MorphoSmart™ CBM
Module integration

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REVISION HISTORY

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1.1	September 2004	SAGEM SA	First official revision
1.2	January 2005	SAGEM SA	Modified pages : • Chap 1 – p1 • Chap 2 – p1 • Chap 3 – p1 to 5 • Chap 4 – p1 and 2 • Chap 5 – p1 and 2 • Chap 7 – p2 and 3 • An 1 – p4
1.3	July 2005	SAGEM DS	Modified pages : • Chap 4 – p1 • Added An 2
1.4	September 2005	SAGEM DS	Update of company name. Added the 'transparent firmware upgrade' chapter.
1.5	December 2005	SAGEM DS	Added the 'CBM Starter's kit wire detail' annex. Added information about the cable lengths on both USB and serial interfaces. Added detailed information on the TTL interface.

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1 Scope

1.1 SCOPE

The MorphoSmart™ Compact Biometric Module (CBM) is a compact, low cost, high quality optical biometric fingerprint device/OEM component with enhanced security features. With its optical technology the MorphoSmart™ CBM reaches high performance and robustness. It is designed for fast capture of quality fingerprint images, and is ideal for a broad range of enrollment, authentication, and identification applications. It offers local matching on the terminal, and comes equipped with standard USB or serial communications. The device is also compatible with the MorphoIntegrator's Kit for remote matching on a host PC. Security is provided through data encryption (secure tunneling), data integrity checking by the host system (digital signature), and capture, processing, and matching all within the component for even more safety. Plus, the MorphoSmart™ CBM features a sculpted scanner surface to optimize fingerprint acquisition, and is offered as an OEM solution for integration to manufacturer specifications. For custom development, it is available with a Software Development Kit (SDK). Whether for off-the-shelf enrollment or custom applications, the MorphoSmart™ CBM offers a flexible, compact, low cost solution for fast, secure processing of quality fingerprint images.

The MorphoSmart™ CBM is perfectly designed for applications such as:

− logical access control to desktop and network,

− physical access control,

− integration in notebook computer, keyboard, kiosk, point of sale terminal, mobile devices, safe and locks, remote controls…

2 Mechanical integration

2.1 MECHANICAL INTEGRATION

The integration requirements to be absolutely taken into account for the compact module integration are given below:

− the performance of the final product integrating the MorphoSmart™ CBM depends on the orientation of the module with respect to the placement of the finger (fundamental finger placement rules are available in the annex section),

− the final product integrating the MorphoSmart™ CBM has to withstand to a supporting strength over 10 kg,

− if a watertightness is anticipated, the gasket is to be positioned on the flange designed for this purpose and it must be in compression,

− for a clip fixing, the clips, must lay on the frame and not on the cap.

The mechanical conception of the product allows several kinds of integration. The recommended solutions are:

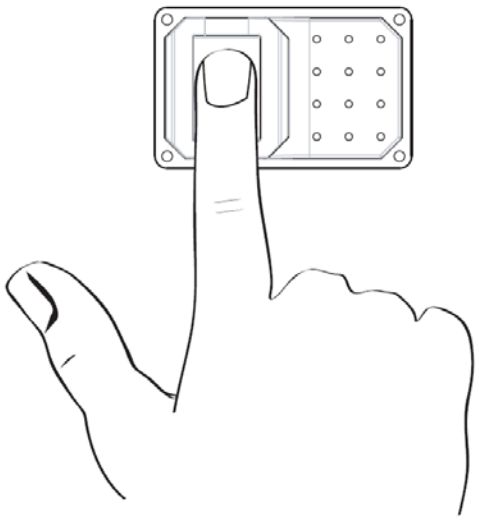
− screw fixing on the cap (see § 3.1 "Screw fixing on the terminal cap"),

− screw fixing on the frame (see § 3.2 "Screw fixing on the terminal frame"),

− clip fixing in the cap (see § 3.3 "Clip fixing on cap or terminal frame").

