F L O F   M A T R I X

Fractal Liquidity & Order Flow Trading System

PORTFOLIO MANAGER
MODULE M16

Cross-Asset Risk Orchestration | Correlation Guard | Backtest Fill Simulation

5 Risk Gates • 7 Functions • Pessimistic Fill Engine • Hot-Path Performance Rules

Version:	**3.4 (Portfolio Manager)**
Classification:	**CONFIDENTIAL**

1. Why the Portfolio Manager Is Critical

Every risk control in the FLOF Matrix currently operates at the individual trade level or the individual profile level. The ConfluenceScorer limits risk per trade (1–2% based on grade). The RiskOverlord enforces daily drawdown limits. But nothing prevents the scenario where multiple profiles fire simultaneously and collectively exceed safe exposure.

1.1 The Simultaneous Signal Scenario

TIME	PROFILE	GRADE	RISK %	SIGNAL
9:31	**ES Futures**	**A+**	2.0%	Extreme OB + Unicorn setup on ES at 5450. Full conviction.
9:31	**SPY Options**	**A+**	2.0%	Same structural move on SPY triggers a Call purchase via OptionsRouter.
9:32	**AAPL Equities**	**A**	1.5%	Gap-FVG + Rejection Block on AAPL. Sector-correlated with the broader move.
9:32	**QQQ Options**	**A**	1.5%	QQQ mirrors SPY. OptionsRouter selects a Call.

Total combined risk: 7.0% of equity **— all from a single correlated market event.**

Each trade individually passed its profile's risk check. But all four are bets on the same thing: the US equity market going up. If the market reverses, all four lose simultaneously. A 7% drawdown from a single correlated event is unacceptable for a system designed to survive.

THE RULE

No combination of simultaneous trades, across any number of profiles, should ever expose more than a configurable maximum percentage of total account equity. The Portfolio Manager enforces this at the portfolio level, above and independent of individual trade sizing.

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2. Module Architecture

2.1 Position in the Execution Chain

The Portfolio Manager sits between the ConfluenceScorer and the ExecutionManager. Every trade signal that passes the 3 pre-scoring gates and the 17-point rubric must ALSO pass the Portfolio Manager's 5 risk gates before it reaches execution.

STEP	EXECUTION CHAIN (REVISED)
1	G1 (Premium/Discount) → G2 (Inducement) → G3 (Chop Detector)
2	Tier 1 (10 pts) → ≥ 7 Gate Check → Tier 2 (4 pts) → Tier 3 (3 pts) → Grade Assignment
3	PORTFOLIO MANAGER (M16) — 5 Risk Gates (NEW). If ANY gate fails, the signal is BLOCKED and logged as "Portfolio-rejected."
4	ExecutionManager → Position Sizing → Order Submission → OCO Bracket

2.2 Independence from RiskOverlord

The Portfolio Manager and RiskOverlord are separate modules with different responsibilities. The Portfolio Manager is a PRE-EXECUTION gate: it decides whether a new trade should be allowed. The RiskOverlord is a POST-EXECUTION safety net: it monitors live positions and forces emergency exits. They never conflict because they operate at different stages. The Portfolio Manager prevents overexposure. The RiskOverlord catches everything else (infrastructure failure, runaway losses, stale data).

3. The Five Portfolio Risk Gates

Every trade signal must pass all five gates. If any gate fails, the trade is rejected. Gates are evaluated in order — the fastest (cheapest) checks run first to avoid unnecessary computation.

3.1 Gate P1: Global Gross Exposure Limit

ELEMENT	SPECIFICATION
What It Checks	The total risk-dollar amount currently deployed across ALL open positions across ALL profiles. If adding the proposed new trade would push total exposure above the global cap, the trade is rejected.
Calculation	current_exposure = sum of (position_size × distance_to_stop) for every open position across all profiles. proposed_risk = proposed_position_size × distance_to_proposed_stop. IF (current_exposure + proposed_risk) / total_equity > global_max_exposure → REJECT.
Default Threshold	global_max_exposure = 6% of total equity. This means the worst-case scenario (every open position hits its stop simultaneously) costs 6% of the account. Configurable via TOML.
Why 6%	At 6% max exposure, even three consecutive max-loss events (all positions stopped on the same day) produces an 18% drawdown — painful but survivable. Professional quant funds typically run 5–10% gross exposure limits for directional strategies. 6% is conservative within that range.

