



**Limit Order Protocol**  
**SMART CONTRACT AUDIT**

11.06.2021

**Made in Germany by Chainsulting.de**



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## 1. Disclaimer

The audit makes no statements or warranties about utility of the code, safety of the code, suitability of the business model, investment advice, endorsement of the platform or its products, regulatory regime for the business model, or any other statements about fitness of the contracts to purpose, or their bug free status. The audit documentation is for discussion purposes only.

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Major Versions / Date	Description
0.1 (01.04.2021)	Layout
0.5 (04.04.2021)	Unit tests
0.6 (05.04.2021)	Testing SWC Checks
0.8 (07.04.2021)	Automated Security Testing Manual Security Testing
0.9 (08.04.2021)	Summary and Recommendation
1.0 (10.04.2021)	Final document
1.2 (06.06.2021)	Re-check after updates
1.3 (11.06.2021)	Added deployed contract

## 2. About the Project and Company

### Company address:

1Inch Limited  
Quijano Chambers, P.O. Box 3159, Road Town  
Tortola, British Virgin Islands

Sergej Kunz Co-Founder & Chief Executive Officer  
Anton Bukov Co-Founder & Chief Technology Officer

Discord: <https://discord.gg/FZADkCZ>

Blog: <https://blog.1inch.io>

Medium: <https://medium.com/@1inch.exchange>

Website: <https://app.1inch.io>

Twitter: <https://twitter.com/1inchExchange>

Reddit: [https://www.reddit.com/r/1inch\\_exchange](https://www.reddit.com/r/1inch_exchange)

Telegram: <https://t.me/OneInchExchange>

Forum: <https://gov.1inch.io>



## 2.1 Project Overview

1inch is a so-called DEX aggregator, which means that it scrapes a handful of decentralized exchanges for the cheapest prices and reroutes its customers' trades between them to try and ensure that they're getting the best prices. This is particularly important when exchanging large token amounts as it reduces the price slippage, ensuring trades are optimized for the best price.

1inch was founded by Sergej Kunz and Anton Bukov in 2019 during ETHNewYork's hackathon. Since then, 1inch has raised about \$15 million in funding from companies such as Binance Labs, Galaxy Digital and Pantera Capital. As of January 2021, 1inch's exchange trades about \$155 million a day.

### 3. Vulnerability & Risk Level

Risk represents the probability that a certain source-threat will exploit vulnerability, and the impact of that event on the organization or system. Risk Level is computed based on CVSS version 3.0.

Level	Value	Vulnerability	Risk (Required Action)
Critical	9 – 10	A vulnerability that can disrupt the contract functioning in a number of scenarios, or creates a risk that the contract may be broken.	Immediate action to reduce risk level.
High	7 – 8.9	A vulnerability that affects the desired outcome when using a contract, or provides the opportunity to use a contract in an unintended way.	Implementation of corrective actions as soon as possible.
Medium	4 – 6.9	A vulnerability that could affect the desired outcome of executing the contract in a specific scenario.	Implementation of corrective actions in a certain period.
Low	2 – 3.9	A vulnerability that does not have a significant impact on possible scenarios for the use of the contract and is probably subjective.	Implementation of certain corrective actions or accepting the risk.
Informational	0 – 1.9	A vulnerability that have informational character but is not effecting any of the code.	An observation that does not determine a level of risk

## 4. Auditing Strategy and Techniques Applied

Throughout the review process, care was taken to evaluate the repository for security-related issues, code quality, and adherence to specification and best practices. To do so, reviewed line-by-line by our team of expert pentesters and smart contract developers, documenting any issues as there were discovered.

### 4.1 Methodology

The auditing process follows a routine series of steps:

1. Code review that includes the following:
  - i. Review of the specifications, sources, and instructions provided to Chainsulting to make sure we understand the size, scope, and functionality of the smart contract.
  - ii. Manual review of code, which is the process of reading source code line-by-line in an attempt to identify potential vulnerabilities.
  - iii. Comparison to specification, which is the process of checking whether the code does what the specifications, sources, and instructions provided to Chainsulting describe.
2. Testing and automated analysis that includes the following:
  - i. Test coverage analysis, which is the process of determining whether the test cases are actually covering the code and how much code is exercised when we run those test cases.
  - ii. Symbolic execution, which is analysing a program to determine what inputs causes each part of a program to execute.
3. Best practices review, which is a review of the smart contracts to improve efficiency, effectiveness, clarify, maintainability, security, and control based on the established industry and academic practices, recommendations, and research.
4. Specific, itemized, actionable recommendations to help you take steps to secure your smart contracts.

