Precise
First Edition January 2003
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P/N AM010021 R1C
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1 INTRODUCTION

This document describes how to develop applications using Precise BioMatch™ Standard Toolkit with BioAPI support. The BioAPI support is provided as a BioAPI BSP (Biometric Service Provider) software component. The reader of this document should be familiar with the BioAPI standard specified by the BioAPI Consortium.

For more information about BioAPI please refer to the web site www.bioapi.org. For more thorough information about Precise Biometrics and our technology, please refer to our web site www.precisebiometrics.com.

For more information about the Precise BioMatch™ technology please refer to the Precise BioMatch™ White Paper to be found in the Documentation folder in this toolkit.

1.1 Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSP</td>
<td>Biometric Service Provider</td>
</tr>
<tr>
<td>ECP</td>
<td>Enhanced Capabilities Port</td>
</tr>
<tr>
<td>FAR</td>
<td>False Acceptance Rate</td>
</tr>
<tr>
<td>FRR</td>
<td>False Rejection Rate</td>
</tr>
<tr>
<td>MDS</td>
<td>Module Directory Service</td>
</tr>
<tr>
<td>PC/SC</td>
<td>A standard facilitating the development of PC / smart card applications. For additional information please refer to <a href="http://www.pcscworkgroup.com">www.pcscworkgroup.com</a>.</td>
</tr>
<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
</tr>
</tbody>
</table>

1.2 Definitions

<table>
<thead>
<tr>
<th>Definition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS_Install</td>
<td>Utility that installs the MDS</td>
</tr>
<tr>
<td>MOD_install</td>
<td>Utility that adds BSPs to the MDS</td>
</tr>
<tr>
<td>bioapi_mds300.dll</td>
<td>MDS engine</td>
</tr>
<tr>
<td>bioapi100.dll</td>
<td>BioAPI framework</td>
</tr>
<tr>
<td>pbbioapi.dll</td>
<td>Precise Biometrics BSP</td>
</tr>
<tr>
<td>Module Registry</td>
<td>BioAPI equality to Windows Registry</td>
</tr>
</tbody>
</table>
1.3 System Requirements

The system requirements in this chapter apply to Precise 100 readers including Precise 100 Drivers. As the Precise Biometrics BSP is dependent on the drivers, these must be installed prior to use of the Precise Biometrics BSP. All readers in the Precise 100 series are compatible with the Precise Biometrics BSP.

1.3.1 Windows XP

• Service pack 1 or higher.
• Pentium 300 MHz or better.
• USB port.
• VGA resolution graphics card or higher.

1.3.2 Windows 2000

• Service pack 3 or higher.
• Pentium 300 MHz or better.
• USB port or Parallel port with ECP support and PS/2 keyboard/mouse port.
• VGA resolution graphics card or higher.

1.3.3 Windows NT

• Windows NT 4 with Service Pack 6 or higher.
• Pentium 300 MHz or better.
• Parallel port with ECP support and PS/2 keyboard/mouse port (Windows NT does not support USB).
• VGA resolution graphics card or higher.

1.3.4 Windows 98

• Windows 98 with Service Pack 1 or Windows 98 SE.
• Pentium 300 MHz or better.
• USB port.
• VGA resolution graphics card or higher.

1.3.5 Windows Me

• Pentium 300 MHz or better.
• USB port.
• VGA resolution graphics card or higher.
1.4 Files in the Toolkit

The files in the toolkit are delivered in a folder structure as described below.

Precise Biometrics

This folder is the root of the folder structure. The folder contains a ReadMe file.

Precise Biometrics/BioAPI/dll

This folder contains the dlls for the MDS engine, the BioAPI framework and the Precise Biometrics BSP.

Note: The bioapi_mds300.dll and bioapi100.dll are standard BioAPI files provided by the BioAPI Consortium (www.bioapi.org).

Precise Biometrics/BioAPI/Reference Implementation

This folder contains the installation program for the BioAPI Reference Implementation provided by the BioAPI Consortium.

Precise Biometrics/BioAPI/Tools/Bat

This folder contains .bat files that can be used for easy installation and removal of BioAPI components.

Precise Biometrics/BioAPI/Tools/Standard

This folder contains the standard tools for installation and uninstallation of BioAPI components. The tools are developed and provided by the BioAPI Consortium.
Precise Biometrics/Documentation


Precise Biometrics/Drivers

This folder contains the Precise 100 Drivers. Merge Modules for easy integration of Precise 100 Drivers into other installation programs are also included. See the ReadMe files in this folder and its sub-folders for further information.

