ST Engineering

DiskCrypt Series
Security Target
Version 0.4

DiskCrypt Series
Security Target
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Chapter 1 – Security Target Introduction

This Security Target (ST) defines the security functionality of the Target of Evaluation (TOE) for the DiskCrypt Series Family.

DiskCrypt Series Family includes:

1. **DiskCrypt M20**

The DiskCrypt M20 comes in a form factor that accommodates SATA M.2 SSD. It comes delivered with internal storage device.

Figure 1 DiskCrypt M20

Description	Part No.
DiskCrypt M20 1TB	9910-2401-099G
DiskCrypt M20 2TB	9910-2401-100G

Table 1. DiskCrypt M20 Product ID

2. **DiskCrypt M200**

   DiskCrypt M200 comes in a form factor that accommodates 2.5 inch SSD. It comes delivered without internal storage device.

Figure 2 DiskCrypt M200

Description	Part No.
DiskCrypt M200	9910-2401-098G

Table 2. DiskCrypt M200 Product ID

1.1 Security Target Reference

ST Title: DiskCrypt Series Security Target

ST Document Version: 0.4

ST Publication Date: 23 June 2025

1.2 TOE Reference

TOE Identification: M331P10J1E1

1.3 TOE Overview

This TOE is a USB data storage encryptor which provides real-time full disk encryption (FDE) for user data stored within its internal storage. The internal storage is out of the TOE scope.

The TOE operates with a paired smart card which stores a smart card keying material (SKM). At the same time, a device keying material (DKM) is stored within the TOE. To access the user data stored within the internal storage, a user must authenticates itself to the smart card using a smart card PIN. After the smart card has successfully authenticated the user, the smart card releases the SKM to the TOE. The SKM and DKM are inputs to the TOE's key derivation function that derives a Data Encryption Key (DEK). The DEK shall then be used for disk encryption/decryption, in turn, the user gains read/write access to the user data stored within the internal storage.

1.3.1 TOE Type

This TOE is a USB data storage encryptor which provides real-time full disk encryption (FDE) for user data stored within its internal storage. The internal storage is out of the TOE scope.

1.3.2 TOE Usage

The TOE has a built-in keypad and smart card reader. It is powered via its USB interface (USB 3.1) by connecting it to a host workstation (USB 3.1/3.0 are supported). The TOE requires users to insert their authorized smart card and input the smart card PIN via the integrated keypad of the TOE to authenticate to the smart card. Upon successful authentication, access to the user data is granted.

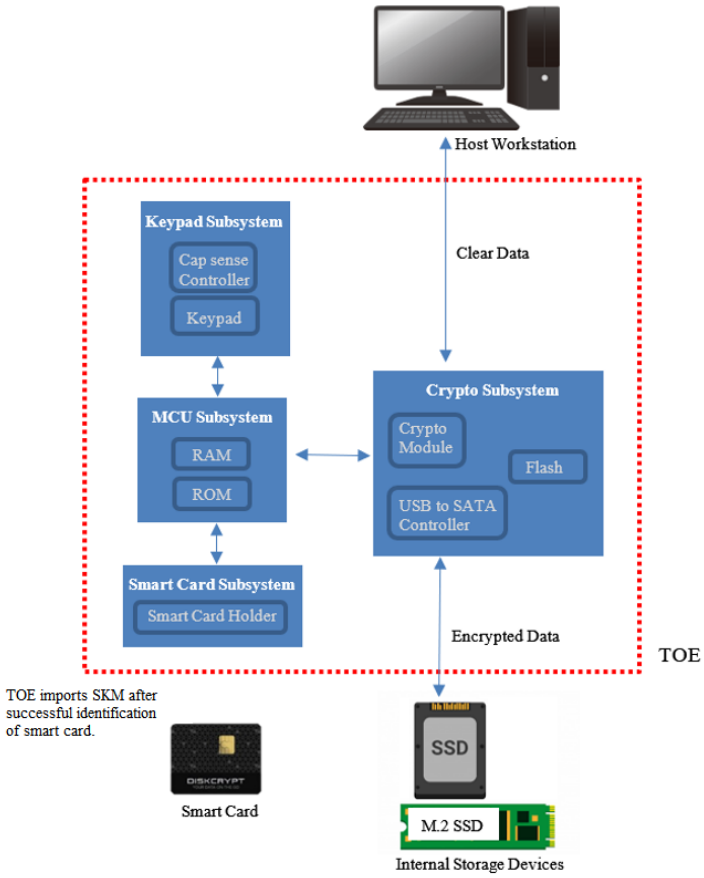

Figure 3 TOE Usage Overview

1.3.3 TOE Security Features

The TOE employs hardware-based full disk encryption using the AES-256 XTS algorithm to encrypt all data stored in the internal storage.

The TOE performs full disk encryption using a Data Encryption key (DEK) derived from 2 separate keying materials. The first keying material, SKM (Smart Card Keying Material), is retrieved from the user's smart card. The second keying material, DKM (Device Keying Material), is injected into the TOE during device setup by the administrator.

The TOE ensures that the DEK, SKM, and Admin PIN are zeroized when no longer used.

The TOE is inbuilt with self-test mechanisms – Power-On-Self-Test (POST) and Known Answer Test (KAT). These self-test mechanisms ensure the integrity and functionality of the TOE.

