Summer Point Token

Smart Contract Audit Report Prepared for The Issuer and Token X

Date Issued:	Sep 16, 2024
Project ID:	AUDIT2024009
Version:	v1.0
Confidentiality Level:	Public

CYBERSECURITY PROFESSIONAL SERVICE

Report Information

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Version	v1.0
Client	The Issuer and Token X
Project	Summer Point Token
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Version History

Version	Date	Description	Author(s)
1.0	Sep 16, 2024	Full report	Patipon Suwanbol

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1. Executive Summary

As requested by The Issuer and Token X, Inspex team conducted an audit to verify the security posture of the Summer Point Token smart contracts on Sep 16, 2024. During the audit, Inspex team examined all smart contracts and the overall operation within the scope to understand the overview of Summer Point Token smart contracts. Static code analysis, dynamic analysis, and manual review were done in conjunction to identify smart contract vulnerabilities together with technical & business logic flaws that may be exposed to the potential risk of the platform and the ecosystem. Practical recommendations are provided according to each vulnerability found and should be followed to remediate the issue.

1.1. Audit Result

In the initial audit, Inspex found 1 medium and 1 info-severity issues. With the project team's prompt response in resolving the issues found by Inspex, all issues were resolved or mitigated in the reassessment. Therefore, Inspex trusts that Summer Point Token smart contracts have high-level protections in place to be safe from most attacks.

1.2. Disclaimer

This security audit is not produced to supplant any other type of assessment and does not guarantee the discovery of all security vulnerabilities within the scope of the assessment. However, we warrant that this audit is conducted with goodwill, professional approach, and competence. Since an assessment from one single party cannot be confirmed to cover all possible issues within the smart contract(s), Inspex suggests conducting multiple independent assessments to minimize the risks. Lastly, nothing contained in this audit report should be considered as investment advice.

2. Project Overview

2.1. Project Introduction

The Summer Point Token is the ERC20 token that has the property of the ERC20TransferLimitable contract, which allows the Summer Point Token contract to have a token transfer limit control mechanism for individual addresses. This mechanism can be managed by an authorized party. It also includes security-related privilege functions, such as pausing mechanisms. This token is only allowed to be used by whitelisted addresses. In addition, the contract provides emergency functions for the authorized party to handle incidents promptly, complying with the regulator's guidelines.

Scope Information:

Project Name	Summer Point Token
Website	https://tokenx.finance/
Smart Contract Type	Ethereum Smart Contract
Chain	Token X (TKX)
Programming Language	Solidity
Category	Token

Audit Information:

Audit Method	Whitebox
Audit Date	Sep 16, 2024
Reassessment Date	Sep 16, 2024

The audit method can be categorized into two types depending on the assessment targets provided:

1. **Whitebox**: The complete source code of the smart contracts are provided for the assessment.
2. **Blackbox**: Only the bytecodes of the smart contracts are provided for the assessment.

2.2. Scope

The following smart contracts were audited and reassessed by Inspex in detail:

Initial Audit: (Commit: 64fa4e7fc968f9d63419315c8f05cecb0b3b6f55)

Contract	Location (URL)
InvestmentTokenM	https://github.com/tokenx-finance/summer-point-token-smart-contracts/blob/64fa4e7fc9/contracts/InvestmentTokenM.sol
ERC20TransferLimitable	https://github.com/tokenx-finance/summer-point-token-smart-contracts/blob/64fa4e7fc9/extensions/ERC20TransferLimitable.sol

Reassessment: (Commit: 7d7c245947fc17e4fb0bafb9dc71a6908df0f167)

Contract	Location (URL)
InvestmentTokenM	https://github.com/tokenx-finance/summer-point-token-smart-contracts/blob/7d7c245947/contracts/InvestmentTokenM.sol
ERC20TransferLimitable	https://github.com/tokenx-finance/summer-point-token-smart-contracts/blob/7d7c245947/extensions/ERC20TransferLimitable.sol

The assessment scope covers only the in-scope smart contracts and the smart contracts that they inherit from.

