 4H < price          → macro direction (EMA)
2. EMA stack 5M: price > EMA20 > EMA50 → entry direction (EMA)
3. MACD Signal Cross 5M bullish → momentum (MACD)
4. MACD 4H > Zero Line         → macro momentum (MACD)
5. ADX 5M ≥ 18 and rising      → active trend (ADX) ← FILTER
6. ADX 15M ≥ 20                → medium trend confirmed (ADX) ← FILTER
7. +DI > -DI on 5M and 15M     → DI direction confirms (ADX)

→ 7 confirmations → maximum quality setup
```

10.4 ADX vs EMA Conflict on Same TF

EMA stack bullish but ADX < 18 (5M):

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```
Interpretation: structural trend exists (EMA confirms) but market currently lacks strength
→ Likely consolidation or slow movement without impulse
→ SKIP according to PSEDYS rule (ADX < 18 = no trade on 5M)
→ Revalidate in 2–3 bars when ADX exceeds 18
```

ADX > 25 and rising but EMAs flat:

```
Interpretation: directional volatility exists (high DX = |+DI - -DI| large)
but price trend has not crystallized in EMA stack
→ Possible new trend that hasn't moved EMAs enough
→ Check +DI vs -DI for direction
→ Possible entry but EMA confirmation pending → reduced sizing
```

---

11. ADX in Sideways Market

11.1 ADX as the Most Accurate Sideways Filter

Unlike flat EMA (near-zero slope) or Choppiness Index, ADX has the most direct mathematical method to detect sideways:

```
ADX < 20 = mathematical definition of "no trend"
         = |+DI - -DI| / (+DI + -DI) < ~0.20 (small DX → small ADX)
         = bullish and bearish forces are approximately equal over the last 14 bars
```

11.2 Combining Sideways Filters

```
Complete sideways filter:
ADX < 18 (5M)       → SKIP
OR Choppiness > 61.8 → SKIP
OR EMA20 slope flat  → SKIP

Confirmed sideways (all 3):
ADX < 15 + Choppiness > 65 + EMA slope ≈ 0 → completely sideways market
```

11.3 ADX Transition from Sideways → Trend

The moment of exiting sideways is detectable with ADX:

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```
ADX below 20 and rising + DI cross confirmed → potential new trend
Anticipated entry signal (with higher risk):
→ ADX > 18 for the first time after a long period below 18
→ +DI surpassing -DI (or vice versa) with increased volume
→ EMA 20 begins to separate from EMA 50

→ Entry with 50% sizing — confirmation comes in 2–3 bars
→ Full sizing when ADX exceeds 20 and continues to rise
```

---

12. PSEDYS — ADX as Filter and Feature

12.1 ADX in PSEDYS Entry Rules

From CLAUDE.md and EMA/MACD documents, ADX is a **dual** filter in the PSEDYS system:

```
Filter 1 — Entry Block:
ADX < 18 on 5M  → entry BLOCKED regardless of EMA/MACD
ADX < 20 on 15M → trend confirmation BLOCKED

Filter 2 — Confidence Score:
ADX > 25 → positive contribution to position score
ADX > 35 + rising → major contribution to position score
ADX < 20 → negative contribution (lower score)
```

12.2 `adx` as a Feature in `entry_features` JSONB

From `live_positions.entry_features` (TI):

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```
-- Check ADX at entry moment on active positions:
SELECT symbol, direction, profile_name,
       (entry_features->>'adx')::float         AS adx_entry,
       (entry_features->>'ema_stack')           AS ema_stack,
       (entry_features->>'macd_cross')          AS macd_cross,
       (entry_features->>'regime_strategy_compat') AS regime
FROM live_positions
WHERE lower(state) != 'closed'
ORDER BY opened_at DESC;

-- Retrospective analysis — ADX entry vs pnl correlation:
SELECT profile_name,
       round(avg((entry_features->>'adx')::float), 1) AS avg_adx_entry,
       round(avg(realized_pnl), 2)                    AS avg_pnl,
       count(*)                                        AS trades
FROM trade_journal
GROUP BY profile_name
ORDER BY avg_pnl DESC;
```

12.3 ADX in `strategy_config` TI

```
-- Check configured ADX threshold per strategy:
SELECT strategy_name, param_name, param_value
FROM strategy_config
WHERE param_name LIKE '%adx%'
ORDER BY strategy_name, param_name;
```

---

13. Bot vs TradingView Validation

13.1 Primary Source of ADX Errors: Standard K vs Wilder

The most common cause of divergence is the misuse of the multiplier:

```
WRONG (Standard EMA — produces significantly different ADX):
K = 2 / (N + 1) = 2/15 = 0.1333

CORRECT (Wilder RMA — produces ADX identical to TradingView):
K = 1 / N = 1/14 = 0.07143
```

Impact: ADX calculated with K=2/15 can be 5–15 points different from TradingView on the same data. A threshold of 18 on the bot may correspond to ~22-23 on TradingView.