3.2 Gate P2: Correlation Guard

ELEMENT	SPECIFICATION
What It Checks	Whether the proposed trade is highly correlated with any existing open position. If two positions would win or lose together, they are effectively the same bet — doubling exposure to a single event.
Correlation Groups	Group A (US Large Cap): ES, SPY, QQQ, SPX, AAPL, MSFT, NVDA, GOOGL, AMZN, META. Group B (US Small Cap): RTY (Russell 2000), IWM. Group C (Crypto Major): BTC, ETH. Group D (Crypto Alt): SOL, AVAX, DOGE, and other altcoins. Group E (Forex Safe Haven): USD/JPY, USD/CHF, EUR/USD (inverse correlation to USD). Group F (Forex Carry): AUD/JPY, NZD/JPY, USD/MXN, USD/TRY. Group G (Energy): CL (Crude Oil), NG (Natural Gas). Custom groups configurable via TOML.
Rule	Maximum 2 concurrent positions from the same correlation group. If the bot already holds ES Futures long AND SPY Options Call, a third signal from Group A (e.g., AAPL long) is REJECTED. The highest-grade position takes priority.
Priority Logic	When the group limit is reached and a higher-grade signal arrives: the new signal is logged but rejected (do NOT close an existing position to make room). The existing positions were entered first and may already be in profit. Preempting them introduces execution risk.

3.3 Gate P3: Daily Loss Circuit Breaker (Global)

ELEMENT	SPECIFICATION
What It Checks	The total realized + unrealized P&L across ALL profiles for the current trading day. If the combined daily loss exceeds the global daily loss limit, ALL profiles are shut down for the remainder of the day. No new entries. Existing positions are managed to their stops/exits but no new risk is taken.
Default Threshold	global_daily_loss_limit = 3% of equity. This is the portfolio-wide version of T27 (Daily Drawdown Breaker), which operates per-profile. P3 is the aggregated cross-profile limit.
Interaction with T27	T27 monitors per-profile drawdown. P3 monitors total portfolio drawdown. Either can trigger independently. If the ES profile loses 2.5% and the Crypto profile loses 0.6%, neither has individually hit T27's 3% limit, but P3's combined 3.1% exceeds the global limit and shuts everything down.
Reset	Resets at the start of each trading day (midnight UTC for Crypto, market open for Equities/Futures). Carry trade positions are excluded from the daily P&L calculation because they operate on weekly/monthly timeframes.

3.4 Gate P4: Consecutive Loss Counter (Global)

ELEMENT	SPECIFICATION
What It Checks	The number of consecutive losing trades across ALL profiles. After N consecutive losses (regardless of which profile generated them), the bot enters a mandatory cooldown period.
Default Threshold	max_consecutive_losses = 3. After 3 consecutive losses (any combination of profiles), the bot pauses all new entries for cooldown_minutes (default: 30 minutes).
Rationale	Three consecutive losses suggests one of two things: (1) the market regime has shifted in a way the bot hasn't adapted to yet, or (2) a structural condition (data feed issue, unusual volatility) is producing false signals. Either way, pausing prevents compounding losses during unfavorable conditions. After the cooldown, the Predator State Machine re-evaluates all structural conditions before resuming.
Reset	The counter resets to 0 after any winning trade. A breakeven exit (stopped at breakeven after Phase 1 partial) counts as neither a win nor a loss and does not affect the counter.

3.5 Gate P5: Profile Allocation Limits

ELEMENT	SPECIFICATION
What It Checks	The maximum percentage of global exposure that any single asset class profile can consume. Prevents one profile from dominating the portfolio's risk.
Default Allocations	Futures: max 40% of global_max_exposure (2.4% of equity at default 6% cap). Equities: max 30% of global_max_exposure (1.8% of equity). Options (buying): max 20% of global_max_exposure (1.2% of equity). Options (selling / condors): max 15% of global_max_exposure (0.9% of equity). Crypto: max 25% of global_max_exposure (1.5% of equity). Forex (intraday): max 20% of global_max_exposure (1.2% of equity). Forex (carry): max 15% of global_max_exposure (0.9% of equity). NOTE: Allocations can sum to > 100% because not all profiles trade simultaneously.

