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Information technology — Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794 —

Part 10:
Hand geometry silhouette data

Technologies de l'information — Méthodologie d'essai de conformité pour formats d'interéchange de données biométriques définis dans l'ISO/CEI 19794 —

Partie 10: Données de silhouette géométrique manuelle

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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 29109 consists of the following parts, under the general title *Information technology — Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794*:

— *Part 1: Generalized conformance testing methodology*

— *Part 2: Finger minutiae data*

— *Part 4: Finger image data*

— *Part 5: Face image data*

— *Part 6: Iris image data*

— *Part 8: Finger pattern skeletal data*

— *Part 9: Vascular image data*

— *Part 10: Hand geometry silhouette data*

The following parts are under preparation:

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

— *Part 14: DNA data*

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Introduction

ISO/IEC 19794-10:2007 specifies a data record interchange format for recording, storing, and transmitting one or more hand geometry silhouette records. This part of ISO/IEC 29109 establishes tests for checking the correctness of the binary record.

The objective of ISO/IEC 19794-10:2007 cannot be completely achieved until biometric products can be tested to determine whether they conform to those specifications. Conforming implementations are a necessary prerequisite for achieving interoperability among implementations; therefore there is a need for a standardized conformance testing methodology, test assertions, and test procedures as applicable to specific modalities addressed by each part of ISO/IEC 19794. The test assertions will cover as much as practical of the ISO/IEC 19794 requirements (covering the most critical features), so that the conformity results produced by the test suites will reflect the real degree of conformity of the implementations to ISO/IEC 19794 Data Interchange Format records. This is the motivation for the development of this conformance testing methodology.

This part of ISO/IEC 29109 supports those applications that require use of hand geometry silhouette data according to ISO/IEC 19794-10:2007. It defines a testing methodology to ensure conformance of a vendor's application or service to ISO/IEC 19794-10:2007. Thus this part of ISO/IEC 29109 is intended to:

— establish elements of the Conformance Testing Methodology framework that are specific to the Hand Geometry Silhouette-based Data Record requirements of ISO/IEC 19794-10:2007 conformance testing,

— define requirements and guidelines for specifying conformance test suites and related test methods for measuring conformity of products and services to the Hand Geometry Silhouette Data Record requirements of ISO/IEC 19794-10:2007, and

— define testing and reporting procedures to be followed before, during, and after conformance testing.

This part of ISO/IEC 29109 is applicable to the development and use of conformity test method specifications, conformity test suites for ISO/IEC 19794-10:2007 records, and conformance testing programs for ISO/IEC 19794-10:2007 conformant products. It is intended primarily for use by testing organizations, but may be applied by developers and users of test method specifications and test method implementations. The table of assertions in Clause 6 specifies levels of testing for the conformance requirements of ISO/IEC 19794-10:2007.

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1 Scope

This part of ISO/IEC 29109 specifies elements of conformance testing methodology, test assertions, and test procedures as applicable to ISO/IEC 19794-10.

This part of ISO/IEC 29109 establishes

— test assertions of the structure of the hand geometry silhouette data format as specified in ISO/IEC 19794-10:2007 (Type A Level 1 as defined in ISO/IEC 29109-1:2009),

— test assertions of internal consistency by checking the types of values that may be contained within each field (Type A Level 2 as defined in ISO/IEC 29109-1:2009),

— informative guidance for testing the consistency of selected encoded data fields with the input biometric data (Type B Level 3 as defined in ISO/IEC 29109-1:2009).

This part of ISO/IEC 29109 does not establish

— test of conformance of CBEFF structures required by ISO/IEC 19794-10:2007,

— test of consistency with input biometric data record (Level 3 as defined in ISO/IEC 29109-1:2009),

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

— test of conformance of systems that do not produce ISO/IEC 19794-10:2007 records.

2 Conformance

Biometric data interchange format Conformance Test Suites (CTS) conform to this part of ISO/IEC 29109 if they satisfy all of the normative requirements related to Clause 6. Additionally, implementations of Level 1 or Level 2 tests shall use the assertions defined in Table 2 and fill out an Implementation Conformance Statement (ICS) based on Table 1.

