

HCP Tracker Product Requirements Document

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Status: Binary Scenario Ordering Update

Current Code Version: v6.3 (ThemeCalculator v2.9+)

1. Executive Summary

1.1 Product Vision

The HCP Tracker is a browser-based portfolio optimization tool implementing the Humble Conviction Portfolio (HCP) Investment Policy Statement v3.10. It provides a guided 10-step workflow with ALL calculations performed client-side, using moving average comparisons for signal generation.

1.2 Key Changes in v3.4.1

- **Scenario Display Order:** 16-scenario matrix now shows scenarios in consistent binary order (0000 to 1111) instead of probability rank order
- **User Experience Improvement:** Consistent positioning enables easier reference and comparison across different market conditions
- **Maintained Functionality:** All probability calculations, color coding, and ranking information preserved






1.3 Previous Features (Retained from v3.4)

- ALL calculations in Tracker
 - MA Comparison Framework
 - Fixed Tier Weights: 35% canary, 40% primary, 25% structural
 - 13 unique indicators across 4 themes
 - Three-tier signal framework
 - IPS v3.10 compliance
 - PRD v3.4 display specifications
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2. Critical Display Specifications (UPDATED v3.4.1)

2.1 Scenario Probability Color Coding





The 16-scenario matrix uses a 5-tier color system based on probability ranges:

Probability Range	Color	CSS Class	Hex Code	Description
> 25%	Dark Green	scenario-very-high	 #155724	Extremely likely scenarios
10-25%	Light Green	scenario-high	 #28a745	Likely scenarios
5-10%	Yellow	scenario-medium	 #ffc107	Moderate probability
1-5%	Light Red	scenario-low	 #dc3545	Unlikely scenarios
< 1%	Dark Red/Gray	scenario-very-low	 #6c757d	Extremely unlikely

Implementation Note: Do NOT use confidence labels (HIGH/MEDIUM/LOW) with probabilities. The color coding itself indicates likelihood.

2.2 Theme Color Assignments

Fixed theme colors for consistency across all displays:

Theme	Color Name	CSS Class	Hex Code	RGB
USD	Red	theme-usd	 #dc3545	rgb(220, 53, 69)
AI/Innovation	Blue	theme-ai	 #007bff	rgb(0, 123, 255)
P/E	Yellow	theme-pe	 #ffc107	rgb(255, 193, 7)
International	Green	theme-intl	 #28a745	rgb(40, 167, 69)

2.3 Data Confidence Indicators

Separate from probability colors, data confidence shows quality of underlying data:

Confidence Level	When to Use	Display
HIGH	All indicators fresh, complete history	Green dot
MEDIUM	Some stale data or interpolation	Yellow dot
LOW	Significant missing data	Red dot

Critical: Data confidence is about data quality, NOT probability levels.

3. Data Key Mapping (CLARIFIED v3.4.1)

3.1 Required Indicator Keys

The FileHandler and data structures MUST use these exact keys:

USD Theme:

- `dxy` (DXY Index)
- `reserve_share` (USD Reserve Share)
- `yuan_swift` (Yuan SWIFT Share)
- `gold_purchases` (Central Bank Gold)

Innovation Theme:

- `qqq_spy` (QQQ/SPY Ratio)
- `productivity` (Productivity Growth)
- `net_margins` (S&P Net Margins)

P/E Theme:

- `forward_pe` (Forward P/E)
- `cape` (Shiller CAPE)
- `risk_premium` (Equity Risk Premium)

International Theme:

- `acwx_spy` (ACWX/SPY Relative)
 - `sp_vs_world` (S&P vs MSCI World)
 - `tic_flows` (TIC Net Flows)
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4. Three-Tier Signal Framework (from v3.2)

4.1 Fixed Tier Weights

- **Canary:** 35% (early warning)
- **Primary:** 40% (core signals)
- **Structural:** 25% (confirmation)

4.2 Indicator Classification

Tier	Indicators	Weight	Per-Indicator Weight
Canary	DXY, QQQ/SPY, Risk Premium, ACWX/SPY	35%	8.75% each
Primary	Forward P/E, Net Margins, Yuan SWIFT, CAPE	40%	10% each
Structural	Productivity, Reserve Share, Gold Purchases, TIC Flows	25%	6.25% each

5. Directional Logic

5.1 For triggered indicators:

Moving away from trigger = strengthening theme confidence

5.2 For non-triggered indicators:

Moving toward trigger = building theme confidence

5.3 Expected Results Validation

With corrected theme strength calculations:

Tech Boom Scenario Data:

- AI theme should show 70-80% (blue bar)
- USD theme should show 20-30% (red bar)
- All 13 indicators must be present
- No uniform 5% probabilities across themes

6. UI Display Requirements

6.1 Step 3 Theme Display

Each theme shows:

- Theme name with theme color bar
- Percentage probability (large, bold)
- **NO confidence labels on probabilities**
- Theme color fill proportional to probability

6.2 Scenario Matrix Display (UPDATED v3.4.1)

Grid of 16 scenarios with:

- Scenario rank (#1-16)
- Binary representation (e.g., "1101")
- Probability percentage
- Background color from 5-tier system
- Theme indicators (USD↓, AI↑, etc.)
- **NEW: Display Order:** Scenarios shown in binary order (0000 to 1111) for consistency, not probability rank order