Precise Biometrics/Examples

This folder contains example code showing how to use this Toolkit.

Precise Biometrics/Microsoft

This folder contains the Microsoft Smart Card Base Components. See the ReadMe file in this folder for further information.
2 INSTALLATION

This chapter describes how to install the Precise Biometrics BioMatch™ Standard Toolkit on a computer for development purposes.

The installation procedure is divided into four main steps.

1. Install the Precise 100 Drivers (chapter 2.1)
2. Install the pbbase.dll (chapter 2.2)
3. Install the Precise BSP (chapter 2.3)
4. Install the BioAPI Reference Implementation (chapter 2.4)

2.1 Installation of Precise 100 Drivers

Depending on which operating system and which Precise 100 reader that is to be used, different drivers have to be installed. The drivers are located in the Drivers folder in the toolkit. Refer to the read-me file in the Drivers folder for installation instructions.

You can always download the latest version of the drivers from our web site www.precisebiometrics.com.

2.2 Installation of pbbase.dll

The pbbase.dll contains the biometric algorithms developed by Precise Biometrics. The pbbase.dll file is located in the BioAPI/dll folder and must be manually copied to the appropriate system folder on the target computer.

On Windows NT, 2000 and XP copy the pbbase.dll to the System32 folder.
On Windows 98 and Me copy the pbbase.dll to the System folder.

2.3 Installation of Precise Biometrics BSP

The BioAPI Consortium provides a couple of tools to handle installation and uninstallation of BioAPI components. To simplify a typical installation, Precise Biometrics has developed .bat files that are included in this toolkit. If you want to use these .bat files go to chapter 2.3.1. If you need full control over the installation procedure go to chapter 2.3.2, where we describe how to use the tools provided by the BioAPI Consortium.
2.3.1 Installing and Uninstalling Using .bat Files

Precise Biometrics has developed .bat files that simplify a typical install and uninstall of the Precise BSP, the BioAPI framework and the MDS. The .bat files are located in the BioAPI/Tools/Bat folder in this toolkit.

*Note:* The .bat files utilize the standard tools described in chapter 2.3.2.

- **install_pb_all.bat**: Installs the MDS, BioAPI framework and Precise BSP on Windows XP/2000/NT/Me/98.
- **install_pb_bsp.bat**: Installs Precise BSP on Windows XP/2000/NT/Me/98. Use this if the MDS and BioAPI framework are already installed.
- **uninstall_pb_all.bat**: Uninstalls the MDS, BioAPI framework and Precise BSP on Windows XP/2000/NT/Me/98.
- **uninstall_pb_bsp.bat**: Uninstalls Precise BSP on Windows XP/2000/NT/Me/98. Use this if you only want to uninstall the Precise BSP.
2.3.2 Installing and Uninstalling Using Standard Tools

The BioAPI Consortium provides the two tools mds_install and mod_install to be used for installation and uninstallation of BioAPI components. In this chapter you will find the command line syntax for the tools and examples of how to use the tools. The tools are located in the BioAPI/Tools/Standard folder.

2.3.2.1 Command Line Syntax for mds_install

mds_install [-u] -s file [-d path]

- **-u** Install the module.
- **-s file** Source file to install. No extension if installing, filename only when uninstalling or refreshing.
- **-d path** Destination path. Required for install.

2.3.2.2 Command Line Syntax for mod_install

mod_install [-fiur] -s file [-d path]

- **-f** Unused option reserved for future use.
- **-i** Install the module.
- **-u** Uninstall the module.
- **-r** Refresh the installation information.

** Options -i, -u, and -r are mutually exclusive. **

- **-s file** Source file to install; no extension if installing, filename only when uninstalling or refreshing.
- **-d path** Destination path; required for install.
2.3.2.3 Installation and Uninstallation Examples

Prerequisites for the following examples:

- The operating environment is WinNT or Win 2000
- The system folder is c:/winnt/system32
- The installation folder is c:/BioAPI
- The bioapi_mds300.dll, bioapi100.dll and pbbioapi.dll are located in c:/BioAPI/dll
- c:/BioAPI/Install is added to the SYSTEM PATH

**Note 1:** The destination of MDS must be in the search path, typically the system folder (e.g. c:/windows/system/ or c:/winnt/system32/).

**Note 2:** The destination of the framework (bioapi100.dll) must be in the search path.

**Note 3:** The destination of the BSP may be anywhere; MDS remembers where, and the framework uses this to locate and load the BSP at runtime

**Important:** The components have a linked dependency and therefore the steps in the examples must be performed in the order in which they appear.

