Smart Contract Audit Report

GMX-Config2

Audit Performed By

Fortknox Security

Professional Smart Contract Auditing

December 9, 2024

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Executive Summary

Fortknox Security has conducted a comprehensive smart contract security audit for **GMX-Config2**. Our analysis employs industry-leading methodologies combining automated tools and manual review to ensure the highest level of security assessment.

8	4	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

4

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 GMX-Config2 smart contract audit reveals **8 total findings** across various security categories. Immediate attention is required for 4 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	GMX-Config2
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 GMX-Config2.

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

H-0 | Atomic Providers Cannot Be Configured

CATEGORY	SEVERITY	LOCATION	STATUS
Logical Error	HIGH	Timelock.sol: 163	Resolved

Description

In the `setAtomicOracleProviderAfterSignal` function the `isOracleProviderEnabledKey` is used instead of the `isAtomicOracleProviderKey`.

```
setAtomicOracleProviderAfterSignal
isOracleProviderEnabledKey
isAtomicOracleProviderKey
```

Recommendation

Change the `isOracleProviderEnabledKey` to the `isAtomicOracleProviderKey`.

```
isOracleProviderEnabledKey
isAtomicOracleProviderKey
```

Resolution

GMX Team: Resolved.

H-1 | Can't set data stream through config

CATEGORY	SEVERITY	LOCATION	STATUS
Validation	HIGH	Config.sol: 119	Resolved

Description

When the `setDataStream` function is called there is a check that ensures the dataStream is not already set. However the check incorrectly does not reference the `dataStore` instead the check only uses the `Keys.dataStreamIdKey(token)` key.

```
setDataStream
dataStore
Keys.dataStreamIdKey(token)
```

Recommendation

Reference Data Store when checking if the stream has already been added.

Resolution

GMX Team: Resolved.

H-2 | MarketSwap Orders May Use Unexpected Prices

CATEGORY	SEVERITY	LOCATION	STATUS
Validation	HIGH	SwapOrderUtils.sol: 30	Partially Resolved

Description

In the `processOrder` function for swap orders, the price timestamp validation includes no `maxOracleTimestamp` validation for `MarketSwap` orders.

```
processOrder
maxOracleTimestamp
MarketSwap
```

Recommendation

When executing a `MarketSwap` order be sure to validate that the `maxOracleTimestamp` is not above the order's `requestExpirationTime`.

```
MarketSwap
maxOracleTimestamp
requestExpirationTime
```

Resolution

GMX Team: Partially Resolved.

H-3 | Atomic Withdrawal Feature Unsable

CATEGORY	SEVERITY	LOCATION	STATUS
Logical Error	HIGH	Oracle.sol:L224	Resolved

Description

During `executeAtomicWithdrawal` modifier `withOraclePrices` is used which when we follow the call trace we will reach the `_validatePrices` function in `Oracle.sol`. In this function we check the provider for the given tokens to validate that it is indeed the same provider given by keeper.

```
executeAtomicWithdrawal
withOraclePrices
_validatePrices
Oracle.sol
```

Recommendation

If the action is atomic withdrawal instead of comparing the provided provider with `oracleProviderForTokenKey`, compare it with `isAtomicOracleProviderKey`.

```
oracleProviderForTokenKey
isAtomicOracleProviderKey
```

Resolution

GMX Team: Resolved.

M-0 | uiFee is Taken Twice During Shift

CATEGORY	SEVERITY	LOCATION	STATUS
Logical Error	MEDIUM	ShiftUtils.sol	Resolved

Description

During shift, `uiFee` taken twice both in withdrawal and also in deposit. Since both deposit and withdrawal done in a single action, it should be taken only once.

```
uiFee
```

Recommendation

Include the `uiFee` on either the deposit or the withdraw, but not both.

```
uiFee
```

Resolution

GMX Team: Resolved.

L-0 | Lacking Configuration Validations

CATEGORY	SEVERITY	LOCATION	STATUS
Validation	LOW	Config.sol: 499-501	Resolved

Description

Newly allowed configuration variables including `OPTIMAL_USAGE_FACTOR`, `BASE_BORROWING_FACTOR`, and `ABOVE_OPTIMAL_USAGE_BORROWING_FACTOR` have not been added to function `_validateRange()`.

```
OPTIMAL_USAGE_FACTOR
BASE_BORROWING_FACTOR
ABOVE_OPTIMAL_USAGE_BORROWING_FACTOR
_validateRange()
```

Recommendation

Add the new factors to `_validateRange` to ensure they do not exceed 100%, similar to `BORROWING_FACTOR`.

```
_validateRange
BORROWING_FACTOR
```

Resolution

GMX Team: Resolved.

L-1 | Atomic Withdrawals Cannot Be Simulated

CATEGORY	SEVERITY	LOCATION	STATUS
Unexpected Behavior	LOW	WithdrawalHandler.sol: 150	Acknowledged

Description

In the `WithdrawalHandler`, the `simulateExecuteWithdrawal` function has been updated to accept a `swapPricingType` parameter, presumably to be able to simulate normal two-step withdrawals as well as atomic withdrawals.

```
WithdrawalHandler
simulateExecuteWithdrawal
swapPricingType
```

Recommendation

Consider making a separate simulation function to allow users and integrators to simulate atomic withdrawals.

Resolution

GMX Team: Acknowledged.

L-2 | Redundant priceFeed Checks

CATEGORY	SEVERITY	LOCATION	STATUS
Optimization	LOW	Oracle.sol: 244	Resolved

Description

In the `_validatePrices` function the reference chainlink price feeds are validated for the `maxRefPriceDeviationFactor` even when the price provider is the `ChainlinkPriceFeedProvider`.

```
_validatePrices
maxRefPriceDeviationFactor
ChainlinkPriceFeedProvider
```

Recommendation

Do not perform the `maxRefPriceDeviationFactor` check when the price provider is the `ChainlinkPriceFeedProvider` as this check is redundant.

```
maxRefPriceDeviationFactor
ChainlinkPriceFeedProvider
```

Resolution

GMX Team: Resolved.

Summary of Recommendations

Based on our comprehensive audit, we provide the following prioritized recommendations to improve the security posture of GMX-Config2.

Priority Matrix

ISSUE ID	TITLE	SEVERITY	PRIORITY
H-0	Atomic Providers Cannot Be Configured	HIGH	High
H-1	Can't set data stream through config	HIGH	High
H-2	MarketSwap Orders May Use Unexpected Prices	HIGH	High
H-3	Atomic Withdrawal Feature Unsable	HIGH	High
M-0	uiFee is Taken Twice During Shift	MEDIUM	Medium
L-0	Lacking Configuration Validations	LOW	Low
L-1	Atomic Withdrawals Cannot Be Simulated	LOW	Low
L-2	Redundant priceFeed Checks	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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