Why Not Equal	Futures (ES) has the most reliable data, most liquid execution, and is the proven baseline — it gets the largest allocation. Options selling has defined risk but high gamma exposure — it gets a smaller allocation. Crypto is volatile and has execution risk (exchange downtime, spoofing) — capped below Futures. These defaults are configurable per user risk appetite.

4. Gate Evaluation Sequence

Gates are evaluated in order from cheapest to most expensive computation. If any gate fails, remaining gates are skipped.

#	GATE	COMPUTE COST	CHECK
P3	Daily Loss Circuit Breaker	Instant	Single comparison: today_pnl vs. threshold. If already tripped, reject immediately without evaluating anything else.
P4	Consecutive Loss Counter	Instant	Single comparison: loss_streak vs. threshold. If in cooldown period, reject.
P5	Profile Allocation Limit	Low	Sum the requesting profile's current exposure. Compare to the profile's allocation cap.
P1	Global Gross Exposure	Low	Sum ALL open position risk. Add proposed risk. Compare to global cap.
P2	Correlation Guard	Medium	Look up the instrument's correlation group. Count active positions in that group. Compare to group limit.

GATE RESULTS ARE LOGGED

Every gate evaluation is logged in the Trade Logger (E02) regardless of pass/fail. The Epistemic Engine uses these logs to analyze: how often is P1 (global exposure) the binding constraint? Are trades being rejected from Group A too frequently? This data informs whether the allocation limits should be adjusted.

5. The Position Ledger

The Portfolio Manager maintains a real-time Position Ledger that tracks every open position across all profiles. This is the single source of truth for all gate calculations.

5.1 Ledger Schema

```
{
  "position_id": "POS-2024-12-15-001",
  "profile": "futures",
  "instrument": "ES",
  "correlation_group": "A",
  "direction": "long",
  "grade": "A+",
  "entry_price": 5450.00,
  "stop_price": 5443.50,
  "current_price": 5452.25,
  "position_size": 2,                  // contracts
  "risk_dollars": 325.00,              // size × distance to stop × tick_value
  "risk_pct": 0.0163,                  // risk_dollars / total_equity
  "unrealized_pnl": 112.50,
  "phase": "phase2_runner",            // phase1_initial | phase2_runner | phase3_climax
  "opened_at": "2024-12-15T09:31:04Z",
  "options_type": null,                // "call" | "put" | "spread" | "condor" | null
}
```

5.2 Ledger Updates

EVENT	LEDGER ACTION
New Trade Entry	Add new record to ledger. Recalculate aggregate risk metrics. All 5 gates were already passed before this entry occurred.
Phase 1 Partial Exit	Update position_size (reduced by scale-out %). Update risk_dollars and risk_pct (the remaining position has less risk because stop is now at breakeven). Update phase to phase2_runner.
Stop Tightened	Recalculate risk_dollars based on new stop distance. A tighter stop means less risk — this frees up capacity under the global exposure cap for new trades.
Trade Closed	Remove record from ledger. Update daily P&L. Update consecutive loss counter (if a loss). Log final result to Trade Logger (E02).
Price Tick Update	Update current_price and unrealized_pnl only. Do NOT recalculate risk_pct on every tick — risk is based on stop distance, not mark-to-market. This is a deliberate performance optimization.

6. Pessimistic Fill Engine (Backtesting)

This section addresses the queue position gap identified in the external review. If the backtest simulator assumes fills on touch, the Epistemic Engine will learn a false reality and produce configurations that look like holy grails but miss every fill in live trading.

6.1 The Three Fill Pessimism Levels

LEVEL	NAME	SPECIFICATION
1	Optimistic	Fill on touch. If price reaches the limit order price at any point during a bar, the order is filled at the limit price. Use ONLY for rough parameter screening where speed matters more than accuracy. Never use for final validation.
2	Standard	Fill through by 1 tick. The order is only filled if price trades at least 1 tick BEYOND the limit price during the bar. Fill price = limit price (not the through price). This simulates the reality that you are not first in the FIFO queue — some orders ahead of you must be filled first. DEFAULT for all Batch Runner experiments.
3	Conservative	Fill through by 2 ticks AND minimum dwell time of 500ms at the price level. The order is only filled if: (a) price trades 2+ ticks beyond the limit, AND (b) the tick data shows that price spent at least 500ms at or below the limit price. This simulates thin markets where even 1-tick-through fills aren't guaranteed. Use for FINAL VALIDATION of any configuration the Epistemic Engine promotes to the Knowledge Graph.

