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Information technology — Biometric data interchange formats —

Part 7: Signature/sign time series data

Technologies de l'information — Formats d'échange de données biométriques —

Partie 7: Données de série chronologique de signature/signe

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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.

ISO/IEC 19794-7 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

This second edition revises the first edition (ISO/IEC 19794-7:2007). Clauses 7 and 8 have been technically revised and it has been amended by Clause 10 and Annex A. It also incorporates the Technical Corrigendum ISO/IEC 19794-7:2007/Cor.1:2009.

ISO/IEC 19794 consists of the following parts, under the general title *Information technology — Biometric data interchange formats*:

— *Part 1: Framework*

— *Part 2: Finger minutiae data*

— *Part 3: Finger pattern spectral data*

— *Part 4: Finger image data*

— *Part 5: Face image data*

— *Part 6: Iris image data*

— *Part 7: Signature/sign time series data*

— *Part 8: Finger pattern skeletal data*

— *Part 9: Vascular image data*

— *Part 10: Hand geometry silhouette data*

— *Part 11: Signature/sign processed dynamic data*

— *Part 14: DNA data*

The following part is under preparation:

— *Part 13:Voice data*

Information technology — Biometric data interchange formats —

Part 7: Signature/sign time series data

1 Scope

This part of ISO/IEC 19794 specifies data interchange formats for signature/sign behavioural data captured in the form of a multi-dimensional time series using devices such as digitizing tablets or advanced pen systems. The data interchange formats are generic, in that they may be applied and used in a wide range of application areas where handwritten signs or signatures are involved. No application-specific requirements or features are addressed in this part of ISO/IEC 19794.

This part of ISO/IEC 19794 contains

— a description of what data may be captured,

— three data formats for containing the data: a full format for general use, a compression format capable of holding the same amount of information as the full format but in compressed form, and a compact format for use with smart cards and other tokens that does not require compression/decompression but conveys less information than the full format, and

— examples of data record contents and best practices in capture.

Specifying which of the format types and which options defined in this part of ISO/IEC 19794 are to be applied in a particular application is out of scope; this needs to be defined in application-specific requirements specifications or application profiles.

It is advisable that cryptographic techniques be used to protect the authenticity, integrity, and confidentiality of stored and transmitted biometric data; yet such provisions are beyond the scope of this part of ISO/IEC 19794.

This part of ISO/IEC 19794 also specifies elements of conformance testing methodology, test assertions, and test procedures as applicable to this part of ISO/IEC 19794. It establishes test assertions on the structure and internal consistency of the signature/sign time series data formats defined in this part of ISO/IEC 19794 (type A level 1 and 2 as defined in ISO/IEC 19794-1:2011/Amd.1), and semantic test assertions (type A level 3 as defined in ISO/IEC 19794-1:2011/Amd.1).

The conformance testing methodology specified in this part of ISO/IEC 19794 does not establish:

— tests of other characteristics of biometric products or other types of testing of biometric products (e.g. acceptance, performance, robustness, security),

— tests of conformance of systems that do not produce data records claimed to conform to the requirements of this part of ISO/IEC 19794.

2 Conformance

A biometric data record conforms to this part of ISO/IEC 19794 if it satisfies the format requirements with respect to its structure, with respect to relations among its fields, and with respect to relations between its fields and the underlying input that are specified within clauses 6–10 of this part of ISO/IEC 19794.

Biometric data interchange format conformance tests conform to this part of ISO/IEC 19794 if they satisfy all of the normative requirements set forth in Annex A. Specifically, all level-1, level-2, and level-3 tests shall use the test assertions defined in Table A.2, Table A.3, and Table A.4 of clause A.2 in conformity with the concept and rules set in ISO/IEC 19794-1:2011/Amd.1.

Implementations of this part of ISO/IEC 19794 tested according to the specified methodology shall be able to claim conformance only to those biometric data record requirements specified in this part of ISO/IEC 19794 that are tested by the test methods established by this methodology.

