# MorphoSmart(TM) Installation Guide (MSO20x, MSO3xx, MSO13x0)

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## REVISION HISTORY

| Revision | Date | Author | Document revision history |
|---|---|---|---|
| 1.0 | 8th November 2002 | SAGEM SA | Creation of the document |
| 1.1 | 15th November 2002 | SAGEM SA | Add chapter “MSO100 Material Compatibility” |
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| 2.7 | December, 13th 2007 | SAGEM Sécurité | Added the MSO1350 |
| 2.8 | May 5, 2008 | SAGEM Sécurité | New plan.<br>Upgrade biometric performances. |

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# 1 Overview

## 1.1 Welcome to MorphoSmart™

Congratulations for choosing the MorphoSmart™ Automatic Fingerprint Recognition Terminal. MorphoSmart™ provides an innovative and effective solution for applications using Fingerprint Verification or/and Identification.

Among the many biometric sciences, the use of finger imaging has significant advantages. Each finger is a unique physical signature developed before birth and is preserved until death.

The MorphoSmart™ terminal integrates Sagem Sécurité image processing and features matching algorithms (MorphoSoft™ and MorphoImaging™). This technology is based on lessons learned during more than 20 years of experience in the field of biometric identification and the processing of literally millions of individual fingerprint identification records.

We believe you will find the MorphoSmart™ fast, accurate, and easy to use as a biometric peripheral.

The MorphoSmart™ offers the following advantages:

- high quality optical scanner,
- software development suite (MorphoSmart™ SDK) for all MorphoSmart™ devices,
- Key Management System (MorphoSmart™ KMS) for Secure MorphoSmart™,
- False Finger detection (only available with MorphoSmart™ MSOxx1),
- PC/SC Smart Card Reader (only available with MorphoSmart™ MSO35x and MSO1350),
- compact size for easy installation and integration into your available office space,
- intuitive interface that is easy to use in both setup and operational modes.

The terminal complies with both European and U.S. standards as follows :

**Europe**: Sagem Sécurité hereby declares that the MorphoSmart™ has been tested and found compliant with the below listed standards as required by the EMC Directive 89/336/EEC: EN55022 (1994) / EN55024 (1998) and by the low voltage Directive 73/23/EEC amended by 93/68/EEC: EN60950 (2000).

**USA**: please refer to FCC Standard section.

To ensure the most effective use of your MorphoSmart™ device, we recommend that you read this Installation Guide entirely.

## 1.2 Contents

The present document describes the MorphoSmart™ packaged devices, and how to install it on a Windows™ PC.

For information about MorphoSmart™ OEM versions, please refer to the documents listed below :

- MorphoSmart™ Module Integration
- MorphoSmart™ CBM Module Integration

# 2 MorphoSmart™ device installation

## 2.1 Safety instructions

The MorphoSmart™ is intended for indoor use only.

The MorphoSmart™ must be placed on a flat clear surface where it will not be at risk of coming in contact with fluids.

## 2.2 MorphoSmart™ Hardware Platform Compatibility

The MorphoSmart™ USB devices are compatible with usual PC configurations, but we therefore strongly advise you to perform a compatibility test with target PC hardware configuration.

The MorphoSmart™ USB devices are compatible with most of the self-powered USB hub available. But we also recommend to perform a compatibility test with target USB Hub.

Please note that USB hub powered only by the USB port, could provide not enough power supply for a normal function of MorphoSmart™ USB devices.

## 2.3 Host system is a Windows™ PC

### 2.3.1 Installation of a MorphoSmart™ USB device (MSO3xx, MSO13x0)

The installation of a MorphoSmart™ USB device is performed in a few steps :

- Install the MorphoSmart™ USB driver on the PC (please refer to MorphoSmart™ USB driver installation section)
- Connect the USB connector of the MorphoSmart™ USB device to a USB port of the PC.
- Wait for USB enumeration process (usually not more than a few seconds).

Then the device is ready for use, for example : with the sample applications delivered with MorphoSmart™ SDK (please refer to MorphoSmartTM SDK section).

### 2.3.2 Installation a MorphoSmart™ RS232 device (MSO20x)

The installation of a MorphoSmart™ RS232 device installation is performed in a few steps :

- Connect the power supply connector to the socket on top of the RS232 connector.
- Connect the power supply to an outlet.
- Then connect the RS232 connector to one of the RS232 port of the PC.

Then the device is ready for use, for example : with the sample applications delivered with MorphoSmart™ SDK (please refer to MorphoSmartTM SDK section).

### 2.3.3 MorphoSmart™ SDK

The MorphoSmart™ Software Development Kit, provides the required elements to enable you to develop your own applications for MorphoSmart™ devices. It is a usually delivered on a CDROM which contains :

- all the documentation required for MorphoSmart™ devices use and integration,
- the MorphoSmart™ USB driver for Windows™ PC,
- sample applications which enables to demonstrate the MorphoSmart™ functions
- source files of sample applications
- libraries (dll) and ActiveX with MorphoSmart™ device functions

To evaluate a MorphoSmart™ device we recommend to install the MorphoSmart™ Software Development Kit on a Windows™ PC :

- insert the MorphoSmart™ SDK CD-ROM into the drive,
- if the installation process doesn't start automatically, double click on the Setup.exe file to start it,
- install MorphoSmart™ USB driver before connecting a MorphoSmart™ USB device,
- connect the MorphoSmart™ device to a USB port, or to a RS232 port (MSO20x only),
- run MSO_Login.exe or MSO_Demo.exe sample application,
- select the MorphoSmart™ device to use,
- try MorphoSmart™ device functions.