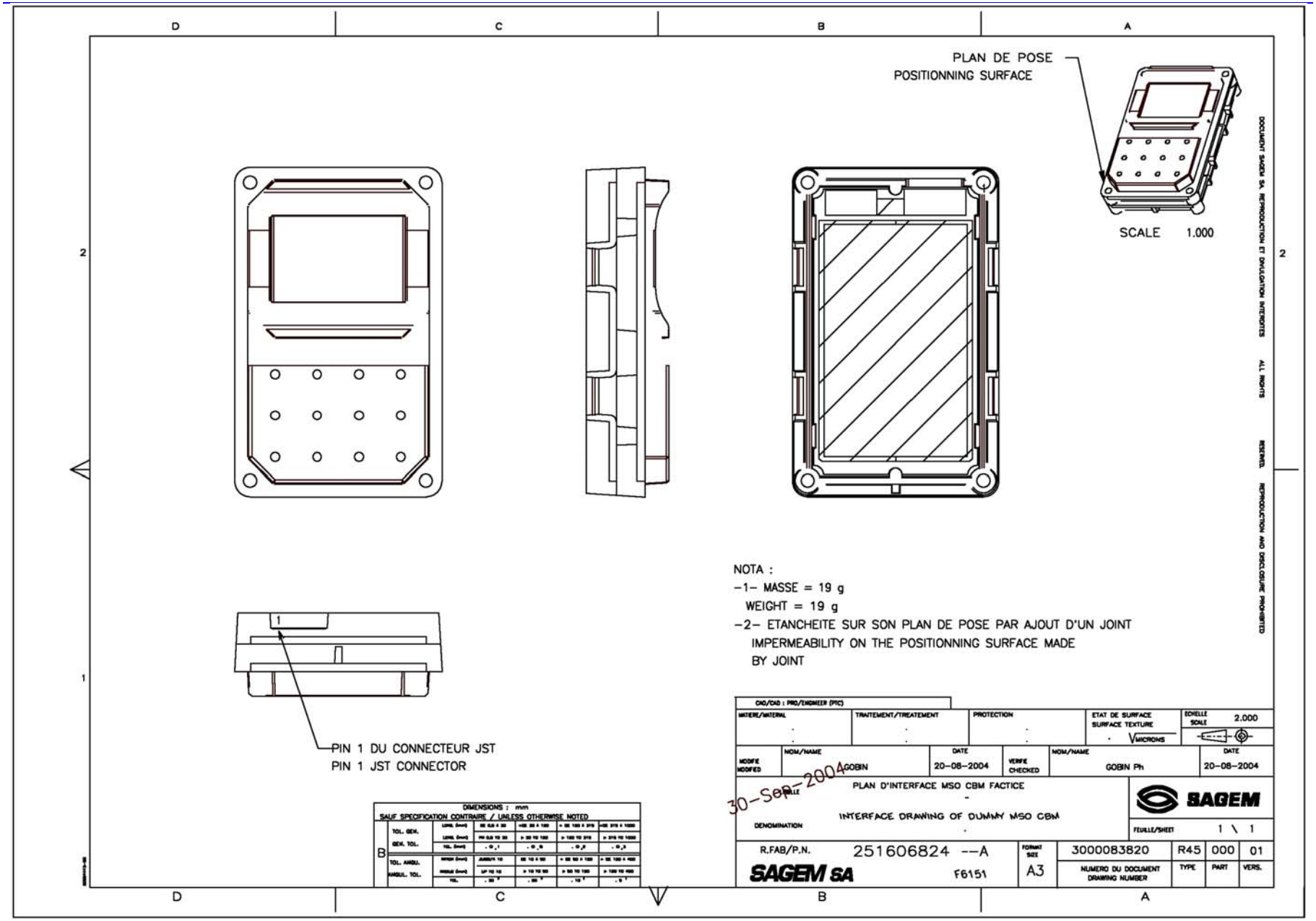
All these solution are described below.

The sensor on the top of the product has a default direction for integration and use: the sensor must be placed on the left and the finger must be placed as below.

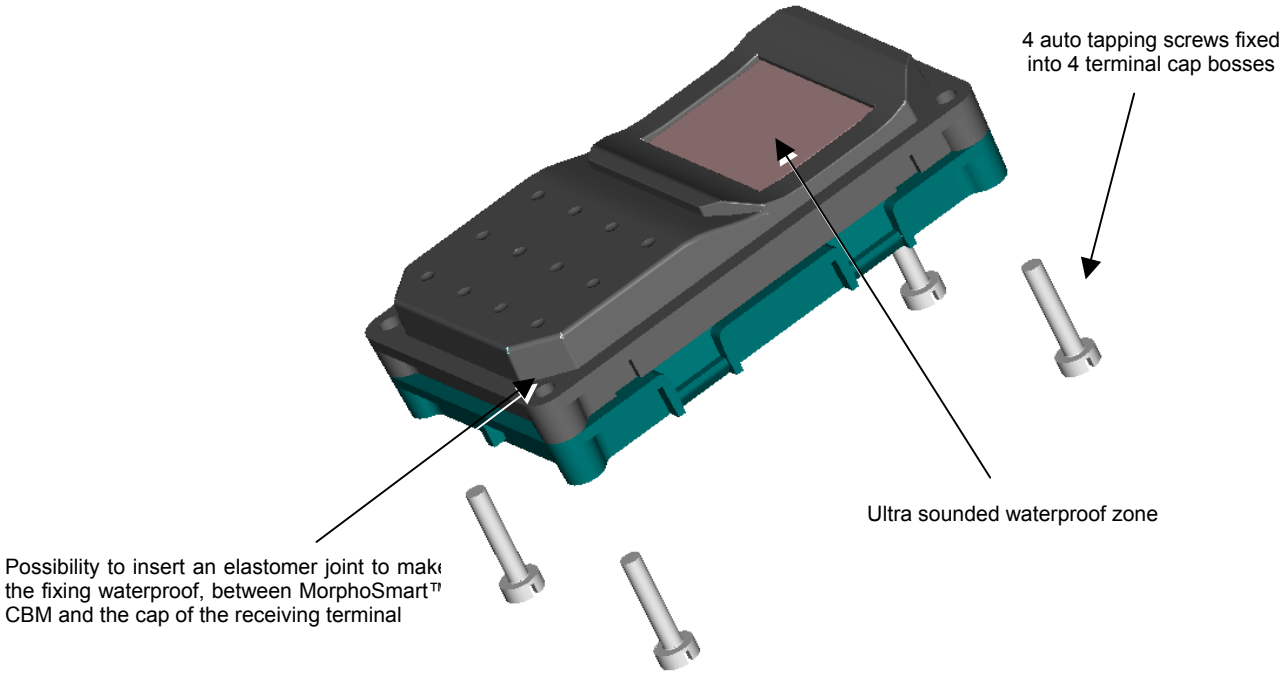


The software allows changing the direction by setting parameter.