Implementations of this part of ISO/IEC 19794 do not necessarily need to conform to all possible aspects of this part of ISO/IEC 19794, but only to those requirements that are claimed to be supported by the implementation in an implementation conformance statement (ICS), filled out in accordance with ISO/IEC 19794-1:2011/Amd.1 and Table A.1 of clause A.1 of this part of ISO/IEC 19794.

3 Normative references

The following referenced documents are indispensable for the application 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 8825-1, *Information technology — ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER) — Part 1*

ISO/IEC 19785-1, *Information technology — Common Biometric Exchange Formats Framework — Part 1: Data element specification*

ISO/IEC 19785-2, *Information technology — Common Biometric Exchange Formats Framework — Part 2: Procedures for the operation of the Biometric Registration Authority*

ISO/IEC 19785-3, *Information technology — Common Biometric Exchange Formats Framework — Part 3: Patron format specifications*

ISO/IEC 19794-1:2011, *Information technology — Biometric data interchange formats — Part 1: Framework*

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19794-1:2011 and the following apply.

4.1
channel
data item (captured, intermediate, or processed) recorded in form of a time series

EXAMPLE pen tip position x and y coordinates, pen tip force, pen tilt along the x and y axes, pen azimuth, pen elevation, pen rotation

4.2
compression
process that reduces the size of a digital file with or without loss of information

Note 1 to entry: The compression format defined in clause 10 includes data compressed by lossless compression schemes.

4.3
pen azimuth
angle measured clockwise from the positive y axis to the perpendicular projection of the pen onto the writing plane

Note 1 to entry: The pen azimuth may range from 0° to 360°.

4.4
pen-down event
event from which on the pen tip is touching the writing plane

4.5
pen elevation
angle between the perpendicular projection of the pen onto the writing plane and the pen

Note 1 to entry: The pen elevation may range from 0° to 90°.

4.6
pen rotation
angle of the rotation of the pen about its longitudinal axis measured counter-clockwise from a device-specific rotational reference position

Note 1 to entry: The pen rotation may range from 0° to 360°.

4.7
pen tilt along the x axis
angle measured clockwise from the positive z axis to the perpendicular projection of the pen onto the x,z plane

Note 1 to entry: The pen tilt along the x axis may range from –90° to +90°.

4.8
pen tilt along the y axis
angle measured clockwise from the positive z axis to the perpendicular projection of the pen onto the y,z plane

Note 1 to entry: The pen tilt along the y axis may range from –90° to +90°.

4.9
pen-up event
event from which on the pen tip is not touching the writing plane, after a pen-down event

4.10
sampling rate
number of samples per second (or per other unit) taken from a continuous signal to make a discrete signal

4.11
signature/sign representation
data recorded from a single signature/sign

4.12
X jitter
sample standard deviation of at least 100 x coordinate samples from a stationary pen

4.13
Y jitter
sample standard deviation of at least 100 y coordinate samples from a stationary pen

4.14
X pixel density
number of dots per millimetre that the capture device resolves in the x (horizontal) direction

4.15
Y pixel density
number of dots per millimetre that the capture device resolves in the y (vertical) direction

5 Abbreviated terms

lsb least significant bit

msb most significant bit

6 Conventions

6.1 Coordinate system

The coordinate system used to express the pen position shall be a three-dimensional Cartesian coordinate system. The x axis shall be the horizontal axis of the writing plane, with x coordinates increasing to the right. The y axis shall be the vertical axis of the writing plane, with y coordinates increasing upwards. The z axis shall be the axis perpendicular to the writing plane, with z coordinates increasing upwards out of the writing plane starting from 0. For an illustration see Figure 1.

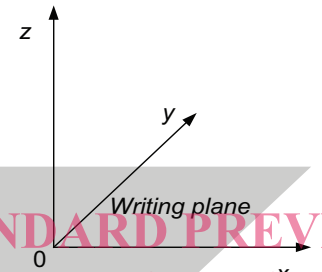

Figure 1 — Coordinate system

NOTE The origin of x and y coordinates is not specified here. Depending on the used technology, it may be, for instance, in the centre of the writing pad, at its lower left corner, or at the pen position at the first pen-down event.