The TOE provides the following administrative functions:

1) Pairing of smart cards
2) DKM injection (during device setup)
3) Enable/disable smart card lockout mode
4) Changing of Admin PIN

The TOE ensures that usage of the administrative functions requires the Administrator to authenticate to the TOE by inserting the paired smart card and providing the Admin PIN. The TOE will disable the administrative function if there are eight consecutive Administrator authentication failures.

Before the issuance of the TOE and smart card to the end-user, the TOE requires the Administrator to prepare the TOE using the abovementioned administrative functions.

1.3.4 Non-TOE Hardware/Software and Firmware

The following components described are hardware/software for supporting some of the TOE device functionality. These components are not part of the physical TOE for evaluation.

1. **DiskCrypt (DC) Smart Card –** Two types of smart cards are provided: Admin Smart Card and User Smart Card. The Smart Cards are PKCS #11 compliant. The Admin Smart Card stores the DKM, and the User Smart Card stores the SKM. The Admin Smart Card is used to inject the DKM into the TOE during TOE preparation. DKM and SKM are input to the key derivation function for the DEK. The Smart Cards are also used for identification.
2. **DiskCrypt Key Management Software (DMS**) - The smart cards issued along with the DiskCrypt are provisioned by the Administrator using the DiskCrypt Key Management software (DMS). The DMS is an external software application for enterprises to manage their smart cards and SKM for usage with DiskCrypt. Administrators may refer to the DMS Guide for installation and operation guidance.
3. **AWP Manager Software Version** – AWP Manager is a software application used for performing cryptographic modification of smart cards issued with DiskCrypt. It communicates with the smart cards through a PKCS #11 module.
4. **Host Workstation –** The TOE requires a host system that provides a USB interface (USB 3.1/3.0) supporting the USB mass storage device class.
5. **KeyCrypt Token –** Used for 2FA login to the DMS software application.
6. **Internal Storage Device –** 2.5inch SSD (use in DiskCrypt M200 Type C) and M.2 SSD with 2280 form factor (used in DiskCrypt M20).

Chapter 2 TOE Description

2.1 Physical Scope of the TOE

The physical scope of the TOE is defined by the enclosure and hardware components which provide the cryptographic function, authentication mechanism, interfaces for authentication and LED indicators. It does not include the smart card and the internal storage device.

The scope of delivery (of the TOE) is listed as follow**s:**

No.	Delivery Items	Format	Delivery method	Part of TOE
1	TOE	Hardware	In-house delivery – for Singapore delivery Trusted courier – for Overseas delivery	Yes
2	Smart cards (User and Admin)	Hardware		No
3	USB cable	Hardware		No
4	KeyCrypt	Hardware		No
5	Internal Storage Device[1]	Hardware		No
6	DiskCrypt Key Management Software (DMS) Software	MSI stored in CD		No
7	AWP Manager Software	MSI stored in CD		No
8	DiskCrypt Administrator's Guide v1.0.2	PDF stored in CD		Yes
9	DMS Guide v2.4	PDF stored in CD		No
10	AWP Manager Guide v1.5	PDF stored in CD		No
11	DiskCrypt User Manual v1.0.2	PDF	Download via developer's website	Yes

Table 3. Scope of Delivery

The TOE is shipped with a default factory configuration.

[1] DiskCrypt M20 comes delivered with internal storage device. DiskCrypt M200 comes delivered without internal storage device.

2.2 Logical Scope of the TOE

The TOE provides the core security functionalities in the following areas.

2.2.1 Identification

The TOE requires the user to be identified before either access to the administrative functions can be granted or user data can be decrypted.

2.2.2 Authentication

The TOE requires the Administrator to be authenticated before they are allowed to administer the TOE using the administrative functions available in the TOE.

Administrators shall present a paired smartcard and input the correct Admin PIN via the integrated keypad, authenticating to the TOE. During Administrator authentication, a hash of the input Admin PIN is computed and compared with the stored hash value. Upon successful authentication, the administrative function selected will be successfully invoked. The Admin PIN is zeroized upon completion of usage.

2.2.3 Cryptographic Support

User data sent from the host machine via the USB interface will be encrypted and stored in the internal storage. Similarly, all data retrieved from the encrypted storage will be decrypted and sent to the host machine. Data encryption is performed using the DEK (AES-256 XTS algorithm) to provide user data confidentiality.

The DEK is derived from 2 separate keying materials. The first keying material (SKM – Smart card Keying Material) is retrieved from the user's smart card. The second keying material (DKM – Device Keying Material) is injected into the TOE during device setup by the administrator.

The TOE performs Hashing to verify the integrity of TSF data (TOE application, configuration data, DKM and Admin PIN) during POST. The Admin PIN is stored as a hash within the TOE during device setup.

The TOE performs zeroization of SKM and DEK when no longer required.

2.2.4 Security Management

The TOE provides the following administrative functions:

1. Injection of DKM into the TOE during device setup
2. Pairing a user smart card with the TOE
3. Change Admin PIN
4. Enable/disable the smart card lockout mode

2.2.5 Protection of TSF

The TOE implements the Power-On Self-Test (POST) of the Micro Controller Unit (MCU) during the initial start-up to ensure correct functionality. Separately, the TOE implements a Known Answer Test of the cryptographic module upon the cryptographic module's start-up to ensure correct operation.

