



Twisted IRM

Security Review



Disclaimer

Security Review

Twisted IRM



Disclaimer

The ensuing audit offers no assertions or assurances about the code's security. It cannot be deemed an adequate judgment of the contract's correctness on its own. The authors of this audit present it solely as an informational exercise, reporting the thorough research involved in the secure development of the intended contracts, and make no material claims or guarantees regarding the contract's post-deployment operation. The authors of this report disclaim all liability for all kinds of potential consequences of the contract's deployment or use. Due to the possibility of human error occurring during the code's manual review process, we advise the client team to commission several independent audits in addition to a public bug bounty program.

Table of Contents

Security Review

Twisted IRM



Table of Contents

Disclaimer	3
Summary	7
Scope	9
Methodology	9
Project Dashboard	13
Risk Section	16
Findings	18

Summary Security Review

Twisted IRM



Summary

Three Sigma audited Twisted IRM in a 0.8 person week engagement. The audit was conducted from 19/03/2026 to 20/03/2026.

Protocol Description

Keyring Euler IRM Logistic is a custom Interest Rate Model (IRM) library designed for integration with the Euler V2 lending protocol. It replaces traditional linear kink-based interest rate curves with a mathematically smooth “twisted logistic” function that maps pool utilization to per-second borrow rates.

The primary design objective of this formulation is to eliminate curvature risk present in piecewise or kinked models, by ensuring smooth first- and second-order derivatives across the utilization domain. However, care must be taken when introducing constraints such as a floor on negative rates. If a lower bound is enforced (e.g., truncating the function at $r(u)=0$), the smoothness guarantees are broken at the truncation point u' . In particular, the second derivative $\partial^2 r(u)/\partial u^2$ becomes singular at this boundary, effectively reintroducing convexity discontinuities.

In the extreme case, this results in a hybrid profile that behaves similarly to a linear kink model: a flat segment where $r(u)=0$ for $u \in [0, u']$, followed by the original curve beyond u' . This undermines the intended risk properties of the logistic formulation and should be explicitly considered when configuring rate floors or other hard constraints.

Scope Security Review

Twisted IRM



Scope

Filepath	nSLOC
src/IRMLogisticTwisted.sol	71
src/IRMLogisticBase.sol	56
Total	127

Methodology Security Review

Twisted IRM



To begin, we reasoned meticulously about the contract's business logic, checking security-critical features to ensure that there were no gaps in the business logic and/or inconsistencies between the aforementioned logic and the implementation. Second, we thoroughly examined the code for known security flaws and attack vectors. Finally, we discussed the most catastrophic situations with the team and reasoned backwards to ensure they are not reachable in any unintentional form.

Taxonomy

In this audit, we classify findings based on ImmuneFi's [Vulnerability Severity Classification System \(v2.3\)](#) as a guideline. The final classification considers both the potential impact of an issue, as defined in the referenced system, and its likelihood of being exploited. The following table summarizes the general expected classification according to impact and likelihood; however, each issue will be evaluated on a case-by-case basis and may not strictly follow it.

Impact / Likelihood	LOW	MEDIUM	HIGH
NONE	None		
LOW	Low		
MEDIUM	Low	Medium	Medium
HIGH	Medium	High	High
CRITICAL	High	Critical	Critical

Project Dashboard Security Review

Twisted IRM



Project Dashboard

Application Summary

Name	Twisted IRM
Repository	https://github.com/Keyring-Network/keyring-euler-irm-logistic
Commit	8ce1e54
Language	Solidity
Platform	Avalanche

Engagement Summary

Timeline	19/03/2026 to 20/03/2026
Nº of Auditors	2
Review Time	0.8 person weeks

Vulnerability Summary

Issue Classification	Found	Addressed	Acknowledged
Critical	0	0	0
High	0	0	0
Medium	0	0	0
Low	0	0	0
None	0	0	0

Category Breakdown

Suggestion	0
Documentation	0
Bug	0
Optimization	0
Good Code Practices	0

Risk Section Security Review

Twisted IRM



Risk Section

No risks were identified.

Findings

Security Review

Twisted IRM



Findings

No findings were identified.