## 4.2 Used Code from other Frameworks/Smart Contracts (direct imports)

Dependency / Import Path	Source
@openzeppelin/contracts/token/ERC20/extensions/draft-ERC20Permit.sol	<a href="https://github.com/OpenZeppelin/openzeppelin-contracts/blob/master/contracts/token/ERC20/extensions/draft-ERC20Permit.sol">https://github.com/OpenZeppelin/openzeppelin-contracts/blob/master/contracts/token/ERC20/extensions/draft-ERC20Permit.sol</a>
@openzeppelin/contracts/utils/math/SafeMath.sol	<a href="https://github.com/OpenZeppelin/openzeppelin-contracts/blob/master/contracts/utils/math/SafeMath.sol">https://github.com/OpenZeppelin/openzeppelin-contracts/blob/master/contracts/utils/math/SafeMath.sol</a>
@openzeppelin/contracts/token/ERC20/utils/SafeERC20.sol	<a href="https://github.com/OpenZeppelin/openzeppelin-contracts/blob/master/contracts/token/ERC20/utils/SafeERC20.sol">https://github.com/OpenZeppelin/openzeppelin-contracts/blob/master/contracts/token/ERC20/utils/SafeERC20.sol</a>
@openzeppelin/contracts/token/ERC20/IERC20.sol	<a href="https://github.com/OpenZeppelin/openzeppelin-contracts/blob/master/contracts/token/ERC20/IERC20.sol">https://github.com/OpenZeppelin/openzeppelin-contracts/blob/master/contracts/token/ERC20/IERC20.sol</a>
@openzeppelin/contracts/token/ERC721/IERC721.sol	<a href="https://github.com/OpenZeppelin/openzeppelin-contracts/blob/master/contracts/token/ERC721/IERC721.sol">https://github.com/OpenZeppelin/openzeppelin-contracts/blob/master/contracts/token/ERC721/IERC721.sol</a>
@openzeppelin/contracts/token/ERC1155/IERC1155.sol	<a href="https://github.com/OpenZeppelin/openzeppelin-contracts/blob/master/contracts/token/ERC1155/IERC1155.sol">https://github.com/OpenZeppelin/openzeppelin-contracts/blob/master/contracts/token/ERC1155/IERC1155.sol</a>

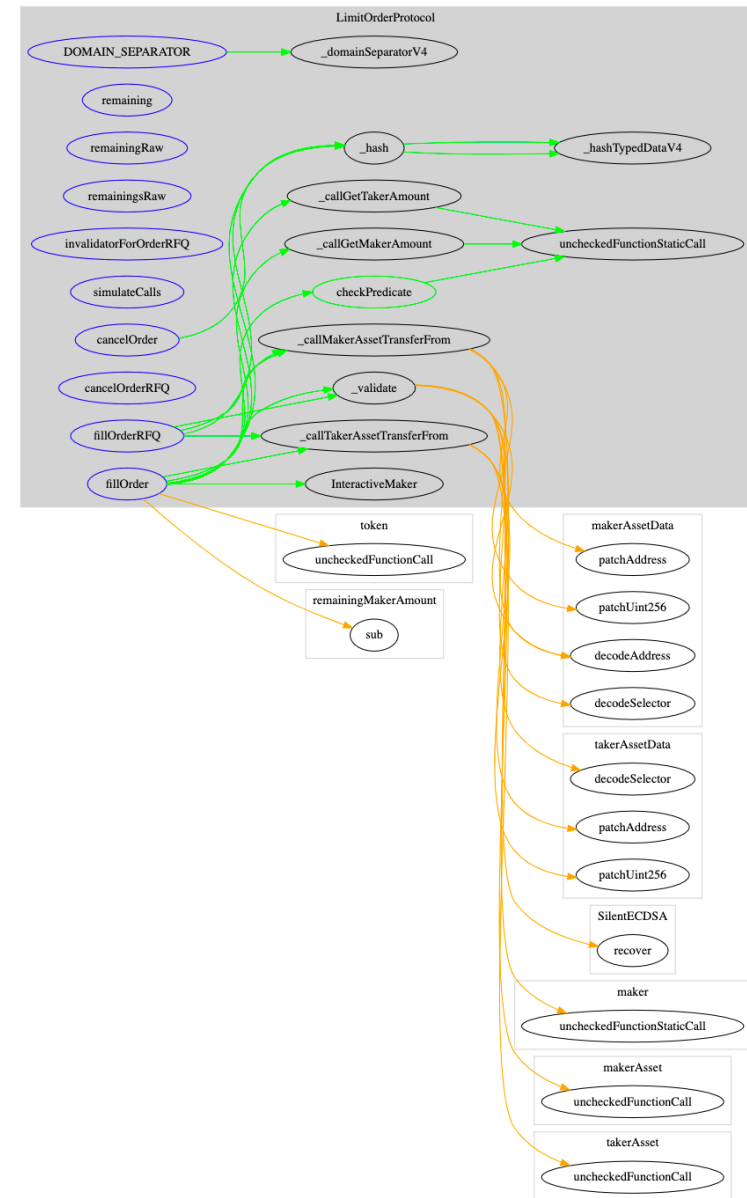
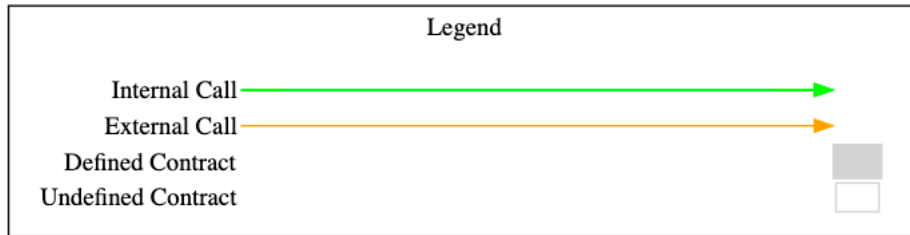