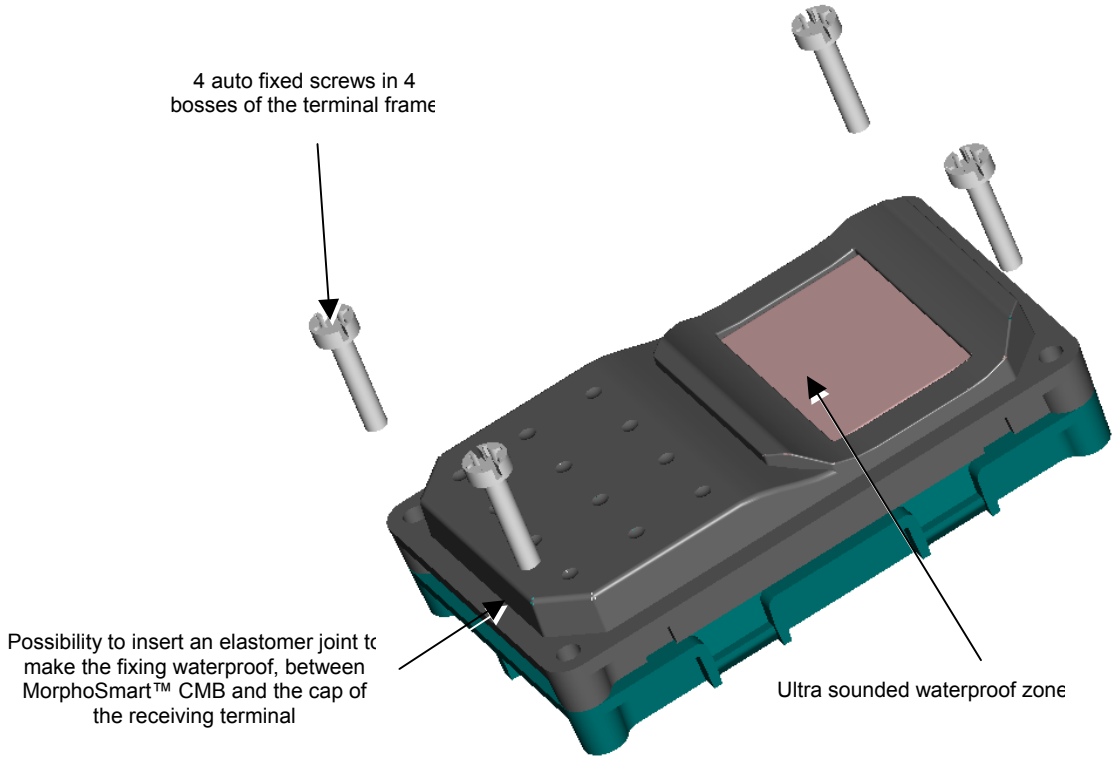
A bad fingerprint placement may decrease performance.



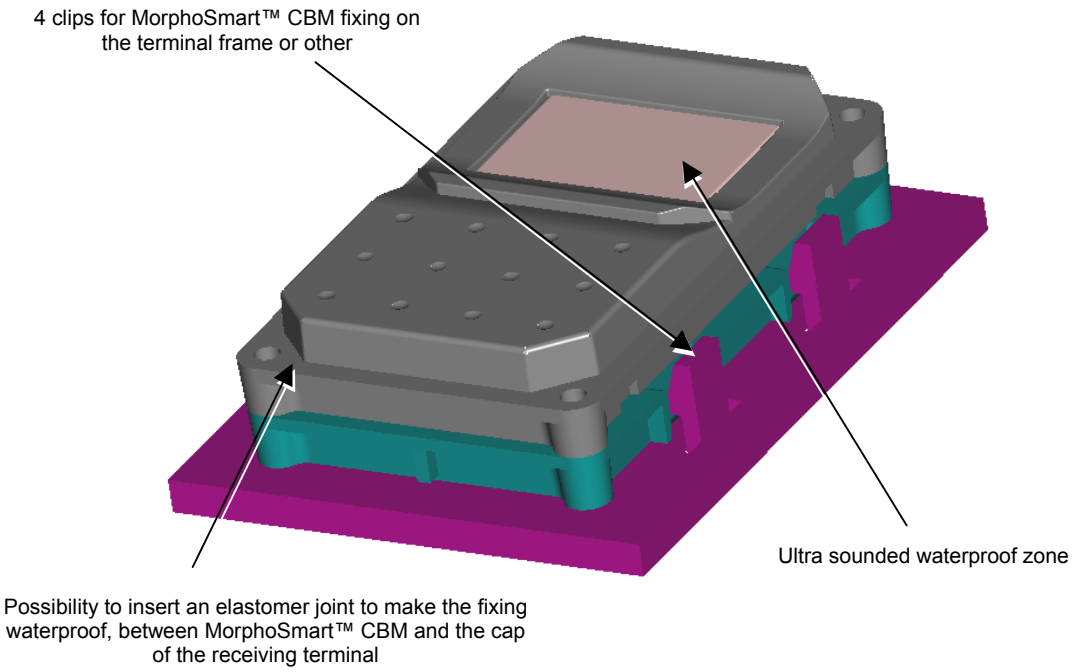
2.2 SCREW FIXING ON THE TERMINAL CAP



2.3 SCREW FIXING ON THE TERMINAL FRAME



2.4 CLIP FIXING ON CAP OR TERMINAL FRAME



3 Connector and pinout

3.1 CONNECTOR AND PINOUT

The product can be interfaced either using a serial link (Open collector) or a USB connection.

A 8 contacts plug JST [Ref.]: 08SUR-32S is needed to connect the product.

The section of the cable is AWG-32.

Seen from the side, sensor up, the first contact is on the right of the plug (for details see chapter 3 "Mechanical integration").

3.2 INTERFACE SELECTION

To select the serial interface as communication interface, pin 3 and pin 4 must be connected (D- and D+ wires).