Chapter 3 – Conformance Claims

The following conformance claims are made for the TOE and ST:

CCv3.1 Rev.5 conformant. The ST and the TOE are Common Criteria conformant to Common Criteria version 3.1 Revision 5.

Part 2 conformant. The ST is Common Criteria Part 2 conformant.

Part 3 conformant. The ST is Common Criteria Part 3 conformant.

Package conformant. The ST is package conformant to the package Evaluation Assurance Level EAL2.

Protection Profile conformant. None**.**

Chapter 4 – Security Problem Definition

4.1 Asset

The TOE is concerned with the protection of the following assets enumerated in the table below.

Identifier	Asset Statement
AST.DATA	Confidential plaintext user data stored in or processed by the TOE.
AST.TSF_DATA	MatchID, DEK, SKM, DKM, Admin PIN and configuration data of the TOE.

Table 4. Assets protected by the TOE

4.2 Threats

The Threats enumerated in the table shown below Table 3 are relevant to the TOE.

Identifier	Threat statement
T.LOGICAL_ ACC	An attacker compromises the confidentiality of AST.DATA or gain unauthorized access to AST.TSF_DATA by applying logical attack on the TOE.
T.PHYSICAL_ACC	An attacker compromises the confidentiality of AST.DATA or gain unauthorized access to AST.TSF_DATA by applying physical attack on the TOE.
T.MALFUNCTION	An attacker may use a malfunction of the TOE to deactivate, modify, or circumvent security functions of the TOE to enable attacks against the confidentiality of AST.DATA or gain unauthorized access to AST.TSF_DATA.

Table 5. Threat Statements

4.3 Organizational Security Policies

No organizational security policy is defined for the TOE.

4.4 Assumptions

This section lists the security-related assumption for the environment in which the TOE is to be used. It can be considered a set of rules for the TOE operator.

A.TRUSTED_USER	Users of the TOE are able to operate the TOE in a secure manner in accordance to the user guidance documentation.
A.ADMIN	Administrator of the TOE is trusted, well-trained and adheres to all guidance documentation provided.
A.SMARTCARD	The smartcard used together with the TOE must conform to the following: • Secure Signature Creation Device Protection Profile Type 2 v1.04, EAL 4+ • Secure Signature Creation Device Protection Profile Type 3 v1.05, EAL 4+

Table 6. Assumptions

Chapter 5 –Security Objectives

This Chapter identifies the security objectives of the TOE and the IT Environment. The security objectives identify the responsibilities of the TOE and the TOE's IT environment in meeting the security needs.

5.1 Security Objectives for the TOE

Security objectives for the TOE are enumerated in the table below.

Identifier	Objective Statement
O.DATA_ACC	Access to user data is only granted to identified users.
O.ADMIN_ACC	Access to administrative functions and TSF data is only granted to legitimate administrators.
O.TOE_INTEGRITY	The security state of the TOE, including TSF data stored persistently on the TOE, is protected against unauthorized modification, and can only be altered by authorized and authenticated parties.
O.ENCRYPT	User data stored in the internal storage is encrypted, providing confidentiality protection in the event of physical and logical attacks on the TOE.

Table 7. Security Objectives for the TOE

5.2 Security Objectives for the Operational Environment

Identifier	Objective Statement
OE.TRUSTED_USER	The TOE users must operate the TOE in accordance to the user guidance documentation.
OE.ADMIN	Administrator of the TOE must administer the TOE by the admin guidance documentation.
OE.SMARTCARD	The smartcard used together with the TOE must conform to the following: • Secure Signature Creation Device Protection Profile Type 2 v1.04, EAL 4+ • Secure Signature Creation Device Protection Profile Type 3 v1.05, EAL 4+

Table 8. Security Objectives for the Operational Environment

5.3 Security Objective Rationale

Threat/Assumption	Objective	Rationale
T.LOGICAL_ACC	O.DATA_ACC O.ADMIN_ACC O.ENCRYPT OE.SMARTCARD	O.DATA_ACC ensures that only identified users are allowed to access the user data. O.ADMIN_ACC ensures that only authorized administrators are allowed to access the TOE's administrative functions and TSF data. O.ENCRYPT ensures that user data are encrypted and prevents unauthorized access to user data. O.DATA_ACC, O.ADMIN_ACC, and O.ENCRYPT make use of OE.SMARTCARD for user identification and storage of SKM.
T.MALFUNCTION	O.TOE_INTEGRITY	O.TOE_INTEGRITY requires the TOE to perform self-tests to ensure that the TOE is functional that and TSF data is not modified. If the self-test fails, the TOE shall preserve a secure state (non-operational).
T.PHYSICAL_ACC	O.ENCRYPT OE.TRUSTED_USER O.TOE_INTEGRITY	O.ENCRYPT ensures that user data are encrypted prior to storage in the internal storage device, hence preventing adversaries from compromising the confidentiality of user data in the event that the TOE is physically compromised. O.TOE_INTERGRITY ensures that the TSF and TSF data are protected against unauthorised modification. OE.TRUSTED_USER ensures user will not leave the TOE unattended, hence reducing risk of physical attack.
A.TRUSTED_USER	OE.TRUSTED_USER	OE.TRUSTED_USER ensures that users practice proper usage procedures in accordance to the user guidance documentation
A.ADMIN	OE.ADMIN	OE.ADMIN ensures that administrative personnel will administer the TOE according to the admin guidance documentation.
A.SMARTCARD	OE.SMARTCARD	OE.SMARTCARD directly upholds A.SMARTCARD.

