PSEDYS | TECHNICAL REFERENCE MANUAL V3.0

# BB — Bollinger Bands

## Technical Reference Manual v1.0

**PSEDYS | Complete Edition**
SMA ± K×StdDev · %B · Bandwidth · Squeeze · Walk the Band · ddof=0 · MTF · Bot vs TradingView

## CONTENTS

1. What are BB? Concept and Origin
2. Calculation Formula — Complete
   - 2.1 Middle Band (SMA)
   - 2.2 Standard Deviation (population, ddof=0)
   - 2.3 Upper and Lower Band
   - 2.4 %B and Bandwidth
   - 2.5 Complete Numeric Example — 50 bars
3. Range and Visual Interpretation
4. Lag and Warm-up
5. Derived Indicators — %B and Bandwidth
6. Trading Signals
   - 6.1 Squeeze and Expansion
   - 6.2 Walk the Band
   - 6.3 M-Top and W-Bottom (John Bollinger)
   - 6.4 %B Extremes
   - 6.5 Combined Filters
7. BB vs Keltner Channel — Comparison
8. BB in Sideways and Trending Markets
9. Multi-Timeframe Analysis (MTF)
10. PSEDYS — BB as Volatility Filter
11. Bot vs TradingView Validation
12. Practical Exercises
13. Cheat Sheet — Quick Summary

## 1. What are BB? Concept and Origin

Bollinger Bands were created by **John Bollinger** in the 1980s and remain one of the most widely used volatility indicators. BB places bands at ±K standard deviations from a simple

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moving average — the bands widen when volatility increases and contract when volatility decreases.

**Philosophy:** ~95% of prices fall within ±2σ from the mean (normal distribution). Price outside the bands = rare statistical event → possible reversal or extreme continuation.

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## 2. Calculation Formula — Complete

### 2.1 Middle Band

```
Middle[i] = SMA(Close, period)[i] = sum(Close[i-period+1..i]) / period
```

**Standard period:** 20

### 2.2 Standard Deviation (Population, ddof=0)

```
Mean = Middle[i]
StdDev[i] = sqrt( sum((Close[j] - Mean)²) / period )   for j = i-period+1..i
```

**Critical:** TradingView uses **population standard deviation** (division by N, ddof=0), **NOT** sample standard deviation (ddof=1, division by N-1). This is the #1 source of divergence from Python libraries (pandas `std()` default ddof=1).

```
# Correct (TradingView):
std = np.std(window, ddof=0)

# Incorrect for TradingView:
std = np.std(window, ddof=1)  # pandas default
```

### 2.3 Upper and Lower Band

```
Upper[i] = Middle[i] + K × StdDev[i]
Lower[i] = Middle[i] − K × StdDev[i]
```

**Standard K:** 2.0 (covers ~95% of normal distribution)
**Variants:** K=1.5 (tighter), K=2.5 (wider), K=3.0 (extreme)

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## 2.4 %B and Bandwidth

```
%B[i]        = (Close[i] − Lower[i]) / (Upper[i] − Lower[i])
Bandwidth[i] = (Upper[i] − Lower[i]) / Middle[i] × 100
```

- **%B = 1.0**: Close = Upper Band
- **%B = 0.5**: Close = Middle Band (SMA)
- **%B = 0.0**: Close = Lower Band
- **%B > 1.0**: Close above Upper (bullish breakout)
- **%B < 0.0**: Close below Lower (bearish breakout)

**Bandwidth:** Relative width compared to SMA. Squeeze = BW at local minimum → imminent volatility explosion.

## 2.5 Complete Numeric Example — period=20, K=2

**Verification bar 20 (first value):**

```
Close[1..20] = [100.00, 100.74, 99.33, 98.79, 98.07, 99.15,
                100.02, 101.64, 100.44, 100.42, 99.02, 98.29,
                98.56, 97.15, 96.35, 97.12, 97.53, 96.80,
                97.36, 98.69]

SMA(20) = 98.7735

Variance = Σ(Close[j] - 98.7735)² / 20 = 2.0303
StdDev   = √2.0303 = 1.4249   (ddof=0)

Upper = 98.7735 + 2 × 1.4249 = 101.6233
Lower = 98.7735 − 2 × 1.4249 = 95.9237  ✓

%B    = (98.69 − 95.9237) / (101.6233 − 95.9237) = 0.4853
BW%   = (101.6233 − 95.9237) / 98.7735 × 100 = 5.77%
```