6.2 Integration with the Epistemic Engine

STEP	PROCESS
1	The Batch Runner (E01) runs initial screening backtests at Level 1 (Optimistic). This is fast and identifies promising parameter combinations. Results are flagged as "unvalidated."
2	Promising combinations (top 10% by profit factor) are re-run at Level 2 (Standard). Many will degrade significantly — this is expected and desired. Only configurations that remain profitable at Level 2 proceed.
3	Level 2 survivors are re-run at Level 3 (Conservative) with the out-of-sample data split. Only configurations profitable at Level 3 on out-of-sample data are stored in the Knowledge Graph as validated findings.
4	The LLM RAG Interface always reports which fill level a finding was validated at. Recommendations based on Level 3 out-of-sample results carry the highest confidence. Recommendations based on Level 1 only are flagged as speculative.

```
[constants.fill_engine]
default_fill_level      = 2      # Standard: fill through 1 tick
screening_fill_level    = 1      # Optimistic: fill on touch
validation_fill_level   = 3      # Conservative: 2 ticks + 500ms dwell
level2_through_ticks     = 1
level3_through_ticks     = 2
level3_dwell_ms          = 500
top_pct_for_rerun        = 0.10  # Rerun top 10% at next level
```

7. Hot-Path Performance Rules

The Portfolio Manager processes every trade signal in the execution chain. It must be fast. These rules ensure it never becomes a bottleneck.

RULE	SPECIFICATION
Pre-allocated Data Structures	The Position Ledger uses a fixed-size NumPy structured array, pre-allocated at startup for max_open_positions (default: 20). No dynamic list resizing during operation. Correlation groups are stored as a pre-built hash map (dict) for O(1) lookup.
No I/O in Hot Path	Gate evaluations never read from disk or network. All data (ledger, P&L counters, loss streak) is held in memory. Logging is async (appended to a queue processed by a background thread).
Aggregate Cache	Total exposure, per-group counts, and per-profile exposure are maintained as running totals that update incrementally when positions open/close. Never recalculated from scratch on each signal. This makes P1, P2, and P5 checks O(1) instead of O(n).
Target Latency	All 5 gates must evaluate in < 1ms total. This adds negligible latency to the execution chain. If any gate takes longer, it indicates a bug (likely an O(n) recalculation that should be O(1)).
Ring Buffer Memory	The 60-second Ring Buffer (for the OrderFlowEngine) must use a pre-allocated NumPy array with a circular index pointer. Never use Python list.append() in the tick-processing loop. Standard pattern: buffer[write_index % buffer_size] = new_tick.

8. Function Specifications

FUNCTION	INPUTS	OUTPUTS	DESCRIPTION	MODULE
evaluate_portfolio_gates()	signal: TradeSignal ledger: PositionLedger config: PortfolioConfig	approved: bool rejected_gate: str or None rejection_reason: str	Master function. Evaluates all 5 gates in sequence (P3 → P4 → P5 → P1 → P2). Returns on first failure. If all pass, returns approved=True.	PortfolioManager
check_global_exposure()	proposed_risk_pct: float current_total_risk: float cap: float	bool (passed)	P1 gate. Returns true if current + proposed ≤ cap. Uses cached running total for current exposure (O(1) lookup).	PortfolioManager
check_correlation_group()	instrument: str group_map: dict active_counts: dict max_per_group: int	bool (passed)	P2 gate. Looks up instrument's group, checks active count in that group against max. O(1) via hash map.	PortfolioManager
check_daily_loss()	today_pnl: float limit: float	bool (passed)	P3 gate. Single comparison. Resets at session start.	PortfolioManager
check_consecutive_losses()	loss_streak: int max_losses: int cooldown_end: datetime	bool (passed)	P4 gate. Checks streak count and whether cooldown has expired.	PortfolioManager
check_profile_allocation()	profile: str profile_exposure: float profile_cap: float	bool (passed)	P5 gate. Checks the requesting profile's current exposure against its allocation cap.	PortfolioManager
update_ledger()	event: TradeEvent (open|partial|close|stop_move)	void	Updates the Position Ledger and all cached aggregates (total exposure, group counts, profile exposure) incrementally.	PortfolioManager

			Called on every trade event, not on every tick.	