2.3. Security Model

2.3.1 Trust Modules

The Summer Point Token has certain privileged roles with the authority to mutate the critical state variables of the contract. Changes to these state variables significantly impact the contract's functionality. The privileged roles and their corresponding privileged functions are enumerated as follows:

- Set AllowlistRegistry contract address, which the token will interact with.
- Enable or disable the global token transfer limit.
- Set or unset the token transfer limit per address.
- Increase or decrease the token transfer limit per address.
- Mint unlimited number of tokens by using the `mint()` function.
- Disable mintable ability of the token.
- Transfer unlimited number of tokens from any address by using the `adminTransfer()` function.
- Burn an unlimited number of tokens from any address by using the `adminBurn()` function.
- Pause or unpause token transfers at any moment.

The Summer Point Token several functionalities have relied on the external component, which may significantly impact the contract if they malfunction. The external components are listed as follows:

- The `AllowlistRegistry` contract provides the list of allowed addresses that can transfer and receive the token.

2.3.2 Trust Assumptions

In the Summer Point Token, the protocol's privileged role, has the ability to change the critical state variables of the contract, also external components were assumed to be trusted. Acknowledging these trust assumptions is important, as it introduces substantial risks to the platform. Trust assumptions include, but are not limited to:

The owner is trusted to perform the following actions at goodwill:

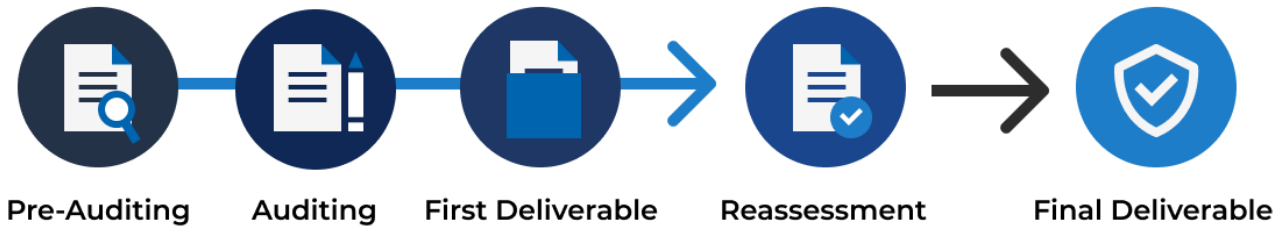
- Set only a legitimate AllowlistRegistry contract address.
- Enable or disable the global token transfer limit according to the protocol document or business logic.
- Set or unset the token transfer limit per address according to the protocol document or business logic.
- Increase or decrease the token transfer limit per address according to the protocol document or business logic.
- Mint unlimited number of tokens by using the `mint()` function according to the protocol document.
- Disable mintable ability of the token according to the protocol document or business logic.
- Transfer number of tokens from any address by using the `adminTransfer()` function when needed.
- Burn the number of tokens from any address by using the `adminBurn()` function when needed.
- Only pause or unpause token transfers when needed.

The `AllowlistRegistry` contract is assumed to provide the list of allowed addresses that can transfer and receive the token according to the protocol document or business logic.

3. Methodology

Inspex conducts the following procedure to enhance the security level of our clients' smart contracts:

1. **Pre-Auditing**: Getting to understand the overall operations of the related smart contracts, checking for readiness, and preparing for the auditing
2. **Auditing**: Inspecting the smart contracts using automated analysis tools and manual analysis by a team of professionals
3. **First Deliverable and Consulting**: Delivering a preliminary report on the findings with suggestions on how to remediate those issues and providing consultation
4. **Reassessment**: Verifying the status of the issues and whether there are any other complications in the fixes applied
5. **Final Deliverable**: Providing a full report with the detailed status of each issue