6.2 Octet and bit order

The more significant bytes of any multi-byte quantity are stored at lower addresses in memory than (and are transmitted before) less significant bytes.

Within a byte, the bits are numbered from 8 to 1, where bit 8 is the 'most significant bit' (msb) and bit 1 the 'least significant bit' (lsb).

6.3 Registered format type identifiers

The data records specified in this part of ISO/IEC 19794 may be embedded in a CBEFF- (ISO/IEC 19785-1) compliant biometric information record (BIR). This clause lists the BDB (biometric data block) format owner identifier and the BDB format type identifiers that shall be used if embedded in a CBEFF BIR. These identifiers are registered with IBIA, the CBEFF Registration Authority (see ISO/IEC 19785-2).

The format owner of the formats defined in ISO/IEC 19794 is ISO/IEC JTC 1/SC 37. The format owner identifier is 257 (0101_{Hex}). Table 1 lists the format type identifiers for the formats defined in this part of ISO/IEC 19794.

Table 1 — Format type identifiers

CBEFF BDB format type identifier	Short name	Full object identifier
14 ($000e_{Hex}$)	signature-sign-time-series-full	{iso(1) registration-authority(1) cbeff(19785) biometric-organization(0) jtc1-sc37(257) bdbs(0) signature-sign-time-series-full(14)}
15 ($000f_{Hex}$)	signature-sign-time-series-compact	{iso(1) registration-authority(1) cbeff(19785) biometric-organization(0) jtc1-sc37(257) bdbs(0) signature-sign-time-series-compact(15)}
30 ($001e_{Hex}$)	signature-sign-time-series-compression	{iso(1) registration-authority(1) cbeff(19785) biometric-organization(0) jtc1-sc37(257) bdbs(0) signature-sign-time-series-compression(30)}

NOTE 1 The format type identifier for the full format defined in this edition of ISO/IEC 19794-7 is the same as the one for the full format defined in ISO/IEC 19794-7:2007. An indication of which version of the full format applies can be determined from the version number included in the general header.

NOTE 2 The compact format defined in this edition of ISO/IEC 19794-7 is the same as the one defined in ISO/IEC 19794-7:2007. Hence, the format type identifier for the compact format defined in this edition of ISO/IEC 19794-7 is also the same as the one for the compact format defined in ISO/IEC 19794-7:2007.

7 Channels

7.1 General

Table 2 lists the channel names and their meanings. Signature/sign time series data captured with different capture devices or used in different applications may contain data from different channels. Either the T channel or the DT channel shall be present, or uniform sampling (constant time difference between adjacent sample points) shall be indicated (see clause 7.6). Inclusion of at least one other channel is mandatory.

Table 2 — Channels

Channel name	Description
X	x coordinate (horizontal pen position)
Y	y coordinate (vertical pen position)
Z	z coordinate (height of pen above the writing plane)
VX	velocity in x direction
VY	velocity in y direction
AX	acceleration in x direction
AY	acceleration in y direction
T	time
DT	time difference
F	pen tip force
S	pen tip switch state (touching/not touching the writing plane)
TX	pen tilt along the x axis
TY	pen tilt along the y axis
A	pen azimuth
E	pen elevation
R	pen rotation

7.2 Pen tip position channels: X, Y, Z

There are three channels defined for recording pen tip position data in the three-dimensional space. The X channel is for recording the x coordinate of the projection of the pen tip on the writing plane. The Y channel is for recording the y coordinate of the projection of the pen tip on the writing plane. The Z channel is for recording the height of the pen tip above the writing plane.

The unit of measurement is millimetres (mm). To restore the actual values, the integer values given in the record body are to be divided by a scaling value given in the channel description. By choosing appropriate scaling values, different degrees of accuracy can be expressed.

7.3 Pen tip velocity channels: VX, VY

The VX channel is for recording the pen tip velocity along the x axis. The VY channel is for recording the pen tip velocity along the y axis.