3.3 USB SLAVE 2.0 INTERFACE (MSO CBM)

Connector pinout

Pin	designation	Signal direction (In/Out)	Voltage level Or type	Wire colour
1	+5 V	In	3 V to 5.5 V / 500 mA	Red
2	+5 V	In	3V to 5.5 V / 500 mA	Red
3	D-	In/Out	USB Level	White
4	D+	In/Out	USB Level	Green
5		Do not connect		
6		Do not connect		
7	GND	In	Ground	Black
8	Shielding	In		

Both wires “D-“ and “D+” will be twisted together in the cable according to the standard.

Wires max size

Using the USB interface, according to the USB 1.1 standard, the cable can be up to 1.5m long. In case of malfunction, it is recommended to use a USB 1.1 compliant HUB.

3.4 SERIAL INTERFACE (MSO CBM)

The serial interface is composed of TX, RX and GND. The levels will be open collector typed. Power will be less or equal to 4 mA for a maximum voltage of 5 V. The transmission speed is up to 115,200 bauds for a 1 meter maximum length.

Connector pinout

Pin	designation	Signal direction (In/Out)	Voltage level Or type	Wire colour
1	+5 V	In	3 V to 5.5 V / 500 mA	Red
2	+5 V	In	3V to 5.5 V / 500 mA	Red
3		Shortcut to pin 4		White
4		Shortcut to pin 3		Green
5	TX (serial)	Out	Open collector (4mA max./5V max.)	Don't care
6	RX(serial)	In	Open collector (0.18mA min./1.8V max.)	Don't care
7	GND	In	Ground	Black
8	Shielding	In		

Please refer to Annex 2 for application notes and sample schematics.

4 Technical characteristics

4.1 ELECTRICAL CHARACTERISTICS

In order to optimize the power consumption, the MSO CBM supports three operating modes:

− standby mode,

− full operating sensor on,

− system idle (waiting for orders).

The power requirements for the MSO CBM are in the range 3 V to 5.5 V and the boot time is typically 0.8 second.

Operating mode	Power consumption		
	USB	Serial 5V	Serial 3V
Standby mode	**500µA**	**300µA**	**400µA**
System idle	**40mA**	**40mA**	**55mA**
Full operating, sensor on	**160mA**	**150mA**	**200mA**

All values are typical.

Voltage drop in the cable should be monitored.

4.2 MECHANICAL CHARACTERISTICS

Compact plastic case including optical and electronic parts.

− Length: 53.7 mm.

− Width: 33.7 mm.

− Height: 13.5 mm.

− Weight: 20 g.

Upon request, SAGEM Défense Sécurité can provide a file with 3D mechanical drawing.

4.3 ENVIRONMENTAL CHARACTERISTICS

− Operating temperature: - 10 to 50°C.

− Storage temperature: - 20 to 70°C.

− Relative humidity : 85% RH.

4.4 BIOMETRIC CHARACTERISTICS

Sensor area: 18 x 22 mm.

− Resolution: 500 dpi, 256 grey scale.

− Fingerprint image capture and enhancement, template calculation, authentication (1:1) and identification (1:500 people) applying the SAGEM Défense Sécurité algorithms, MorphoSoft™ Embedded and MorphoImaging™.

− Authentication (1:1) timing: 1.2 sec.

− Identification (1:500 people) timing: 1.5 sec.

− Adjustable false acceptance rate.

5 Software integration/MorphoSmart™ architecture overview

The MSO CBM is part of the new generation of SAGEM MorphoSmart biometric terminal.

It can be either compatible with:

− windows platforms using the MorphoSmart SDK for USB link,

− any type of host using the MorphoSmart Host System Interface Specification (only available with serial interface) for serial link.

For information, please refer to the MSO SDK Overview, MSO SDK Programmer's Guide and the MSO Host System Interface Specification.

5.1 SCHEME

The following figure describes the MorphoSmart™ software architecture.

<table>
<tr><td colspan="5">ILV Interface</td><td rowspan="2">SmartCard Interface</td></tr>
<tr><td>Database</td><td>Module manager</td><td rowspan="2">Biometric algorithms</td><td>SPILV</td><td>Image</td></tr>
<tr><td colspan="2">File System</td><td>Com</td><td>Sensor</td></tr>
</table>

Figure 1 - General MorphoSmart™ architecture

5.2 MAIN COMMANDS

5.2.1 Initialization functions

- 0x05 GET_DESCRIPTOR: Retrieves information from biometric module.

5.2.2 Biometric functions

- 0x20 VERIFY: Capture and verify against a reference template.
- 0x21 ENROLL: Capture and add to database and/or export templates.
- 0x22 IDENTIFY: Capture and identify against the local database.
- 0x23 VERIFY MATCH: Verify a list of reference templates against a search template.
- 0x24 IDENTIFY MATCH: Identify a search template against the local database.

5.2.3 Database management functions

- 0x30 CREATE BASE: Create a local database.
- 0x32 ERASE BASE: Erase the local database (destroy all records, not database structure).
- 0x34 ERASE ALL BASE: Erase all local database (destroy all records, not database structure).
- 0x3B DESTROY BASE: Destroy the local database.
- 0x33 DESTROY ALL BASE: Destroy all local databases.
- 0x35 ADD RECORD: Add a record to the local database.
- 0x36 REMOVE RECORD: Remove a record from the local database.
- 0x38 FIND USER BASE: Search record matching a given pattern.
- 0x3C UPDATE PUBLIC DATA: Update a database public field.
- 0x3D UPDATE PRIVATE DATA: Update a database field (public or private).
- 0x3E GET PUBLIC FIELDS: Get database public field list.
- 0x3F GET DATA: Get a database public field.
- 0x07 GET BASE CONFIG: Get database configuration.