Implementations of ISO/IEC 19794-10:2007 tested according to the methodology specified shall be able to claim conformance only to those Biometric Data Record (BDR) requirements specified in ISO/IEC 19794-10:2007 that are tested by the test methods established by this methodology.

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Implementations of ISO/IEC 19794-10:2007 do not necessarily need to conform to all possible aspects of ISO/IEC 19794-10:2007, but only to those ISO/IEC 19794-10:2007 requirements that are claimed to be supported by the implementation in an Implementation Conformance Statement, filled out in accordance with Clause 8 of ISO/IEC 29109-1:2009 and Table 1 of this part of ISO/IEC 29109.

A system does not need to be capable of using biometric data records that cover all possible aspects of ISO/IEC 19794-10:2007, but only those that are claimed to be supported by the system in an Implementation Conformance Statement, filled out using the template provided in A.2.

NOTE Level 3 and higher are not tested.

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 19794-10:2007, *Information technology — Biometric data interchange formats — Part 10: Hand geometry silhouette data*

ISO/IEC 29109-1:2009, *Information technology — Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794 — Part 1: Generalized conformance testing methodology*

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1
biometric data interchange record
BDIR
data package containing biometric data that claims to be in the form prescribed by a base standard

[ISO/IEC 29109-1]

4.2
Freeman Chain Code
FCC
compact method for representing the contours of an object

NOTE First made popular by Herbert Freeman.

[ISO/IEC 19794-10]

4.3
hand geometry view record
HGVR
block of data that contains a hand silhouette captured from one camera point of view during one hand placement

NOTE The block contains metadata, silhouette data, and optional extended data.

[ISO/IEC 19794-10]

4.4
implementation under test
IUT
that which implements the base standard being tested

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NOTE Depending on the conformance requirements of the base standard, this may simply be a set of biometric data interchange records or it may be a computer algorithm in the form of an implementation under test that creates the BDIR and/or uses the data contained in the BDIR.

[ISO/IEC 29109-1]

5 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO/IEC 29109-1 apply.

6 Conformance testing methodology

The testing methodology specified in Clauses 6, 7 and 8 of ISO/IEC 29109-1:2009 shall apply. The content of the tables below is based on the conformance testing methodology outlined in ISO/IEC 29109-1:2009 and shall only be used in the context of that testing methodology.

Table 1 — Requirements of ISO/IEC 19794-10:2007

Require-ment ID	Reference in base standard	Requirement Summary	Level	Status (see note)	IUT Support	Supported Range	Test Result
R-1	Forward	ISO shall not be held responsible for identifying any or all such patent rights.	3C	O-1		N/A	N/A
R-2	5.2	To conserve space, the hand silhouette shall be recorded using a Freeman Chain Code (FCC).	2	M		N/A	
R-3	5.2.1	Each element of the FCC shall be stored immediately following its predecessor, without regard to byte boundaries.	2	M		N/A	
R-4	5.2.1	If necessary, the silhouette shall be padded with trailing zeros to ensure that the BDB is an integral number of octets.	2	M		N/A	
R-5	5.2.1	Silhouette data contained in BDBs conforming to this part of ISO/IEC 19794 (see clause 2) shall be body centric.	3B	M		N/A	
R-6	5.3	The BDB format specified in this part of ISO/IEC 19794 shall be embedded in a CBEFF-compliant Biometric Information Record (BIR) according to ISO/IEC 19785-1.	3C	O-1		N/A	N/A
R-7	5.3	The CBEFF Format Owner identifier assigned by the CBEFF Registration Authority to ISO/IEC JTC 1/SC 37 shall be used in […] This is the sixteen-bit value 0x0101 (hexadecimal 101 or decimal 257).	3C	O-1		N/A	N/A
R-8	5.3	The sixteen-bit [CBEFF Type Code] 0x0018 (hexadecimal 18 or decimal 24) shall be used for data records specified in this part of 19794.	3C	O-1		N/A	N/A
R-9	6.1	after data acquisition and processing, each silhouette shall have the orientation shown in Figure 3a for top-view images, or Figure 3b for side-view images.	3B	M		N/A	

