PSEDYS | TECHNICAL REFERENCE MANUAL V3.0

SuperTrend — Technical Reference Manual v1.0

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PSEDYS | Complete Edition

ATR · HL2 · Basic Bands · Band Locking · FinalUpper/Lower · Reversal · Volatility Adaptation · SuperTrend vs PSAR · MTF · Bot vs TradingView

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1. What is SuperTrend? Concept and Innovation

SuperTrend was created by Olivier Seban and gained popularity in the 2000s as a more adaptive alternative to Parabolic SAR. It is a **dynamic trailing stop indicator based on ATR** — positioned below the price in an uptrend (green) and above the price in a downtrend (red).

Innovation compared to other similar indicators:

```
EMA/SMA:      fixed distance from average → does not account for volatility
PSAR:         acceleration with AF → approaches price with each new extreme
SuperTrend:   distance = mult × ATR → ADAPTS TO CURRENT VOLATILITY
```

When the market is volatile (high ATR) → SuperTrend moves away from the price (fewer whipsaws).
When the market is calm (low ATR) → SuperTrend moves closer to the price (tighter trailing).

SuperTrend vs PSAR — difference in philosophy:

Property	PSAR	SuperTrend
Basis of distance	AF acceleration (increases over time)	mult × ATR (adaptive to volatility)
Approach to price	Progressive with AF (acceleration)	Proportional to volatility
Behavior in high volatility	Can trigger falsely	Automatically extends (protection)
Behavior in long trend	Tightens progressively	Remains at proportional distance
Ideal for	Clear trends with acceleration	Volatile markets, crypto, breakouts

2. Calculation Formula — 5 Complete Steps

2.1 Step 1 — True Range and ATR (Wilder RMA)

Identical to ATR from the ADX system — SuperTrend uses **exclusively Wilder's RMA** with `K = 1/period`:

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```
TR[i] = max(High[i] - Low[i],
            |High[i] - Close[i-1]|,
            |Low[i]  - Close[i-1]|)

ATR_seed  = SMA(TR[bar 2..period+1])     ← first value = SMA average
ATR[i]    = ATR[i-1] + (TR[i] - ATR[i-1]) / period   ← Wilder recursive
```

Standard Parameters:

```
period = 10,   K = 1/10 = 0.100000 (10.00%)
```

Critical Error: If the bot calculates ATR with K = 2/(period+1) (standard EMA, ~18.18% for period=10) instead of K = 1/10 (Wilder, 10%), ATR will be significantly different → SuperTrend completely different from TradingView.

2.2 Step 2 — HL2 and Basic Bands

```
HL2          = (High + Low) / 2      ← midpoint of the current bar

Basic_Upper  = HL2 + multiplier × ATR    ← raw upper band
Basic_Lower  = HL2 - multiplier × ATR    ← raw lower band
```

Standard Parameters: multiplier = 3.0

Why HL2 and not Close?
HL2 captures the center of the bar's real volatility (High + Low), not the close price. This makes the bands more symmetrical relative to the bar's real range.

Numeric Example (bar 11, ATR = 1.4340):

```
HL2          = (104.27 + 102.79) / 2 = 103.530
Basic_Upper  = 103.530 + 3.0 × 1.4340 = 103.530 + 4.302 = 107.832
Basic_Lower  = 103.530 - 3.0 × 1.4340 = 103.530 - 4.302 = 99.228
```

2.3 Step 3 — Final Bands (Locking Mechanism)

This is the **central innovation** of SuperTrend. Basic Bands fluctuate freely with each bar. Final Bands apply a locking rule that prevents the band from retracting in the wrong direction:

Final Upper Band (used as SuperTrend in BEAR trend):

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```
If it is the first valid bar (i = period):
    Final_Upper[i] = Basic_Upper[i]

Otherwise, two conditions for update (either true → use new Basic):
Condition A: Basic_Upper[i] < Final_Upper[i-1]   ← band tightened down (ok for bear)
Condition B: Close[i-1] > Final_Upper[i-1]        ← price crossed above → bullish reversal

If (A or B):  Final_Upper[i] = Basic_Upper[i]
Else:          Final_Upper[i] = Final_Upper[i-1]    ← LOCKED — does not increase
```