**Installation Example**

```
mds_install -s c:\BioAPI\dll -d c:\winnt\system32
mod_install -if -s c:\BioAPI\dll\bioapi100 -d c:\winnt\system32
mod_install -if -s c:\BioAPI\dll\pbbioapi -d c:\winnt\system32
```

**Uninstallation Example**

```
mod_install -u -s c:\winnt\system32\pbbioapi.dll
mod_install -u -s c:\winnt\system32\bioapi100.dll
mds_install -u
```
2.4 Installation of BioAPI Reference Implementation

To be able to develop BioAPI compliant applications, the BioAPI Reference Implementation has to be installed. To install the Reference Implementation, execute the bioapi.exe file in the BioAPI/Reference Implementation folder in this toolkit.

You can always download the latest version of the Reference Implementation from the BioAPI Consortium web site www.bioapi.org.

2.5 File Locations for Installed Files

This chapter describes which files, folders and registry keys the mds_install and mod_install tools creates and/or updates, assuming the system folder is c:/winnt/system32/.

`mds_install -s c:\BioAPI\dll -d c:\winnt\system32`

Copies the file `bioapi_mds300.dll` to `c:/winnt/system32`.

Creates the folder `BioAPIFFDB` where the Module Registry database resides.

Creates registry keys in the Windows Registry below the key:
`HKEY_LOCAL_MACHINE/SOFTWARE/BioAPI`

`mod_install -if -s c:\BioAPI\dll\bioapi100 -d c:\winnt\system32`

Copies the file `bioapi100.dll` to `c:/winnt/system32`.

Creates registry keys in the Module Registry.

`mod_install -if -s c:\BioAPI\dll\pbbioapi -d c:\winnt\system32`

Copies the file `pbbioapi.dll` to `c:/winnt/system32`.

Creates registry keys in the Module Registry.
2.6 Files, Folders and Registry Keys Remaining after Uninstalling

2.6.1 .bat Files
When uninstalling using the .bat files provided by Precise Biometrics, registry keys will be left in the Windows Registry below the key:

    HKEY_LOCAL_MACHINE/SOFTWARE/BioAPI

2.6.2 Standard Tools
When uninstalling using the standard tools mds_install and mod_install, some files, folders and registry keys that were created during installation are not deleted.

After a complete installation and uninstallation these files and folders are left in the system folder:

    bioapi_mds300.dll
    bioapi100.dll
    pbbioapi.dll
    BioAPIFFDB (empty folder)

Registry keys will be left in the Windows Registry below the key:

    HKEY_LOCAL_MACHINE/SOFTWARE/BioAPI
3 SYSTEM SOLUTION

Once the Precise Biometrics BSP support is integrated into your application, there are two ways to deliver the solution to customers.

3.1 Integration in Application

The installation of the Precise Biometrics BSP can be integrated into the installation of your application. A license agreement of Precise BioMatch™ Standard then has to be signed with Precise Biometrics. Please contact your commercial contact at Precise Biometrics for more information on the license agreement.

The system solution could then look like this:

- Application developed by you including the Precise Biometrics components:
  - pbbase.dll installed as described in chapter 2.2.
  - Precise Biometrics BSP installed as described in chapter 2.3.
- Precise 100 reader. The driver comes with the reader and is also available for free at our web site.

**Note:** The pbbase.dll will not be required in future releases of Precise BioMatch™ standard.

3.2 Non-integration in Application

You can choose not to integrate the installation of the Precise Biometrics BSP into the installation of your application. In this case the end-customer has to purchase the BSP, i.e. Precise BioMatch™ Standard, from Precise Biometrics.

The system solution could then look like this:

- Application developed by you.
- Precise 100 reader.
- Precise BioMatch™ Standard. This product installs both the reader driver, the BSP, pbbase.dll and if necessary the MDS.
4 PRECISE BIOMATCH™ STANDARD FUNCTIONALITY

This chapter delineates the BioAPI operations and proprietary parameters supported by Precise BioMatch™ Standard. All mandatory BioAPI operations are supported. Please refer to the BioAPI Specification located in the Documentation folder of this toolkit for the complete operation reference.