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Table 1 (*continued*)

Require-ment ID	Reference in base standard	Requirement Summary	Level	Status (see note)	IUT Support	Supported Range	Test Result
R-10	6.2	The silhouette shall represent either the left or right hand and shall be presented in one of the orientations depicted in Figures 3a and 3b.	3B	M		N/A	
R-11	6.2	Silhouettes taken from a left hand pinned platen shall be flipped (mirror image) to match the form of Figure 3a.	3B	M		N/A	
R-12	6.3	The aspect ratio shall be 1:1, within a tolerance of ±2 %.	3B	M		N/A	
R-13	6.4	The starting point shall be in the rightmost column of the silhouette in Figure 1, at the uppermost row occupied by the silhouette in that column.	2	M		N/A	
R-14	6.4	Successive points shall trace the outline in a counterclockwise direction.	2	M		N/A	
R-15	6.4	The silhouette shall be a closed shape (i.e., it shall have no gaps in the outline, and the final outline point shall be collocated with the starting point).	2	M		N/A	
R-16	6.4	The starting point shall occur exactly twice in the silhouette, as the first and last points only (the silhouette will not cross through the starting point at any other time).	2	M		N/A	
R-17	6.4	The right column shall be vertical (i.e., the penultimate point shall occur directly below the starting point, and no points occur to the right of the starting point).	2	M		N/A	
R-18	6.5	The platen shall form a right angle with the side-view reference plane.	3C	O-1		N/A	N/A
R-19	6.5	For imaging systems utilizing optical cameras, the optical axis for top-view images shall be orthogonal to the platen.	3C	O-1		N/A	N/A
R-20	6.5	the optical axis for side-view images shall be orthogonal to the side-view reference plane.	3C	O-1		N/A	N/A
R-21	7	Silhouette data shall be represented in a common format, containing both basic and extended data.	3A	M		N/A	
R-22	7	The BDB format specified in this part of ISO/IEC 19794 shall be embedded in a CBEFF-compliant Biometric Information Record (BIR) as described in clause 5.3.	3C	O-1		N/A	N/A
R-23	7.1	Table 1 – Record length – Size of the entire BDB, including this header and multiple HGVRs.	2	M		40 – (2^32-1)	
R-24	7.1	Table 1 – Reserved for future use – Bytes shall be set to zero by producers of a BDB, and should be ignored by users of the BDB.	2	M		N/A	
R-25	7.1.1	The BDB shall begin with the three ASCII characters “HND” to identify the record, followed by a zero byte as a null string terminator.	2	M		N/A	

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Table 1 (*continued*)