## 4.3 Tested Contract Files

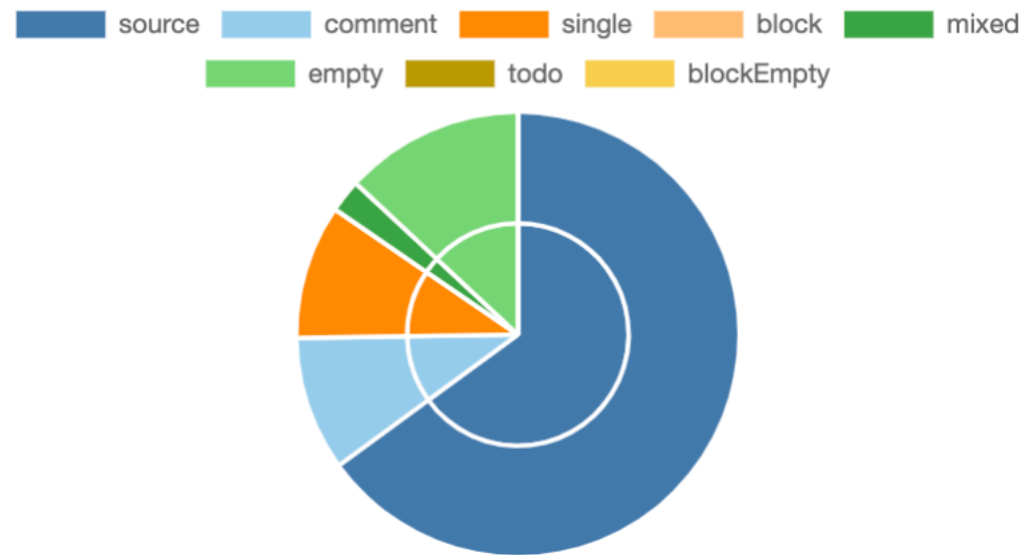
The following are the MD5 hashes of the reviewed files. A file with a different MD5 hash has been modified, intentionally or otherwise, after the security review. You are cautioned that a different MD5 hash could be (but is not necessarily) an indication of a changed condition or potential vulnerability that was not within the scope of the review

File	Fingerprint (MD5)
LimitOrderProtocol.sol	c3a67acd9bb129885c03bc19718143cb
./libraries/ArgumentsDecoder.sol	0991a750f78c14fdc01d43e18f0f6d5b
./libraries/UncheckedAddress.sol	a5f723dad51a7046470ffdf5df6a3d13
./libraries/SilentECDSA.sol	ede3aec76ededc4d8ac5b7074e5b4e08
./interfaces/AggregatorV3Interface.sol	1140ecccd2cb513c243a1c5e144f146a
./interfaces/InteractiveMaker.sol	5ebc6825022d4839d7f040a099440800
./helpers/AmountCalculator.sol	e9129d2d02616c95372389ed1efa17ff
./helpers/ChainlinkCalculator.sol	e8b539759b8e682732c29ae5c90a56b7
./helpers/ERC20Proxy.sol	ba24c0eff24709a8a7ae767f917021b7
./helpers/ERC721Proxy.sol	c5d76a8093b357525504ca4a3305ea61
./helpers/ERC1155Proxy.sol	870764e5a5e8c5c40ae1949a26600b40
./helpers/ImmutableOwner.sol	f7a07545b7fd3a6e1e0f81d70058018e
./helpers/NonceManager.sol	245ac5d6bf34343d1b367d3fc61c5fbc
./helpers/PredicateHelper.sol	b29178b094ba4428212159c936647f17




