
**Information technology — Guidelines
for slap tenprint fingerprinture**

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

This first edition cancels and replaces ISO/IEC TS 20027:2015, which has been technically revised.

The main changes compared to the previous edition are as follows:

- Clauses 2 and 3 have been added according to the ISO/IEC Directives, Part 2;
- in 5.2, a new example of ways to give feedback has been added.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The slap tenprint capture process captures multiple slap images which contain all ten fingerprints.

Slap fingerprints, or “simultaneous plain impressions”, are simply multiple flat fingerprints captured at the same time.

A single slap image contains four fingerprints from one hand, so two slap images contain eight fingerprints.

A third slap image is captured containing the two thumbprints, so three slap images contain all ten fingerprints.

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Information technology — Guidelines for slap tenprint fingerprinture

1 Scope

This document provides guidelines to follow during the acquisition process of slap tenprints in order to obtain fingerprints of the best quality possible within acceptable time constraints.

Non-cooperative users are out of the scope of this document.

When using ten-fingerprint sensors, it is fundamental to know how to use them and how to proceed with the acquisition. This document describes how to capture fingerprints correctly by specifying best practices for slap tenprint captures.

It gives recommendations on the following topics:

- 1) hardware of the fingerprint sensor and its deployment;
- 2) user guidance;
- 3) enrolment process including a sample workflow;
- 4) application software for developers and system integrators;
- 5) processing, compression and coding of the acquired fingerprint images;
- 6) operational issues and data logging;
- 7) evaluation of a solution and its components.

Although this document primarily focuses on reaching optimal data quality for enrolment purposes, the recommendations given here are applicable for other purposes. All processes which rely on good quality tenprint slaps can take advantage of the best practices.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 2382-37, *Information technology — Vocabulary — Part 37: Biometrics*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 2382-37 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

4 Sensor hardware requirement

Image quality should comply with the quality specifications from ISO/IEC 19794-4. EBTS V 8.002:2008^[6], Annex F corresponds to ISO/IEC 19794-4:2011, B.1, and BSI TR-03121^[5] corresponds to ISO/IEC 19794-4:2011, B.2.

This document considers recommendations based on the experience of the use of fingerprint optical sensors based on the principle of frustrated total internal reflection. The recommendations are to be considered properly when considering the use of a new technology, as specificities of the technology may induce specific recommendation that will be included in a future version of this document.

The sensor device should provide methods for re-calibration in the field by qualified service staff if the device technically supports it.

The need for calibration or re-calibration depends on the sensor technology and calibration might not be necessary for all devices.

The compliance of a sensor device to the applicable quality standard should be verified at any time in the operational environment.

5 Acquisition software

5.1 Acquisition process

For the acquisition process, the highest quality images should be used. The acquisition of these images should be done automatically. If the automatic acquisition process does not provide images of sufficient quality, an alternative manual process may be activated. For example, after 3 captures of insufficient quality, manual capture may be proposed to the operator.

The sequence of images having the highest quality should be used; if a timeout has occurred then these may be below the desired quality levels. The best images may not be the last acquired.

Some devices support surface heating and may assist in better quality images where fingers are especially dry.

An example of an acquisition process design can be found in [Annex A](#) and [Annex B](#). An example of a quality metric process design can be found in [Annex C](#).

5.2 User feedback

The presence of a user interface is strongly advised to provide user feedback.

Feedback can be given, for example, by:

- a screen attached in close proximity to the sensor;
- illuminated pictograms on the sensor;
- LEDs assigned to pictograms directly on the sensor.
- Sound coming from the sensor or from the PC to which the sensor is connected.

The following information should be given to the user:

- assistance to finger positioning with images and/or video on the screen and/or audio instructions (for instance to instruct the user to move their fingers to the left/right/top/bottom);
- visual and/or audio notification when a successful acquisition has been completed;
- a quality indicator for each acquisition; this indicator should follow the NIST fingerprint image quality (NFIQ) measurement;

- if possible, the reason for a bad quality acquisition (e.g. wrong positioning of the hand).