**Table bars 20–50:**

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| Bar | Close | SMA | Upper | Lower | %B | BW% |
|---|---|---|---|---|---|---|
| 20 | 98.69 | 98.774 | 101.623 | 95.924 | 0.485 | 5.77% |
| 25 | 98.20 | 98.556 | 101.274 | 95.837 | 0.435 | 5.52% |
| 30 | 98.86 | 98.201 | 100.224 | 96.178 | 0.663 | 4.12% |
| 35 | 104.13 | 99.155 | 102.891 | 95.419 | **1.166** | 7.54% |
| 40 | 107.96 | 101.206 | 107.446 | 94.965 | **1.041** | 12.33% |
| 45 | 106.92 | 103.596 | 111.090 | 96.101 | 0.722 | 14.47% |
| 50 | 104.05 | 104.964 | 110.184 | 99.744 | 0.413 | 9.95% |

## 3. Range and Visual Interpretation

The bands are not horizontal — they dynamically adapt to volatility:
- **Wide bands** = high volatility, active trend or post-spike
- **Narrow bands (Squeeze)** = low volatility, accumulation → precedes explosion
- **Price near Upper** = relatively bullish; **near Lower** = relatively bearish
- **Price above Upper** = bullish breakout or extreme OB
- **Price below Lower** = bearish breakout or extreme OS

## 4. Lag and Warm-up

```
First BB value: bar period = bar 20
Warm-up: 20 bars
Lag: (period-1)/2 = 9.5 bars (SMA lag)
StdDev: calculated on the same window as SMA → identical lag
```

## 5. Derived Indicators — %B and Bandwidth

**%B** is the most useful derivative — normalizes the Close position relative to the bands:

```
%B > 0.8:  Close in the upper quartile → bullish
%B < 0.2:  Close in the lower quartile → bearish
%B > 1.0:  Close above Upper → breakout or extreme OB
%B < 0.0:  Close below Lower → breakdown or extreme OS
```

**Bandwidth Squeeze:**

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```
Squeeze = BW at minimum from the last N bars (e.g., 125 bars)
→ Compressed volatility → imminent explosion
→ Explosion direction: confirmed by the first close outside the band
```

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# 6. Trading Signals

## 6.1 Squeeze and Expansion

```
Squeeze detected: BW[i] < min(BW[i-125..i-1])
→ Wait for direction: Close > Upper → Long; Close < Lower → Short
→ Confirmed with increased volume or MACD cross
```

## 6.2 Walk the Band

```
Strong bullish trend: Close hits Upper bar after bar → "walking the upper band"
→ NOT a Short signal — it is trend confirmation
→ Short only on close below Middle (SMA)

Bearish trend: Close hits Lower bar after bar → "walking the lower band"
→ NOT a Long signal
```

## 6.3 M-Top and W-Bottom (John Bollinger)

**M-Top Bearish:**

```
1. Close hits or exceeds Upper (first touch — tag)
2. Pullback to Middle
3. Second touch of Upper — but %B lower than first (divergence)
4. RSI or MACD confirms weakening
→ Entry Short on break below Middle
```

**W-Bottom Bullish:**

```
1. Close at or below Lower (first bottom)
2. Bounce to Middle
3. Second bottom — %B higher than first (bullish divergence)
4. Close > Middle → confirmation
→ Entry Long
```

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### 6.4 %B Extremes

```
%B > 1.0 (Close above Upper):
  → Strong trend: riding with trailing SL
  → Range: possible Short with confirmation (RSI > 70, bearish divergence)

%B < 0.0 (Close below Lower):
  → Bearish trend: riding short
  → Range: possible Long with confirmation (RSI < 30, bullish divergence)
```

### 6.5 Combined Filters

```
entry_long = (
    close < lower_bb and          # touch lower band
    rsi < 35 and                  # oversold confirmed
    ema_stack_bullish_4h and      # macro bullish trend
    adx > 20                      # strength
)

squeeze_breakout_long = (
    bandwidth_squeeze and          # BW at minimum 125 bars
    close > upper_bb and          # bullish breakout
    volume > volume_avg * 1.5     # volume confirmed
)
```

## 7. BB vs Keltner Channel — Comparison

| Aspect | BB | Keltner Channel |
|---|---|---|
| **Middle** | SMA | EMA |
| **Band width** | StdDev (statistical volatility) | ATR (range volatility) |
| **Reaction to spike** | Immediate (StdDev spikes) | Gradual (ATR Wilder smooths) |
| **Squeeze detection** | Yes (BW) | Yes (KC narrower than BB = squeeze) |
| **Standard** | period=20, K=2 | period=20, mult=2, ATR=14 |

**Combined BB+KC Squeeze:**