For more information on the MorphoSmart™ Software Development Kit, please refer to the MorphoSmart Programmer Guide document.

## 2.4 Host system is not a Windows™ PC

### 2.4.1 RS232 connection

The MorphoSmart™ MSO200 can be physically connected to other host than Windows™ PC, but the 'MorphoSmart™ communication protocol over RS232' must be developed for the host system.

The 'MorphoSmart™ communication protocol over RS232', is described in the MorphoSmart Host System Interface specification document. And a sample of development of this protocol, with C language source files, is provided the MorphoSmart™ SDK.

### 2.4.2 USB connection

A MorphoSmart™ USB device can be physically connected to other host than Windows™ PC, but the 'MorphoSmart™ communication protocol over USB' and a compatible USB driver must be developed for the host system.

The integrated USB driver of the MorphoSmart™ terminal emulates a RS232 serial port. The MorphoSmart™ terminal is processed as a Communication Device Class (CDC), in accordance with the "USB Device Class Specifications, version 1.1" available from the www.usb.org web site, in "developers, documents" section. The device may also be used with a USB2.0 controller, but will still use the USB 1.1 full speed transfer rate (12 Mbits/s).

The 'MorphoSmart™ communication protocol over USB', is described in the MorphoSmart Host System Interface specification document.

# 3 MorphoSmart™ USB driver installation

## 3.1 MorphoSmart™ USB driver setup

The MorphoSmart™ USB driver can be installed from MorphoSmart™ SDK, when it is installed.

For MorphoSmart™ SDK V4.0.3.0 (and later versions), the USB driver installation installs and starts the "SAGEM MorphoSmart Service Provider Usb Server" too.

- Start the MorphoSmart™ USB driver installation from the MorphoSmart™ SDK PROGRAMS folders in the windows start menu:

  *START / PROGRAMS / MorphoSmart SDK / PC / Drivers / Install (Desinstall) the USB driver for MorphoSmart*

- Use the Next and Back buttons to navigate through the wizard.
- Plug the MorphoSmart™ USB device to an available USB port on your PC with the supplied USB cord.

## 3.2 Important Notice

MorphoSmart™ USB devices are currently compatible with Windows 2000 SP4, Windows XP Professional Edition SP2 and Windows Server 2003 Enterprise.

Administrator rights on your local computer are required when plugging the MorphoSmart™ USB device for the first time.

## 3.3 Windows XP ® Embedded

***Note for Windows XP ® Embedded:***

If you are using Windows XP ® Embedded, the automatic installer based on MSI won't work, since MSI is not installed on this platform. You will need to make the installation in a manual way.

First uncompress the ***.cab*** file situated in *START / PROGRAMS / MorphoSmart SDK / PC / Drivers* to another directory.

Then, register the driver. To do this, simply plug a MSO device. In the new hardware dialog box, simply point to the directory where you uncompressed the ***.cab*** file.

The next step is to register the service.

Copy the service file ***Serv_SpUsb.exe*** from the uncompressed ***.cab*** directory to the *C:\Windows\System32* directory.

Execute the two following commands:

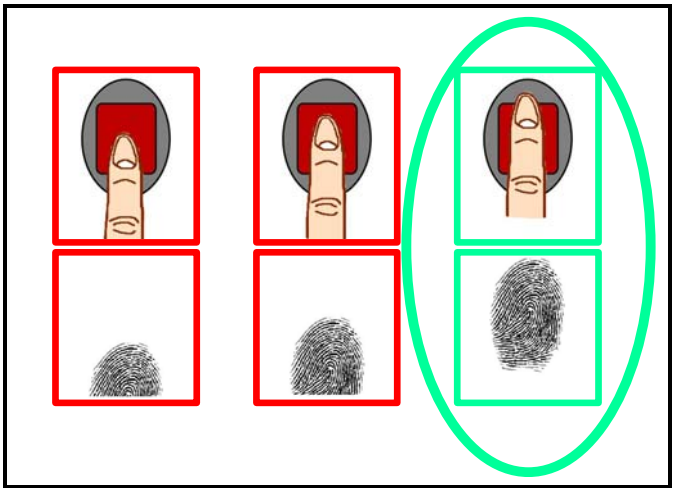
```
sc create MSO_SpUsb_Service binPath="C:\WINDOWS\System32\Serv_SpUsb.exe" type=own start=auto
error=ignore DisplayName="SAGEM MorphoSmart Service Provider Usb Server" tag=no
```

`sc start MSO_SpUsb_Service` ( equivalent to the command net start "SAGEM MorphoSmart Service Provider Usb Server" )

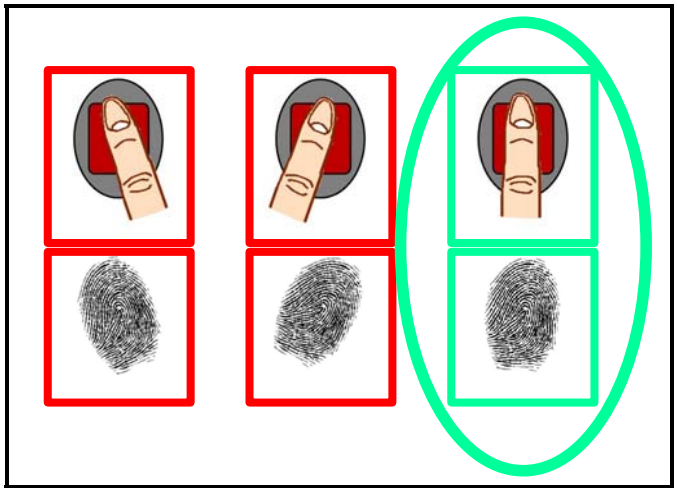
# 4 Finger Placement Rules

MorphoSmart™ biometric performance is increased when the finger is optimally positioned.