The unit of measurement is millimetres per second (mm/s). To restore the actual values, the integer values given in the record body are to be divided by a scaling value given in the channel description. By choosing appropriate scaling values, different degrees of accuracy can be expressed.

7.4 Pen tip acceleration channels: AX, AY

The AX channel is for recording the pen tip acceleration along the x axis. The AY channel is for recording the pen tip acceleration along the y axis.

The unit of measurement is millimetres per square second (mm/s^2). To restore the actual values, the integer values given in the record body are to be divided by a scaling value given in the channel description. By choosing appropriate scaling values, different degrees of accuracy can be expressed.

7.5 Time channel: T

The T channel is for recording the time elapsed since the first sample.

The unit of measurement is seconds (s). To restore the actual values, the integer values given in the record body are to be divided by a scaling value given in the channel description. By choosing appropriate scaling values, different degrees of accuracy can be expressed.

7.6 Time difference channel: DT

The DT channel is for recording the time elapsed since the previous sample point.

The unit of measurement is seconds (s). To restore the actual values, the integer values given in the record body are to be divided by a scaling value given in the channel description. By choosing appropriate scaling values, different degrees of accuracy can be expressed.

In case of uniform sampling, the channel inclusion field (see clause 8.3.2.8.1) in the representation header should indicate the DT channel as present, but the DT channel values should be absent in the representation body while the channel description preamble (see clause 8.3.2.8.2) for the DT channel indicates the time differences between adjacent sample points as constant.

7.7 Pen tip force channel: F

The F channel is for recording the magnitude of the pen tip force.

The unit of measurement is Newton (N). To restore the actual values, the integer values given in the record body are to be divided by a scaling value given in the channel description. By choosing appropriate scaling values, different degrees of accuracy can be expressed.

NOTE The direction of the pen-tip force depends on the capture device technology, which is identified by the capture device technology identifier.

7.8 Pen tip switch state channel: S

The S channel is for recording whether the pen tip touches the writing plane or not. The value shall be 0 in case that the pen tip does not touch the writing plane. In case of pen-down events, the value shall also be 0. The value shall be 1 in case that the pen tip touches the writing plane. In case of pen-up events, the value shall also be 1.

NOTE Temporarily maintaining a value of 0 when the pen tip starts touching the writing plane allows a recognition of pen-down events even if the capture device provides no sample points for pen-up strokes.

7.9 Pen orientation channels: TX, TY, A, E, R

There are five channels defined for recording pen orientation data. The A channel is for recording the pen azimuth. The E channel is for recording the pen elevation. The TX channel is for recording the pen tilt along the x axis. The TY channel is for recording the pen tilt along the y axis. The R channel is for recording the rotation of the pen about its longitudinal axis. It may be chosen to use

— pen azimuth and pen elevation or

— pen tilt along the x and y axes

with or without the pen rotation. For illustrations see Figure 2 and Figure 3.

The unit of measurement for the pen orientation angles is degree (°).To restore the actual values, the integer values given in the record body are to be divided by a scaling value given in the channel description. By choosing appropriate scaling values, different degrees of accuracy can be expressed.

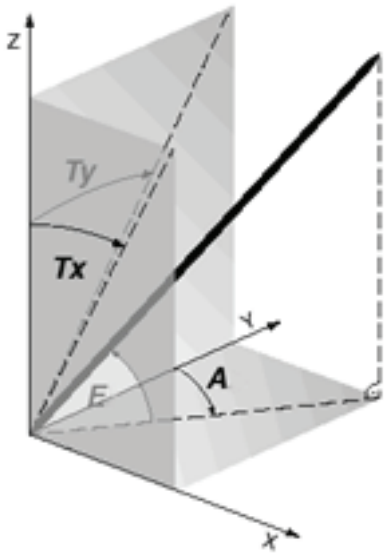

Figure 2 — Pen orientation angles

Figure 3 — Pen rotation

8 Full format

8.1 Record organisation

A signature/sign time series data record in the full format shall consist of the following data elements in the given order:

— a general header, containing descriptive information about the structure and contents of the data record, and

— a record body, containing at least one signature/sign representation.