Require-ment ID	Reference in base standard	Requirement Summary	Level	Status (see note)	IUT Support	Supported Range	Test Result
R-26	7.1.2	The number for the version of this part of ISO/IEC 19794 used for constructing the BDB shall be placed in four bytes.	1	M		N/A	
R-27	7.1.2	This version number shall consist of three ASCII numerals followed by a zero byte as a NULL string terminator.	2	M		N/A	
R-28	7.1.2	Upon approval of this specification, the version number shall be “010” – Version 1 revision 0.	2	M		N/A	
R-29	7.1.4	The number of hand silhouettes included in the BDB shall be recorded in one byte.	2	M		N/A	
R-30	7.1.4	Multiple silhouettes of the same hand shall be counted separately.	2	M		N/A	
R-31	7.1.4	Top-view and side-view silhouettes that are linked by the same HGVR index (see 7.2.2) shall be counted separately.	2	M		N/A	
R-32	7.1.5	<reserved field> Bytes shall be set to zero by producers of a BDB, and should be ignored by users of the BDB.	2	M		N/A	
R-33	Table2	<reserved field> Bytes shall be set to zero by producers of a BDB.	2	M		N/A	
R-34	7.2.1	<HGVR Length> shall specify the total number of bytes including the length of the metadata, the silhouette data and the extended data for that view.	2	M		N/A	
R-35	7.2.3	<Hand index> Where several HGVRs are captured at the same time, it is normal (but not required) to assign the same HGVR index to all the HGVRs.	3B	M		N/A	
R-36	7.2.3	<Hand identifier> This bitmapped one-byte field shall identify the hand and camera orientation used to capture the associated hand (or subset thereof) silhouette.	3B	M		N/A	
R-37	7.2.4	<Hand integrity> This one-byte field shall identify hands that have missing/mangled digits and/or hands that have difficulty being placed flat against the platen.	3B	M		N/A	
R-38	7.2.4	<Hand integrity bits 5-6> shall be set to zero by producers of a BDB in this version of this part of ISO/IED 19794, and should be ignored by users of the BDB.	2	M		N/A	
R-39	7.2.5	<Data resolution> shall specify the resolution of the silhouette, measured in pixels per centimeter.	3B	M		N/A	
R-40	7.2.5	This resolution shall apply to both the horizontal and vertical resolution.	3B	M		N/A	
R-41	7.2.6	<Distortion> This signed byte indicates the geometric distortion of the system used to capture the hand silhouette.	3C	O-1		N/A	

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Table 1 (*continued*)

Require-ment ID	Reference in base standard	Requirement Summary	Level	Status (see note)	IUT Support	Supported Range	Test Result
R-42	7.2.7	The quality of the overall Hand Silhouette Data shall either be between 0 and 100 or encoded as –1 or –2 as specified for BioAPI_QUALITY in ISO/IEC 19784-1, and recorded in the low byte of this 3-byte field.	1, 3	M		0-100	
R-43	7.2.7	A value of 0 shall represent the lowest possible quality and the value 100 shall represent the highest possible quality (the value 0 also represents an unknown quality factor).	3C	O-1		N/A	
R-44	7.2.8.2	If the position of the camera is unknown, then this field shall contain the value –128, otherwise this field shall be set using the value POS: POS = displacement / 4.	3C	O-1		N/A	
R-45	7.2.8.2	If POS is in the range –126 to +126 then the field shall contain the POS value.	3C	O-1		N/A	
R-46	7.2.8.2	If POS is greater than +126 then the field shall contain the value +127.	3C	O-1		N/A	
R-47	7.2.8.2	If POS is less than –126 then the field shall contain the value –127.	3C	O-1		N/A	
R-48	7.2.10	This field shall be calculated as Z-POS = (uint8) millimeters / 4.	3C	O-1		N/A	
R-49	7.2.16	<Data compression algorithm> Currently the only supported compression methods for the silhouette data are the 8-direction and 4-direction FCC, represented by values of zero and one respectively.	1	M		0-1	
R-50	7.2.17	<Hand scanning technology> Valid scanning technologies are: 0=unspecified, 1=optical camera, 2=linear scanning array.	1,2	M		0-1	
R-51	7.2.18	<Extended data length> This two-byte field contains the length in bytes of the extended data block.	1	M		0-65535	
R-52	7.2.19	<Reserved> Bytes shall be set to zero by producers of a BDB.	1,2	M		N/A	
R-53	7.2.21	The Product ID in the CBEFF wrapper (see clause 5.3) shall be used to uniquely identify the system Vendor or Producer or Owner and the Type of the encoding equipment that generated the extended data.	3C	O-1		N/A	
R-54	B.1	This part of ISO/IEC 19794 defines the format in which a hand silhouette shall be recorded in a BDB.	3C	O-1		N/A	

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Status Notes for Level 3 Requirements:

The following short notes provide more details about why a specific conformance test assertion is not specified for the corresponding requirement(s):

1) Level 3 Assertion is too difficult to test

No method has been defined to test the conformance of the IUT or BDIR for this mandatory requirement of the ISO/IEC 19794-10:2007. For the purposes of this part of ISO/IEC 29109, this requirement is marked as Optional until an appropriate test method is established.