3.1. Test Categories

Inspex smart contract auditing methodology consists of both automated testing with scanning tools and manual testing by experienced testers. We have categorized the tests into 3 categories as follows:

1. **General Smart Contract Vulnerability (General)** - Smart contracts are analyzed automatically using static code analysis tools for general smart contract coding bugs, which are then verified manually to remove all false positives generated.
2. **Advanced Smart Contract Vulnerability (Advanced)** - The workflow, logic, and the actual behavior of the smart contracts are manually analyzed in-depth to determine any flaws that can cause technical or business damage to the smart contracts or the users of the smart contracts.
3. **Smart Contract Best Practice (Best Practice)** - The code of smart contracts is then analyzed from the development perspective, providing suggestions to improve the overall code quality using standardized best practices.

3.2. Audit Items

The testing items checked are based on our Smart Contract Security Testing Guide (SCSTG) v1.0 (https://github.com/InspexCo/SCSTG/releases/download/v1.0/SCSTG_v1.0.pdf) which covers most prevalent risks in smart contracts. The latest version of the document can also be found at (https://docs.inspex.co/smart-contract-security-testing-guide/).

The following audit items were checked during the auditing activity:

Testing Category	Testing Items
1. Architecture and Design	1.1. Proper measures should be used to control the modifications of smart contract logic 1.2. The latest stable compiler version should be used 1.3. The circuit breaker mechanism should not prevent users from withdrawing their funds 1.4. The smart contract source code should be publicly available 1.5. State variables should not be unfairly controlled by privileged accounts 1.6. Least privilege principle should be used for the rights of each role
2. Access Control	2.1. Contract self-destruct should not be done by unauthorized actors 2.2. Contract ownership should not be modifiable by unauthorized actors 2.3. Access control should be defined and enforced for each actor roles 2.4. Authentication measures must be able to correctly identify the user 2.5. Smart contract initialization should be done only once by an authorized party 2.6. tx.origin should not be used for authorization
3. Error Handling and Logging	3.1. Function return values should be checked to handle different results 3.2. Privileged functions or modifications of critical states should be logged 3.3. Modifier should not skip function execution without reverting
4. Business Logic	4.1. The business logic implementation should correspond to the business design 4.2. Measures should be implemented to prevent undesired effects from the ordering of transactions 4.3. msg.value should not be used in loop iteration
5. Blockchain Data	5.1. Result from random value generation should not be predictable 5.2. Spot price should not be used as a data source for price oracles 5.3. Timestamp should not be used to execute critical functions 5.4. Plain sensitive data should not be stored on-chain 5.5. Modification of array state should not be done by value 5.6. State variable should not be used without being initialized

Testing Category	Testing Items
6. External Components	6.1. Unknown external components should not be invoked 6.2. Funds should not be approved or transferred to unknown accounts 6.3. Reentrant calling should not negatively affect the contract states 6.4. Vulnerable or outdated components should not be used in the smart contract 6.5. Deprecated components that have no longer been supported should not be used in the smart contract 6.6. Delegatecall should not be used on untrusted contracts
7. Arithmetic	7.1. Values should be checked before performing arithmetic operations to prevent overflows and underflows 7.2. Explicit conversion of types should be checked to prevent unexpected results 7.3. Integer division should not be done before multiplication to prevent loss of precision
8. Denial of Services	8.1. State changing functions that loop over unbounded data structures should not be used 8.2. Unexpected revert should not make the whole smart contract unusable 8.3. Strict equalities should not cause the function to be unusable
9. Best Practices	9.1. State and function visibility should be explicitly labeled 9.2. Token implementation should comply with the standard specification 9.3. Floating pragma version should not be used 9.4. Builtin symbols should not be shadowed 9.5. Functions that are never called internally should not have public visibility 9.6. Assert statement should not be used for validating common conditions

3.3. Risk Rating

OWASP Risk Rating Methodology (https://owasp.org/www-community/OWASP_Risk_Rating_Methodology) is used to determine the severity of each issue with the following criteria:

- **Likelihood**: a measure of how likely this vulnerability is to be uncovered and exploited by an attacker
- **Impact**: a measure of the damage caused by a successful attack

Both likelihood and impact can be categorized into three levels: **Low**, **Medium**, and **High**.