9. Configuration

```
[portfolio_manager]
enabled                 = true

# Gate P1: Global Gross Exposure
global_max_exposure_pct    = 0.06     # 6% of total equity

# Gate P2: Correlation Guard
max_positions_per_group    = 2

# Gate P3: Daily Loss Circuit Breaker
global_daily_loss_limit    = 0.03     # 3% of equity

# Gate P4: Consecutive Loss Counter
max_consecutive_losses     = 3
cooldown_minutes           = 30

# Gate P5: Profile Allocation Limits (as fraction of global_max_exposure)
[portfolio_manager.profile_allocations]
futures       = 0.40
equities      = 0.30
crypto        = 0.25
options_buy   = 0.20
options_sell  = 0.15
forex_intraday = 0.20
forex_carry   = 0.15

# Correlation Groups
[portfolio_manager.correlation_groups]
A_US_LARGE_CAP = ["ES", "SPY", "QQQ", "SPX", "AAPL", "MSFT", "NVDA", "GOOGL", "AMZN", "META"]
B_US_SMALL_CAP = ["RTY", "IWM"]
C_CRYPTO_MAJOR = ["BTC", "ETH"]
D_CRYPTO_ALT   = ["SOL", "AVAX", "DOGE"]
E_FX_SAFE      = ["USD/JPY", "USD/CHF", "EUR/USD"]
F_FX_CARRY     = ["AUD/JPY", "NZD/JPY", "USD/MXN", "USD/TRY"]
G_ENERGY       = ["CL", "NG"]

# Performance
max_open_positions         = 20
target_gate_latency_ms     = 1
```

10. Updated System Summary (v3.4)

COMPONENT	TOTAL
Feature Toggles	50 (T01–T50). Plus 2 deferred (T35, T37). Unchanged from v3.3.
Modules	17: 12 original + SessionProfiler + LiquidationFeed + OptionsRouter + CarryTradeModule + PortfolioManager (M16).
Pre-Scoring Gates	3 structural gates (G1–G3) + 5 portfolio gates (P1–P5) = 8 total gates before execution.
Execution Chain	G1 → G2 → G3 → Tier 1 → ≥ 7 Gate → Tier 2 → Tier 3 → Grade → Portfolio Manager (P3→P4→P5→P1→P2) → Size → Execute.
Backtesting Fill Levels	3 levels: Optimistic (screening), Standard (default), Conservative (final validation). Progressive filtering from L1 → L2 → L3.
Safety Layers	Pre-execution: Portfolio Manager (5 gates). Post-execution: RiskOverlord (Nuclear Flatten). Infrastructure: OCO Brackets, EOD Flatten (T49), GEX Gate, No-Naked-Sell Lock, VIX Risk-Off (carry), Human Approval Gate (Epistemic).

REVISED EXECUTION CHAIN (COMPLETE)

1. Structural Pre-Screening: G1 (Premium/Discount) → G2 (Inducement) → G3 (Chop Detector)
2. Confluence Scoring: Tier 1 (10 pts) → ≥ 7 Gate → Tier 2 (4 pts) → Tier 3 (3 pts) → Grade (A+/A/B/C)
3. Portfolio Risk Gates: P3 (Daily Loss) → P4 (Consecutive Loss) → P5 (Profile Allocation) → P1 (Global Exposure) → P2 (Correlation Guard)
4. Execution: Position Sizing → Order Type Selection (MWP/Aggressive Limit/Limit) → Order Submission → OCO Bracket Placement
5. Post-Execution Monitoring: RiskOverlord (continuous) → Phase Management (P1/P2/P3) → Trail/Exit

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FLOF Matrix — Portfolio Manager (M16) v3.4

Read in conjunction with all prior FLOF Matrix documents (v1.0 through v3.3).