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13.2 ADX Validation Checklist

```
STEP 1 — Verify K for ALL components:
□ ATR: K = 1/N (Wilder)   ← NOT 2/(N+1)
□ +DM_s: K = 1/N           ← NOT 2/(N+1)
□ -DM_s: K = 1/N           ← NOT 2/(N+1)
□ ADX (on DX): K = 1/N     ← NOT 2/(N+1)

STEP 2 — Verify seeds:
□ ATR_seed = SMA(TR[bars 2..N+1])
□ +DM_s_seed = SMA(+DM[bars 2..N+1])
□ -DM_s_seed = SMA(-DM[bars 2..N+1])
□ ADX_seed = SMA(DX[bars N+1..2N])

STEP 3 — Verify TR formula:
□ TR = max(H-L, |H-C_prev|, |L-C_prev|)
□ NOT just H-L (omitting gaps produces lower ATR)

STEP 4 — Verify +DM/-DM formula:
□ UpMove = High_curr - High_prev
□ DownMove = Low_prev - Low_curr  ← ATTENTION to direction
□ Case UpMove = DownMove: both = 0

STEP 5 — Numeric test:
□ Run calculation on 100 real OHLC bars
□ Compare with TradingView on the same symbol/TF
□ Tolerance: < 0.5 ADX points (ADX is in 0-100, higher tolerance than EMA)
□ If difference > 1 ADX point → check steps 1-4

STEP 6 — Cold start verification:
□ First 2N+1 = 29 bars → no ADX signal
□ Bars 29-42 → ADX signal with reduced precision
□ From bar 42+ → ADX production
```

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13.3 Python Validation Script

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```
def wilder_rma(values: list, period: int) -> list:
    """Wilder's RMA: K = 1/period. Ignore None values."""
    valid = [(i, v) for i, v in enumerate(values) if v is not None]
    result = [None] * len(values)
    if len(valid) < period:
        return result
    seed_pos = valid[period - 1][0]
    seed_val = sum(v for _, v in valid[:period]) / period
    result[seed_pos] = seed_val
    for j in range(seed_pos + 1, len(values)):
        if values[j] is None:
            continue
        result[j] = result[j-1] + (values[j] - result[j-1]) / period
    return result

def adx(high: list, low: list, close: list, period: int = 14):
    n = len(close)
    tr_list   = [None]
    pdm_list  = [None]
    ndm_list  = [None]

    for i in range(1, n):
        tr = max(
            high[i] - low[i],
            abs(high[i] - close[i-1]),
            abs(low[i]  - close[i-1])
        )
        upmove   = high[i] - high[i-1]
        downmove = low[i-1] - low[i]
        pdm = upmove   if (upmove > downmove   and upmove > 0)   else 0
        ndm = downmove if (downmove > upmove   and downmove > 0) else 0
        tr_list.append(tr)
        pdm_list.append(pdm)
        ndm_list.append(ndm)

    atr_s  = wilder_rma(tr_list, period)
    pdm_s  = wilder_rma(pdm_list, period)
    ndm_s  = wilder_rma(ndm_list, period)

    di_plus  = [None] * n
    di_minus = [None] * n
    dx_list  = [None] * n

    for i in range(n):
        if atr_s[i] is None or atr_s[i] == 0:
```

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```
            continue
        dp = 100 * pdm_s[i] / atr_s[i]
        dm = 100 * ndm_s[i] / atr_s[i]
        di_plus[i]  = dp
        di_minus[i] = dm
        denom = dp + dm
        dx_list[i] = 100 * abs(dp - dm) / denom if denom != 0 else 0

    adx_vals = wilder_rma(dx_list, period)
    return di_plus, di_minus, adx_vals

# Validation: compare adx_vals[-1] with TradingView → difference < 0.5 = OK
```

---

14. Practical Exercises with Complete Answers

Exercise 1: ADX below threshold — enter or skip?

Situation: On 5M, EMA stack bullish (price > EMA20 > EMA50, slope +0.08%). MACD Signal Cross recently bullish, Histogram positive and rising. Choppiness = 40 (ok). But ADX 5M = 15 and falling.

Question: EMA and MACD give a bullish signal. Do you enter Long?

Answer:

SKIP — ADX < 18 on 5M is a hard block according to PSEDYS rule.

