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bioCLASS®

**Field Enroller Template
Storage Location Details**

APPLICATION NOTES – AN0123

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Introduction

The bioCLASS Field Enroller captures fingerprint templates from a fingerprint sensor on the unit. Then, written are the fingerprint templates to an iCLASS 13.56MHz smart card. Because of the expansive memory of an iCLASS smart card, the location where the bioCLASS Field Enroller writes templates is configurable. This document covers the setup details of template storage location for the bioCLASS Field Enroller.

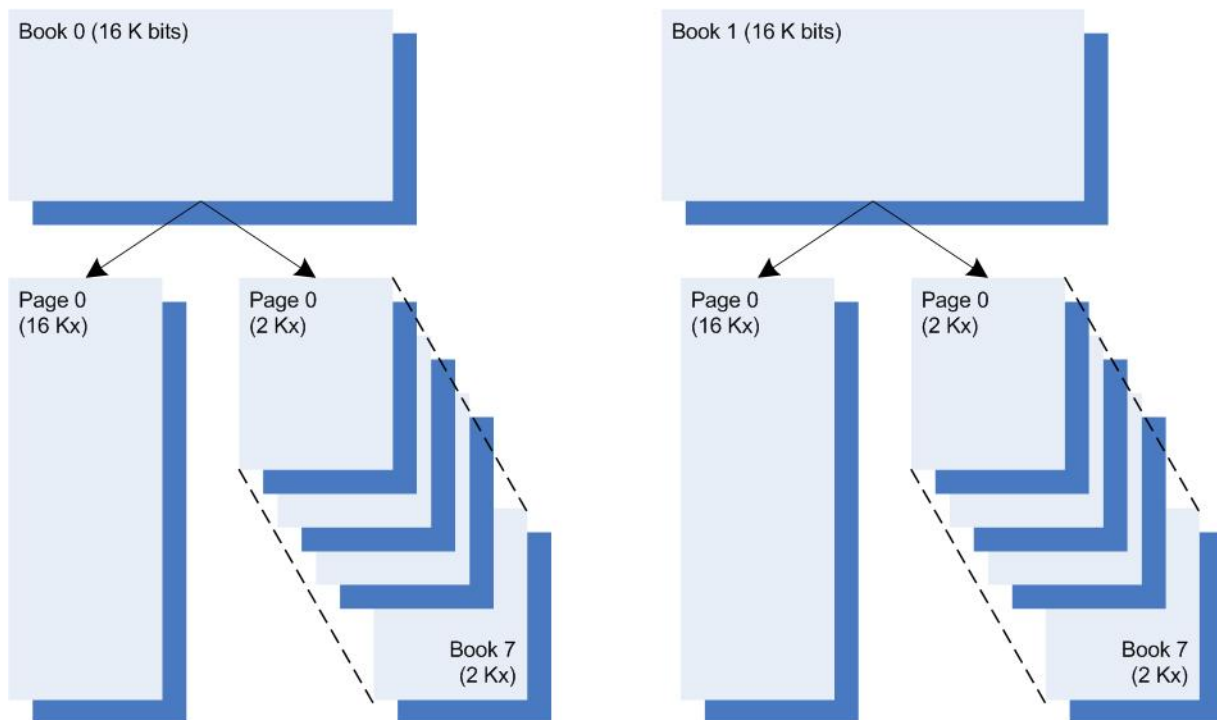
iCLASS Memory Card Structure

iCLASS cards come in three sizes, 2Kbit, 16Kbit and 32Kbit. The bioCLASS readers require, at a minimum, 16K iCLASS cards. The 16K card contains one book (1 x 16K of memory,) where the 32K card contains two books (2 x 16K of memory). Within each book, pages exist.

Divide the book into one of two configurations:

- 16K/2 that containing one page
- 16K/16 that contains eight pages

The following graphic depicts the configuration of a 32K card containing two books. Each book contains either one or eight pages.





Typically configured into each page are two application areas. Thus, a 16K/2 book typically contains two application areas, and a 16K/16 book contains 16 application areas. Stored is the fingerprint template within the application areas (blocks 6 thru 31). See the following example.

