PSEDYS | TECHNICAL REFERENCE MANUAL V3.0

ROC — Rate of Change

Technical Reference Manual v1.0

PSEDYS | Complete Edition
Percentage Formula · Zero-line Cross · ROC vs MOM · Divergences · Scaling · MTF · Bot vs TradingView

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1. What is ROC? Concept and Origin

ROC (Rate of Change) is one of the simplest momentum indicators — it compares the **current price with the price from N bars ago**, expressing the percentage difference. It was popularized in classical technical analysis and remains the mathematical basis of many more complex oscillators.

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Philosophy: If today's price is higher than the price 14 days ago, momentum is positive. The percentage amplitude indicates the strength of this momentum.

Position in the indicator family:
- ROC is the **normalized (percentage) version** of the Momentum Indicator (MOM)
- MOM = absolute difference; ROC = percentage difference
- RSI normalizes cumulative gains/losses → different from ROC which compares only 2 points

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2. Calculation Formula — Complete

2.1 Standard Formula (Percentage)

```
ROC[i] = (Close[i] − Close[i − period]) / Close[i − period] × 100
```

Equivalent (TradingView):

```
ROC[i] = (Close[i] / Close[i − period] − 1) × 100
```

The two forms are **mathematically identical** — no numerical difference.

Standard period: 14 (or 9, 12, 20)

2.2 Formula Variants

Variant	Formula	Result	Platform
Percentage ROC	`(C[i]-C[i-N])/C[i-N]×100`	`%` relative to base N	TradingView, standard
Factor ROC	`C[i]/C[i-N]×100`	100 = neutral, >100 bullish	Some platforms
Absolute MOM	`C[i]-C[i-N]`	Absolute difference	Pine ROC default
ROC_1	`(C[i]-C[i-1])/C[i-1]×100`	Period=1 = previous bar	Micro-speed

Note: Some Python libraries (e.g., `ta-lib`) calculate ROC as `(C/C[i-N]-1)×100` — identical to TradingView. Others calculate `C/C[i-N]×100` (the factor, not the percentage) — zero-line becomes 100, not 0. Check the scale before comparing with TradingView.

2.3 Complete Numerical Example — period=14, 50 bars

Dataset (synthesized):

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Bar	Close
1	100.00
2	100.74
3	99.33
4	98.79
5	98.07
6	99.15
7	100.02
8	101.64
9	100.44
10	100.42
11	99.02
12	98.29
13	98.56
14	97.15
15	96.35
…	…
40	107.96
…	…
50	104.05

Verification bar 15 (first ROC value):

```
Close[15] = 96.35
Close[1]  = 100.00  (bar from 14 bars ago)

ROC = (96.35 − 100.00) / 100.00 × 100
    = −3.65 / 100.00 × 100
    = −3.6500  ✓  (bearish — price decreased by 3.65% compared to bar 1)
```

Selection table bars 15–50:

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Bar	Close	Close[i−14]	ROC%	Zone
15	96.35	100.00	**−3.65**	BEAR
19	97.36	98.07	−0.72	BEAR
23	99.47	100.44	−0.97	BEAR
27	99.73	98.56	**+1.19**	BULL
31	99.47	97.53	+1.99	BULL
35	104.13	97.21	**+7.12**	BULL+
39	106.44	98.20	+8.39	BULL+
43	108.11	97.39	**+11.01**	BULL+
47	105.01	101.84	+3.11	BULL
50	104.05	103.95	+0.10	BULL

Zero-line cross on this dataset:
- **Bar 26:** ROC crosses from −0.83 to +1.79 → bullish cross
- **Bar 49:** ROC crosses from +1.60 to −0.77 → bearish cross
- **Bar 50:** ROC re-enters positive → rapid bullish cross

2.4 Alternative Parameters

Variant	Period	Warm-up	Characteristic
Fast	9	9	Reactive, noisy
Standard	**14**	**14**	**PSEDYS default**
Medium	20	20	Smoother filter
Slow	25–50	25–50	Macro momentum, medium cycle

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3. ROC Range — Unlimited

ROC **has no theoretical upper limits** — it can exceed +100% in extreme crises/pumps. The theoretical lower limit is −100% (price becomes 0), but in practice:

```
Typical daily crypto ROC: −15% to +15%
Typical crypto ROC 14 bars (active trending): −30% to +50%
ROC in extreme pump/crash: ±50% to ±200%
```

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Implication: There is no absolute OB/OS for ROC — levels are set contextually on the analyzed instrument (backtesting over 1–2 years).