- **Diagnosis:** EMA and MACD confirm direction and momentum, but ADX < 18 indicates that the **strength** of the trend is insufficient. A trend on paper (EMA stack) without real strength (low ADX) produces moves that do not reach their targets.
- **Falling ADX worsens:** The trend is actively weakening → probability that the EMA stack will break increases.
- **Choppiness 40 is contradictory:** Low Choppiness suggests a directional market, low ADX suggests weak strength. Likely cause: small but consistent directional movement — weak real trend, not sideways, but insufficient for entry.
- **Correct action:** Monitor. Wait for ADX to exceed 18 and be rising. When ADX > 18 and rising with EMA/MACD confirmed → valid entry.

Exercise 2: Extreme ADX (> 50) — do you add or exit?

Situation: BTC has risen 8% in the last 4 hours on 15M. ADX 15M = 58 and has risen from 35 in 6 hours. +DI = 42, -DI = 5. EMA stack bullish on all TFs. MACD positive. You are already in a Long position with +4% profit.

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Question 1: Do you add to the position (scale in)?
Question 2: How do you manage the existing position?

Answer:

Question 1 — DO NOT add at high ADX = 58:
- ADX 58 > 50 = extreme trend, possibly in the final exhaustion phase
- Risk/reward for scaling in at extreme ADX is unfavorable — entering at the peak of strength
- Rule: **do not add to existing positions when ADX > 50**

Question 2 — Managing existing position:
- At ADX 58, the trend is at maximum strength → **do not exit immediately**, but prepare exits
- Actions in order:
1. Move SL to breakeven if not already there
2. If +DI remains >> -DI → trend continues — tighten trailing SL
3. Monitor ADX: if ADX peaks and starts falling (58→55→50) → execute progressive TP
4. At ADX falling below 45 with -DI approaching +DI → exit 50% of the position
5. At ADX < 40 falling → complete exit or SL at TP1 level

Exercise 3: DI Crossover with ADX in sideways

Situation: On 15M, +DI (22) has just crossed above -DI (20) from below (DI Bullish Cross). ADX 15M = 17 and trending sideways. Choppiness = 58.

Question: DI cross bullish on 15M — do you enter Long?

Answer:

NO — DI Cross with ADX < 20 is a quasi-guaranteed false signal.

- **Diagnosis:** +DI (22) ≈ -DI (20) → spread of only 2 points. The DIs are at nearly the same level, the cross is marginal. ADX = 17 < 20 = bullish and bearish forces are nearly equal, neither dominates clearly.
- **Confirmed flat and low ADX sideways:** The tendency of DIs to repeatedly cross is specific to sideways — precisely when +DI ≈ -DI = low ADX.
- **Choppiness 58 close to the 61.8 threshold:** Additional confirmation that the market lacks direction.
- **Correct action:** Skip. Wait for ADX > 20 and rising + spread |+DI - -DI| > 8 before validating the DI cross as a signal. If ADX rises and the spread increases simultaneously → then the DI cross becomes valid.

Exercise 4: ADX confirms but +DI/-DI direction contradicts EMA

Situation: On 4H: EMA 200 < price (macro bullish). ADX 4H = 32 and rising. But -DI (28) > +DI (15). On 1H: EMA stack slightly bullish, MACD > Signal but with histogram decreasing.

Question: ADX 4H = 32 is solid. Do you enter Long on the 5M signal?

Answer:

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DO NOT enter — DI system direction contradicts EMA.

- **Diagnosis:** ADX 32 = strong trend (yes). But **-DI (28) > +DI (15)** = bearish force dominates bullish force on 4H, even if the price is above EMA 200.
- **Reconciling the contradiction:** The price can be above EMA 200 (which has a lag of ~99 bars) but in active correction for several days. Recent +DMs are weak, -DMs are strong → high ADX on an internal bearish trend.
- **Decreasing MACD histogram on 1H** further confirms that bullish momentum is depleting.
- **Correct action:**
- Do not enter Long — high risk of continued correction
- Monitor: wait for +DI to exceed -DI on 4H (DI bullish cross 4H) to confirm the resumption of the macro bullish trend
- Or look for a SHORT setup aligned with -DI > +DI 4H, ADX 32 rising

---

Exercise 5: Complete ADX + EMA + MACD Setup on All TFs

Situation:
- 4H: EMA 200 < price (+3%). ADX = 28, +DI = 30, -DI = 10. MACD 4H > 0.
- 1H: EMA20 > EMA50, ADX = 25 rising, +DI = 27, -DI = 12.
- 15M: EMA stack bullish, ADX = 22 rising, Signal Cross bullish confirmed.
- 5M: EMA stack bullish, ADX = 20 rising, Signal Cross bullish, Histogram rising.
- Choppiness 5M = 35. Funding Rate = +0.03%.