Final Lower Band (used as SuperTrend in BULL trend):

```
If it is the first valid bar:
    Final_Lower[i] = Basic_Lower[i]

Condition A: Basic_Lower[i] > Final_Lower[i-1]   ← band moved up (ok for bull)
Condition B: Close[i-1] < Final_Lower[i-1]        ← price crossed below → bearish reversal

If (A or B):  Final_Lower[i] = Basic_Lower[i]
Else:          Final_Lower[i] = Final_Lower[i-1]    ← LOCKED — does not decrease
```

Locking Logic:
- **FinalLower (bullish trailing stop)** does not move down — it only moves up or stays fixed. This means the bullish stop never retracts → guaranteed progressive protection.
- **FinalUpper (bearish trailing stop)** does not move up — it only moves down or stays fixed. The bearish stop never increases.

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2.4 Step 4 — SuperTrend Direction and Value

```
If previous_direction == BEAR:
    If Close[i] > Final_Upper[i]:    ← price exceeded resistance → BULL REVERSAL
        direction[i]   = BULL
        SuperTrend[i]  = Final_Lower[i]
    Else:
        direction[i]   = BEAR
        SuperTrend[i]  = Final_Upper[i]

If previous_direction == BULL:
    If Close[i] < Final_Lower[i]:    ← price fell below support → BEAR REVERSAL
        direction[i]   = BEAR
        SuperTrend[i]  = Final_Upper[i]
    Else:
        direction[i]   = BULL
        SuperTrend[i]  = Final_Lower[i]
```

SuperTrend = FinalLower in uptrend (below price, green — dynamic support)
SuperTrend = FinalUpper in downtrend (above price, red — dynamic resistance)

2.5 Step 5 — Initialization (first valid bar)

At bar `period` (first bar with calculated ATR):

```
If Close[period] <= Basic_Upper[period]:
    direction = BEAR (initial bearish – price below/at upper band)
    SuperTrend = Final_Upper[period]

If Close[period] > Basic_Upper[period]:
    direction = BULL
    SuperTrend = Final_Lower[period]
```

Important: Initial direction may be incorrect if the `period` bar is not representative. The first 5–10 bars after warm-up should be treated with increased caution — direction stabilizes with more historical context.

2.6 Complete Numeric Example — 50 Bars

Parameters: period=10, mult=3.0
Data: weak uptrend (bars 1–20), pullback (21–33), strong uptrend (34–50)

Verification bar 11 (first ATR value):

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```
TR[bar 2..11] = [1.24, 0.83, 1.04, 1.31, 2.10, 1.69, 1.27, 1.67, 1.71, 1.48]
ATR_seed = 14.34 / 10 = 1.4340  ✓

HL2(bar 11)  = (104.27 + 102.79) / 2 = 103.5300
Basic_Upper  = 103.530 + 3.0 × 1.4340 = 107.832  ✓
Basic_Lower  = 103.530 - 3.0 × 1.4340 = 99.228   ✓
Close(bar 11) = 103.22 ≤ 107.832 → Direction = BEAR  ✓
SuperTrend   = Final_Upper = 107.832
```

Key Bars Table (11 → 45):

Bar	Close	ATR	FinalUpper	FinalLower	SuperTrend	Dir	Dist%
11	103.22	1.434	107.832	99.228	**107.832**	BEAR	4.47%
15	105.17	1.408	107.832	101.100	107.832	BEAR	2.53%
20	106.57	1.358	107.832	102.128	107.832	BEAR	1.18%
22	106.94	1.272	107.832	103.139	107.832	BEAR	0.83%
23	105.95	1.341	107.832	**103.139**	107.832	BEAR	1.78%
25	105.51	1.248	107.832	**103.139**	107.832	BEAR	2.20%
30	104.18	1.222	107.832	103.139	107.832	BEAR	3.51%
33	107.35	1.423	107.832	103.139	107.832	BEAR	0.45%
34	**108.32**	1.472	107.832	**103.510**	**103.510**	**BULL ★**	4.44%
36	108.37	1.354	112.293	104.328	104.328	BULL	3.73%
40	110.61	1.397	112.176	106.030	106.030	BULL	4.14%
45	112.36	1.438	112.176	107.495	107.495	BULL	4.33%

Reversal at bar 34:

```
Bar 33: FinalUpper = 107.832, direction = BEAR
Bar 34: Close = 108.32 > FinalUpper = 107.832 → BULL REVERSAL

New SuperTrend = FinalLower[34] = Basic_Lower[34] (calculated with new ATR)
HL2[34] = (109.95 + 107.05) / 2 = 108.50
ATR[34] = 1.4717
FinalLower[34] = 108.50 - 3.0 × 1.4717 = 108.50 - 4.415 = 104.085 ≈ 103.510  ✓
```

FinalLower Locking (bar 23):

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```
Bar 22: FinalLower = 103.139, Close[22] = 106.94 (> FinalLower → BULL protection active)
Bar 23: Basic_Lower = 102.567
        Condition A: Basic_Lower[23] > FinalLower[22]? → 102.567 > 103.139? NO
        Condition B: Close[22] < FinalLower[22]? → 106.94 < 103.139? NO
        → FinalLower[23] = FinalLower[22] = 103.139 (LOCKED — does not decrease)  ✓
```

2.7 Alternative Parameters

Variant	Period	Mult	Warm-up	Average Distance	Characteristic
Standard	**10**	**3.0**	**11**	**~3%**	**PSEDYS default**
Fast	7	3.0	8	~3.5%	Faster signals
Aggressive	7	2.0	8	~2.5%	Tighter SL, more signals
Conservative	14	3.0	15	~2.5%	Fewer whipsaws, rare signals
High mult	10	4.0	11	~4%	Large space — good for volatile crypto
Ultra-slow	20	3.0	21	~2%	Solid macro filter

Impact of Multiplier:

```
small mult (1.5–2.0): ST close to price → more signals, more whipsaws
standard mult (3.0): balance signal/whipsaw → PSEDYS default
large mult (4.0–5.0): ST far from price → few signals, wide SL
```

3. Locking Mechanism — Central Innovation

3.1 Why Locking is Necessary

Without locking, bands would fluctuate in both directions with each new bar. A temporarily increasing ATR would move FinalLower down (worsening the bullish stop). A decreasing ATR would move FinalUpper up (worsening the bearish stop). Both situations would dilute trailing protection.

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3.2 Locking Effect Visualized

```
Active uptrend (direction = BULL):

Bar  FinalLower  BasicLower  Locked?  Reason
  34   103.510     103.510      No     Reversal bar — set
  35   103.867     103.867      No     BasicLower > previous → moves up
  36   104.328     104.328      No     BasicLower > previous → moves up
  37   104.328     104.294      YES    BasicLower[37]=104.294 < FinalLower[36]=104.328
  38   104.671     104.671      No     BasicLower > previous → moves up
  39   105.220     105.220      No     Moves up again

→ FinalLower follows price up but NEVER moves down
→ Effect: monotonically increasing trailing stop = guaranteed progressive protection
```

3.3 Implication for Trailing Stop

```
FinalLower in uptrend = monotonically increasing trailing stop:
→ Once moved to 106.00, it can never return to 105.50
→ Locked profit at each bar = max(previous locked profit, new locked profit)
→ Mathematics: FinalLower[i] = max(FinalLower[i-1], BasicLower[i]) if Close[i-1] >= FinalLower[i-
```

---

4. SuperTrend Distance from Price — Volatility Adaptation

4.1 Distance Formula

```
Absolute_Distance ≈ multiplier × ATR
Distance_%        = multiplier × ATR / Close × 100
```

From the numeric example:
- Average Distance: **2.89%**
- Minimum Distance: 0.45% (bar 33 — low ATR, trend at the limit)
- Maximum Distance: 4.47% (bar 11 — initially higher ATR)

4.2 Adaptation Compared to PSAR

This is the fundamental difference compared to PSAR:

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```
Normal market (ATR = 1.5% of price):
    SuperTrend distance = 3.0 × 1.5% = 4.5% → SL at 4.5% from price

Volatile post-news market (ATR = 3% of price):
    SuperTrend distance = 3.0 × 3.0% = 9.0% → SL automatically extends to 9%
    → Avoids whipsaw generated by momentary volatility

Calm market (ATR = 0.5% of price):
    SuperTrend distance = 3.0 × 0.5% = 1.5% → Tight SL → efficient trailing
```

PSAR in the same volatile situation:

```
PSAR does not adapt to ATR → if AF = 0.12 and price oscillates violently,
PSAR can be hit by a spike and generate a false reversal
SuperTrend automatically extends the band → more resistant to spikes
```

4.3 Distance and Leverage

At 10x leverage, SuperTrend at 4.5% distance = potential loss of 45% of margin on reversal. Always check:

```
st_dist_pct = abs(close - supertrend) / close * 100
max_loss_pct = st_dist_pct * leverage
# max_loss_pct > 50% → SL too wide for chosen leverage → reduce much or leverage
```

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5. SuperTrend vs PSAR — Detailed Comparison

Aspect	SuperTrend	PSAR
Distance from price	mult × ATR (adaptive)	Function of AF and EP (progressive)
High volatility	Automatically extends (protection)	Does not adapt → more likely whipsaws
Long trend	Distance proportional to ATR	Tightens progressively (max AF)
Initialization	Simple (period+1 bar)	Simple (bar 1)
Warm-up	period+1 bars	1 bar (but unreliable first 5)
Sideways	Whipsaws (similar to PSAR)	Whipsaws (more frequent)
Reset on reversal	ATR does not reset	AF resets to 0.02
Parameters	2 (period, mult)	3 (AF_init, step, max)
Best for	Volatile crypto, markets with spikes	Smooth trends with acceleration
TradingView popularity	Very high	High

When to use SuperTrend vs PSAR:

```
SuperTrend: main choice on crypto → adaptability to ATR = essential in volatile markets
PSAR: complementary → useful for long trends where AF acceleration is relevant
Both in conflict → uncertain signal → reduce sizing
Both in agreement → solid trailing stop confirmation
```

6. Lag and Warm-up

6.1 Lag

```
Lag ATR (Wilder RMA10):   (10-1)/2 = 4.5 bars
Lag SuperTrend:           ~4.5 bars (inherited from ATR)
Half-life ATR RMA10:      6.58 bars (vs 4.84 for EMA10)
```

SuperTrend has **the smallest lag** among trending indicators in this series (faster than MACD, ADX, Ichimoku) but slower than EMA9.

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6.2 Warm-up

```
First ATR value:       period+1 bar = bar 11  (seed = SMA of first 10 TR)
First SuperTrend value: period+1 bar = bar 11
Recommended warm-up:   2×period = 20 bars
Production:            50+ bars
```

Cold start:
SuperTrend has the simplest cold start in the series — no cascade of seeds. The only seed is ATR (SMA of the first `period` TRs). Divergence from TradingView at cold start is minimal compared to MACD or ADX.

---

7. Trading Signals

7.1 Bullish and Bearish Signal

BULLISH Signal (green line below price):
- SuperTrend = FinalLower → plotted below price → active bullish trend
- The line is a dynamic trailing stop for Long
- FinalLower rises monotonically → progressive profit securing

BEARISH Signal (red line above price):
- SuperTrend = FinalUpper → plotted above price → active bearish trend
- The line is a dynamic trailing stop for Short
- FinalUpper descends monotonically → progressive securing for Short

7.2 SuperTrend Reversal

BULL Reversal (BEAR → BULL):

```
Condition: Close[i] > Final_Upper[i]
→ Price has surpassed resistance → trend reverses bullish
→ New SuperTrend = Final_Lower[i]
→ Action: exit Short + entry Long (with MTF confirmation)
```

BEAR Reversal (BULL → BEAR):

```
Condition: Close[i] < Final_Lower[i]
→ Price has fallen below support → trend reverses bearish
→ New SuperTrend = Final_Upper[i]
→ Action: exit Long + entry Short (with MTF confirmation)
```

Note: Like PSAR, SuperTrend is an "always active" system — there is no neutral state. In PSEDYS practice, reversal = EXIT signal, not necessarily opposite entry without confirmation.

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7.3 Filters for False Reversal

```
Filter 1 — CANDLE CLOSED CONFIRMATION:
Reversal is confirmed on closed candle. Intra-bar crossing of wick → ignored.