## 4.4 Metrics / CallGraph





## 4.5 Metrics / Source Lines




## 4.6 Metrics / Capabilities





Solidity Versions observed		 Experimental Features		 Can Receive Funds		 Uses Assembly		 Has Destroyable Contracts			
<code>^0.8.0</code>						**** (0 asm blocks)					
 Transfers ETH		 Low-Level Calls		 DelegateCall		 Uses Hash Functions		 ECTrecover		 New/Create/Create2	
						<code>yes</code>					

 Public	 Payable			
11	0			
External	Internal	Private	Pure	View
10	14	0	0	11

### StateVariables

Total	 Public
8	2

## 4.7 Metrics / Source Unites in Scope

Type	File	Logic Contracts	Interfaces	Lines	nLines	nSLOC	Comment Lines	Complex. Score	Capabilities
	contracts/LimitOrderProtocol.sol	1		359	359	273	41	221	
	<b>Totals</b>	<b>1</b>		<b>359</b>	<b>359</b>	<b>273</b>	<b>41</b>	<b>221</b>	

Legend: [—]

- **Lines:** total lines of the source unit
- **nLines:** normalized lines of the source unit (e.g. normalizes functions spanning multiple lines)
- **nSLOC:** normalized source lines of code (only source-code lines; no comments, no blank lines)
- **Comment Lines:** lines containing single or block comments
- **Complexity Score:** a custom complexity score derived from code statements that are known to introduce code complexity (branches, loops, calls, external interfaces, ...)

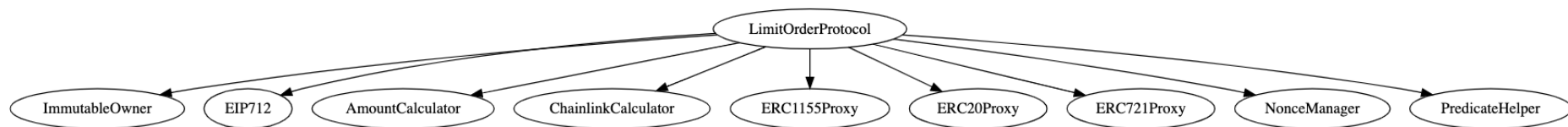
## 5. Scope of Work

The 1inch Team provided us with the files that needs to be tested. The scope of the audit is the Limit Order Protocol contract.

Following contracts with the direct imports has been tested:

- LimitOrderProtocol.sol

The main goal of this audit was to verify the overall smart contract security. The auditors can provide additional feedback on the code upon the client's request.



## 5.1 Manual and Automated Vulnerability Test

### **CRITICAL ISSUES**

During the audit, Chainsulting's experts found **no Critical issues** in the code of the smart contract.

### **HIGH ISSUES**

During the audit, Chainsulting's experts found **no High issues** in the code of the smart contract.

### **MEDIUM ISSUES**

During the audit, Chainsulting's experts found **no Medium issues** in the code of the smart contract.

### **LOW ISSUES**

During the audit, Chainsulting's experts found **no Low issues** in the code of the smart contract.

## 5.2. SWC Attacks

ID	Title	Relationships	Test Result
<a href="#">SWC-131</a>	Presence of unused variables	<a href="#">CWE-1164: Irrelevant Code</a>	
<a href="#">SWC-130</a>	Right-To-Left-Override control character (U+202E)	<a href="#">CWE-451: User Interface (UI) Misrepresentation of Critical Information</a>	
<a href="#">SWC-129</a>	Typographical Error	<a href="#">CWE-480: Use of Incorrect Operator</a>	
<a href="#">SWC-128</a>	DoS With Block Gas Limit	<a href="#">CWE-400: Uncontrolled Resource Consumption</a>	
<a href="#">SWC-127</a>	Arbitrary Jump with Function Type Variable	<a href="#">CWE-695: Use of Low-Level Functionality</a>	
<a href="#">SWC-125</a>	Incorrect Inheritance Order	<a href="#">CWE-696: Incorrect Behavior Order</a>	
<a href="#">SWC-124</a>	Write to Arbitrary Storage Location	<a href="#">CWE-123: Write-what-where Condition</a>	
<a href="#">SWC-123</a>	Requirement Violation	<a href="#">CWE-573: Improper Following of Specification by Caller</a>	