Question: Evaluate the complete setup.

Answer:

High probability bullish setup — valid entry with full sizing.

Filter	Value	Status
EMA 200 4H	Price above by 3%	✅
ADX 5M ≥ 18	ADX = 20, rising	✅
ADX 15M ≥ 20	ADX = 22, rising	✅
+DI > -DI on 5M/15M	30 vs 10 (4H)	✅
MACD 4H > 0	Yes	✅
Signal Cross 5M	Confirmed bullish	✅
EMA stack 5M	price > EMA20 > EMA50	✅
Choppiness 5M	35 < 61.8	✅
Funding Rate	+0.03% < +0.1%	✅

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Score: 9/9 filters confirmed. Rare and high-quality setup.

Actions:

1. Enter Long at market or minor pullback to EMA 20 on 5M
2. SL below the last swing low or below EMA 50 5M
3. Aggressive trailing SL — rising ADX on all TFs = accelerating trend
4. At ADX 5M > 35 → tighten trailing (trend at maturity, momentum at maximum)

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15. Cheat Sheet — Rapid Summary

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Concept	Value / Rule
Formula TR	`max(H-L, \\\\|H-C_prev\\\\|, \\\\|L-C_prev\\\\|)`
Formula +DM	`UpMove` if UpMove > DownMove and > 0, otherwise 0
Formula -DM	`DownMove` if DownMove > UpMove and > 0, otherwise 0
Formula +DI	`100 × +DM_s / ATR`
Formula -DI	`100 × -DM_s / ATR`
Formula DX	`100 × \\\\|+DI - -DI\\\\| / (+DI + -DI)`
Formula ADX	`Wilder_RMA(DX, N)`
K Wilder (RMA)	`1/N = 1/14 = 0.071429` — NOT `2/(N+1)`
K EMA standard	`2/15 = 0.1333` — INCORRECT for ADX
Half-life RMA14	9.35 bars (vs EMA14: 4.84 bars)
Lag ATR / +DI / -DI	~6.5 bars
Lag ADX	~13.0 bars (two RMA levels)
Minimum Warm-up	29 bars (bar 2N+1)
Recommended Warm-up	42 bars (3N)
Production	100 bars minimum
ADX = strength	NOT direction — direction = +DI vs -DI
ADX < 18 on 5M	MANDATORY SKIP PSEDYS
ADX < 20 on 15M	SKIP confirmation filter PSEDYS
ADX 20–25	Weak-medium trend — with other confirmations
ADX 25–40	Solid trend — valid signal
ADX 40–50	Strong trend — aggressive trailing
ADX > 50	Extreme trend — do not add, tighten SL
ADX rising	Trend intensifies → favored riding
ADX falling	Trend decelerates — NO automatic reversal
ADX Hump	Peak > 40 + constant decline → progressively reduce position
+DI > -DI	Dominant bullish strength → LONG bias
-DI > +DI	Dominant bearish strength → SHORT bias
DI Bullish Cross	+DI surpasses -DI above, ADX > 20 → bullish change

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Concept	Value / Rule
DI Bearish Cross	-DI surpasses +DI above, ADX > 20 → bearish change
DI Cross with ADX < 20	False signal — skip
Spike → ADX	ADX ALWAYS rises after strong spike (regardless of direction)
Spike filter	Skip ADX signal if recent spike (H-L > 3×ATR14)
`adx` **feature TI**	`entry_features->>'adx'` from `live_positions`
Bot vs TV Tolerance	< 0.5 ADX points (scale 0–100)
Cause #1 divergence	K = 2/(N+1) instead of K = 1/N → Completely different ADX
Complete Combination	EMA200 4H + EMA stack 5M + MACD cross + ADX ≥ 18 + +DI > -DI
MTF Score 4/4	Entry with full sizing
MTF Score 3/4	Entry with 50–75% sizing
ADX 4H -DI > +DI	DO NOT enter Long even if EMA 200 is bullish

---

PSEDYS ADX Technical Manual v1.0 — May 2026
Covers: 6-step formula (TR→+DM/-DM→Wilder cascade→+DI/-DI→DX→ADX), verified numeric example 50 bars, 3-level compound warm-up, lag quantified per cascade level (~13 bars total), ADX strength vs direction (central distinction), PSEDYS thresholds (18/5M, 20/15M), complete +DI/-DI system, DI Crossover with filters, ADX rising/falling interpretation, ADX Hump and exhaustion (>50), behavior on spikes (ADX rises regardless of direction), complete MTF with alignment score, *adx* feature from entry_features TI, bot vs TradingView validation (standard K error vs Wilder), complete Python script, 5 practical exercises.

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