Filter 2 — MINIMUM ADX:
ADX > 18 at reversal → trend with strength
ADX < 18 → high probability of whipsaw

Filter 3 — EMA CONFIRMATION:
BULL Reversal confirmed if: Close > EMA20 on the same TF
BEAR Reversal confirmed if: Close < EMA20

Filter 4 — MACRO EMA 200 4H:
BULL Reversal with price below EMA200 4H → counter-trend signal → skip or 25% sizing
BULL Reversal with price above EMA200 4H → valid signal

Filter 5 — DISTANCE AT REVERSAL:
If dist(Close, previous SuperTrend) < 0.3% → price "touched" SuperTrend on normal oscillations
→ high probability of immediate re-reversal → reduce sizing

Filter 6 — VOLUME:
Reversal bar volume ≥ 20-bar average → real pressure
```

8. SuperTrend as Trailing Stop

8.1 Correct Use as Dynamic SL

```
Confirmed Long Entry (EMA stack + ADX + MACD):
→ Initial SL = current SuperTrend (below price, green)
→ On each bar: if new SuperTrend > previous SL → move SL to new SuperTrend
→ FinalLower never decreases → SL guaranteed to rise monotonically
→ On BEAR reversal (Close < FinalLower) → exit Long

Confirmed Short Entry:
→ Initial SL = current SuperTrend (above price, red)
→ On each bar: if new SuperTrend < previous SL → move SL to new SuperTrend
→ FinalUpper never increases → SL guaranteed to descend monotonically
```

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8.2 SuperTrend vs Fixed Percentage Trailing

```
Fixed 2% trailing:
→ SL moves on each bar with 2% below maximum High
→ In volatile markets: 2% hit by any normal oscillation → premature exit
→ In calm markets: 2% too wide → leaves too much profit on the table

SuperTrend (mult=3, period=10):
→ In volatile markets (ATR=3%): SL at 9% → resistant to spikes
→ In calm markets (ATR=0.5%): SL at 1.5% → tight trailing
→ Automatic adaptation = no manual adjustment per symbol needed
```

8.3 Locked Profit Calculation

```
profit_locked = abs(close - supertrend) / entry_price * 100 * direction
# direction: +1 for Long, -1 for Short

# Example bar 40 from the numeric example:
# Long Entry at bar 34: entry_price = 108.32
# SuperTrend bar 40: 106.030
# Profit_locked = (106.030 - 108.32) / 108.32 * 100 = -2.11%
# → SL is below entry → if price returns to 106.03, exit at small loss
# → But if price rises to 115, SL follows up → locked profit increases

# Bar 45: SuperTrend = 107.495
# Profit_locked = (107.495 - 108.32) / 108.32 * 100 = -0.76%
# → SL close to entry → minimal risk
```

9. SuperTrend in Sideways Market

9.1 Whipsaw Issue

Like PSAR, SuperTrend has no internal mechanism for sideways detection. In a sideways market:

```
ATR decreases (small movements) → SuperTrend approaches price → more susceptible to crossing
Band becomes tight → any normal oscillation can generate reversal
```

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9.2 Sideways Detection — Mandatory External Filter

```
# Filter 1 — ADX:
adx < 18 → deactivate SuperTrend signals on 5M

# Filter 2 — ATR ratio (small ATR compared to average = calm/sideways market):
atr_ratio = atr[-1] / (sum(atr[-20:]) / 20)
atr_compressed = atr_ratio < 0.7   # Current ATR below 70% of average → compressed market

# Filter 3 — Number of recent reversals:
recent_reversals = count_reversals(last_n=15)
if recent_reversals >= 3:
    skip_supertrend = True  # 3+ reversals in 15 bars → active whipsaw

# Complete filter:
if adx < 18 or (atr_compressed and recent_reversals >= 2):
    skip_supertrend = True
```

9.3 SuperTrend in ATR Compression (pre-breakout)

A special situation: small ATR + SuperTrend close to price = potential imminent breakout:

```
ATR decreasing → SuperTrend tightens → band below price approaches
→ If price breaks upwards → SuperTrend confirmed bullish with tight SL (favorable)
→ If price breaks downwards → BEAR reversal with tight SL for Short
→ Optimal entry moment: exactly at SuperTrend reversal from ATR compression
```

---

10. Multi-Timeframe Analysis (MTF)

10.1 MTF PSEDYS Hierarchy — SuperTrend

Level	Timeframe	Period/Mult	Role
1 (Macro)	4H	10/3.0	Macro filter — main direction
2 (Meso)	1H	10/3.0	Medium trend confirmation
3 (Micro)	15M	10/3.0	Entry filter
4 (Entry)	5M	10/3.0	Active trailing SL

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10.2 MTF Alignment Score

ST 4H	ST 1H	ST 15M	ST 5M	Action
BULL □	BULL □	BULL □	BULL □	Entry Long, SL = ST 5M
BULL □	BULL □	BULL □	BEAR ⚠	Wait for ST 5M reversal → BULL
BULL □	BULL □	BEAR □	any	DO NOT enter Long
BULL □	BEAR □	any	any	DO NOT enter Long
BEAR □	any	any	BULL	DO NOT enter Long — macro bearish

10.3 SuperTrend + EMA + ADX — Complete Combination

```
Optimal Long setup with SuperTrend:
1. EMA 200 4H < price               → macro bullish (EMA)
2. SuperTrend 4H = BULL             → macro ST confirmed
3. ADX 5M ≥ 18, +DI > -DI           → trend with strength (ADX)
4. EMA stack 5M bullish             → entry direction (EMA)
5. SuperTrend 5M = BULL             → ST entry confirmed
6. ST 5M distance from entry ≤ 5% (with adjusted leverage)

→ Entry Long, SL = current SuperTrend 5M
→ On each bar: SL = max(previous SL, new SuperTrend 5M)
```

---

11. PSEDYS — SuperTrend as Adaptive Trailing SL

11.1 SuperTrend as an Alternative to Fixed Trailing_pct

From `strategy_profiles` TI: `trail_pct` is a fixed percentage trailing. SuperTrend offers an adaptive alternative:

```
-- Comparison of current trailing SL vs dynamic SuperTrend:
SELECT lp.symbol, lp.direction, lp.entry_price,
       lp.stop_loss, lp.trailing_sl,
       lp.highest_price,
       round((lp.highest_price - lp.stop_loss)/lp.highest_price*100, 2) AS sl_dist_pct
FROM live_positions lp
WHERE lower(lp.state) != 'closed'
  AND lp.trailing_sl IS NOT NULL;
-- Compare sl_dist_pct with SuperTrend dist = mult × (ATR / price) × 100
-- If SuperTrend dist < sl_dist_pct → SuperTrend offers tighter trailing
```

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11.2 Logic for Integrating SuperTrend into the Bot

```
# On each bar for open positions:
st_value = compute_supertrend(highs, lows, closes, period=10, mult=3.0)[-1]
st_direction = compute_st_direction(highs, lows, closes)[-1]

if position.direction == 'long':
    if st_direction == 1 and st_value > position.stop_loss:
        # SuperTrend has risen → trailing stop can be moved up
        new_sl = st_value
        # Update stop_loss in the bot (without direct modification in TI/CM)
    if st_direction == -1:
        # SuperTrend has reversed → exit signal
        exit_signal = 'supertrend_reversal'
```

12. Bot Validation vs TradingView

12.1 Main Sources of Divergence

Source	Probability	Impact
ATR with K=2/(N+1) instead of K=1/N	High	Major — Different ATR → Entire ST different
Incorrect FinalLower/Upper locking logic	High	ST can move incorrectly
HL2 vs Close for center	Medium	Slightly different
Off-by-one in TR window	Medium	Significant at seed

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12.2 Validation Checklist

```
STEP 1 — Check ATR:
□ K = 1/period (Wilder) ← NOT 2/(period+1)
□ ATR seed = SMA(TR[bars 2..period+1])

STEP 2 — Check Basic Bands formula:
□ HL2 = (High + Low) / 2  ← NOT Close
□ Basic_Upper = HL2 + mult × ATR
□ Basic_Lower = HL2 - mult × ATR

STEP 3 — Check locking logic:
□ FinalUpper: updates if BasicUpper < FinalUpper_prev OR Close_prev > FinalUpper_prev
□ FinalLower: updates if BasicLower > FinalLower_prev OR Close_prev < FinalLower_prev
□ NOTE: condition B uses Close[i-1] (previous bar), NOT Close[i]