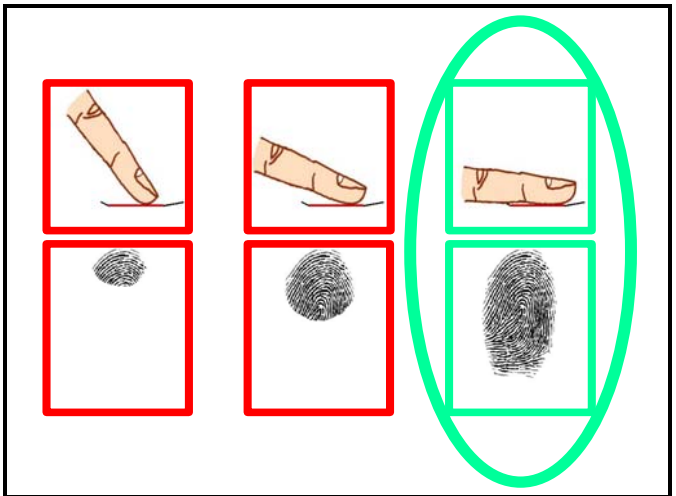
Common non-optimal finger positioning is illustrated below, followed by an illustration of best finger placement.



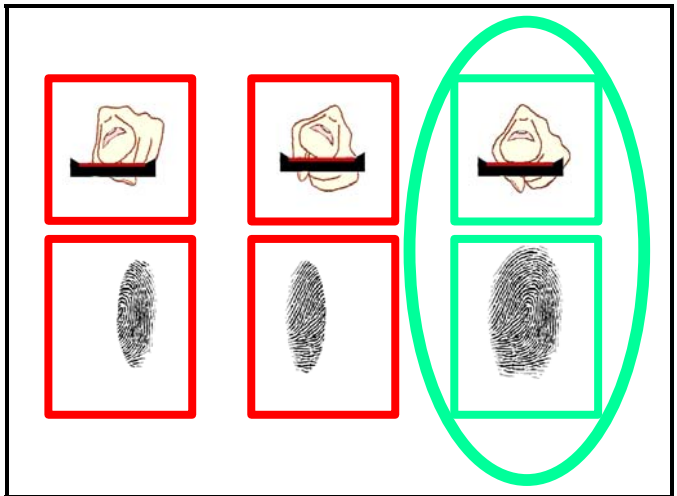
**Fingerprint Placement**



**Fingerprint Orientation**



**Fingerprint Inclination**



**Fingerprint Rotation**

Other recommendations for acquiring a quality finger image:

- Fingers should neither be too moist nor extremely dry,
- Exert firm, but not excessive, finger pressure on the surface of the sensor,
- Once a finger is placed on the scanner keep the finger still until advised to move or remove the finger from the scanner.

# 5 MorphoSmart™ MSO20x

## 5.1 Physical Characteristics

The MSO20x is dedicated to be connected to a RS232 port, and to an external power supply.

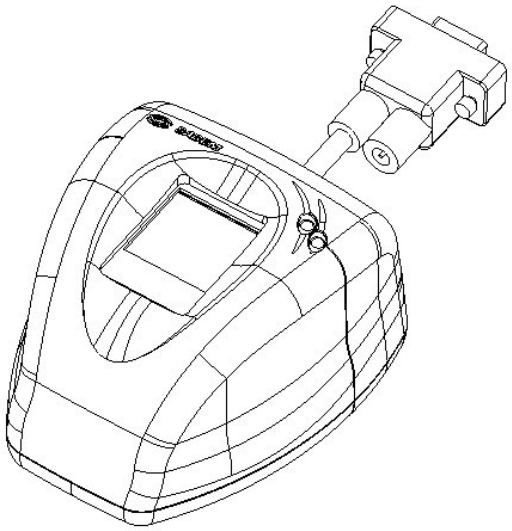


**Figure 1 : MorphoSmart™ MSO20x 3D view**

## 5.2 Safety instructions

Before plugging your MSO20x into a power source, check that the power source to which you intend to connect it, complies with the voltage, current and frequency specifications on the rating label of the power supply unit (depending on model).

Only use the power supply unit provided with your MorphoSmart™. Do not use any other power supply.

The device does not have an on/off switch and can only be powered off and on by unplugging and plugging the power source. For this reason the device should be connected to an outlet that is easily accessible. The power outlet must be located within a maximum of 8 feet of the terminal.