5.2.4 Security management functions

- 0x80 SECU GET CONFIG: Get MorphoSmart™ security configuration.
- 0x81 SECU READ CERTIFICATE ID: Get X509 certificate from MSO certification path.
- 0x82 SECU STORE CERTIFICATE: Load a host X509 certificate.
- 0x83 SECU STORE PKCS12: Load a PKCS#12 token.
- 0x84 SECU MUTUAL AUTH INIT 1: First step to establish a secure tunnel.
- 0x85 SECU MUTUAL AUTH INIT 2: Second step to establish a secure tunnel.
- 0x86 SECU PROTOCOLE: Security envelope Configuration.
- 0x90 GET_MSO_CONFIG: Retrieve the value of one configuration parameter.
- 0x91 MODIFY_MSO_CONFIG: Modify the value of one configuration parameter.

5.2.5 Miscellaneous

- 0xEE CONFIG UART: Change UART configuration.
- 0x71 ASYNC MESSAGE: Asynchronous message.
- 0x70 CANCEL: Cancel a live finger acquisition.

5.2.6 Invalid ILV

- 0x50 ILV_INVALID Invalid ILV.

5.3 PRODUCT COMPATIBILITY

The SDK is the same for MSO200 and MSO300 products.

6 Annex 1 – Finger positionning

6.1 ROLE OF THE ENROLMENT?

− To record two fingerprints in the Access Control System database. This operation needs to be processed with extreme care.

− To:

- get the best image quality,
- increase recognition performance,
- reduce recognition time.

6.2 TO GET A GOOD QUALITY OF IMAGE, ONE NEEDS TO

− Maximise the finger/sensor contact.

− Position the centre of the finger tip according to the centre of the sensor.

− Ensure a good quality contact:

- do not press too hard,
- do not move during image acquisition,
- leave your finger on the sensor at least 2 seconds,
- do not slide nor roll your finger across the sensor.

Figure 2 - Where is the fingerprint interesting information located?