Table 9. Security Objective Rationale

Chapter 6 – Extended Components Definition

There are no extended components applicable to the TOE, hence none of the requirements for the Extended Components Definition (ASE_ECD) applies to this ST.

Chapter 7 – IT Security Requirements

This section identifies the Security Functional Requirements for the TOE. The Security Functional Requirements included in this section are derived from Part 2 of the Common Criteria for Information Technology Security Evaluation, Version 3.1, Revision 5, dated: April 2017 and all international interpretations.

7.1 Conventions

The CC defines operations on Security Functional Requirements: assignments, selections, assignments within selections and refinements. This document uses the following font conventions to identify the operations defined by the CC:

- Assignment: Indicated with ***bold italicized*** text.
- Refinement: Indicated with **bold** text.
- Selection: Indicated with *italicized* text.
- Iteration: Indicated by appending the iteration symbol.

  e.g., FCS_COP.1/AES, FCS_COP.1/Hash

7.2 Security Functional Requirements

7.2.1 Class FIA: Identification and Authentication

7.2.1.1 FIA_UID.2 User identification before any action

Hierarchical to:	FIA_UID.1 Timing of identification
Dependencies:	No dependencies.
FIA_UID.2.1	The TSF shall require each user to be successfully identified before allowing any other TSF-mediated actions on behalf of that user.

7.2.1.2 FIA_UAU.2 User authentication before any action

Hierarchical to:	FIA_UAU.1 Timing of authentication
Dependencies:	FIA_UID.1 Timing of identification
FIA_UAU.2.1	The TSF shall require each user to be successfully authenticated before allowing any other TSF-mediated actions on behalf of that user.

7.2.1.3 FIA_SOS.1 Verification of secrets

Hierarchical to:	No other components.
Dependencies:	No dependencies
FIA_SOS.1.1	The TSF shall provide a mechanism to verify that secrets meet ***the requirements where the PIN entered through the Keypad must be 8 digits in length.*** **Application Note:** Applicable to the authentication of the Administrator.

7.2.1.4 FIA_AFL.1 Authentication failure handling

Hierarchical to:	No other components.
Dependencies:	FIA_UAU.1 Timing of authentication.
FIA_AFL.1.1	The TSF shall detect when ***8 (eight)*** unsuccessful authentication attempts occur related ***to the authentication of the Administrator.***
FIA_AFL.1.2	When the defined number of unsuccessful authentication attempts has been *met*, the TSF shall ***disable all future access to administrative functions of the TOE***. **Application note**: In the case when TOE's administrative function is disabled, the TOE's encryption/decryption of user data as enforced by FCS_COP.1/AES remains functional. To recover the administrative function, a TOE user is required to return the TOE to the developer to re-flash its firmware.

7.2.2 Class FCS: Cryptographic support

7.2.2.1 FCS_CKM.1 Cryptographic key generation

Hierarchical to:	No other components.
Dependencies:	[FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction
FCS_CKM.1.1	The TSF shall generate **DEK** by a specified cryptographic key generation algorithm ***XOR*** and specified cryptographic key sizes **512 bits** that meet the following: ***none***
	Application Note: Applicable to FCS_COP.1/AES

7.2.2.2 FCS_CKM.4/MCU Cryptographic Key Destruction

Hierarchical to:	No other components.
Dependencies:	[FDP_ITC.1 Import of user data without security attributes, or FDP_ITC.2 Import of user data with security attributes, or FCS_CKM.1 Cryptographic key generation]
FCS_CKM.4.1/MCU	The TSF shall destroy cryptographic keys by a specified cryptographic key destruction method with ***7 rounds of zeroization*** that meets the following ***none***
	Application Note: Applicable to zeroization of DEK from MCU.

7.2.2.3 FCS_CKM.4/Crypto Cryptographic Key Destruction

Hierarchical to:	No other components.
Dependencies:	[FDP_ITC.1 Import of user data without security attributes, or FDP_ITC.2 Import of user data with security attributes, or FCS_CKM.1 Cryptographic key generation]
FCS_CKM.4.1/Crypto	the TSF shall destroy cryptographic keys by a specified cryptographic key destruction method ***writing zero to the specific memory location*** that meets the following ***none.***
	Application Note*:* Applicable to zeroization of DEK from the Cryptographic module.

7.2.2.4 FCS_COP.1/AES - Cryptographic operation

Hierarchical to:	No other components.
Dependencies:	[FDP_ITC.1 Import of user data without security attributes, or FDP_ITC.2 Import of user data with security attributes, or FCS_CKM.1 Cryptographic key generation] FCS_CKM.4 Cryptographic key destruction
FCS_COP.1.1/AES	The TSF shall perform ***data encryption and decryption*** by a specified cryptographic algorithm ***AES 256 XTS mode*** and cryptographic key sizes ***512 bits*** that meet the following: ***IEEE P1619-2018 Standard.***

7.2.2.5 FCS_COP.1/Hash - Cryptographic operation

Hierarchical to:	No other components.
Dependencies:	[FDP_ITC.1 Import of user data without security attributes, or FDP_ITC.2 Import of user data with security attributes, or FCS_CKM.1 Cryptographic key generation] FCS_CKM.4 Cryptographic key destruction
FCS_COP.1.1/Hash	The TSF shall perform ***cryptographic hashing*** by a specified cryptographic algorithm ***SHA-256*** and **message digest** sizes ***256 bits*** that meet the following: ***FIPS PUB 180-4, "Secure Hash Standard".*** **Application note:** SHA-256 was used for Integrity check during POST and Admin PIN verification.