Example: Memory for iCLASS

- ✓ Located to the right is *One Page*
- ✓ Within the *Page* exists:
 - ✓ One *Header* (Blocks 0-5)
 - ✓ Two *Application Areas*

- ✓ Within Each *Application Area* exists:
 - ✓ Thirteen *Blocks* of data

- ✓ Within Each *Block* of data exists:
 - ✓ Eight *Bytes* of data

- ✓ 1 Block = 8 Bytes = 64 Bits
- ✓ 13 Blocks = 104 Bytes = 832 Bits (App)
- ✓ 26 Blocks = 208 Bytes = 1664 Bits (Page)
- ✓ 16K/16 = 8 Pg * 208 Bytes = 1664 Bytes
- ✓ 16K/2 = 1 Pg * 237 Blocks * 8Bytes = 1896 Bytes

Block #	Data
0	Card Serial Number
1	Configuration Data
2	Stored Value Area
3	Key 1
4	Key 2
5	Application Issuer Data
6	Application Area 1
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	Application Area 2
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

Template Setup

Template size depends on the configuration of the bioCLASS Field Enroller.

Legacy Style Template

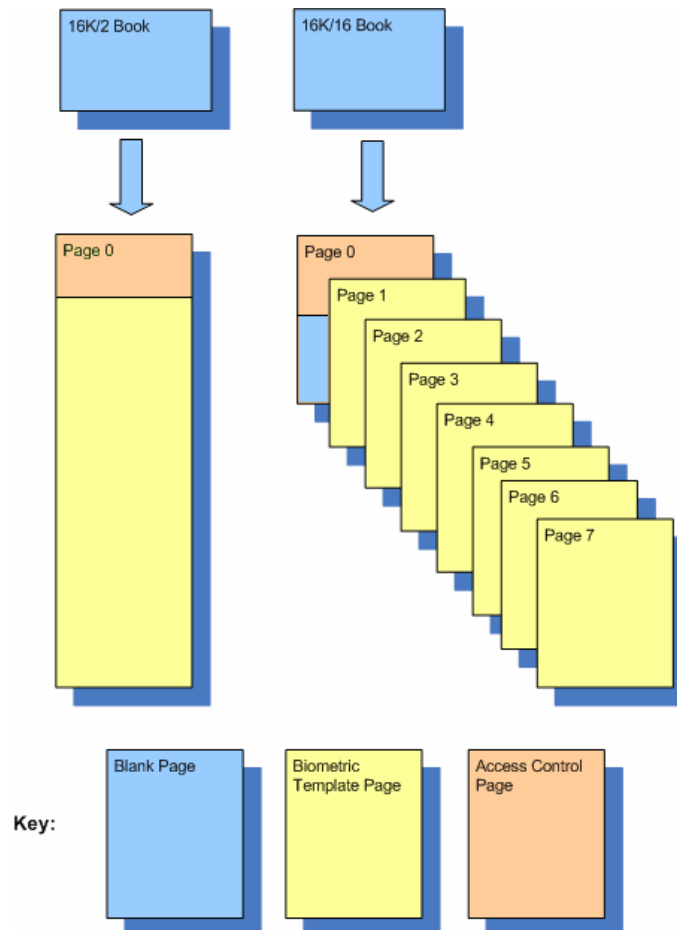
By default the bioCLASS Field Enroller is configured to write a legacy style template onto a smart card. This legacy style template can only be placed onto book 0 of a 16K or 32K card. The purpose of writing this style template is to maintain backward compatibility with existing card population enrolled using the previous enrollment application: the CP575 (template enroller only) or CP575A (template enroller – legacy style, plus access card data programmer).

This default location (legacy style template) is setup using the following combination.



Since the above combination is an illegal position to start writing templates (do not write templates before block 6), the above location instead signifies the legacy style template. A legacy style template takes up the following memory within book 0 of a 16K or 32K iCLASS card:

- 16K/2 Book: Template takes up all of application area 2, on page 0.
- 16K/16 Book: Template takes up pages 1-7, leaving only the page 0 application area 2 available for alternate applications.



New Style Template

For new card/bioCLASS populations, or existing card populations programmed using CP575A (template enroller – new style or initial bioCLASS self enrollers), the location for the templates shall be changed to a non-default location that enables enrollment of (a) smaller sized templates (compared to legacy templates) and (b) dynamic template location.