4.1 Framework Operations

- BioAPI_Init
- BioAPI_Terminate
- BioAPI_EnumModules
- BioAPI_ModuleLoad
- BioAPI_ModuleUnload
- BioAPI_ModuleAttach
- BioAPI_ModuleDetach
- BioAPI_QueryDevice

4.2 BSP Operations

4.2.1 Handle Operations

- BioAPI_FreeBIRHandle
- BioAPI_GetBIRFromHandle
- BioAPI_GetHeaderFromHandle

4.2.2 Callback and Event Operations

- BioAPI_EnableEvents

4.2.3 Biometrics Operations

- BioAPI_Capture
- BioAPI_Process
- BioAPI_VerifyMatch
- BioAPI_Enroll
- BioAPI_Verify
- BioAPI_SetPowerMode

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4.3 Optional Sub-functions

The following table specifies which optional capabilities, according to the BioAPI Specification, the Precise Biometrics BSP currently supports.

<table>
<thead>
<tr>
<th>Capability</th>
<th>Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return of raw/audit data</td>
<td>No</td>
</tr>
<tr>
<td>Return of quality</td>
<td>Yes</td>
</tr>
<tr>
<td>Application-controlled GUI</td>
<td>No</td>
</tr>
<tr>
<td>GUI streaming callbacks</td>
<td>No</td>
</tr>
<tr>
<td>Detection of source presence</td>
<td>No</td>
</tr>
<tr>
<td>Payload carry</td>
<td>Yes</td>
</tr>
<tr>
<td>BIR signing</td>
<td>No</td>
</tr>
<tr>
<td>BIR encryption</td>
<td>No</td>
</tr>
<tr>
<td>Return of FRR</td>
<td>No</td>
</tr>
<tr>
<td>Model adaptation</td>
<td>No</td>
</tr>
<tr>
<td>Binning</td>
<td>No</td>
</tr>
<tr>
<td>Client/server communications</td>
<td>No</td>
</tr>
<tr>
<td>Supports self-contained device</td>
<td>No</td>
</tr>
</tbody>
</table>

4.4 Proprietary Parameters

There are a couple of proprietary parameters in the Precise BioAPI BSP implementation to cater to the special needs of some applications. The BioAPI API does however not have any way for an application to affect these parameters, so we have chosen to control them from the Windows registry. Normally these parameters do not have to be changed and if their corresponding registry keys are not created, the Precise BioAPI BSP will use the default values.

The parameters that may be changed are:

- Latent Finger Protection
- Fingerprint Representation
- Default Fingers to Enroll

4.4.1 Latent Finger Protection

The Precise Biometrics software has a mechanism for protecting against attacks using the latent fingerprint on the sensor. The latent finger protection will report a failed match when it believes that someone is trying to match using a latent print. The operative word here is believe – there is a risk that it incorrectly classifies a correct finger as an attempted use of a latent print, and thus will give the user a slightly higher FRR than possible. While this is not a problem during normal use, it may be a problem for some kind of evaluations using databases, so this mechanism may be turned off.
Use of latent finger protection is controlled by the registry key `LatentProtection` (of type REG_DWORD) in `HKLM\Software\Precise Biometrics\BioMatch Standard`

The valid `LatentProtection` values are:

0  Disable latent finger protection.
1  Enable latent finger protection.

The default value is 1.

### 4.4.2 Fingerprint Representation

The GUI in the Precise BioAPI BSP displays the location of the fingerprint to help the user get an optimal finger placement. The fingerprint can be represented in different ways in the GUI and the representation is determined from the registry key `FPR` (of type REG_DWORD) in `HKLM\Software\Precise Biometrics\BioMatch Standard`

The valid `FPR` values are:

0  The fingerprint representation that Precise Biometrics thinks is the most appropriate in this version and in future releases of Precise BioMatch™ Standard. (See figure below).
1  A fingerprint representation that does not show the pattern of the captured fingerprint. (See figure below).
2  A transformed view of the original fingerprint image that looks good on the screen. Note that future readers with embedded biometrics will (probably) not be able to return as good-looking images as you might expect. (See figure below).

The default value is 0 (same as 1 in this version).
4.4.3 Default Fingers to Enroll

The registry key **DefaultEnroll** (of type **REG_BINARY**) in **HKLM\Software\Precise Biometrics\BioMatch Standard** determines which fingers are pre-selected in the “Choose Fingers” page in the enrollment wizard. It is codes as ten bytes where the first byte represents the left little finger, the second byte represent the left ring finger etc. A value of 1 means that the finger should be pre-selected and a value of 0 that it should not be pre-selected.

Example: “00 00 00 00 00 01 01 00 00” pre-selects the right pointer and middle finger.

**Note:** This value is overwritten with a new default value when users press the “set as default” button.
5 PROGRAMMING GUIDELINES

In this chapter some programming specific issues are discussed. The guidelines in this chapter should be followed for optimal performance when implementing support for the Precise Biometrics BSP.

