Smart Contract Audit Report

Smardex

Audit Performed By

Fortknox Security

Professional Smart Contract Auditing

March 3, 2025

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Executive Summary

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

8	1	LOW	100%
TOTAL ISSUES FOUND	CRITICAL + HIGH	OVERALL RISK	CODE COVERAGE

Security Assessment Overview

Critical Issues

1

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 Smardex smart contract audit reveals **8 total findings** across various security categories. Immediate attention is required for 1 critical/high severity issues before deployment. 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	Smardex
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 Smardex.

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

C-0 | pendingBalanceVault Underflow

CATEGORY	SEVERITY	LOCATION	STATUS
Rounding	CRITICAL	Global	Resolved

Description

The `pendingBalanceVault` is deducted by the anticipated withdrawal amount when a withdrawal action is initiated.

```
pendingBalanceVault
```

Recommendation

It may not be deemed too complex to handle this edge case in all locations for this iteration of the protocol. However be aware of this edge case and consider handling it.

Resolution

Smardex Team: The issue was resolved.

M-0 | Tick Liquidation Penalty Cannot Be Reset

CATEGORY	SEVERITY	LOCATION	STATUS
Unexpected Behavior	MEDIUM	UsdnProtocolLongLibrary.sol: 332	Resolved

Description

In the `_removeAmountFromPosition` function the liquidationPenalty is not reset on the tick data after all positions have been removed.

```
_removeAmountFromPosition
```

Recommendation

Reset the tick's `liquidationPenalty` to zero after all positions have been removed from the tick in the

```
liquidationPenalty
```

Resolution

Smardex Team: The issue was resolved.

M-1 | Fee Change Hurts Traders

CATEGORY	SEVERITY	LOCATION	STATUS
Logical Error	MEDIUM	UsdnProtocolActionsLongLibrary.sol: 572	Acknowledged

Description

In the `_prepareValidateOpenPositionData` function the `startPrice` is affected by the current fee in storage, however this fee may be different than the one that was applied upon initiation and validated against the `userMaxPrice`.

```
_prepareValidateOpenPositionData
startPrice
userMaxPrice
```

Recommendation

Consider caching the `_positionFeeBps` value upon initiation in the open position object to be applied on validation.

```
_positionFeeBps
```

Resolution

Smardex Team: Acknowledged.

M-2 | Bad Debt Not Handled In Validate Withdraw

CATEGORY	SEVERITY	LOCATION	STATUS
DoS	MEDIUM	UsdnProtocolVaultLibrary.sol: 1063	Resolved

Description

Validate Withdraw decreases the balance of the vault by the calculated `assetToTransferAfterFees` amt and does not cap it at zero. Therefore if this amt is bigger than the `_balanceVault` (for example as bad debt was taken between init and validate) an underflow occurs which leads to a long term DoS as this is a validation function.

```
assetToTransferAfterFees
_balanceVault
```

Recommendation

Handle bad debt in the validate withdraw function. For example, this can be done by capping `assetToTransferAfterFees` to `s._balanceVault` to avoid an underflow.

```
assetToTransferAfterFees
s._balanceVault
```

Resolution

Smardex Team: The issue was resolved

M-3 | Closed Amt Not Seized If Its Value Is < 0

CATEGORY	SEVERITY	LOCATION	STATUS
Validation	MEDIUM	UsdnProtocolActionsLongLibrary.sol: 796-828	Resolved

Description

The `_validateClosePositionWithAction` function checks if the position is liquidatable and if so seizes it's `closeBoundedPositionValue` and gives it the vault.

```
_validateClosePositionWithAction
closeBoundedPositionValue
```

Recommendation

Seize the `closeBoundedPositionValue` if the position value is <= 0.

```
closeBoundedPositionValue
```

Resolution

Smardex Team: The issue was resolved

L-0 | Fee Amounts Use Round Down Division

CATEGORY	SEVERITY	LOCATION	STATUS
Rounding	LOW	Global	Resolved

Description

Throughout the codebase rounding occurs in favor of the user when instead these operations should round in favor of the protocol. For instance, the fee charged to the user is rounded down in the

Recommendation

Throughout the codebase and particularly in those areas mentioned, be sure to round in favor of the protocol instead of the user.

Resolution

Smardex Team: Acknowledged.

L-1 | Incorrect Action Id Used

CATEGORY	SEVERITY	LOCATION	STATUS
Logical Error	LOW	UsdnProtocolActionsUtilsLibrary.sol: 155	Resolved

Description

In the `_prepareClosePositionData` function when fetching the oracle price the actionId is calculated based on the `params.owner` instead of the validator. This is invalid as the action id is intended to be based on the validator and the owner may not be the validator of the close position action.

```
_prepareClosePositionData
params.owner
```

Recommendation

Use the `params.validator` for the action id in the `_prepareClosePositionData` function.

```
params.validator
_prepareClosePositionData
```

Resolution

Smardex Team: The issue was resolved.

L-2 | Lacking Configuration Validations

CATEGORY	SEVERITY	LOCATION	STATUS
Validation	LOW	LiquidationRewardsManagerModule.sol: 117	Resolved

Description

In the `setRewardsParameters` function there are validations such that the gas usage values cannot be assigned above a set maximum. However there are no maximum bounds for the `baseFeeOffset`, `gasMultiplierBps`, `positionBonusMultiplierBps`, fixedReward, and `maxReward` values.

```
setRewardsParameters
baseFeeOffset
gasMultiplierBps
positionBonusMultiplierBps
maxReward
```

Recommendation

Consider if any of these values should be validated against a maximum and implement these validations as necessary.

Resolution

Smardex Team: The issue was resolved

Summary of Recommendations

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

Priority Matrix

ISSUE ID	TITLE	SEVERITY	PRIORITY
C-0	pendingBalanceVault Underflow	CRITICAL	Immediate
M-0	Tick Liquidation Penalty Cannot Be Reset	MEDIUM	Medium
M-1	Fee Change Hurts Traders	MEDIUM	Medium
M-2	Bad Debt Not Handled In Validate Withdraw	MEDIUM	Medium
M-3	Closed Amt Not Seized If Its Value Is < 0	MEDIUM	Medium
L-0	Fee Amounts Use Round Down Division	LOW	Low
L-1	Incorrect Action Id Used	LOW	Low
L-2	Lacking Configuration Validations	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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