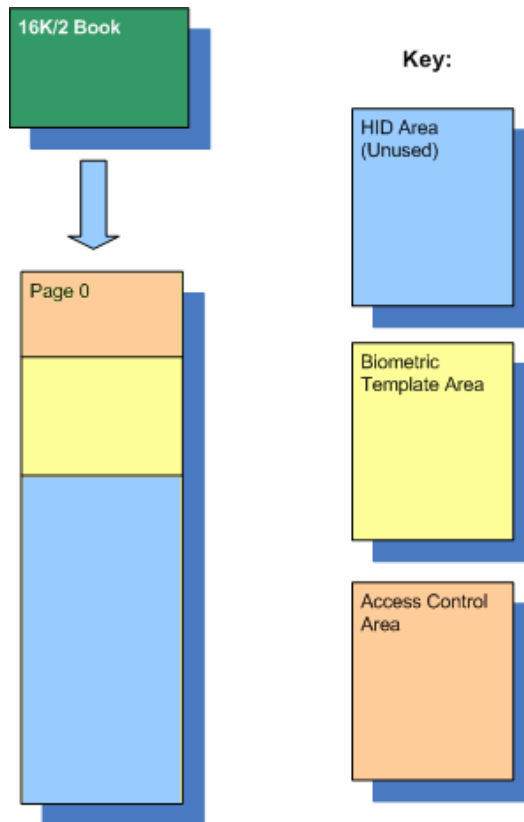
By taking advantage of the new style, smaller sized templates, the card now can contain additional application space for storage of other applications on the iCLASS card. Additionally, if these other applications already exist, or are destined to exist in a location that would interfere with the bioCLASS template, modify the template location to work around existing applications. **NOTE:** This is only true for 16K/16 books. Since 16K/2 books only have two applications (application area 1 and 2), and application area 1 on book 0 is used for access control identification, application area 2 is the only application area left, and is used to store fingerprint templates.

If no other applications exist on the iCLASS card, change the template location to the following:

- For 16K/2, or 32K (16K/2 + 16K/1) cards, change the location to:



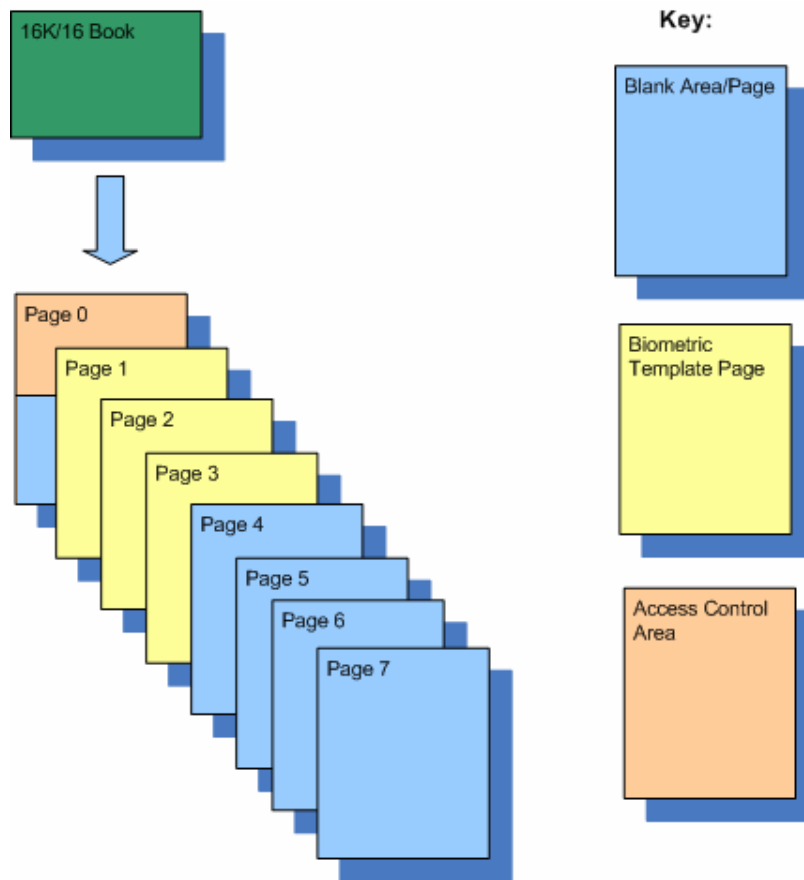
Changing the location to the above settings will secure the template within application area 2. Similar to the legacy style templates, all of application area 2 is reserved for the fingerprint template, but within the application area, the newer and smaller sized template will be written. The main benefit this setting has over the legacy style template is the space available for potential future applications, or additions to HID's biometric application.