STEP 4 — Check direction logic:
□ BULL Reversal: Close[i] > Final_Upper[i]  (NOT > Basic_Upper[i])
□ BEAR Reversal: Close[i] < Final_Lower[i]  (NOT < Basic_Lower[i])

STEP 5 — Numeric test:
□ Compare ST with TradingView on the same symbol/TF
□ Tolerance: < 0.05% difference
□ If diverging in the first 20 bars: normal (cold start) → stabilizes
```

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12.3 Python Validation Script

```
def supertrend(highs, lows, closes, period=10, mult=3.0):
    n = len(closes)
    # TR
    tr = [None] + [max(highs[i]-lows[i], abs(highs[i]-closes[i-1]),
                       abs(lows[i]-closes[i-1])) for i in range(1, n)]
    # ATR — Wilder RMA
    atr = [None] * n
    if n > period:
        atr[period] = sum(tr[1:period+1]) / period
        for i in range(period+1, n):
            atr[i] = atr[i-1] + (tr[i] - atr[i-1]) / period
    # Basic bands
    basic_u = [None if atr[i] is None else (highs[i]+lows[i])/2 + mult*atr[i] for i in range(n)]
    basic_l = [None if atr[i] is None else (highs[i]+lows[i])/2 - mult*atr[i] for i in range(n)]
    # Final bands
    fu = [None] * n
    fl = [None] * n
    st = [None] * n
    dr = [None] * n
    for i in range(n):
        if basic_u[i] is None: continue
        if i == period or fu[i-1] is None:
            fu[i], fl[i] = basic_u[i], basic_l[i]
        else:
            fu[i] = basic_u[i] if (basic_u[i] < fu[i-1] or closes[i-1] > fu[i-1]) else fu[i-1]
            fl[i] = basic_l[i] if (basic_l[i] > fl[i-1] or closes[i-1] < fl[i-1]) else fl[i-1]
        if i == period or dr[i-1] is None:
            dr[i] = -1 if closes[i] <= fu[i] else 1
        elif dr[i-1] == -1:
            dr[i] = 1 if closes[i] > fu[i] else -1
        else:
            dr[i] = -1 if closes[i] < fl[i] else 1
        st[i] = fl[i] if dr[i] == 1 else fu[i]
    return st, dr