Figure 4 depicts a signature/sign time series data record in full format. The solid boxes indicate fields that shall be present. The dashed boxes indicate optional fields. The length of each field in bytes is indicated in parentheses at the bottom of the corresponding box. The ellipses indicate that more fields of the same format may follow.

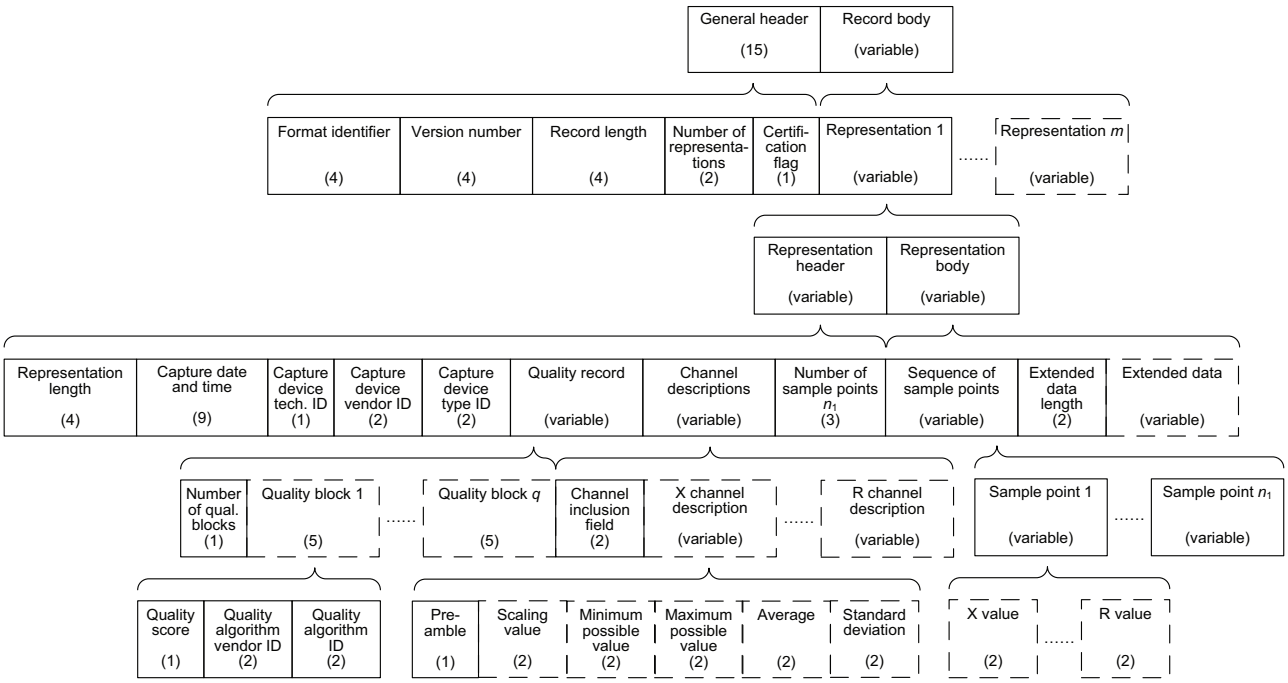

Figure 4 — Full format

8.2 General header

8.2.1 Structure

The general header shall contain information applicable to all signature/sign representations. The general header shall consist of the following data elements in the given order:

— a format identifier,

— a version number,

— the length of the data record,

— a field indicating the number of subsequent signature/sign representations, and

— a certification flag.

8.2.2 Format identifier

The format identifier shall be recorded in four bytes. The format identifier shall consist of the three ASCII characters “SDI” (534449_{Hex}) followed by Null (00_{Hex}) as a string terminator.