## 5.3 General Description

### 5.3.1 Top view

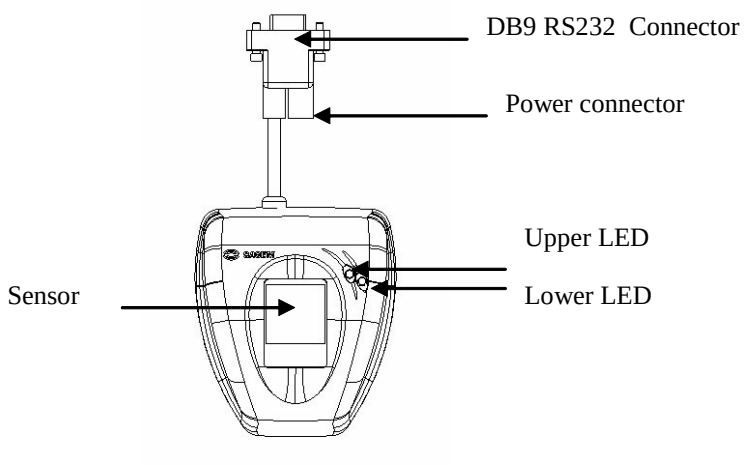



**Figure 2 : MorphoSmart™ MSO20x top view**

### 5.3.2 Bottom view

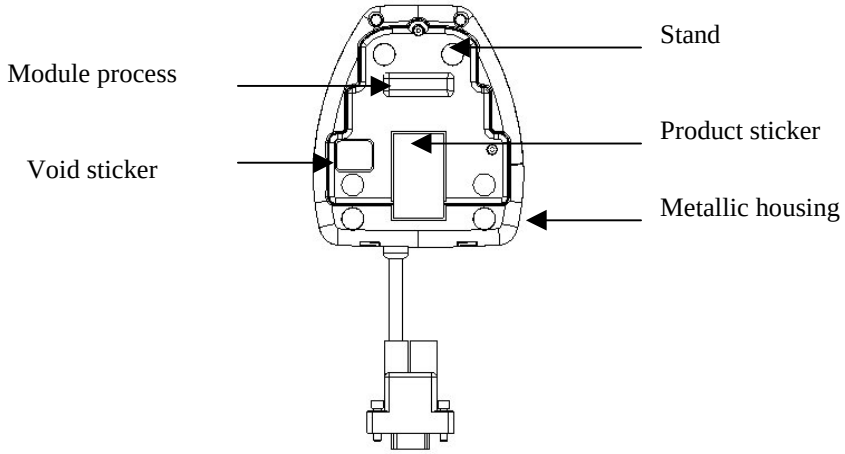



**Figure 3 : MorphoSmart™ MSO20x bottom view**

# 6 MorphoSmart™ MSO3xx

## 6.1 Physical Characteristics

The MSO3xx is dedicated to be connected to an USB port, which supplies the required power.