7.2.3 Class FDP: User Data Protection

7.2.3.1 FDP_RIP.1 Subset residual information protection

Hierarchical to: No other components.

Dependencies: No dependencies.

FDP_RIP.1.1 The TSF shall ensure that any previous information content of a resource is made unavailable upon the *deallocation of the resource from* the following objects: ***Admin PIN, SKM.***

7.2.3.2 FDP_ACF.1 Security attribute-based access control

Hierarchical to: No other components.

Dependencies: FDP_ACC.1 Subset access control
FMT_MSA.3 Static attribute initialisation

FDP_ACF.1.1 The TSF shall enforce the ***role-based SFP*** **to** objects based on the following:

Subjects	***All subjects acting on behalf of users***
Objects	***User data***
Security Attributes	***MatchID, smartcard VERIFY PIN response, SKM***

FDP_ACF.1.2 The TSF shall enforce the following rules to determine if an operation among controlled subjects and controlled objects is allowed:

- ***Subject with the role "Identified User" is allowed to encrypt and decrypt (based on FCS_COP.1/AES) user data.***
- ***Subject with the role "Identified User" is allowed to import SKM into the TOE***

FDP_ACF.1.3 The TSF shall explicitly authorize access of subjects to objects based on the following additional rules: ***none***

FDP_ACF.1.4 The TSF shall explicitly deny access of subjects to objects based on the following additional rules:

- ***POST Failure***
- ***KAT Failure***

7.2.3.3 FDP_ACC.1 Subset access control

Hierarchical to: No other components.

Dependencies: FDP_ACF.1 Security attribute-based access control

FDP_ACC.1.1 The TSF shall enforce the ***role-based SFP*** on**:**

Subjects	***All subjects acting on behalf of users***
Objects	***User data***
Operations	***Encryption & Decryption***

7.2.4 Class FMT: Security management

7.2.4.1 FMT_SMR.1 Security roles

Hierarchical to:	No other components.
Dependencies:	FIA_UID.1 Timing of identification.
FMT_SMR.1.1	The TSF shall maintain the roles, ***Unidentified user, Identified user, Administrators***
FMT_SMR.1.2	The TSF shall be able to associate users with roles.

7.2.4.2 FMT_SMF.1 Specification of Management Functions

Hierarchical to:	No other components.
Dependencies:	No dependencies
FMT_SMF.1.1	The TSF shall be capable of performing the following management functions: ***1) Enable/disable the smartcard lockout mode.*** ***2) Change Admin PIN***

7.2.4.3 FMT_MOF.1 Management of security functions behaviour

Hierarchical to:	No other components.
Dependencies:	FMT_SMR.1 Security roles FMT_SMF.1 Specification of Management Functions
FMT_MOF.1.1	The TSF shall restrict the ability to *disable, enable* the function of ***lockout mode*** to ***Administrator.***

7.2.4.4 FMT_MTD.1 Management of TSF data

Hierarchical to:	No other components.
Dependencies:	FMT_SMR.1 Security roles FMT_SMF.1 Specification of Management Functions
FMT_MTD.1.1	The TSF shall restrict the ability to *change_default, modify* the ***Admin PIN, DKM, and MatchID*** to ***Administrator***.

7.2.4.5 FMT_MSA.1 Management of security attributes

Hierarchical to:	No other components.
Dependencies:	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] FMT_SMR.1 Security roles FMT_SMF.1 Specification of Management Functions
FMT_MSA.1.1	The TSF shall enforce the ***role-based SFP*** to restrict the ability to *modify* the security attributes from ***Role*** to ***None.***

Application note: Roles are pre-programmed into the TOE and not modifiable

7.2.4.6 FMT_MSA.3 Static attribute initialisation

Hierarchical to:	No other components.
Dependencies:	FMT_MSA.1 Management of security attributes FMT_SMR.1 Security roles
FMT_MSA.3.1	The TSF shall enforce the ***role-based SFP*** to provide *restrictive* default values for security attributes that are used to enforce the SFP.
FMT_MSA.3.2	The TSF shall allow the ***None*** to specify alternative initial values to override the default values when an object or information is created.