5.1 Verification

Two verification operations are provided, BioAPI_VerifyMatch and BioAPI_Verify. They are implemented in the Precise Biometrics BSP to fulfill two different purposes and for optimal performance they should be used for those purposes.

5.1.1 Local Verification – Match-on-PC

The traditional way to perform a verify operation is to let the application drive the process by doing something along the line of

BioAPI_Capture();
BioAPI_Process();
BioAPI_VerifyMatch();

Use of the BioAPI_Verify operation ensures all of the above processes are handled by a single call that returns only upon a successful verification, time-out, or a sure match failure.

Another primary benefit of using the BioAPI_Verify operation is that it can seamlessly take advantage of the several images per second captured by the Precise 100 reader to perform multiple verifications before final return.

Only enrolled fingers will be selectable in the verification GUI when using the BioAPI_Verify operation. This is an advantage compared to using the BioAPI_Capture operation where all 10 fingers will be selectable.

To get optimal performance we strongly recommend you use the BioAPI_Verify operation in environments where the Precise 100 reader is directly accessible from the computer where the verification is performed.

5.1.2 Remote Verification – Match-on-Server

In environments where the Precise 100 reader is not directly attached to the computer where the verification is performed, e.g. a client server environment, the image capturing will have to be performed on one computer and the verification on another.

In this case the BioAPI_Capture and the BioAPI_Process operations should be used on the client and the BioAPI_VerifyMatch operation should be used on the server.
5.2 FAR/FRR

The BioAPI verification operations allow the caller to specify desired FAR/FRR values. These two parameters are however strongly correlated and the Precise Biometrics BSP will provide best performance if only desired FAR is specified. The BSP will then optimize the FRR to be as low as possible given the selected FAR.

A FAR value of 1:20,000 is recommended unless the customer explicitly wants a lower value. Note that the desired FAR parameter (MaxFARRequested) is a 32-bit integer value (N) that indicates a FAR of N/(2^{31}-1). If for example the desired FAR is 1:20,000, the MaxFARRequested parameter has to be set to 107,374.

The highest acceptable FAR value should always be used to achieve as low FRR as possible.

The FRR is not only dependent on the FAR, but also on other more abstract parameters, such as:

- The users experience of the fingerprint reader.
- The quality of the enrolled fingerprint template.
- The skin condition of the users fingerprint.
- The time since the last cleaning of the fingerprint sensor.

This implies that different individuals will achieve different FRR although the same FAR level is used.

5.3 Payload

The Precise Biometrics BSP supports the payload mechanism, i.e. it is possible for the application to bound opaque data to a template.

The maximum size of a payload is 0xFFFFFFFF bytes.

The payload is not encrypted by the BSP.

No FAR threshold is set, i.e. any successful verification will grant access to the payload.
6 Smart Card

This chapter discusses PC/SC compliance for our Precise combo readers, i.e. readers with integrated smart card reader and fingerprint sensor. Precise combo readers are fully PC/SC compatible.

6.1 PC/SC Name

Precise Biometrics has three different types of combo readers and to each reader a unique PC/SC name is associated. The table below shows the readers and their PC/SC names.

<table>
<thead>
<tr>
<th>Precise Reader</th>
<th>PC/SC Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precise 100 SC PAR, Precise 100 SC BioKeyboard PAR</td>
<td>Precise Biometrics Precise 100 SC Par</td>
</tr>
<tr>
<td>Precise 100 SC USB, Precise 100 SC BioKeyboard USB</td>
<td>Precise Biometrics Precise 100 SC</td>
</tr>
<tr>
<td>Precise 100 MC</td>
<td>Precise Biometrics Precise 100 MC</td>
</tr>
</tbody>
</table>

Note: The PC/SC name for the readers Precise 100 SC PAR and Precise 100 SC BioKeyboard PAR might be changed to “Precise Biometrics Precise 100 SC” in future parallel drivers.

The Precise 100 PC-Card MC product includes a non Precise Biometrics PC/SC smart card reader.
The PC/SC name of this reader is “SCM Microsystems Inc. SCR241 PCMCIA”.
To find and choose a reader, standard Microsoft PC/SC functions have to be used.
7 SUPPORT

The support e-mail address for Precise BioMatch™ Standard Toolkit questions is support@precisebiometrics.com. For a quick reply, please type “Precise BioMatch Standard Toolkit” in the subject field of the mail.

Some questions may be answered by the FAQ list available on our web site www.precisebiometrics.com.