The MSO35x device includes a smart card reader

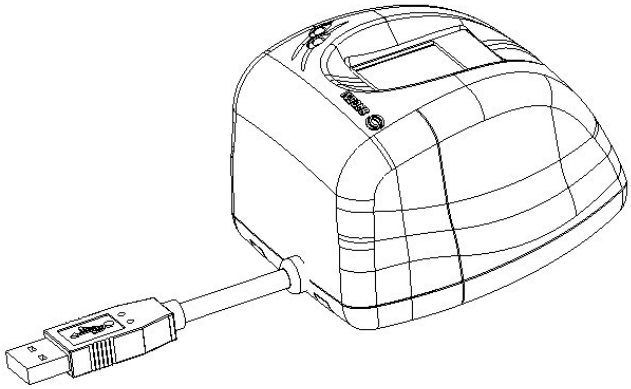


**Figure 4: MorphoSmart™ MSO300 3D View**

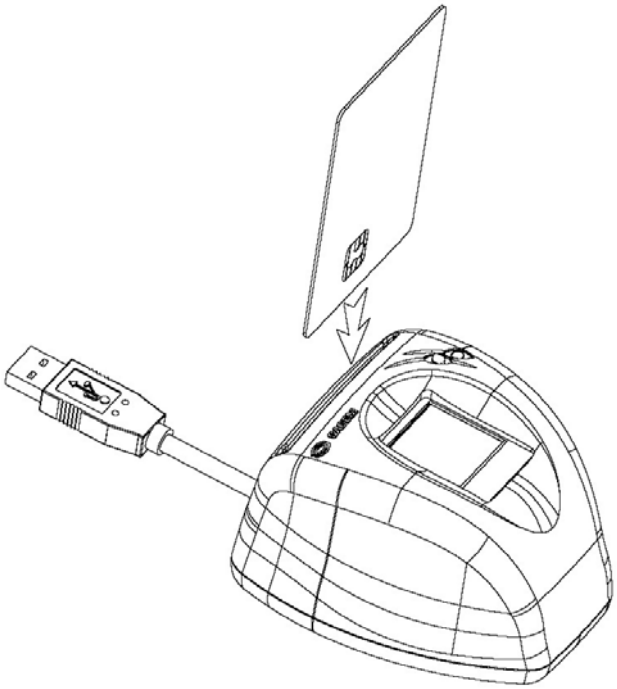


**Figure 5: MorphoSmart™ MSO350 3D View**

## 6.2 General description

### 6.2.1 Top view

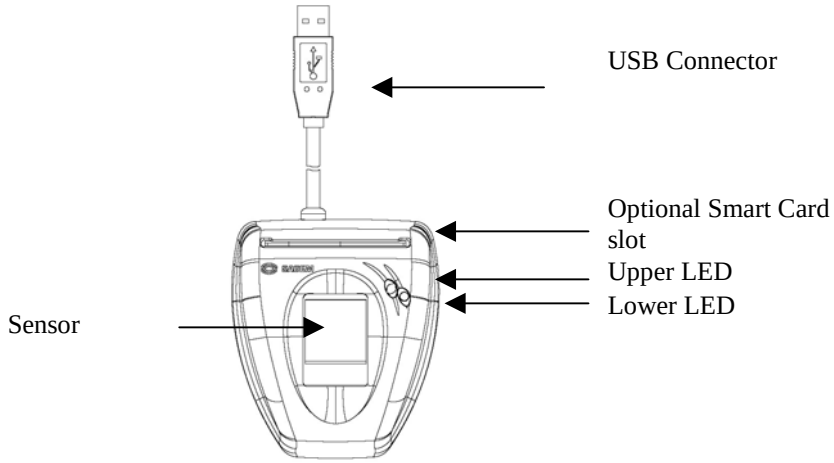



**Figure 6: MorphoSmart™ MSO3xx Top View**

### 6.2.2 Bottom view

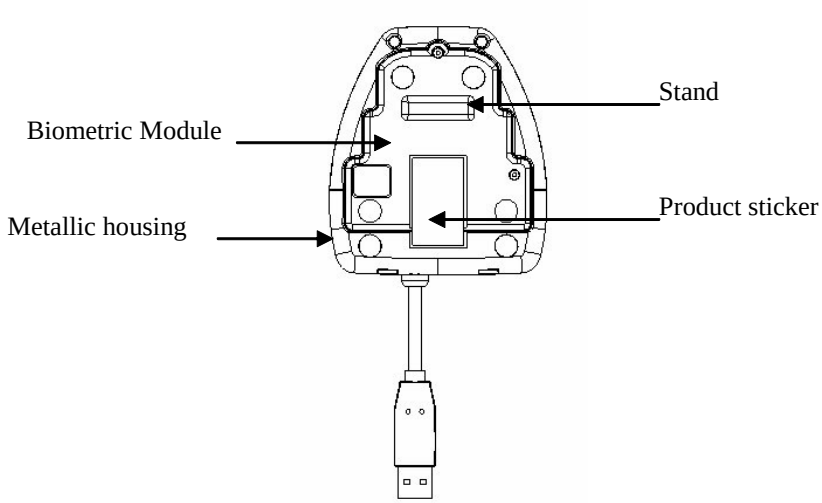



**Figure 7: MorphoSmart™ MSO3xx Bottom View**

# 7 MorphoSmart™ MSOxx1 : Fake Finger Detection

## 7.1 MorphoSmart™ MSOxx1 devices

The MorphoSmart™ terminals of the MSO xx1 series have security enhanced features. These terminals integrate a specific mechanism (Sagem Sécurité patents) enabling the device to detect fake fingers, such as paper copied ones.

The following terminals include this mechanism :

- MSO201
- MSO301
- MSO351

## 7.2 Specific recommendations

**We advise persons with pacemaker or other electronic disposals against using this MSO xx1 version of the MorphoSmart™ terminal.**

## 7.3 Cleaning Precautions

It is recommended to clean the sensor when it is dirty. Dust lowers the MSO xx1 performances. The cleaning material for sensor must be a soft material to prevent scratches. It is advised to clean the sensor after 1000 uses, with a lightly damp rag, to dry it and to wait a few minutes before starting up again the terminal.

In order to eliminate organic marks, a weekly cleaning is required. In this case, using a rag moistened with diluted dishwashing liquid is advised.

Scratch materials, alcohol and acids products are forbidden.

# 8 MorphoSmart™ MSO1300

## 8.1 Physical Characteristics

The MSO1300 device is dedicated to be connected to an USB port, which supplies the required power.

**Figure 8: MorphoSmart™ MSO13xx**

## 8.2 General description

### 8.2.1 3D view

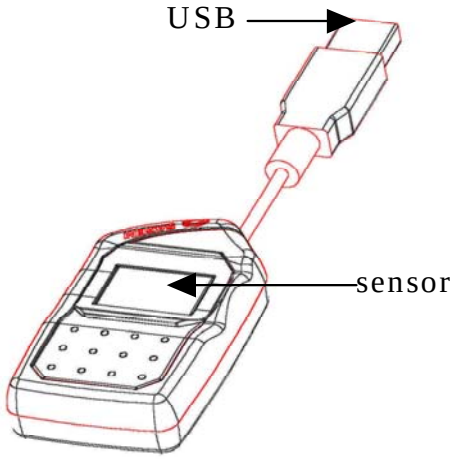



**Figure 9: MorphoSmart™ MSO1300 3D view**

### 8.2.2 Bottom view

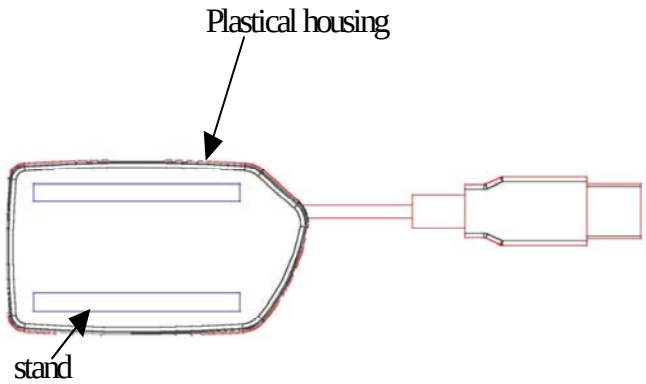



**Figure 10: MorphoSmart™ MSO1300 Bottom view**

# 9 MorphoSmart™ MSO1350

## 9.1 Physical Characteristics

The MSO1350 includes a smart card reader, and is dedicated to be connected to an USB port, which supplies the required power.


