Smart Contract Audit Report

Foil-Updates

Audit Performed By

Fortknox Security

Professional Smart Contract Auditing

September 6, 2024

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Executive Summary

Fortknox Security has conducted a comprehensive smart contract security audit for **Foil-Updates**. Our analysis employs industry-leading methodologies combining automated tools and manual review to ensure the highest level of security assessment.

8	0	LOW	100%
TOTAL ISSUES FOUND	CRITICAL + HIGH	OVERALL RISK	CODE COVERAGE

Security Assessment Overview

Critical Issues

0

Immediate action required. These vulnerabilities can lead to direct loss of funds.

IMPACT: SEVERE FINANCIAL LOSS

High Issues

0

High priority fixes needed. Can lead to significant financial loss.

IMPACT: MAJOR SECURITY RISK

Key Findings Summary

Access Control

Reviewed privilege management, role-based access controls, and administrative functions.

Economic Security

Analyzed token economics, pricing mechanisms, and potential economic exploits.

Logic Validation

Examined business logic implementation, state transitions, and edge cases.

Input Validation

Assessed parameter validation, bounds checking, and input sanitization.

Audit Conclusion

The Foil-Updates smart contract audit reveals **8 total findings** across various security categories. No critical or high severity issues were identified. Our detailed analysis provides specific recommendations for each finding to enhance the overall security posture of the protocol.

Audit Methodology

Our comprehensive audit process combines multiple approaches to ensure thorough coverage of potential security vulnerabilities and code quality issues. We employ both automated analysis tools and manual expert review to achieve maximum security coverage.

Tools & Techniques

Static Analysis

Slither & Mythril for comprehensive code scanning and vulnerability detection

Manual Review

Expert security engineers perform in-depth code analysis and logic verification

Business Logic

Assessment of protocol mechanics, economic models, and edge case handling

Gas Analysis

Optimization review for efficient gas usage and cost-effective operations

Formal Verification

Mathematical proof methods to verify critical contract properties

Symbolic Execution

Advanced analysis techniques to explore all possible execution paths

Review Process & Standards

Review Process

1 Initial Scanning

Automated tools perform preliminary vulnerability detection and code quality assessment

2 Manual Review

Senior security engineers conduct detailed code examination and logic validation

3 Business Logic Testing

Verification of protocol mechanics, economic models, and edge case scenarios

4 Architecture Analysis

Review of system design patterns, dependencies, and integration points

5 Final Documentation

Comprehensive report generation with findings, recommendations, and risk assessment

Severity Classification

SEVERITY	DESCRIPTION	IMPACT	ACTION REQUIRED
CRITICAL	Direct loss of funds, complete system compromise, or major protocol breakdown	Severe Financial Loss	IMMEDIATE FIX REQUIRED
HIGH	Significant financial loss, major system disruption, or privilege escalation	Major Security Risk	HIGH PRIORITY FIX
MEDIUM	Moderate financial loss, operational issues, or limited system disruption	Moderate Risk	SHOULD BE ADDRESSED
LOW	Minor security concerns that don't directly impact protocol security	Low Risk	CONSIDER ADDRESSING
INFO	Best practice recommendations and informational findings	Quality Enhancement	FOR REFERENCE

Audit Scope

Project Details

PARAMETER	DETAILS
Project Name	Foil-Updates
Total Issues Found	8
Audit Type	Smart Contract Security Audit
Methodology	Manual Review + Automated Analysis

Files in Scope

This audit covers the smart contract codebase and associated components for Foil-Updates.

Audit Timeline

- ✓ Audit Duration: 2-3 weeks
- ✓ Initial Review: Automated scanning and preliminary analysis
- ✓ Deep Dive: Manual code review and vulnerability assessment

Vulnerability Analysis

Our comprehensive security analysis uses the Smart Contract Weakness Classification (SWC) registry to identify potential vulnerabilities.