7.2.5 Class FPT: Protection of the TSF

7.2.5.1 FPT_FLS.1 Failure with preservation of secure state

Hierarchical to:	No other components.
Dependencies:	No dependencies.
FPT_FLS.1.1	The TSF shall preserve a secure state when the following types of failures occur ***failure of self-test as defined in FPT_TST.1)***

7.2.5.2 FPT_TST.1 TSF Testing

Hierarchical to:	No other components.
Dependencies:	No dependencies.
FPT_TST.1.1	The TSF shall run a suite of self-tests *during the initial start-up* to demonstrate the correct operation of ***the TSF.***
FPT_TST.1.2	The TSF shall provide authorised users with the capability to verify the integrity of ***none.***
FPT_TST.1.3	The TSF shall provide authorised users with the capability to verify the integrity of ***none***

7.3 Security Requirement Dependency Rationale

SFR	Dependency	Fulfilment
FIA_UID.2	No dependencies	-
FIA_UAU.2	FIA_UID.1	FIA_UID.2
FIA_SOS.1	No dependencies	-
FIA_AFL.1	FIA_UAU.1	FIA_UAU.2
FCS_CKM.1	[FCS_CKM.2 or FCS_COP.1] FCS_CKM.4	FCS_COP.1/AES FCS_CKM.4/MCU, FCS_CKM.4/Crypto
FCS_CKM.4/MCU	FDP_ITC.1 or FDP_ITC.2 or FCS_CKM.1	FCS_CKM.1
FCS_CKM.4/Crypto	FDP_ITC.1 or FDP_ITC.2 or FCS_CKM.1	FCS_CKM.1
FCS_COP.1/AES	[FDP_ITC.1 or FDP_ITC.2 or FCS_CKM.1] FCS_CKM.4	FCS_CKM.1 FCS_CKM.4/MCU, FCS_CKM.4/Crypto
FCS_COP.1/Hash	[FDP_ITC.1 or FDP_ITC.2 or FCS_CKM.1] FCS_CKM.4	Keys are not required for hashing.
FDP_RIP.1	No dependencies	-
FDP_ACF.1	FDP_ACC.1 FMT_MSA.3	FDP_ACC.1 FMT_MSA.3
FDP_ACC.1	FDP_ACF.1	FDP_ACF.1
FMT_SMR.1	FIA_UID.1	FIA_UID.2
FMT_SMF.1	No dependencies	-
FMT_MOF.1	FMT_SMR.1 FMT_SMF.1	FMT_SMR.1 FMT_SMF.1
FMT_MTD.1	FMT_SMR.1 FMT_SMF.1	FMT_SMR.1 FMT_SMF.1

SFR	Dependency	Fulfilment
FMT_MSA.1	[FDP_ACC.1 or FDP_IFC.1] FMT_SMR.1 FMT_SMF.1	FDP_ACC.1 FMT_SMR.1 FMT_SMF.1
FMT_MSA.3	FMT_MSA.1 FMT_SMR.1	FMT_MSA.1 FMT_SMR.1
FPT_FLS.1	No dependencies	-
FPT_TST.1	No dependencies	-

Table 10. Security Requirement Dependency Rationale

7.4 Security Functional Requirements Rationale

SFR	O.DATA_ACC	O.ADMIN_ACC	O.TOE_INTEGRITY	O.ENCRYPT
FIA_UID.2	X	X		
FIA_UAU.2		X		
FIA_SOS.1		X		
FIA_AFL.1		X		
FCS_CKM.1				X
FCS_CKM.4/MCU				X
FCS_CKM.4/Crypto				X
FCS_COP.1/AES	X			X
FCS_COP.1/Hash		X	X	
FDP_RIP.1	X	X		
FDP_ACF.1	X			
FDP_ACC.1	X			
FMT_SMR.1	X	X		
FMT_SMF.1		X		
FMT_MOF.1		X		
FMT_MTD.1		X		
FMT_MSA.1	X	X		
FMT_MSA.3		X		
FPT_FLS.1			X	X
FPT_TST.1			X	X

Table 11. Security Requirements to Security Objective Mapping

The security objective of the SFR mapping rationale is summarized in the table below.

Security objective	SFR Mapping	Rationale
O.DATA_ACC	FIA_UID.2	This requirement helps meet the objective by ensuring only the legitimate user can access the user data in the internal storage.
	FCS_COP.1/AES	This requirement helps meet the objective by ensuring that user data is encrypted in the internal storage and only accessible by the legitimate user.
	FDP_RIP.1	This requirement helps meet the objective by ensuring that SKM is zeroized from the TOE after use.
	FDP_ACF.1	This requirement helps meet the objective by ensuring that the Subject with the role "Identified User" is allowed to encrypt and decrypt (based on FCS_COP.1/AES) user data and import SKM into the TOE.
	FDP_ACC.1	
	FMT_SMR.1	This requirement helps meet the objective by ensuring only legitimate smartcards can access the user data.
	FMT_MSA.1	This requirement helps meet the objective by ensuring that no users can modify the security attribute: Role.
O.ADMIN_ACC	FIA_UID.2	This requirement helps meet the objective by ensuring that access to the TOE's administrative functions is granted only upon the insertion of a paired smartcard.
	FIA_UAU.2	This requirement helps meet the objective by ensuring that only authenticated Administrators can access the TOE's administrative functions.
	FIA_SOS.1	This requirement helps meet the objective by ensuring that the Admin PIN is 8 digits in length.