**Figure 11 : MorphoSmart™ MSO1350**

## 9.2 General description

### 9.2.1 Top view and Side view

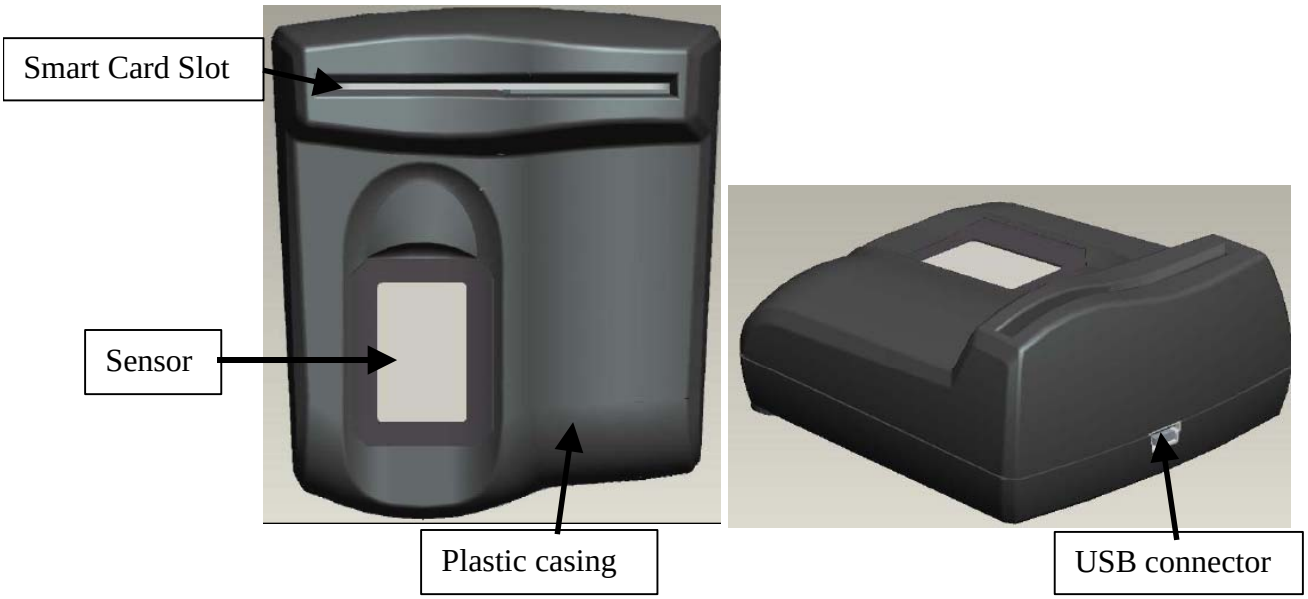



**Figure 12: MorphoSmart™ MSO1350 top view and side view**

### 9.2.2 Bottom view

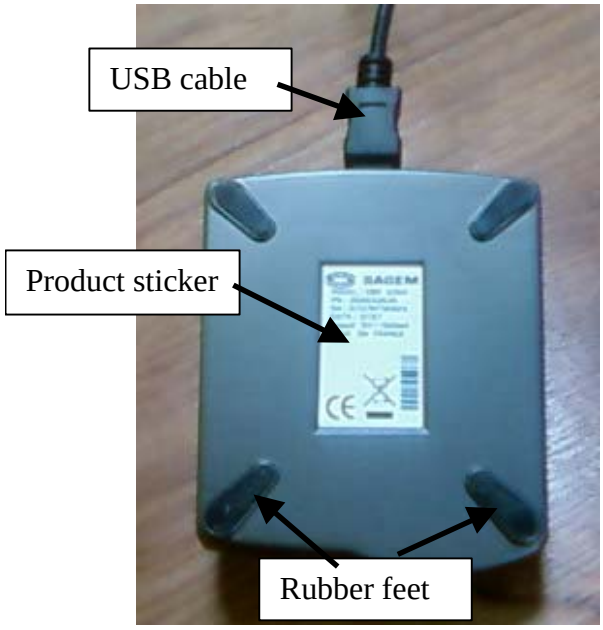



**Figure 13: MorphoSmart™ MSO1350 bottom view**

# 10 MorphoSmart™ device Technical Characteristics

## 10.1 Physicals characteristics

### 10.1.1 Dimensions and Weight

| Device | Dimensions (L x w x h) | Weight (without cord) | Sensor |
|---|---|---|---|
| MSO20x/MSO3xx | 80 x 92 x 57 mm | 300 g | 416 x 416 pixels |
| MSO1300 | 53.7 x 33.7 x 13.5 mm | 20 g | 400 x 256 pixels |
| MSO1350 | 82 x 71 x 41 mm | 140 g | 400 x 256 pixels |

### 10.1.2 Temperature range and humidity

| Device | Temperature range | | Humidity | |
|---|---|---|---|---|
| | Operating | Storage | Operating | Storage |
| MSO1300/MSO1350 | 0°C to 50°C | - 20°C to 70°C | 10% < RH < 85% | RH < 95% |
| MSO20x/MSO3xx | 0°C to 40°C | - 20°C to 70°C | 10% < RH < 80% non-condensing | RH < 95% |

### 10.1.3 USB (All USB MorphoSmart™ devices)

- USB 1.1 compliant (compatible with USB 2.0)

### 10.1.4 RS232 (MSO200 only)

- 9600 up to 115 200 bps

### 10.1.5 Smart Card (MSO35x and MSO1350)

- ISO 7816 1-4
- PC/SC
- CCID (over USB)