6.3 FINGER POSITIONING – FINGER HEIGHT

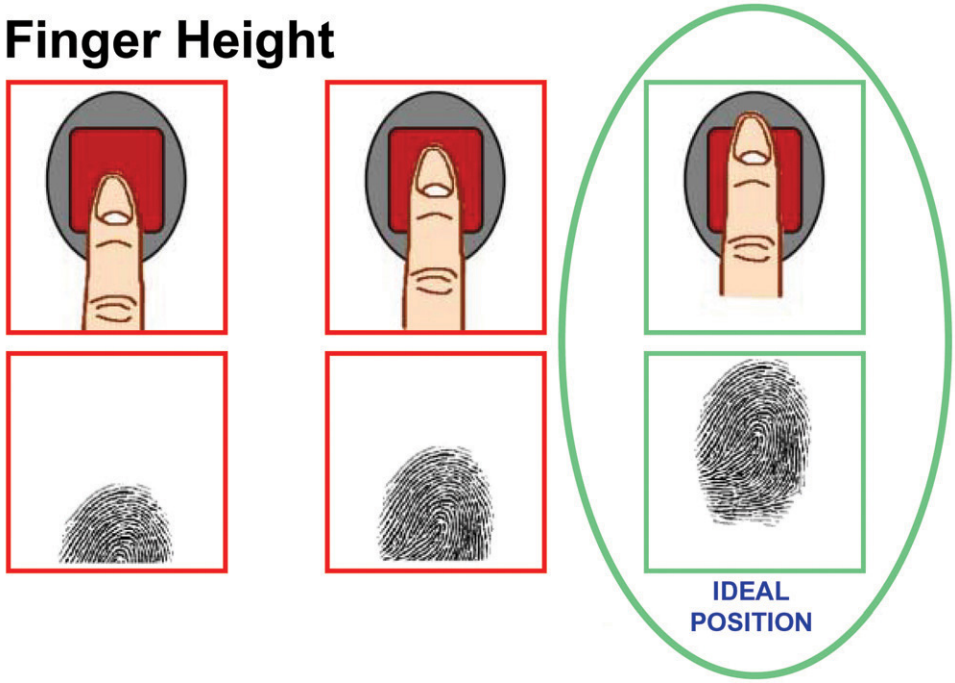


Figure 3 - How to position your finger correctly on the sensor - Height

6.4 FINGER POSITIONING – FINGER ANGLE

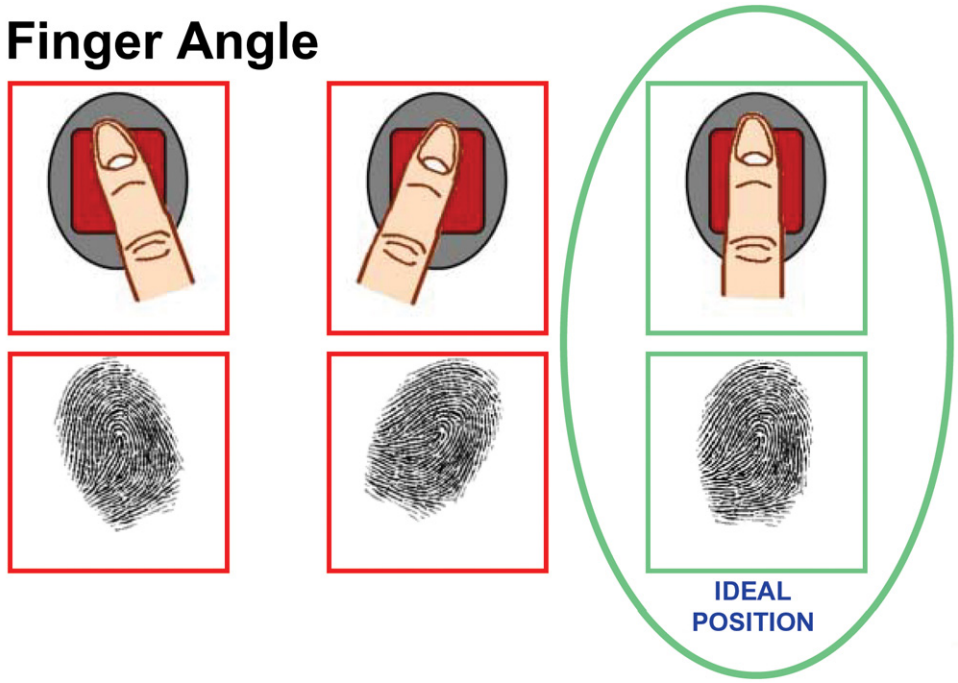


Figure 4 - How to position your finger correctly on the sensor - Angle

6.5 FINGER POSITIONING – FINGER INCLINATION

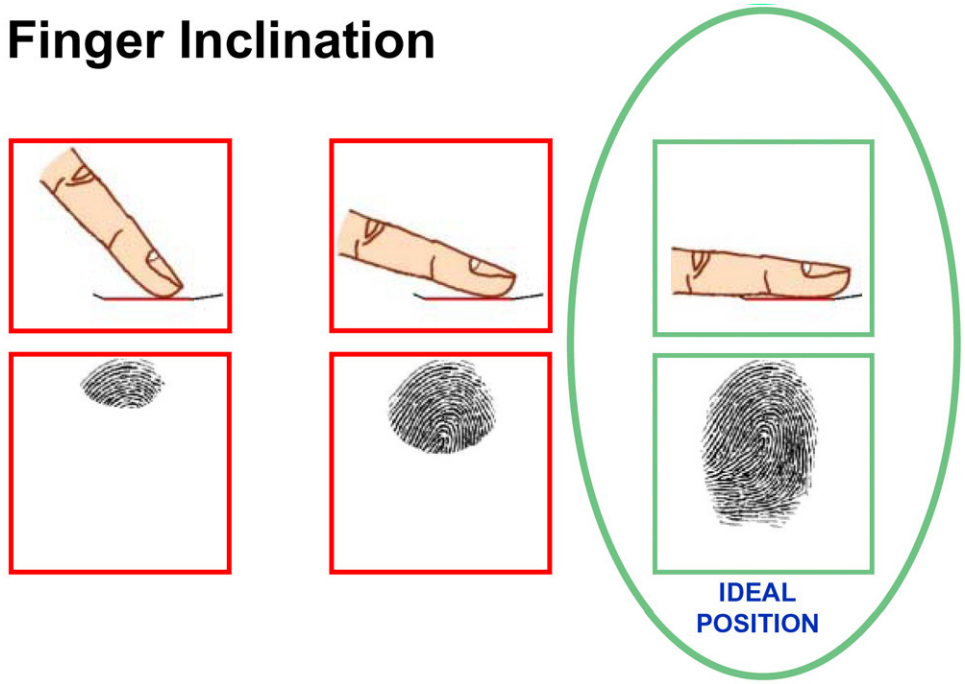


Figure 5 - How to position your finger correctly on the sensor - Inclination

6.6 FINGER POSITIONING – FINGER ROTATION

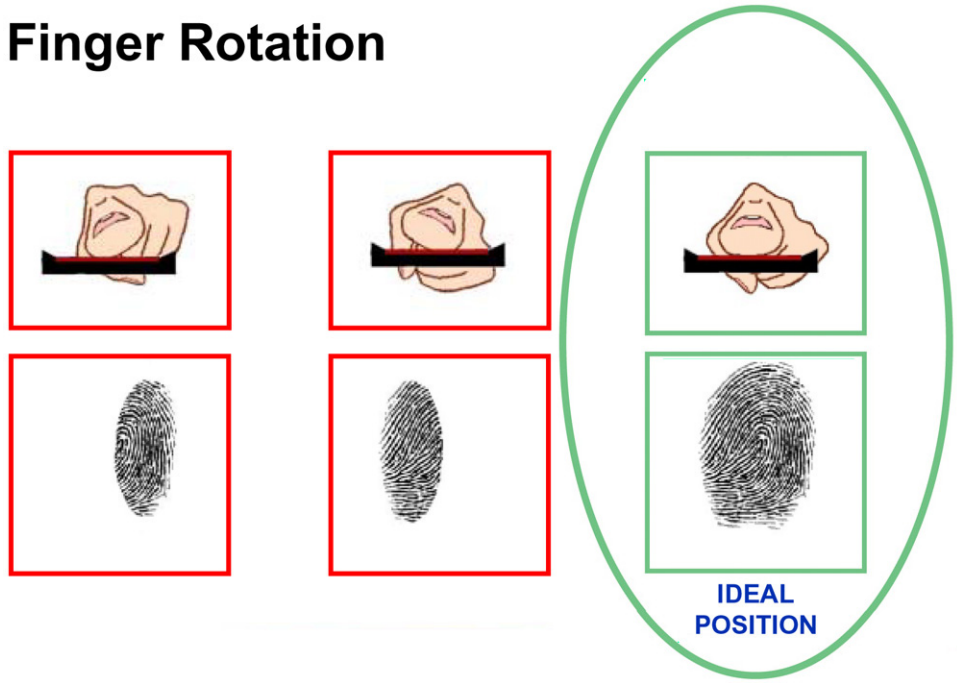


Figure 6 - How to position your finger correctly on the sensor – Rotation

6.7 IN WHICH CASES THE FINGERPRINTS QUALITY IS NOT THE BEST?

- Cause : dry finger or cold finger.
- Consequence : complex image processing.
- Solution : warm up finger tip.