Security objective	SFR Mapping	Rationale
	FIA_AFL.1	This requirement helps meet the objective by ensuring that access to administrative functions will be made unavailable upon 8 unsuccessful authentication attempts.
	FCS_COP.1/Hash	This requirement helps meet the objective by ensuring that the Admin PIN is stored as a hash using SHA-256.
	FDP_RIP.1	This requirement helps meet the objective by ensuring that Admin PIN is zeroized from TOE.
	FMT_MTD.1	This requirement helps meet the objective by ensuring that only the Administrator can access the TSF data on the TOE.
	FMT_SMF.1	This requirement helps meet the objective by providing administrative functions for the management of the TOE.
	FMT_SMR.1	This requirement helps meet the objective by ensuring only legitimate Administrators can access the administrative functions.
	FMT.MOF.1	This requirement helps meet the objective by ensuring that only authenticated Administrators can access the administrative functions.
	FMT.MSA.1	This requirement helps meet the objective by ensuring that only legitimate administrators can modify the security attribute: Role.
	FMT.MSA.3	This requirement helps meet the objective by ensuring that no one shall be able to define initial restrictive values for the security attribute: Role.
O.TOE_INTEGRITY	FCS_COP.1/Hash	This requirement ensures the integrity of the TOE configuration through the use of SHA-256 hash

Security objective	SFR Mapping	Rationale
	FPT_FLS.1	This requirement helps meet the objective by ensuring that the TOE will enter a "halt" state with secret parameters zeroized when the integrity of the TOE is deemed compromised or at risk (e.g., POST failure).
	FPT_TST.1	This requirement helps meet the objective by ensuring that the TOE will self-test to ensure that the TOE can operate correctly and that the integrity of internal application data and TSF data stored persistently in the TOE is intact.
O.ENCRYPT	FCS_CKM.1	This requirement provides the key derivation function for the encryption key that is utilised in FCS_COP.1/AES.
	FCS.CKM.4/MCU	This requirement helps meet the objective by ensuring that the DEK is zeroized from the MCU memory. E.g., upon removal of the smartcard when lockout mode is enabled. This is to minimize any possible compromise of the DEK.
	FCS_CKM.4/Crypto	This requirement helps meet the objective by ensuring that the DEK is zeroized from the Cryptographic Module memory. E.g., upon removal of the smartcard when lockout mode is enabled. This is to minimize any possible compromise of the DEK.
	FCS_COP.1/AES	This requirement helps meet the objective by ensuring that all user data are encrypted using the AES-256 XTS algorithm.
	FPT_FLS.1	This requirement helps meet the objective by ensuring that in the event of a malfunction of the Cryptographic module which performs the full disk encryption, the TOE will enter a "halt" state with secret parameters zeroized when the integrity of the device is deemed compromised or at risk (e.g., KAT failure).

Security objective	SFR Mapping	Rationale
	FPT_TST.1	This requirement helps meet the objective by ensuring that the cryptographic function of the TOE which performs the full disk encryption is functional and unaltered.

Table 12. Security Objective to SFR mapping Rationale

7.5 Security Assurance Requirements

The security assurance requirements for the TOE are the Evaluation Assurance Level 2 components, as specified in (CC) part 3. No operations are applied to the assurance components.

The assurance components are summarised in the table below.

Assurance Class	Assurance components
ADV: Development	ADV_ARC.1 Security architecture description
	ADV_FSP.2 Security-enforcing functional specification
	ADV_TDS.1 Basic design
AGD: Guidance documents	AGD_OPE.1 Operational user guidance
	AGD_PRE.1 Preparative procedures
ALC: Life-cycle support	ALC_CMC.2 Use of a CM system
	ALC_CMS.2 Parts of the TOE CM coverage
	ALC_DEL.1 Delivery procedures
ASE: Security Target evaluation	ASE_CCL.1 Conformance claims
	ASE_ECD.1 Extended components definition
	ASE_INT.1 ST introduction
	ASE_OBJ.2 Security objectives
	ASE_REQ.2 Derived security requirements
	ASE_SPD.1 Security problem definition
	ASE_TSS.1 TOE summary specification
ATE: Tests	ATE_COV.1 Evidence of Coverage
	ATE_FUN.1 Functional testing
	ATE_IND.2 Independent testing - sample
AVA: Vulnerability assessment	AVA_VAN.2 Vulnerability analysis

Table 13. Assurance Components

7.6 Security Assurance Requirement Rationale

The evaluation assurance package selected for the evaluation of the TOE is Evaluation Assurance Level 2 (EAL2). EAL2 was chosen to provide a low to moderate level of assurance that is consistent with commercial products of this sort. The chosen assurance level is appropriate for the threats defined for the environment (limited interface and access to the TOE).

Chapter 8 – TOE Summary Specification

This section summarizes the Security Functions of the TOE (TSF) - a high-level description of how the TOE implements the claimed security functional requirements.

8.1 SF1 – Identification and Authentication

The default state upon the powering up of the TOE provides access only to the **identification** and **authentication** mechanism.

Identification

Each smartcard is paired to a TOE by a "MatchID". The MatchID is required for both User and Administrator access. The MatchID of the smartcard is verified against the MatchID stored in the TOE.

Users are first required to insert a paired smartcard containing the correct SKM. Upon successful identification of the smartcard (MatchID) and, subsequently, successful authentication by the smartcard, the SKM will be allowed to be imported by the TOE allowing decryption of the data (Master Boot Record, file allocation table, etc) to enable access to the user data that is encrypted in the internal storage. If an unpaired smartcard is inserted, no access to the decryption/encryption function is allowed.