### 10.1.6 Power (All MorphoSmart™ devices)

- Supply : 5V
- Standby mode : 500 µA (Typical)
- System Idle : 50 mA (Typical)
- Full operating sensor on : 500 mA maximum
- Boot time : 0.8 second

## 10.2 Biometric characteristics

### 10.2.1 Database size

The table below describes the maximum number of 2 fingerprints records available in the local database, and the configuration required to support it.

| Number of records required | ≤ 500 | ≤ 2000 | ≤ 3000 | ≤ 5000 |
|---|---|---|---|---|
| Flash size required | ≥ 1Mbytes | ≥ 2 Mbytes | ≥ 4 Mbytes | ≥ 4 Mbytes |
| License required | None | IdentLite | IdentLite | IdentPlus |

### 10.2.2 Database fulfill time

The table below gives typical duration of database fulfill with 2 fingerprints records, when redundant template check is off (please refer to the description of ID_No_Check_On_Template optional ILV in 'MorphoSmart Host System Interface Specification' documentation).

| Number of records | 100 | 500 | 1000 | 2000 | 3000 | 4000 | 5000 |
|---|---|---|---|---|---|---|---|
| **USB** | < 1.5 s | < 7 s | < 15 s | < 30 s | < 45 s | < 60 s | < 80 s |
| **RS232 at 115200 Bd** | < 20 s | < 1 mn | < 2 mn | < 4 mn | < 6 mn | < 8 mn | < 10 mn |

### 10.2.3 Verify performances

The verify process compare the search fingerprint to one or more reference fingerprints : less than 1 second (typical time).

Please not that :

- the measure starts with finger valid placement on the sensor and stops with result returned to the host system.
- the time value is intended for typical fingerprints : more characteristic points per fingerprint (such as for a thumb fingerprint) means more time.
- No extra time when matching involve one search template and two reference
- Add 1 second to the specified value, in case of 'no match found', when 'advanced matching' is used (please refer to the definition of ID_Matching_Strategy optional ILV in 'MorphoSmart Host System Interface specification' document)
- No extra time is required when 'not oriented matching' is used (please refer to the definition of value 2 for Sensor_Window_Position ILV definition in 'MorphoSmart Host System Interface specification' document)

### 10.2.4 Identify performances

The identify process compare the search fingerprint to all the records of the database.

The identify process compare first the search fingerprint to all the 1st fingerprint (**fingerprint # 1**) of each database record. If a match is found, the comparison process stops, else, the identify process compare the search fingerprint to all 2nd fingerprint (**fingerprint # 2**) of each database record. It means that the identification process is faster when the user place on the sensor, a finger which is recorded as the 1st fingerprint of the user's record. It also means that the time required to reject a fingerprint (**No Hit**) is higher than the time required to match with the 1st fingerprint of a record.

| Number of records | Hit fingerprint # 1 | Hit fingerprint # 2 | No Hit |
|---|---|---|---|
| **100** | **≤ 1 s** | **≤ 1.5 s** | **≤ 1.5 s** |
| **500** | **≤ 1.1 s** | **≤ 1.5 s** | **≤ 1.5 s** |
| **2000** | **≤ 1.5 s** | **≤ 2 s** | **≤ 2 s** |
| **3000** | **≤ 2 s** | **≤ 2.5 s** | **≤ 2.5 s** |
| **5000** | **≤ 2.5 s** | **≤ 3 s** | **≤ 3 s** |

Please not that :

- The measure starts with finger valid placement on the sensor and stops with result returned to the host system.
- the time value is intended for typical fingerprints : more characteristic points per fingerprint (such as for a thumb fingerprint) means more time.
- Add 1 second to 'no hit' time when 'advanced matching' is used (please refer to the definition of ID_Matching_Strategy optional ILV in 'MorphoSmart Host System Interface specification' document)
- The time value can be multiplied by 2 when 'not oriented matching' is used (please refer to the definition of value 2 for Sensor_Window_Position ILV definition in 'MorphoSmart Host System Interface specification' document).

# 11 Man Machine Interface

## 11.1 MSO2xx/MSO3xx Man Machine Interface

### 11.1.1 Description

In addition to the sensor light, there are two LEDs to provide information to the user :

- when the sensor light is on, it usually means that the device is waiting for the user to place a finger on the sensor,
- the upper led is mainly used for smart card reader status (MSO35x only),
- the lower led is mainly used for biometric process status.

The tables below describe the meaning of the light signals.

### 11.1.2 System status

| Status | Sensor | Lower LED | Upper LED |
|---|---|---|---|
| Suspend (low power mode) | Off | Off | Off |
| Stand By (wait for a request) | Off | Flashing Green | See Table 3 |
| Maintenance State (such as firmware update in progress) | Off | Blinking Red | Blinking Red |
| Personalization State (secure MSO) | Off | Blinking Red | Blinking Red |
| Unrecoverable Error or USB enumeration Error (see note) | Off | Red | Red |

**Table 1 : MSO20x/MSO3xx status**

NOTE: Both LEDs are red from successful power-up until the USB device is successfully enumerated by the host system (usually a few seconds).