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4. Lag and Warm-up

```
First value: bar period+1 = bar 15 (for period=14)
Warm-up: period bars
Semantic lag: N/2 bars (compare current Close with Close from N bars ago →
              "center" of information is at bar i−N/2 = 7 bars back)
```

ROC has no smoothing — it is faster than MA-based oscillators (RSI with RMA, Stoch with SMA), but noisier.

Lag comparison:

```
ROC(14):      implicit lag ~7 bars (N/2)
RSI(14):      lag ~14+ bars (Wilder RMA seed + recursive)
MACD(12,26):  lag ~26 bars (dominant slow EMA)
```

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5. ROC Levels — Interpretation

Levels are **relative to the instrument and timeframe** — there is no absolute standard like RSI 70/30.

Guideline for crypto (TF: 4H):

ROC	Interpretation	Observation
> +10%	Extreme bullish momentum	Possible tight trailing
+3% to +10%	Active bullish momentum	Long Bias
0	**Zero-line**	Price equal to N bars ago
−3% to 0	Weak bearish momentum	Consolidation / pullback
< −10%	Extreme bearish momentum	Possible bounce

Calibration on instrument: Run ROC over 200 bars and identify historical extremes → set OB/OS thresholds at the 85/15 percentile.

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6. Trading Signals

6.1 Zero-line Cross

```
ROC cross 0 bullish (from negative to positive):
  Close[i] has surpassed the value of Close[i−N] → momentum becomes positive again

ROC cross 0 bearish (from positive to negative):
  Close[i] has fallen below the value of Close[i−N] → momentum becomes negative again
```

Zero-cross ROC ≈ zero-cross MOM ≈ price returns to the level from N bars ago.

Filter: Zero-cross alone = **slow and noisy signal**. Combined with EMA stack or ADX, it becomes more reliable.

6.2 OB/OS Relative

```
ROC > threshold_ub (e.g., +8% on 4H): extreme bullish momentum
  → Do not automatically enter Short. In trend: tight trailing. In range: possible Short with SL

ROC < threshold_lb (e.g., −8% on 4H): extreme bearish momentum
  → Possible bounce. In bearish trend: do not exit Short.
```

Thresholds = customized per instrument via backtesting.

6.3 Divergences

Identical to RSI/MACD:

```
Bearish divergence: Price High[2] > High[1] + ROC High[2] < ROC High[1]
  → Momentum does not confirm the new high → possible reversal

Bullish divergence: Price Low[2] < Low[1] + ROC Low[2] > ROC Low[1]
  → Bears are not pushing as hard → possible bounce
```

ROC for divergences: Similar to MACD Histogram, but more direct (no smoothing). ROC divergences are visible earlier but also more false.

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6.4 Combined Filters

```
entry_long = (
    ema_stack_bullish and      # macro direction
    adx > 20 and               # active trend
    roc > 0 and                # positive momentum
    roc_slope > 0              # ROC increasing (bullish acceleration)
)

entry_long_pullback = (
    ema_stack_bullish and
    roc < 0 and                # temporary pullback
    roc > -3 and               # minor retracement (not a crash)
    roc_slope > 0              # momentum returning
)
```

7. ROC vs MOM vs RSI — Comparison

Aspect	ROC	MOM	RSI
Formula	`(C-C[N])/C[N]×100`	`C-C[N]`	Avg Gain/Avg Loss
Normalization	Percentage	Absolute	Relative (0-100)
Range	Unlimited %	Unlimited value	0–100
Zero-line	0%	0	50
Smoothing	None	None	Wilder RMA
Sensitive to spikes	Yes (compares 2 closes)	Yes	Partially (RMA dampens)
Divergences	Yes	Yes	Yes (more reliable with smoothing)
Lag	N/2 bars (implicit)	N/2 bars (implicit)	N+ bars (Wilder seed)

ROC ↔ MOM Relationship:

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```
ROC = MOM / Close[i-N] × 100    (normalized to base)
MOM = ROC × Close[i-N] / 100   (denormalized)

Example: Close[i]=108, Close[i-14]=100
  MOM = 108 - 100 = 8
  ROC = 8 / 100 × 100 = 8%
  (numerically identical when base = 100; differs when base ≠ 100)
```

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8. ROC in Sideways and Trending Markets

Sideways: ROC oscillates around the zero-line with small amplitude (±2–5%). Frequent crossings = noise. Useful filtering with ADX < 20.

Bullish trend: ROC remains positive, with spikes during impulses. Decline towards 0 = normal retracement (entry opportunity). Decline below 0 = possible trend end or deep consolidation.

Bearish trend: ROC remains negative. Rise towards 0 = technical bounce. Rise above 0 = possible reversal or bearish retracement ended.

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9. MTF

Level	Timeframe	Long Condition
Macro	4H	ROC > 0 (positive momentum over 14 bars 4H)
Meso	1H	ROC > −2 and increasing
Entry	5M	ROC cross 0 bullish or ROC > 0 with EMA stack

Combined MTF:

```
4H: ROC(14) > +3%          → active bullish macro trend
1H: ROC(14) > 0 increasing  → positive meso momentum
5M: ROC cross 0 bullish     → timing entry
→ Long with triple confirmation
```

Indicator manual: ROC — Rate of Change
Part 2 of 2.

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10. PSEDYS — ROC as Speed Filter

In PSEDYS, ROC complements the EMA stack and ADX:
- **EMA stack** = direction
- **ADX** = strength
- **ROC** = acceleration / momentum speed

```
# PSEDYS Filter
velocity_ok = roc_14 > 0 and roc_14 > roc_14_prev  # positive acceleration
momentum_ok = roc_14 > threshold_bull               # above calibrated threshold
```

ROC(14) on 5M vs ROC(14) on 4H provides dual-timeframe perspective without computational overhead (simple formula).

Limitation: ROC is sensitive to isolated spikes — a bar with a large gap creates a large ROC peak that abruptly disappears N bars later (ghost effect similar to SMA, but more pronounced).

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11. Bot Validation vs TradingView

Sources of divergence:

```
□ TradingView Formula: ROC = (Close[i] / Close[i-period] - 1) × 100
  Some libraries: ROC = Close[i] / Close[i-period] × 100 (factor, not %)
  → Divergence: values with +100 compared to TradingView

□ Period off-by-one: window [i-period+1:i+1] vs [i-period:i]
  → 1 bar difference in lookback = values differ

□ Index: Close[i-period] is the bar NOW period bars ago (including current bar)
  → for period=14, Close[14 bars ago], NOT Close[14 bars excluding current bar]
```

Checklist:

```
□ ROC = (Close[i] / Close[i-period] - 1) × 100
□ Window: Close[i-period] is exactly period bars ago (no off-by-one)
□ First value: bar period+1 (index period, 0-indexed)
□ Tolerance: < 0.01 ROC points (formula is simple, no smoothing errors)
```

Python Script:

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```
def roc(closes, period=14):
    n = len(closes)
    roc_v = [None] * n
    for i in range(period, n):
        base = closes[i - period]
        roc_v[i] = (closes[i] / base - 1) * 100 if base != 0 else 0.0
    return roc_v
```

---

12. Practical Exercises

Exercise 1: ROC cross zero or zero-line oscillation?

Situation: On 1H, ROC(14) = −0.3%, oscillates between −1% and +1% for 6 bars. ADX = 14. EMA 200 4H above price.

Answer: Skip — market choppiness with bearish bias. ROC micro-oscillating around zero-line with ADX < 20 = range without trend. Macro context bearish (EMA 200 4H above price). Wait for either ADX > 20 with clear positive or negative ROC for direction, or breakout from range.

Exercise 2: Extremely bullish ROC — exit Long or riding?

Situation: On 4H, ROC(14) = +18%. EMA stack bullish. ADX = 42. Long position already open at +6%.

Answer: Do not exit — riding trend with tight trailing SL. ROC = +18% = active pump confirmed by ADX 42 (very strong trend). Tighten trailing SL to 1.5–2× ATR below current High. Do not exit active trend based on isolated extreme ROC. Exit when ADX drops below 25 or ROC falls below +5%.

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13. Cheat Sheet — Quick Summary

Concept	Value / Rule
Formula	`(Close[i] / Close[i−period] − 1) × 100`
Identical Alternative	`(Close[i] − Close[i−period]) / Close[i−period] × 100`
Standard Period	14
Range	Unlimited (−100% theoretical min, +∞ max)
Zero-line	0 — price equal to N bars back
Zero cross bullish	ROC from negative to positive → momentum turns positive
Zero cross bearish	ROC from positive to negative → momentum turns negative
OB/OS	Calibratable per instrument (no absolute standard)
Warm-up	period bars
Lag	N/2 bars implicit (compare 2 close)
Smoothing	None (raw)
ROC vs MOM	ROC = MOM normalized percentage-wise relative to base
ROC vs RSI	ROC = 2 points; RSI = average gains/losses (smoothed)
Ghost effect	Spike from N bars back disappears abruptly → ROC jump
Bearish divergence	Price HH + ROC LH
Bullish divergence	Price LL + ROC HL
Cause #1 divergence	Formula factor (×100 = 100 base) vs percentage (×100−100)
Cause #2 divergence	Off-by-one at index Close[i-period]
PSEDYS	Speed filter: ROC>0 + EMA stack + ADX>20 → Long

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