```
BB < KC (Lower BB > Lower KC AND Upper BB < Upper KC):
→ Extreme squeeze → imminent explosion (Larry Connors / John Carter method)
```

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## 8. BB in Sideways and Trending Markets

**Sideways:** BB works excellently. Price bounces between Upper and Lower. Entry at Lower with target Middle or Upper; Short at Upper with target Middle or Lower.

**Bullish trend:** Price walks the upper band. Lower band consistently rises. Middle band = dynamic support. Do not short at Upper touch.

**Bearish trend:** Walk the lower band. Upper band = resistance. Do not long at Lower touch.

## 9. MTF

| Level | Timeframe | BB Usage |
|---|---|---|
| Macro | 4H | Squeeze identification, trend direction (price relative to Middle) |
| Meso | 1H | %B position for timing |
| Entry | 5M | Touch Lower/Upper + confirmation for entry |

## 10. PSEDYS — BB as Volatility Filter

```
# Squeeze filter
bb_squeeze = bandwidth < bandwidth_min_125

# Relative position
position_upper = pct_b > 0.8   # near Upper
position_lower = pct_b < 0.2   # near Lower
position_mid   = 0.4 < pct_b < 0.6  # at Middle

# Entry on pullback (bullish trend)
entry_pullback_long = (
    ema_stack_bullish and
    pct_b < 0.3 and           # pullback to Lower
    adx > 20
)
```

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## 11. Bot vs TradingView Validation

```
□ StdDev: ddof=0 (population), NOT ddof=1 (sample) → cause #1
□ Middle = SMA(Close, period), NOT EMA
□ Upper = SMA + K × StdDev; Lower = SMA − K × StdDev
□ Inclusive window: Close[i-period+1:i+1]
□ %B = (Close − Lower) / (Upper − Lower)
□ Tolerance: < 0.001 for bands
```

**Python Script:**

```
def bollinger_bands(closes, period=20, k=2.0):
    n = len(closes)
    mid = [None]*n; upper = [None]*n; lower = [None]*n
    pct_b = [None]*n; bw = [None]*n
    for i in range(period-1, n):
        w = closes[i-period+1:i+1]
        m = sum(w)/period
        sd = (sum((x-m)**2 for x in w)/period)**0.5  # ddof=0
        mid[i]=m; upper[i]=m+k*sd; lower[i]=m-k*sd
        if upper[i]-lower[i] != 0:
            pct_b[i] = (closes[i]-lower[i])/(upper[i]-lower[i])
        bw[i] = (upper[i]-lower[i])/m*100
    return mid, upper, lower, pct_b, bw
```

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Indicator manual: BB — Bollinger Bands
Part 2 of 2.

## 12. Practical Exercises

### Exercise 1: %B > 1.0 in a bullish trend — Short or riding?

**Situation:** On 4H, %B = 1.12 (Close above Upper). EMA stack bullish. ADX = 35. Long position open.

**Answer: Riding with tight trailing SL.** %B > 1.0 in an active trend = walk the upper band = strong trend confirmation. Do not Short. Tighten trailing SL to 1.5×ATR below Close. Exit at %B < 0.5 (Close below Middle) or ADX falling below 20.

### Exercise 2: Squeeze on 4H after 15 days sideways

**Situation:** BW at minimum from 125 bars. Price sideways. EMA stack neutral. ADX = 12.

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**Answer: Wait for confirmed breakout.** Squeeze = compressed volatility → imminent explosion, but unknown direction. Entry only at: Close > Upper (Long) or Close < Lower (Short), confirmed with volume ×1.5 above average and full bar close above/below band.

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## 13. Cheat Sheet — Quick Summary

| Concept | Value / Rule |
|---|---|
| **Middle** | `SMA(Close, 20)` |
| **StdDev** | `√(Σ(C-SMA)²/N)` — ddof=0 (population) |
| **Upper** | `SMA + 2 × StdDev` |
| **Lower** | `SMA − 2 × StdDev` |
| **Standard K** | 2.0 |
| **Standard Period** | 20 |
| **%B** | `(Close − Lower) / (Upper − Lower)` |
| **%B = 1** | Close = Upper; **%B = 0** = Close = Lower |
| **Bandwidth** | `(Upper − Lower) / Middle × 100` |
| **Squeeze** | BW at local minimum → imminent explosion |
| **Walk the band** | Close hits Upper/Lower consecutively → trend confirmed |
| **M-Top** | 2 touches at Upper, 2nd weaker → bearish reversal |
| **W-Bottom** | 2 bottoms at Lower, 2nd higher → bullish reversal |
| **Warm-up** | 20 bars |
| **Lag** | 9.5 bars (SMA) |
| **Cause #1 divergence** | ddof=1 instead of ddof=0 |
| **Cause #2 divergence** | EMA instead of SMA as Middle |
| **BB vs KC squeeze** | BB < KC = extreme squeeze |

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