Additional information (e.g. a poster or a video) can be used to illustrate to users how to use the system. This information can be displayed close to the sensor and additionally in the waiting zone.

Operators should be trained to give guidance to the users.

5.3 Acquisition check

The software linked to the sensor should account for the following during the acquisition process in order to perform a better acquisition:

- Any feedback provided by the sensor software (background correction, quality evaluation, end of acquisition, etc.).
- A timeout for capturing the best available image in case the specified quality threshold is not reached.
- The inability of the subject to provide a full set of fingerprints. Acceptable images for certain fingers may not have been captured, which could be due to:
 - missing fingers;
 - inability for the subject to interact with the sensor correctly;
 - temporary or permanent issues with the subject's fingerprints.
- The image quality of the captured images. This is to enable the system to finish the acquisition process after the preset quality level or a timeout has been reached.
- The subject's fingers have been removed from the sensor at the end of the acquisition process.
- Check two consecutively captured slaps and captured thumbs are not identical. A duplicate check should also be performed to ensure that all expected fingers have been captured once and once only.

NOTE Due to computational time constraints this recommendation can also be enforced by the operator instead of the software.

- Residual traces have not been acquired.
- The fingerprint images are as originally acquired. Optionally, segmented images can be produced.
- Hand inversion between left and right slap has not occurred. This check can be based on the different physical characteristics of the shapes of both hands.

5.4 Image processing

5.4.1 Resolution

Fingerprints should only be taken at 500 ppi or 1 000 ppi. Ideally scanning and transmission resolution should be identical. However, if an image is captured at 1 000 ppi and is to be transmitted at 500 ppi, then the guidance for down-sampling contained in the document NIST Special Publication 500-289 Compression Guidance for 1 000 ppi Friction Ridge Imagery^[1] should be followed in order to produce a 500 ppi image with the minimal effect on the image contents and quality.

5.4.2 Segmentation

Depending on the call to capture one, two, three or four fingerprints, this number of individual fingerprints should be extracted from the input image and provided as single fingerprints generated by a segmentation process which takes into account fingers reported to be missed.

For this segmentation process, the following criteria should be fulfilled:

- ability to accept rotated fingerprints having the same direction at an angle up to 45°;
- rotated fingerprints having the same direction should be corrected to be vertical;
- segment the first part over the finger (first phalanx);
- segmentation should be performed on uncompressed data;
- recording of any missing, damaged or amputated fingers.

Recommended size for fingerprint images is given in ISO/IEC 19794-4:2011, D.1.

NOTE Size limitation is done in order to prevent performance issues.

5.4.3 Compression

Wavelet Scalar Quantization (WSQ) compression should be used for 500 ppi images, and JPEG 2000 compression for 1 000 ppi images.

Fingerprint images should be compressed according to the recommendations in ISO/IEC 19794-4:2011, 8.3.17.

The implementation of the WSQ algorithm used should be certified by a registered authority and referenced as such (for example, the US Federal Bureau of Investigation and the respective certificate number can both be coded in the WSQ header).

Multiple lossy compressions should be avoided as they degrade image quality.

6 Logging and evaluation of data

6.1 Logging data

The purpose of the logging data is not to track people but to give guidance to the staff in charge of the enrolment and to maintain a constant quality of the acquisition process.

The following data, or parts of it, should be logged:

- transaction ID;
- timestamp of acquisition;
- duration of biometric acquisition process;
- number of captured images;
- number of successful captures;
- quality scores for all captured fingerprints;
- overall quality score of captured slap or tenprints sets (if present);
- information about vendor, software, hardware and versions;
- information about the origin (e.g. Agency Identifier);
- information about errors (e.g. about uniqueness check, segmentation, etc.);
- size of acquired data;
- testing flags (if applicable);