SWC Security Checks

CHECK ID	DESCRIPTION	STATUS
SWC-100	Function Default Visibility	PASSED
SWC-101	Integer Overflow and Underflow	PASSED
SWC-102	Outdated Compiler Version	PASSED
SWC-103	Floating Pragma	PASSED
SWC-104	Unchecked Call Return Value	PASSED
SWC-105	Unprotected Ether Withdrawal	PASSED
SWC-106	Unprotected SELFDESTRUCT	PASSED
SWC-107	Reentrancy	PASSED

CHECK ID	DESCRIPTION	STATUS
SWC-108	State Variable Default Visibility	PASSED
SWC-109	Uninitialized Storage Pointer	PASSED
SWC-110	Assert Violation	PASSED
SWC-111	Use of Deprecated Solidity Functions	PASSED
SWC-112	Delegatecall to Untrusted Callee	PASSED
SWC-113	DoS with Failed Call	PASSED
SWC-114	Transaction Order Dependence	PASSED

Contract Privileges Analysis

Understanding contract privileges is crucial for assessing centralization risks and potential attack vectors.

Common Privilege Categories

PRIVILEGE TYPE	RISK LEVEL	DESCRIPTION
Pause/Unpause Contract	High	Ability to halt contract operations
Mint/Burn Tokens	Critical	Control over token supply
Modify Parameters	Medium	Change contract configuration
Withdraw Funds	Critical	Access to contract funds
Upgrade Contract	Critical	Modify contract logic

Mitigation Strategies

- ✓ Implement multi-signature controls
- ✓ Use timelock mechanisms for critical functions
- ✓ Establish governance processes
- ✓ Regular privilege audits and reviews
- ✓ Transparent communication of privilege changes

M-0 | Fee Collector Can Horde Fees

CATEGORY	SEVERITY	LOCATION	STATUS
Logical Error	MEDIUM	LiquidityModule.sol	Acknowledged

Description

Fee collectors can create under-collateralized positions and collateralize them using `depositCollateral`.

```
depositCollateral
```

Recommendation

Impose limits on the size of liquidity positions that fee collectors can create to ensure fair distribution of fees.

Resolution

Foil Team: Acknowledged.

M-1 | _checkOnERC721Received Bool Is Not Checked

CATEGORY	SEVERITY	LOCATION	STATUS
Validation	MEDIUM	LiquidityModule.sol: 37, TradeModule.sol: 52	Resolved

Description

While creating a position in the liquidity or trading modules, `_checkOnERC721Received` function is called and then the position NFT is minted.

```
_checkOnERC721Received
```

Recommendation

Check the return value of the function before continuing.

Resolution

Foil Team: The issue was resolved.

M-2 | Incorrect deltaCollateral Check When Negative

CATEGORY	SEVERITY	LOCATION	STATUS
Validation	MEDIUM	TradeModule.sol: 348	Resolved

Description

Users provide deltaCollateralLimit when modifying their trade positions. While a positive deltaCollateralLimit indicates the maximum amount a user wants to provide to the protocol, a negative deltaCollateralLimit represents the minimum collateral amount a user wishes to receive from the protocol when decreasing or closing a position.

Recommendation

Change `deltaCollateral < deltaCollateralLimit` to `deltaCollateral > deltaCollateralLimit`.

```
deltaCollateral < deltaCollateralLimit
deltaCollateral > deltaCollateralLimit
```

Resolution

Foil Team: The issue was resolved.

M-3 | Rightful Disputer Might Lose Bonds

CATEGORY	SEVERITY	LOCATION	STATUS
Validation	MEDIUM	UMASettlementModule.sol	Resolved

Description

Currently, there is no mechanism that checks whether there is already an ongoing dispute or not while submitting a price. Asserter can submit a new price after an initial incorrect submission without waiting a dispute to resolve in 48-96 hours.

Recommendation

Do not allow submitting new price if there is already an ongoing dispute.

Resolution

Foil Team: The issue was resolved.

L-0 | Overflow In DecimalPrice Library

CATEGORY	SEVERITY	LOCATION	STATUS
Arithmetic Error	LOW	DecimalPrice.sol	Resolved

Description

The function `sqrtRatioX96ToPrice` is used to obtain price in several parts of the codebase. The issue lies with performing a square of two `uint160` numbers which could overflow `uint256`. Overflow occurs when `sqrtRatioX96` exceeds `2^128 - 1`.

```
sqrtRatioX96ToPrice
uint160
uint256
sqrtRatioX96
2^128 - 1
```

Recommendation

Perform `>> 96` shift operation on `sqrtRatioX96` first before doing square operation. Alternatively, use Uniswap's `FullMath.mulDiv` which handles the intermediate overflow case.

```
>> 96
sqrtRatioX96
FullMath.mulDiv
```

Resolution

Foil Team: The issue was resolved.