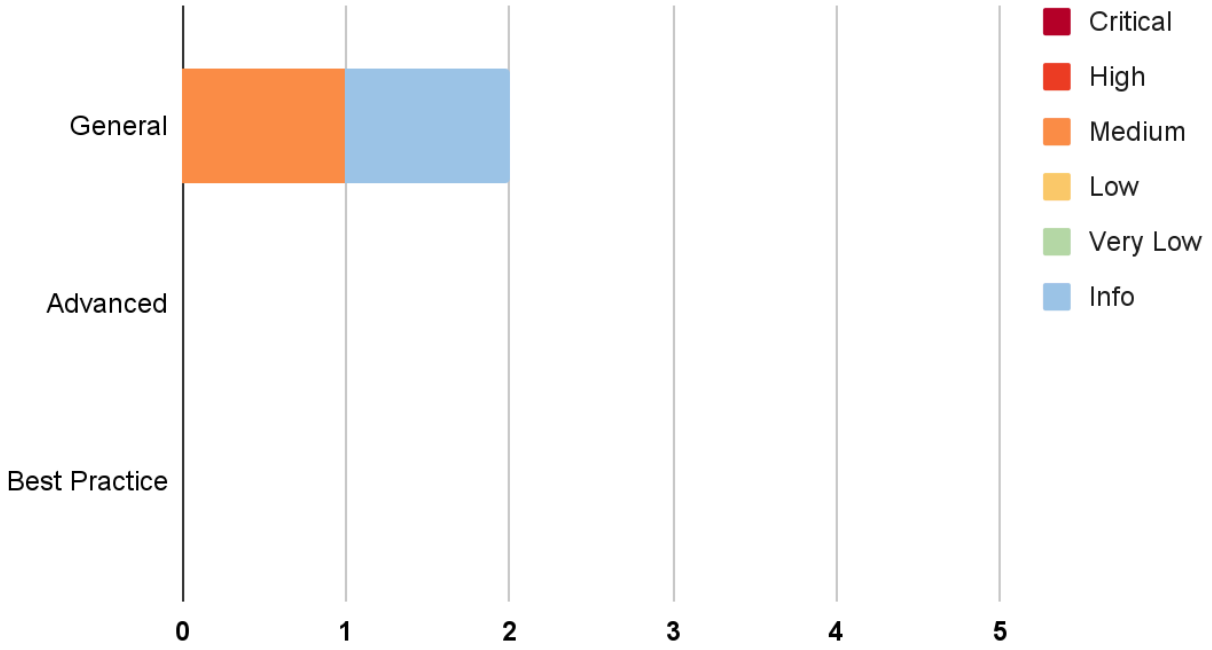
Severity is the overall risk of the issue. It can be categorized into five levels: **Very Low**, **Low**, **Medium**, **High**, and **Critical**. It is calculated from the combination of likelihood and impact factors using the matrix below. The severity of findings with no likelihood or impact would be categorized as **Info**.

Impact \ Likelihood	Low	Medium	High
Low	Very Low	Low	Medium
Medium	Low	Medium	High
High	Medium	High	Critical