7 Annex 2 – Serial interface application note and schematics

7.1 RS232 INTERFACE

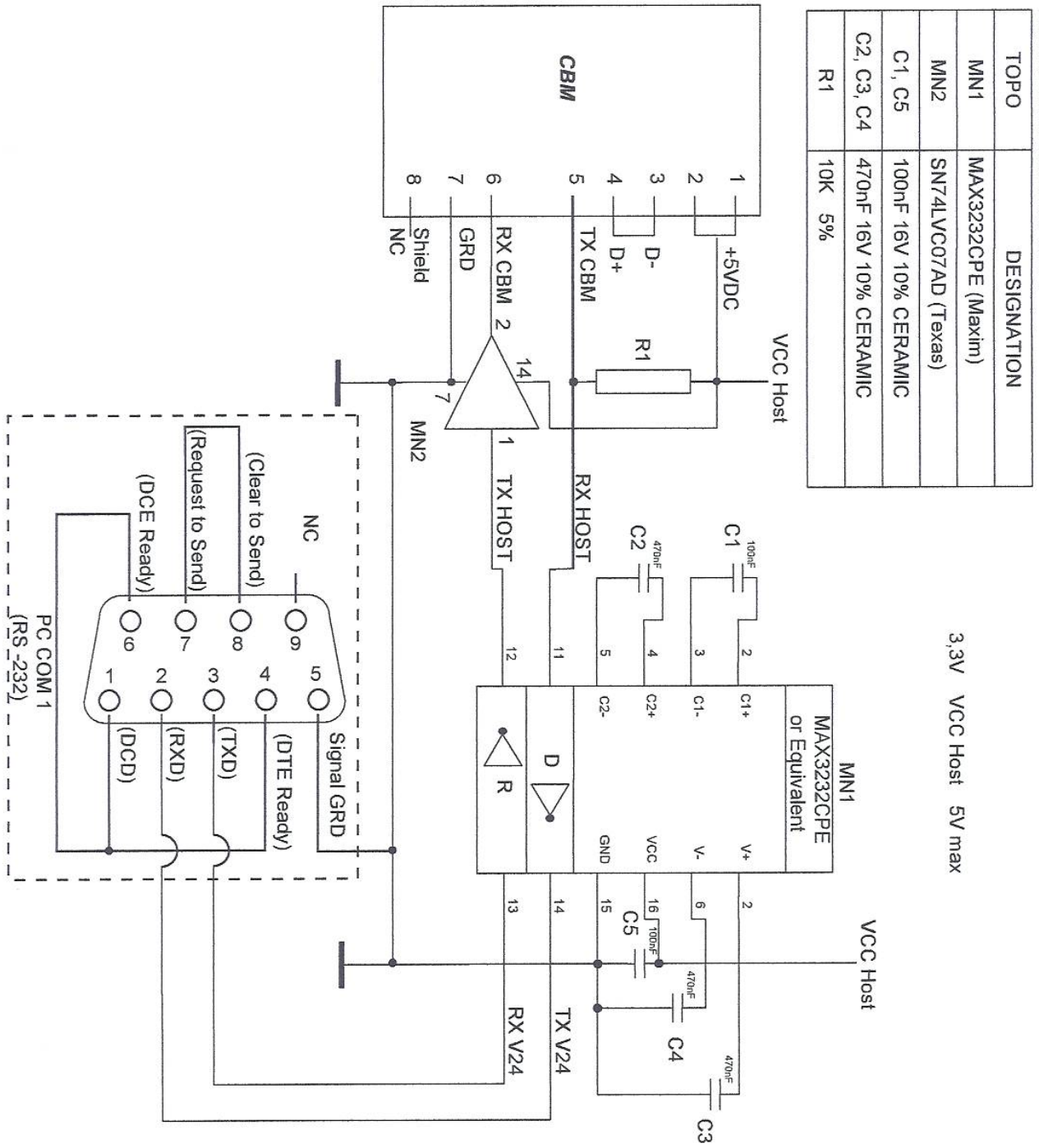


Figure 7 - RS232 serial interface sample schematics

7.2 TTL INTERFACE

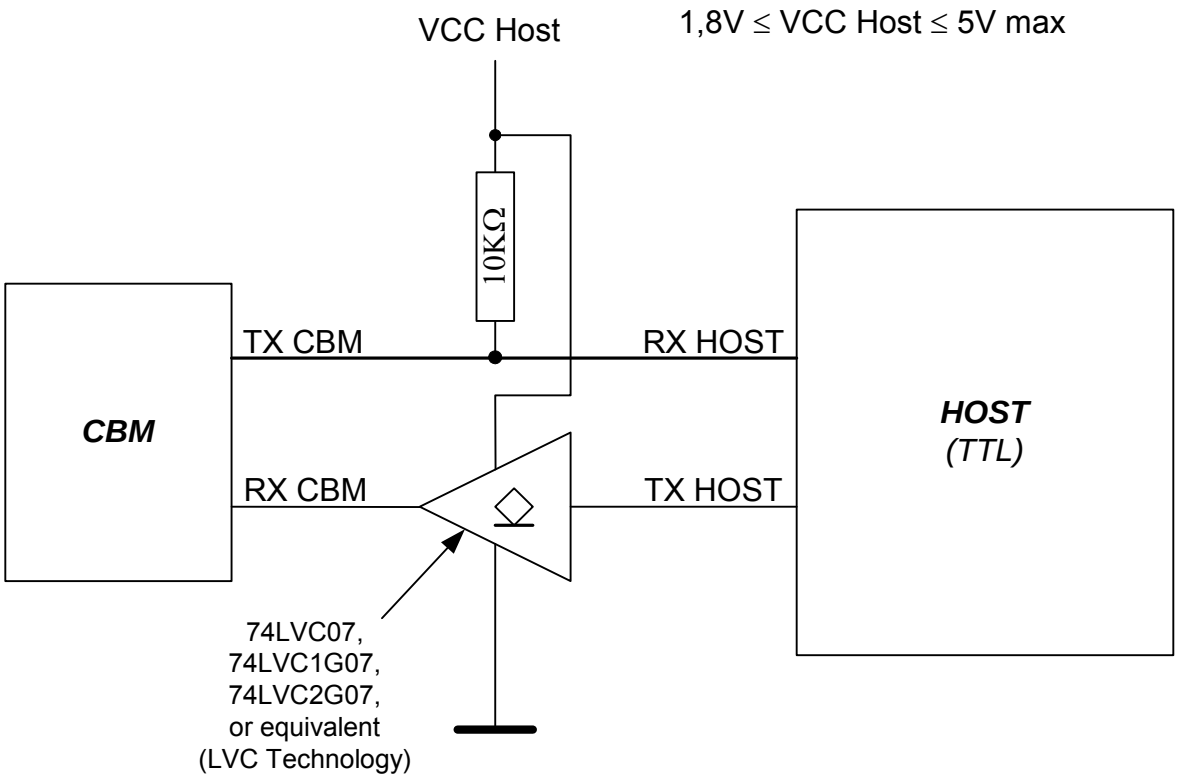


Figure 8 - TTL serial interface sample schematics

7.3 CABLE LENGTH

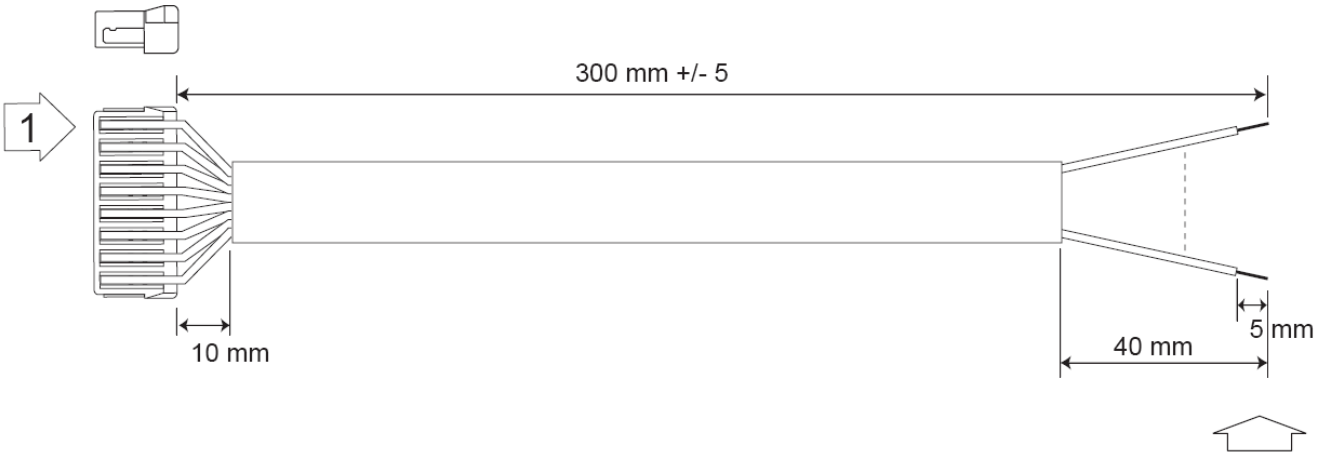
When using the serial interface on the CBM, the wires from the interface to the CBM has to be as short as possible, due to the low voltage signals used on this interface. A length of less then 10 cm is recommended.

8 Annex 3 - Transparent firmware upgrade