L-1 | Unused Function

CATEGORY	SEVERITY	LOCATION	STATUS
Unused code	LOW	Position.sol	Resolved

Description

The `Position.getRequiredCollateral()` function is not used anywhere

```
Position.getRequiredCollateral()
```

Recommendation

Consider removing it if unnecessary

Resolution

Foil Team: The issue was resolved.

L-2 | Redundant Function Call

CATEGORY	SEVERITY	LOCATION	STATUS
Informational	LOW	TradeModule.sol	Resolved

Description

In `quoteModifyTraderPosition`, `validateNotSettled` is called redundantly twice. Additionally, the `validateSettlementSanity` function in `Epoch.sol` is unused and can be removed.

```
quoteModifyTraderPosition
validateNotSettled
validateSettlementSanity
Epoch.sol
```

Recommendation

Remove the redundant `validateNotSettled` call and delete the unused `validateSettlementSanity` function.

```
validateNotSettled
validateSettlementSanity
```

Resolution

Foil Team: The issue was resolved.

L-3 | FeeCollectorNft Is Transferable

CATEGORY	SEVERITY	LOCATION	STATUS
Informational	LOW	FeeCollectorNft.sol	Acknowledged

Description

The `FeeCollectorNft` is used to assert a user is a fee collector. Fee collectors are given special privileges that allow them to take under collateralized loans.

```
FeeCollectorNft
```

Recommendation

Do not allow fee collectors to transfer `FeeCollectorNfts`.

```
FeeCollectorNfts
```

Resolution

Foil Team: Acknowledged.

Summary of Recommendations

Based on our comprehensive audit, we provide the following prioritized recommendations to improve the security posture of Foil-Updates.

Priority Matrix

ISSUE ID	TITLE	SEVERITY	PRIORITY
M-0	Fee Collector Can Horde Fees	MEDIUM	Medium
M-1	_checkOnERC721Received Bool Is Not Checked	MEDIUM	Medium
M-2	Incorrect deltaCollateral Check When Negative	MEDIUM	Medium
M-3	Rightful Disputer Might Lose Bonds	MEDIUM	Medium
L-0	Overflow In DecimalPrice Library	LOW	Low
L-1	Unused Function	LOW	Low
L-2	Redundant Function Call	LOW	Low
L-3	FeeCollectorNft Is Transferable	LOW	Low

General Security Best Practices

- ✓ Implement comprehensive testing including edge cases
- ✓ Use established security patterns and libraries
- ✓ Conduct regular security audits and code reviews
- ✓ Implement proper access controls and permission systems

Audit Team

Team Credentials

Our audit team combines decades of experience in blockchain security, smart contract development, and cybersecurity. Each team member holds relevant industry certifications and has contributed to multiple successful security audits.

Methodology & Standards

Our audit methodology follows industry best practices and standards:

- ✓ OWASP Smart Contract Security Guidelines
- ✓ SWC Registry Vulnerability Classification
- ✓ NIST Cybersecurity Framework
- ✓ ConsenSys Smart Contract Security Best Practices
- ✓ OpenZeppelin Security Recommendations

Audit Process

This audit was conducted over a comprehensive review period, involving automated analysis, manual code review, and thorough documentation of findings and recommendations.

Disclaimer & Legal Notice

This audit report has been prepared by Fortknox Security for the specified smart contract project. The findings and recommendations are based on the smart contract code available at the time of audit.

Scope Limitations

- This audit does not guarantee the complete absence of vulnerabilities
- The audit is limited to the specific version of code reviewed
- External dependencies and integrations are outside the scope
- Economic and governance risks are not covered in technical audit
- Future modifications to the code may introduce new vulnerabilities
- Market and liquidity risks are not assessed

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Contact Information

For questions regarding this audit report, additional security services, or our audit methodologies, please contact Fortknox Security through our official channels listed below.

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