8.2.3 Version number

The number of the version of this part of ISO/IEC 19794 shall be placed in four bytes. This version number shall consist of three ASCII characters followed by Null (00_{Hex}) as a string terminator. The first and second characters represent the major revision number and the third character represents the minor revision number.

In a signature/sign time series data record following this second edition of this part of ISO/IEC 19794, the version number shall be $3032\ 3000_{Hex}$, i.e. “020” (an ASCII ‘0’ followed by an ASCII ‘2’ and an ASCII ‘0’) followed by Null (00_{Hex}) as a string terminator.

8.2.4 Length of the data record

The length in bytes of the entire BDIR (biometric data interchange record) shall be recorded in four bytes. This count shall be the total length of the BDIR including the general header and one or more representation records.

8.2.5 Number of representations

The total number of representation records contained in the BDIR shall be recorded in two bytes. A minimum of one representation is required.

8.2.6 Certification flag

The one-byte certification flag indicates whether each representation header includes a certification record. Its value shall be 00_{Hex} to indicate that no representation contains a certification record.

NOTE The certification flag has been added for upward compatibility with later versions of the full format in which representation headers may contain certification records.

8.3 Record body

8.3.1 Structure

The record body shall consist of a sequence of at least one signature/sign representation. Each signature/sign representation shall consist of the following data elements in the given order:

— a representation header and

— a representation body.

8.3.2 Representation header

8.3.2.1 Structure

A signature/sign representation header shall contain representation-specific descriptive information. A representation header shall consist of the following data elements in the given order:

— a representation-length field,

— the capture date and time,

— a capture device technology identifier,

— a capture device vendor identifier,

— a capture device type identifier,

— a quality record,

— a sequence of channel descriptions, and

— a field indicating the number of sample points.

8.3.2.2 Length of the signature/sign representation

The four-byte representation-length field denotes the length in bytes of the representation including the representation header.

8.3.2.3 Capture date and time

The capture date and time field shall indicate when the capture of this representation started in Coordinated Universal Time (UTC). The capture date and time field shall consist of 9 bytes. Its value shall be encoded in the form given in ISO/IEC 19794-1:2011.

8.3.2.4 Capture device technology identifier

The capture device technology ID shall be encoded in one byte. This field shall indicate the class of capture device technology used to acquire the captured biometric sample. A value of 00_{Hex} indicates unknown or unspecified technology. See Table 3 for the list of possible values.

Table 3 — Signature/sign capture device technology identifiers

Identifier	Capture device technology
00_{Hex}	Unknown or unspecified
01_{Hex}	Electromagnetic
02_{Hex}	Semiconductor
04_{Hex}	Special pen with acceleration sensors
08_{Hex}	Special pen with optical sensors
all others	Reserved by ISO/IEC JTC 1/SC 37 for future use

8.3.2.5 Capture device vendor identifier

The capture device vendor identifier shall identify the biometric organisation that owns the product that created the BDIR. The capture device vendor identifier shall be encoded in two bytes carrying a CBEFF biometric organization identifier (registered by IBIA or other approved registration authority). A value of all zeros shall indicate that the capture device vendor is unreported.

8.3.2.6 Capture device type identifier

The capture device type identifier shall identify the product type that created the BDIR. It shall be assigned by the registered product owner or other approved registration authority. Registered product types shall include all valid combinations of writing tablet and pen as a single product where applicable. A value of all zeros shall indicate that the capture device type is unreported. If the capture device vendor identifier is 0000_{Hex}, then also the capture device type identifier shall be 0000_{Hex}.

8.3.2.7 Quality record

The quality record shall consist of a length field followed by zero or more quality blocks. The length field shall consist of one byte. It shall represent the number of quality blocks as an unsigned integer.

Each quality block shall consist of

— a quality score,

— a quality algorithm vendor identifier, and

— a quality algorithm identifier.

A quality score should express the predicted comparison performance of a representation. A quality score shall be encoded in one byte as an unsigned integer. Allowed values are

— 0 to 100 with higher values indicating better quality,

— 255, i.e. ff_{Hex}, for indicating that an attempt to calculate a quality score failed.