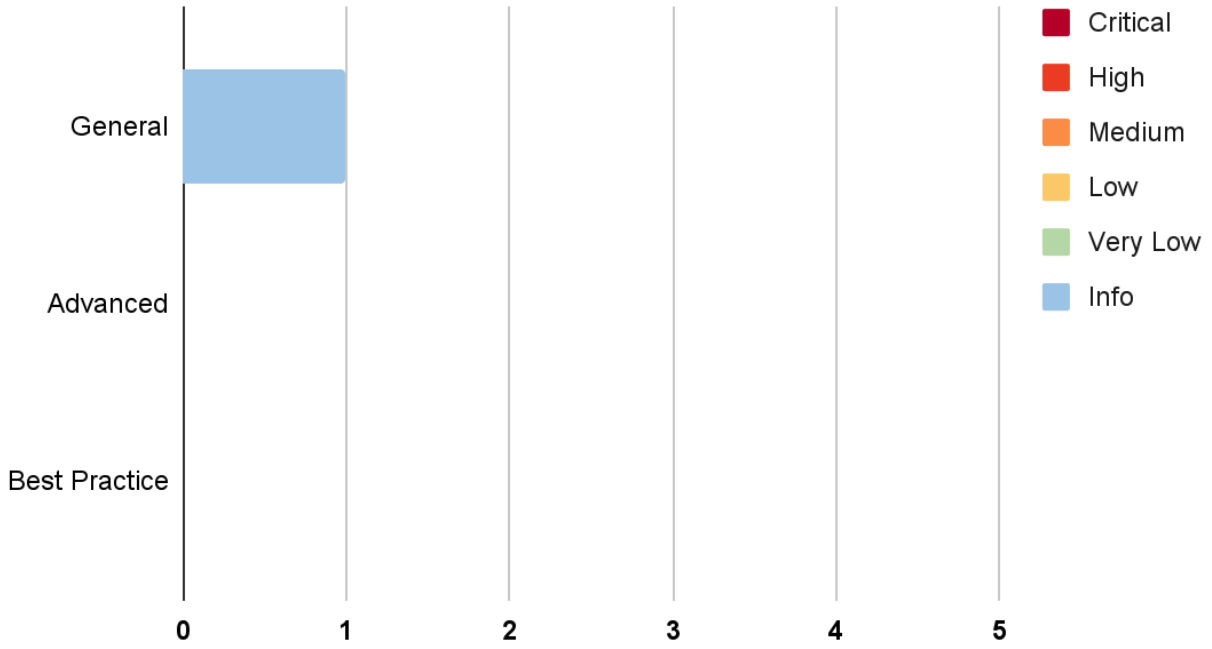
4. Summary of Findings

The following charts show the number of the issues found during the assessment and the issues acknowledged in the reassessment, categorized into three categories: **General**, **Advanced**, and **Best Practice**.

Assessment:



Reassessment:



The statuses of the issues are defined as follows:

Status	Description
Resolved	The issue has been resolved and has no further complications.
Resolved *	The issue has been resolved with mitigations and clarifications. For the clarification or mitigation detail, please refer to Chapter 5.
Acknowledged	The issue's risk has been acknowledged and accepted.
No Security Impact	The best practice recommendation has been acknowledged.

The information and status of each issue can be found in the following table:

ID	Title	Category	Severity	Status
IDX-001	Centralized Authority Control	General	Medium	Resolved *
IDX-002	Outdated Compiler Version	General	Info	No Security Impact

* The mitigations or clarifications by The Issuer and Token X can be found in Chapter 5.

5. Detailed Findings Information

5.1. Centralized Authority Control

ID	IDX-001
Target	InvestmentTokenM
Category	General Smart Contract Vulnerability
CWE	CWE-284: Improper Access Control
Risk	**Severity:** Medium **Impact:** High The controlling authorities have the ability to manipulate critical state variables, altering the contract's behavior and potentially increasing their profits. This manipulation can lead to malfunctions and render the system unreliable, which is unfair to platform users. **Likelihood:** Low The private key of the controlling authorities is unlikely to be compromised. Nevertheless, if it were to be compromised, there are no restrictions preventing unauthorized changes from being made.
Status	Resolved * The TokenX team has mitigated this issue by delegating control to a multi-sig wallet for those privileged functions to ensure that all the critical actions are properly reviewed according to the regulation.