The transparent firmware upgrade is needed when using the MorphoSmart™ product embedded in another product.

Please refer to the ***MorphoSmart™ Host System Interface Specification*** document for details about this operating mode.

9 Annex 4 – CBM Starter's kit wire detail



CONNECTEUR 8 CONTACTS / *8 CONTACTS PLUG*

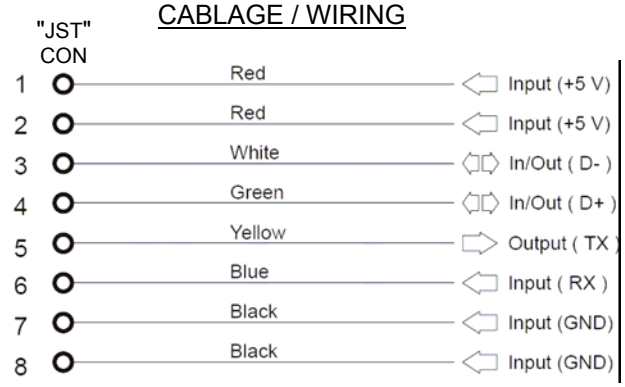
Etamage / *Tinning*

- Réf : "JST" 08SUR-32S
- Outillage / Tooling : WC-SH2832 "JST"

CABLE

- Fils jauge AWG 32 / *Conductors AWG 32*
- Couleurs des fils voir cablage / *Colors conductors see wiring.*
- Gaine externe couleur noire mat / *lustreless black external jacket.*
- Gaine / *Jacket material* : PVC UL94 V0.

CABLAGE / WIRING



REAL COLOR