Table 2 — Level 1 and Level 2 conformance test assertions

Test Number	Section	Requirement ID	Level	Field Name	Operator	Operand	Test Note	Status	IUT Support	Supported Range	Test Result
1	General Record Header	R-25	1	Format Identifier	EQ	0x484E4400					
1.1		R-25	1	Format Identifier	NEQ	0x0044E484	1				
2		R-26,R-27, R-28	1	Version number	EQ	0x30313000					
2.1		R-26,R-27, R-28	1	Version number	NEQ	0x00031303	1				
3		R-23	1	Record Length	EQ	40 – (2^32-1)					
3.1		R-23	2	Record Length	EQ	Total Bytes Read					
3.2		R-23	2	Record Length	EQ	Total Bytes Expected	2				
4		R-29,R-30, R-31	1	Number of HGVRs	EQ	1 – 255					
4.1		R-29,R-30, R-31	2	Number of HGVRs	EQ	HGVRs Read					
5		R-32	1	Reserved for future use	EQ	0x0000					
6	HGVR Header	R-34	1	Length of HGVR	EQ	25 – (2^16-1)					
7		R-35	1	HGVR index	NONE	N/A					
8		R-36	1	Hand Identifier	NONE	N/A					
9		R-38	1	Hand integrity	EQ	0 – 31, 128 – 159					
10		R-39	1	Data resolution	NONE	N/A	3				
11		R-41	1	Distortion	NONE	N/A	3				
12		R-42	1	Silhouette quality	EQ	0 – 100, 254, 255					
13		R-44,R-45, R-46, R-47	1	Camera X position	NONE	N/A	3				
14		R-44,R-45, R-46, R-47	1	Camera Y position	NONE	N/A	3				

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Table 2 (*continued*)

Test Number	Section	Requirement ID	Level	Field Name	Operator	Operand	Test Note	Status	IUT Support	Supported Range	Test Result
15		R-48	1	Camera Z position	NONE	N/A	3				
16		R-44,R-45, R-46, R-47	1	Target X position	NONE	N/A	3				
17		R-44,R-45, R-46, R-47	1	Target Y position	NONE	N/A	3				
18		R-44,R-45, R-46, R-47	1	Target Z position	NONE	N/A	3				
19		R-44,R-45, R-46, R-47	1	X Position of the silhouette starting point	NONE	N/A					
20		R-44,R-45, R-46, R-47	1	Y Position of the silhouette starting point	NONE	N/A					
21		R-49	1	Data compression algorithm	EQ	0 – 1					
21.1		R-49	2	Data compression algorithm	C	N/A	4				
22		R-50	1	Hand scanning technology	EQ	0 – 2					
23		R-51	1	Extended data length	NONE	N/A					
24		R-24,R-33, R-52	1	Reserved for future use	EQ	0x000000					
25	HGVR Data	R-13,R-15, R-16, R-17	2	Silhouette data	C	PASS	4				
26		R-51	1	Extended data	NONE	N/A					
27	Shalls	R-2, R-3, R-13,R-15, R-16, R-17	2	Additional silhouette tests	C	PASS	4				
28		R-4	2	Padding at end of FCC	C	PASS	5				

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NOTE 1 Test 1.1 and Test 2.1 check to see if these multi-byte quantities have been encoded as the Little-Endian equivalent of the correct Big-Endian value. These tests fail if that is true but pass in all other cases. By reviewing the combination of the results of Test 1, 1.1, 2 and 2.1, it should be simple to determine whether or not the implementation under test is using the correct Big-Endian encoding.

NOTE 2 The following calculation will be evaluated once the {Extended data length} field for the last finger view has been parsed successfully (not having reached an End-of-File marker prematurely). In the event that an End-of-File marker is reached prematurely this test will be marked as having failed, but no value of {Total Bytes Expected} will be produced.

The initial value of SUMBYTES below corresponds to the length of the General Record Header in bytes (15).

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