5.1.1. Description

Critical state variables can be updated at any time by the controlling authorities. Changes in these variables can cause impacts to the users, so the users should accept or be notified before these changes are effective.

However, there is currently no mechanism in place to prevent the authorities from altering these variables without notifying the users. In the event that the private key of the controlling authorities is compromised by an attacker, they can manipulate the contract's behavior and profit without any restrictions.

The following table contains all functions that modify critical state variables, potentially impacting the user platform.

File	Contract	Function	Modifier
InvestmentTokenM.sol (L:59)	InvestmentTokenM	setAllowlistRegistry()	onlyOwner
InvestmentTokenM.sol (L:74)	InvestmentTokenM	enableTransferLimitable()	onlyOwner
InvestmentTokenM.sol (L:89)	InvestmentTokenM	disableTransferLimitable()	onlyOwner

File	Contract	Function	Modifier
InvestmentTokenM.sol (L:104)	InvestmentTokenM	setTransferLimit()	onlyOwner
InvestmentTokenM.sol (L:119)	InvestmentTokenM	unsetTransferLimit()	onlyOwner
InvestmentTokenM.sol (L:134)	InvestmentTokenM	increaseTransferLimit()	onlyOwner
InvestmentTokenM.sol (L:149)	InvestmentTokenM	decreaseTransferLimit()	onlyOwner
InvestmentTokenM.sol (L:163)	InvestmentTokenM	mint()	onlyOwner
InvestmentTokenM.sol (L:325)	InvestmentTokenM	adminTransfer()	onlyOwner
InvestmentTokenM.sol (L:338)	InvestmentTokenM	adminBurn()	onlyOwner

5.1.2. Remediation

In the ideal case, the critical state variables should not be modifiable to keep the integrity of the smart contract. However, if modification is needed, Inspex suggests implementing a community-run smart contract governance to control the use of this function.

If removing the function or implementing the smart contract governance is not possible, Inspex suggests mitigating the risk of this issue by using a timelock mechanism to delay the changes for a reasonable amount of time or using the multi-signature contract to reduce the risk of unauthorized or malicious alterations to the smart contract.

5.2. Outdated Compiler Version

ID	IDX-002
Target	InvestmentTokenM ERC20TransferLimitable
Category	General Smart Contract Vulnerability
CWE	CWE-1104: Use of Unmaintained Third Party Components
Risk	**Severity:** Info **Impact: None** **Likelihood: None**
Status	No Security Impact There are no known security issues in Solidity version 0.8.25.

5.2.1. Description

The Solidity compiler versions specified in the smart contracts were outdated (https://docs.soliditylang.org/en/latest/bugs.html). As the compilers are regularly updated with bug fixes and new features, the latest stable compiler version should be used to compile the smart contracts for best practice.

InvestmentTokenM.sol

```
1 // SPDX-License-Identifier: GPL-2.0-or-later
2 // TokenX Contracts v1.0.3 (contracts/InvestmentTokenM.sol)
3 pragma solidity 0.8.25;
```

The following table contains all contracts in which the outdated compiler version is declared.

Contract	Version
InvestmentTokenM	0.8.25
ERC20TransferLimitable	0.8.25

5.2.2. Remediation

Inspex suggests upgrading the Solidity compiler to the latest stable version (https://github.com/ethereum/solidity/releases). At the time of audit, the latest stable version of the Solidity compiler in major 0.8 is 0.8.27.

InvestmentTokenM.sol

```
1 // SPDX-License-Identifier: GPL-2.0-or-later
2 // TokenX Contracts v1.0.3 (contracts/InvestmentTokenM.sol)
3 pragma solidity 0.8.27;
```

6. Appendix

6.1. About Inspex

Inspex is formed by a team of cybersecurity experts highly experienced in various fields of cybersecurity. We provide blockchain and smart contract professional services at the highest quality to enhance the security of our clients and the overall blockchain ecosystem.

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