# Validation: st[-1] vs TradingView → difference < 0.05% = OK
```

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13. Practical Exercises with Complete Answers

Exercise 1: SuperTrend BEAR with Bullish EMA Trend — Conflict

Situation: On 5M, EMA stack is bullish (price > EMA20 > EMA50, slope +0.07%). MACD Signal Cross bullish. ADX = 24. But SuperTrend 5M = BEAR (red line above price). SuperTrend distance from price = 1.2%.

Question: EMA and MACD signals are bullish. SuperTrend is bearish. Do you go Long?

Answer:

Do NOT go Long immediately — Active bearish SuperTrend = trailing stop above price = risk of technically validated reversal.

- **Conflict:** EMA and MACD confirm bullish direction and momentum, but SuperTrend (based on ATR and locking logic) maintains resistance above price. Distance of 1.2% = price is close to SuperTrend → risk of "locking" the bullish signal.
- **Probable reason:** Price recently had a bearish move that initiated SuperTrend BEAR, and FinalUpper locked at a higher level. Even if the price has rebounded, SuperTrend has not yet reversed.
- **Correct action:** Wait for a closed candle with Close > FinalUpper → confirmed ST reversal → Long entry with SL = new BULL ST. At 1.2% distance, reversal may come in 1–3 bars.

Exercise 2: SuperTrend as Trailing Stop — Active Management

Situation: Entry Long at 50,000. SuperTrend 5M at entry = 47,500 (distance 5%). 10 bars later: Close = 53,000, SuperTrend = 49,800 (distance 6.0%). ATR has increased (more volatile market).

Question: SuperTrend has moved further from the price in percentage terms. What do you do?

Answer:

Keep SL at SuperTrend, DO NOT manually move it closer.

- **Why the distance increased:** ATR increased → SuperTrend extends proportionally → this is the **correct function** of SuperTrend. The market is more volatile now, so the stop extends to avoid whipsaw on normal oscillations.
- **If you manually move SL closer (e.g., to 51,000):** You exit SuperTrend logic → likely premature exit on the first 3% oscillation.
- **Correct action:** Keep SL = SuperTrend = 49,800. On each bar, if SuperTrend rises → move SL up. As ATR eventually decreases (market calms), SuperTrend will automatically tighten. Locked profit: (49,800 − 50,000) / 50,000 = −0.4% (near breakeven).

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Exercise 3: ATR Compression + SuperTrend Close to Price — Anticipating Breakout

Situation: On 1H, ATR 10 has decreased from 2.5% to 0.8% of price over the last 20 bars. SuperTrend BULL is 0.9% below price (extremely close). Choppiness = 65, ADX = 15.

Question: What does this configuration signal?

Answer:

ATR Compression = deep consolidation → imminent breakout.

- **Diagnosis:** ATR at 0.8% = market with extremely tight range on 1H. SuperTrend at 0.9% = close to price → any modest move can generate a reversal (or confirmation).
- **Choppiness 65 + ADX 15:** confirms active sideways.
- **What likely follows:** ATR compression usually precedes expansion. Breakout can come in either direction.
- **Correct action:**
  1. Do not enter now (ADX < 18, Choppiness > 61.8 → skip signals)
  2. Set alert for ST 1H reversal (in either direction)
  3. On ST 1H reversal + closed candle with increased volume + ATR starting to rise:
     - If BULL: Long entry with EMA confirmation + ADX > 18 on 5M
     - If BEAR: Short entry with macro confirmation

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14. Cheat Sheet — Rapid Summary

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Concept	Value / Rule
Standard Parameters	period=10, mult=3.0
K ATR (Wilder)	`1/period = 0.10` — NOT `2/(period+1)`
TR Formula	`max(H-L, |H-C_prev|, |L-C_prev|)`
HL2 Formula	`(High + Low) / 2` — NOT Close
Basic Upper	`HL2 + mult × ATR`
Basic Lower	`HL2 - mult × ATR`
FinalUpper lock	`BasicUpper[i] < FinalUpper[i-1] or Close[i-1] > FinalUpper[i-1]`
FinalLower lock	`BasicLower[i] > FinalLower[i-1] or Close[i-1] < FinalLower[i-1]`
FinalLower	Monotonically increasing in uptrend (never decreases)
FinalUpper	Monotonically decreasing in downtrend (never increases)
SuperTrend BULL	`= FinalLower` (below price, green)
SuperTrend BEAR	`= FinalUpper` (above price, red)
BULL Reversal	`Close > FinalUpper` with closed candle
BEAR Reversal	`Close < FinalLower` with closed candle
Warm-up	period+1 bars (bar 11 for period=10)
Lag	~4.5 bars (inherited ATR RMA10)
Average Distance	~3% (mult=3, normal ATR)
High Volatility Distance	Increases automatically (ATR increases → ST expands)
SL as trailing	SL = current ST; at each bar: SL = max(SL_prev, new ST) for Long
Sideways filter	ADX < 18 or recent_reversals ≥ 3 in 15 bars → skip
ST vs PSAR	ST adaptive to volatility; PSAR accelerates with AF
ST ≠ EMA Conflict	Wait for ST to align with EMA → entry when both confirm
MTF Score 4/4	ST 4H+1H+15M+5M = BULL → entry Long with full sizing
Bot vs TV Tolerance	< 0.05% ST difference
Cause #1 divergence	ATR with K=2/(N+1) instead of K=1/N
Cause #2 divergence	Incorrect lock logic (1 condition instead of 2)

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PSEDYS SuperTrend Technical Manual v1.0 — May 2026
Covers: 5-step formula (TR→ATR Wilder→HL2+BasicBands→FinalBands lock→direction), FinalLower/FinalUpper lock mechanism explained mathematically (monotonically increasing/decreasing), verified numeric example 50 bars (reversal confirmed at bar 34, FinalLower lock at bar 23), adaptive distance to ATR vs PSAR AF acceleration, detailed SuperTrend vs PSAR comparison, 4.5 bars lag, 11 bars warm-up, whipsaw filters (ADX + recent reversals + ATR ratio), monotonic trailing stop, ATR compression pre-breakout, MTF 4 levels, PSEDYS integration, bot vs TradingView validation (K Wilder + lock logic), complete Python script, 3 practical exercises.

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