Authentication

Administrators, similarly, are required to insert a paired smartcard and authenticate successfully to the TOE to successfully invoke any Admin function (modification of: Admin PIN, lockout mode - DKM, MatchID) of the TOE. The administrator is required to enter an 8-digit PIN to authenticate to the TOE. The TOE maintains a counter of the number of failed consecutive Admin authentication attempts. All-access to administrative functions will be blocked after 8 consecutive wrong PIN entries. In the event, that an unpaired smartcard is inserted, only access to the Admin functions: initialize smartcard shall be allowed upon successful authentication.

The TOE is also designed with a "lockout mode" feature. If lockout mode is enabled, the TOE shall automatically zeroize the DEK whenever the smartcard is removed. This would require users to re-perform the authentication process to gain user access.

This TSF is mapped to the following SFRs: FIA_UID.2, FIA_UAU.2, FIA_AFL.1, FDP_ACC.1, FDP_ACF.1, FMT_MSA.1, FMT_MSA.3, FMT_SMR.1, FIA_SOS.1

8.2 SF2 – Cryptographic Support

The TOE provides cryptographic functions such as symmetric data encryption/decryption and integrity verification using secure hashing.

The SKM retrieved from the inserted smartcard and the DKM that is stored in the TOE are used as inputs to a key derivation function to generate the DEK. The DEK is then loaded into the cryptographic module of the TOE where the MBR or file allocation table will be decrypted and sent to the host PC; thereafter user may access the encrypted data stored in the internal storage of the TOE.

The TOE's cryptographic module utilizes the DEK to perform real-time data encryption when data is transferred from the host machine to internal storage and vice versa. Encryption and decryption of user data are performed by the cryptographic algorithm AES-256 XTS mode.

This TSF is mapped to the following SFRs: FCS_COP.1/AES, FCS_COP.1/Hash, FCS_CKM.1

8.3 SF3 – Security Management

The TOE shall provide the following administrative functions to the Administrator:

1) Pairing of the legitimate smartcard to TOE
2) Enable/disable the smartcard lockout mode.
3) Change Admin PIN.
4) DKM injection (device setup)

Option 1: enables the Administrator to pair a smartcard with a TOE using the smartcard's MatchID attribute. The smartcard's MatchID is stored in the TOE.

Option 2: enables the Administrator to enable/disable the lockout mode (enabled by default). When lockout mode is enabled, the TOE will enter an unauthenticated state whenever the smartcard is removed from the TOE.

Option 3: enables the Administrator to change the Admin PIN. The Admin PIN must be 8 digits in length and will be stored as a hash (SHA-256) within the TOE.

Option 4: enables the Administrator to inject the DKM (from the Administrator smartcard) into the TOE during device setup.

The TOE enters a "**halt**" state upon the successful invocation of each of the four administrative functions. The Administrator is required to power cycle the TOE and authenticate again should they want to invoke any of the administrative functions again.

This TSF is mapped to the following SFRs: FIA_UID.2, FIA_UAU.2, FIA_SOS.1, FCS_COP.1/Hash, FMT_SMR.1, FMT_SMF.1, FMT_MOF.1, FMT_MSA.1, FMT_MSA.3, FMT_MTD.1, FDP_ACC.1, FDP_ACF.1

8.4 SF4 – Protection of the TSF

The TOE is designed with protection and detection mechanisms to prevent and detect possible malfunction or compromised TSF/TSF data.

After the DEK is derived from the SKM and DKM, the TOE transfers the DEK to the cryptographic module and performs the zeroization of the SKM and the DEK from the MCU's memory.

The TOE performs zeroization of the Admin PIN upon completion of usage.

The "lockout mode" feature forces the TOE to automatically zeroize the DEK whenever the smartcard is removed from the TOE..

The TOE performs a POST upon every power-up to perform integrity checks on the MCU, a critical subsystem of the TOE.
In the event of any POST failure, the TOE will enter a "halt" state. POST includes the following tests:

1) LED Display Test
2) Memory Read/Write Test (includes MCU's internal RAM)

3) ROM (EEPROM) Integrity Check
4) SHA-256 Hash Check

The cryptographic module conducts a Known Answer Test whenever it is enabled. The TOE performs zeroization of all parameters (e.g., DEK) upon failure of the KAT.

In the event of failure of any of the above self-tests, the TOE enters a “halt” and secure state, and the “ERROR” LED will be lighted up. In this state, the TOE is non-operational.

This TSF is mapped to the following SFRs: FCS_CKM.4/MCU, FCS_CKM.4/Crypto, FCS_COP.1/Hash, FDP_RIP.1, FPT_TST.1, FPT_FLS.1.

8.5 TOE Summary SFR to TSF mapping

SFR	Security Functions
FIA_UAU.2	SF1, SF3
FIA_UID.2	SF1, SF3
FIA_SOS.1	SF3
FIA_AFL.1	SF1
FCS_CKM.1	SF2
FCS_CKM.4/MCU	SF4
FCS_CKM.4/Crypto	SF4
FCS_COP.1/AES	SF2
FCS_COP.1/Hash	SF2, SF3, SF4
FDP_RIP.1	SF4
FDP_ACF.1	SF1, SF3
FDP_ACC.1	SF1, SF3
FMT_SMR.1	SF1, SF3
FMT_SMF.1	SF3
FMT.MOF.1	SF3
FMT.MSA.1	SF1, SF3
FMT.MSA.3	SF1, SF3
FMT_MTD.1	SF3
FPT_FLS.1	SF4
FPT_TST.1	SF4

Table 14. SFR to Security Functions mapping