- For 16K/16, or 32K (16K/16 + 16K/1) cards, change the location to:



Changing the location to the above settings will secure the template, starting in page 1 and continuing through page 3. The main benefit this setting has over the legacy style template is the additional pages left open for alternate applications. Typically the size of the templates are less than 100 bytes (1 page), but the fingerprint template algorithm can produce templates as large as 256 bytes (2.5 pages). The graphic below depicts 2 templates taking up > 208 bytes (> 2 pages) but less than 312 bytes (<4 pages) for both templates. This worse than average case enables additional application storage space on pages 4-7, in addition to page 0, application area 2.



Other Configurations

The Sagem data sheet states that a template could be 256 bytes. Empirically, templates are less than 128 Bytes (~70 bytes). If you starting at block 6, both templates fit onto the same page.

Always start at block 6, and allow for 2 pages to fit the templates. Page 6 is the last page recommended for safely placing a template.



Book1 Configuration

Shipped are most iCLASS 32k cards from HID with Book1 configured as 1x16k with no fuses burnt. Byte 7 of the configuration bio Field Enrollment command card block byte gives the user the option to reconfigure the Book1 to 8x2k before writing a template to Book1. By default the reader will attempt to reconfigure 32k cards when book 1 is selected. This allows for using the remaining pages by other applications.

This byte mimics Block 1, Byte5, bit7 of an iClass Card. This is the Memory Configuration byte for card (book)

See the Inside Contactless Picopass 32k(s) datasheet for more details.

When programming a card, the core processor first reads the Memory Configuration byte on the card. (Book1, Page0, Block1, byte 5). Compare this with the value of Book1 configuration in the SELF_ENROLL_ADMIN_CARD (SelfEnrollConfigData Array) in memory. If the card is set to 1x16k, and the personalization fuse is not burnt, the reader will attempt to rewrite the configuration of book 1.

Book1 Configuration Blocks and Keys

When book1 is re-written to an 8x2k configuration, the reader uses the configuration block (Block1) and keys are shown in the following table.

	Block 1 - Configuration	Block 2 - e-purse	Kd (App Area1 Key)	Kc (App Area2 Key)
Page 0	3CFF 3FE9 FFFF FFFF	FFFFFFFF FFFFFFFF	Kd Bk1 Pg 0 only Public key	Kc Page 0 Public Key
Page 1	BCFF 7FE9 FFFF FFFF	FFFFFFFF FFFFFFFF	Kd Page 1 Public Key	Kc Page 1 Public Key
Page 2	BCFF 7FE9 FFFF FFFF	FFFFFFFF FFFFFFFF	Kd Page 2 Public Key	Kc Page 2 Public Key
Page 3	BCFF 7FE9 FFFF FFFF	FFFFFFFF FFFFFFFF	Kd Page 3 Public Key	Kc Page 3 Public Key
Page 4	BCFF 7FE9 FFFF FFFF	FFFFFFFF FFFFFFFF	Kd Page 4 Public Key	Kc Page 4 Public Key
Page 5	BCFF 7FE9 FFFF FFFF	FFFFFFFF FFFFFFFF	Kd Page 5 Public Key	Kc Page 5 Public Key
Page 6	BCFF 7FE9 FFFF FFFF	FFFFFFFF FFFFFFFF	Kd Page 6 Public Key	Kc Page 6 Public Key
Page 7	BCFF 7FE9 FFFF FFFF	FFFFFFFF FFFFFFFF	Kd Page 7 Public Key	Kc Page 7 Public Key



After reconfiguring book1, written is the biometric template to the desired page and block. If the biometric application overlaps a page boundary, continued on the next page is the application. If the biometric application overruns the end of memory, reported is an error.

Each Page that contains the biometric application has its app limit set to 0xFF. Kd of the Page is changed to the biometric fingerprint application key (Key 45 in the internal Key ROM table). (Typically this is the same as the Kmd key, but it may be changed to a custom key.)

Below is an example of a biometric application written to page 5, block 17.

First, the HID App directory is shown that points to the extended application on Book1, Page 5, Block 17.

Next, shown are the actual templates on Pages 5 and 6 on Book 1.

NOTE: Used is the entire page as the application limit that is set to FF. The remaining pages on Book1 are available for use and programmed with the public keys.