Implementation Details:

- **Box 1:** Binary 0000 - "Base Case" (no themes triggered)
- **Box 2:** Binary 0001 - "INTL↑" (international only)
- **Box 3:** Binary 0010 - "P/E↓" (P/E reversion only)
- **Box 4:** Binary 0011 - "P/E↓ + INTL↑"
- ...continuing in binary progression...
- **Box 16:** Binary 1111 - "USD↓ + AI↑ + P/E↓ + INTL↑" (all themes)

Technical Implementation:

```
javascript
```

```
// Sort scenarios by ID (binary order) not by probability
```

```
const scenariosInBinaryOrder = [...analysis.scenarios].sort((a, b) => a.id - b.id);
```

User Experience Benefits:

- Consistent positioning across different market conditions
- Easy reference: "Box 5 is always AI theme only"
- Logical progression from simple to complex combinations
- Rank number and color coding still show relative probability

6.3 Missing Data Handling

If indicators are missing:

- Display error message listing missing indicators

- Prevent calculation until all data present
- Show which theme is affected

Example error:

Missing Innovation indicators:

- qqq_spy: QQQ/SPY Ratio
- net_margins: S&P Net Margins

Please ensure data file contains all 13 indicators.

7. Common Implementation Errors to Avoid

7.1 Data Key Mismatches

- ❌ Wrong: 'qqqSpy', 'netMargins' (camelCase)
- ✅ Right: 'qqq_spy', 'net_margins' (snake_case)

7.2 Confidence Label Confusion

- ❌ Wrong: Showing "HIGH" next to 5% probability
- ✅ Right: No labels on probabilities, only color coding

7.3 Missing Indicators

- ❌ Wrong: Generating only 1 of 3 AI indicators
- ✅ Right: All 13 indicators present in every data generation

7.4 Color Inconsistency


- ❌ Wrong: Using different colors for themes across displays
- ✅ Right: Consistent theme colors everywhere

7.5 Boundary Condition Errors

- ❌ Wrong: Uniform 30%/5% probabilities due to boundary condition interference
- ✅ Right: Variable probabilities based on momentum and trend analysis

7.6 Display Order Inconsistency (NEW v3.4.1)

- ❌ Wrong: Showing scenarios in probability rank order (changes positions)

-  Right: Binary order 0000-1111 for consistent positioning
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8. Testing Validation

8.1 Scenario Probability Colors

Test that probabilities display correct colors:

- 30% → Dark Green
- 15% → Light Green
- 7% → Yellow
- 3% → Light Red
- 0.5% → Dark Red/Gray

8.2 Theme Calculations (UPDATED v3.4)

With tech_boom scenario data and corrected theme strength calculations:

- AI theme should show 70-80% (blue bar)
- USD theme should show 20-30% (red bar)
- All indicators must be present
- **No uniform low probabilities** (was critical bug in previous versions)

8.3 Data Completeness

FileHandler must generate:

- Exactly 13 indicators
- All organized in nested theme structure
- Extended history (450+ points) for MA calculations
- No missing keys or null current values

8.4 Scenario Display Order (NEW v3.4.1)

Validate that scenarios appear in consistent binary order:

- Position 1: Always "Base Case" (0000)
- Position 5: Always "AI↑" only (0100)
- Position 16: Always "USD↓ + AI↑ + P/E↓ + INTL↑" (1111)
- Rank numbers and colors change based on probabilities

- Positions remain consistent across different market scenarios
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9. Version History

v3.4.1 (2025-08-31)

- **UPDATED:** Scenario matrix display order to binary progression (0000-1111)
- **IMPROVED:** User experience through consistent scenario positioning
- **MAINTAINED:** All probability calculations and color coding functionality

v3.4 (2025-08-31)

- Enhanced theme strength probability calculations
- Removed problematic boundary conditions
- Fixed trigger detection logic
- Boosted signal strength for realistic results

v3.3 (2025-08-29)

- Scenario probability color coding system
- Theme display colors specification
- Confidence label removal requirement
- Data key mapping clarification

v3.2 (2025-08-25)

- MA comparison framework
 - Three-tier signal system
 - Fixed tier weights
 - 13 indicators across 4 themes
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10. Implementation Notes (NEW v3.4.1)

10.1 Theme Strength vs Regime Transition

The fundamental breakthrough in v3.4 was correcting the conceptual framework. Previous versions calculated when themes would END (regime transition) instead of how strong themes currently ARE (theme confidence for allocation).

10.2 Boundary Condition Removal

ThemeCalculator v2.6+ removed problematic boundary conditions that were forcing uniform 30%/5% probabilities and preventing the sophisticated IPS v3.10 methodology from expressing strong signals.

10.3 Extended Historical Data

FileHandler v1.4 generates 450 data points instead of 6 to support moving average calculations up to 400 periods (required for DXY long MA).

10.4 Nested Data Structure

All data generation uses nested theme structure: `{usd: {dxy: {...}}, innovation: {qqq_spy: {...}}}` for proper ThemeCalculator integration.

10.5 Binary Display Order (NEW v3.4.1)

Scenarios displayed in binary order (0000 to 1111) provide consistent user experience across different market conditions while preserving all probability ranking information through rank numbers and color coding.

End of Product Requirements Document v3.4.1