### 11.1.3 Biometric process status

| Status | Sensor | Lower LED |
|---|---|---|
| Waiting For Finger | On | Off |
| Waiting For Finger Removal | On | Green |
| Finger Misplaced Or Latent | On | Blinking Red |
| Switch To Next Finger (enroll process) | On | Blinking Green |
| Recognized Finger | Off | 2 seconds in Green |
| Finger Unknown / Failure | Off | 2 seconds in Red |

**Table 2 : MSO20x/MSO3xx biometric process status**

### 11.1.4 Smart card reader status

| Status | Upper LED |
|---|---|
| Smart Card powered on | Green |
| Smart Card powered off | Off |
| Smart Card treatment in progress | Blinking Green |

**Table 3 : MSO35x smart card request status**

## 11.2 MSO13xx Man Machine Interface

### 11.2.1 Description

This section applies to MSO1300 and to MSO1350 devices which have none additional LED : the Man Machine Interface is reduced to the sensor light.

### 11.2.2 System status

| Status | Sensor |
|---|---|
| Suspend (low power mode) | Off |
| Stand By (wait for a request from host system) | Off |
| Maintenance State (such as firmware update in progress) | Blinking |
| Personalization State (secure MSO) | Blinking |
| Unrecoverable Error or USB enumeration Error | Off |

**Table 4 : MSO13x0 system status**

### 11.2.3 Biometric request status

| Status | Sensor |
|---|---|
| Waiting For Finger | On |
| Waiting For Finger Removal | On |
| Finger Misplaced Or Latent | On |
| Switch To Next Finger (enroll process) | On |
| Recognized Finger | Off |
| Finger Unknown / Failure | Off |

**Table 5 : MSO13x0 biometric process status**

### 11.2.4 Smart card reader status (MSO1350)

| Status | Sensor |
|---|---|
| Smart Card powered on | One blink |
| Smart Card powered off | No signal |
| Smart Card treatment in progress | No signal |

**Table 6 : MSO1350 smart card request status**

# 12 Secure MorphoSmart™ getting started

In addition to normal installation process, the secure MORPHOSMART™ device must be unlocked and personalized. To perform this, the security information provided with the batch of secure MORPHOSMART™ devices are required: two transport files (usually send by email), and their corresponding password (usually send under secure cover).

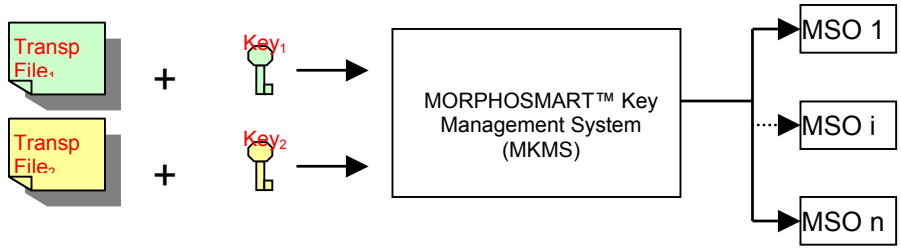



**Figure 1**: MORPHOSMART™ S unlocking

Insert the **MKMS** CD into your CDROM drive. If installation does not start automatically, run setup.exe from the root directory of the CD.

After installation, start the DAO 3.6 driver installation from the PROGRAMS folders:

*START / PROGRAMS / MorphoSmartKeyManagementSystem / InstallDAO 3.6 /.*

After installation, start the **MKMS application** from the PROGRAMS folders:

*START / PROGRAMS / MorphoSmartKeyManagementSystem / Exe /*

Select the '**Root key generation**' action in the '**Initialization**' menu, to create your MORPHOSMART™ Certification Authority.

Click '**Insert Transport Files**' button to import the two transport files and their passwords into the **MKMS** database (figure 1).

Set up the value of the **security configuration parameters** and of the **key parameters** ('**Initialization**' menu).

Then connect a new MORPHOSMART™ device to the PC, and use the '**MSO Personalization**' button to unlock it, and to put it in operational condition.

Perform the previous action for each new secure MORPHOSMART™ device of the batch.

For more information about the secure MORPHOSMART™ , please refer to the **MorphoSmartKeyManagementSystem.pdf** file from the PROGRAMS folders:

*START / PROGRAMS / MORPHOSMART™KeyManagementSystem /Documentation /*

# 13 Recommendations

## Areas containing combustibles

It is strongly recommended that you do not install your **MorphoSmart™** in the vicinity of gas stations, petroleum processing facilities or any other facility containing flammable or combustible gasses or materials.

## General precautions

- Do not attempt to repair your **MorphoSmart™** yourself. The manufacturer cannot be held responsible for any damage/accident that may result from attempts to repair components. Any work carried out by non-authorized personnel will invalidate your warranty.
- Use your SAGEM MorphoAccess™ with original accessories. Attempts to integrate the **MorphoSmart™** with unapproved accessories will void your warranty.
- Do not use your **MorphoSmart™** in damp areas (ex: swimming pools etc). It must be protected from water and other liquids.
- Do not expose your **MorphoSmart™** to extreme temperatures.
- Do not expose your **MorphoSmart™** to direct sunlight.
- Due to electrostatic discharge, and depending on the environment, synthetic carpet should be avoided in areas where the **MorphoSmart™** has been installed.

## Cleaning precautions

- A dry cloth should be used, specially for fingerprint sensor window.
- **Acid liquids, alcohol or abrasive materials are forbidden**.

## Warning

The manufacturer cannot be held responsible if the above recommendations are not followed or if the **MorphoSmart™** is used incorrectly.

# 14 FCC Standard

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**Caution:** User changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**Responsible Party:** Sagem Morpho Inc, 1145 Broadway Plaza, Suite 200, Tacoma, Washington (USA), 98402, (800) 346-2674.

**Note:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

# 15 Table of figures