ID	Title	Relationships	Test Result
<a href="#">SWC-122</a>	Lack of Proper Signature Verification	<a href="#">CWE-345: Insufficient Verification of Data Authenticity</a>	✓
<a href="#">SWC-121</a>	Missing Protection against Signature Replay Attacks	<a href="#">CWE-347: Improper Verification of Cryptographic Signature</a>	✓
<a href="#">SWC-120</a>	Weak Sources of Randomness from Chain Attributes	<a href="#">CWE-330: Use of Insufficiently Random Values</a>	✓
<a href="#">SWC-119</a>	Shadowing State Variables	<a href="#">CWE-710: Improper Adherence to Coding Standards</a>	✓
<a href="#">SWC-118</a>	Incorrect Constructor Name	<a href="#">CWE-665: Improper Initialization</a>	✓
<a href="#">SWC-117</a>	Signature Malleability	<a href="#">CWE-347: Improper Verification of Cryptographic Signature</a>	✓
<a href="#">SWC-116</a>	Timestamp Dependence	<a href="#">CWE-829: Inclusion of Functionality from Untrusted Control Sphere</a>	✓
<a href="#">SWC-115</a>	Authorization through tx.origin	<a href="#">CWE-477: Use of Obsolete Function</a>	✓
<a href="#">SWC-114</a>	Transaction Order Dependence	<a href="#">CWE-362: Concurrent Execution using Shared Resource with Improper Synchronization ('Race Condition')</a>	✓

ID	Title	Relationships	Test Result
<a href="#">SWC-113</a>	DoS with Failed Call	<a href="#">CWE-703: Improper Check or Handling of Exceptional Conditions</a>	✓
<a href="#">SWC-112</a>	Delegatecall to Untrusted Callee	<a href="#">CWE-829: Inclusion of Functionality from Untrusted Control Sphere</a>	✓
<a href="#">SWC-111</a>	Use of Deprecated Solidity Functions	<a href="#">CWE-477: Use of Obsolete Function</a>	✓
<a href="#">SWC-110</a>	Assert Violation	<a href="#">CWE-670: Always-Incorrect Control Flow Implementation</a>	✓
<a href="#">SWC-109</a>	Uninitialized Storage Pointer	<a href="#">CWE-824: Access of Uninitialized Pointer</a>	✓
<a href="#">SWC-108</a>	State Variable Default Visibility	<a href="#">CWE-710: Improper Adherence to Coding Standards</a>	✓
<a href="#">SWC-107</a>	Reentrancy	<a href="#">CWE-841: Improper Enforcement of Behavioral Workflow</a>	✓
<a href="#">SWC-106</a>	Unprotected SELFDESTRUCT Instruction	<a href="#">CWE-284: Improper Access Control</a>	✓
<a href="#">SWC-105</a>	Unprotected Ether Withdrawal	<a href="#">CWE-284: Improper Access Control</a>	✓
<a href="#">SWC-104</a>	Unchecked Call Return Value	<a href="#">CWE-252: Unchecked Return Value</a>	✓

ID	Title	Relationships	Test Result
<a href="#">SWC-103</a>	Floating Pragma	<a href="#">CWE-664: Improper Control of a Resource Through its Lifetime</a>	✗
<a href="#">SWC-102</a>	Outdated Compiler Version	<a href="#">CWE-937: Using Components with Known Vulnerabilities</a>	✓
<a href="#">SWC-101</a>	Integer Overflow and Underflow	<a href="#">CWE-682: Incorrect Calculation</a>	✓
<a href="#">SWC-100</a>	Function Default Visibility	<a href="#">CWE-710: Improper Adherence to Coding Standards</a>	✓

## 6. Executive Summary

Two (2) independent Chainsulting experts performed an unbiased and isolated audit of the smart contract codebase. The overall code quality of the project is very good. It implemented the newest versions of the widely-used and reviewed contracts from OpenZeppelin.

The main goal of the audit was to verify the claims regarding the security of the smart contract. During the audit, no critical issues were found, after the manual and automated security testing. The auditors have been very satisfied with the documentation and overall code quality.

## 7. Deployed Smart Contract

VERIFIED

Smart Contract is deployed here:

<https://etherscan.io/address/0x3ef51736315f52d568d6d2cf289419b9cffe782#code>

