

ANSI/NIST-ITL 1-2000

**DATA FORMAT FOR THE INTERCHANGE
OF FINGERPRINT, FACIAL & SMT INFORMATION**

INTERPOL IMPLEMENTATION

prepared by

The Interpol AFIS Expert Group

Version No. 4.22 – October 07, 2004

VERSION HISTORY						
Ver- sion	Date	Originator	Modification	Modified	Fields added	Deleted
4.10	2003-05-23	Gerd Hardt	1 st draft of INT-I v. 4.10			
4.11	2003-09-15	Gerd Hardt	Correction	Table 10.6e		
			Modification	Fields: 2.026 13.004 14.004 15.004		
4.12	2003-11-13	Gerd Hardt	Correction	Field 2.026		
4.20	2003-12-12	Gerd Hardt	Modification	Fields: 1.013 2.003 2.074 Table 7.1 Chapter 7		
			Addition		Field 2.085	
4.21	2004-05-04	Gerd Hardt	Modification	Table 4.1: code "8" added for unknown impression type		
			Modification	Field 1.013		
4.22	2004-05-14	Gerd Hardt	Modification	Table 4.1: code "8" adapted to ISO/IEC JTC 1/SC 37 N464 code "9" added for unknown impression type		
			Addition		Field 2.083	
			Modification	Field 1.007 Field 2.003		
	2004-07-12					
	2004-10-07		Correction	Field 1.013		

CONTENTS

Introduction	1
File Content Overview	3
1. File header	3
2. Descriptive text (user defined)	3
3. Low resolution gray-scale image	3
4. High resolution gray-scale image	3
5. Low resolution binary image	4
6. High resolution binary image	4
7. User-defined image	4
8. Signature image	4
9. Minutiæ record	4
10. Facial and/or SMT Binary Image Record	4
11. Variable-Resolution Latent Image Record	5
12. Variable-Resolution Tenprint fingerprint impressions	5
13. Variable-Resolution Palmprint Image Record	5
Record format	5
1. Information separators	5
2. Record layout	7
3. International character sets	7
1 Type-1 Logical Record: the File Header	9
1.1 Fields for Type-1 Logical Record	9
1.1.1 Field 1.001: Logical Record Length (LEN)	9
1.1.2 Field 1.002: Version Number (VER)	9
1.1.3 Field 1.003: File Content (CNT)	9
1.1.4 Field 1.004: Type of Transaction (TOT)	10
1.1.5 Field 1.005: Date of Transaction (DAT)	13
1.1.6 Field 1.006: Priority (PRY)	14
1.1.7 Field 1.007: Destination Agency Identifier (DAI)	14
1.1.8 Field 1.008: Originating Agency Identifier (ORI)	14
1.1.9 Field 1.009: Transaction Control Number (TCN)	14
1.1.10 Field 1.010: Transaction Control Response (TCR)	15
1.1.11 Field 1.011: Native Scanning Resolution (NSR)	15
1.1.12 Field 1.012: Nominal Transmitting Resolution (NTR)	15
1.1.13 Field 1.013: Domain name (DOM)	15
1.1.14 Field 1.014: Greenwich mean time (GMT)	16
Field 1.015: Directory of character sets (DCS)	16
2 Type-2 Logical Record: Descriptive Text	17
2.1 Fields for Type-2 Logical Record	17
2.1.1 Field 2.001: Logical Record Length (LEN)	17
2.1.2 Field 2.002: Image Designation Character (IDC)	17
2.1.3 Field 2.003: System Information (SYS)	17
2.1.4 Field 2.004: Date of Record (DAR)	18
2.1.5 Field 2.005: Date of Last Update (DLU)	18

2.1.6	Field 2.006: Send Copy To (SCT)	18
2.1.7	Field 2.007: Case Number (CNO)	18
2.1.8	Field 2.008: Sequence Number (SQN)	19
2.1.9	Field 2.009: Latent Identifier (MID)	19
2.1.10	Field 2.010: Criminal Reference Number (CRN)	19
2.1.11	Field 2.011: Other Reference Number (ORN)	20
2.1.12	Field 2.012: Miscellaneous Identification Number (MN1)	20
2.1.13	Field 2.013: Miscellaneous Identification Number (MN2)	20
2.1.14	Field 2.014: Miscellaneous Identification Number (MN3)	20
2.1.15	Field 2.015: Miscellaneous Identification Number (MN4)	20
2.1.16	Field 2.016: Miscellaneous Identification Number (MN5)	20
2.1.17	Field 2.017: Finger Number (FNU)	21
2.1.18	Field 2.018: Fingerprint Identification Byte (FIB)	21
2.1.19	Field 2.019: Date Fingerprinted (DPR)	22
2.1.20	Field 2.020: Time of Fingerprinting (TOF)	22
2.1.21	Field 2.021: Reason Fingerprinted (RFP)	22
2.1.22	Field 2.022: Place Of Arrest (POA)	22
2.1.23	Field 2.023: Owing Bureau (OBU)	23
2.1.24	Field 2.024: Date of Notice (DON)	23
2.1.25	Field 2.025: Station Inputting Latent (SIM)	23
2.1.26	Field 2.026: Quality Measure (QLM)	23
2.1.27	Field 2.027: Coarse Classification of Patterns (CCP)	23
2.1.28	Field 2.028: Fine Classification of Patterns (FCP)	24
2.1.29	Field 2.029: Nominal File (NLF)	24
2.1.30	Field 2.030: Name (NAM)	24
2.1.31	Field 2.031: Maiden Name (MNA)	24
2.1.32	Field 2.032: Address (ADD)	25
2.1.33	Field 2.033: True Identity (TRU)	25
2.1.34	Field 2.034: Aliases (AKA)	25
2.1.35	Field 2.035: Date of Birth (DOB)	25
2.1.36	Field 2.036: Date of Birth Range (DBR)	25
2.1.37	Field 2.037: Place of Birth (POB)	26
2.1.38	Field 2.038: Nationality (NAT)	26
2.1.39	Field 2.039: Sex (SEX)	26
2.1.40	Field 2.040: Color (COL)	26
2.1.41	Field 2.041: Height (HGT)	27
2.1.42	Field 2.042: Build (BLD)	27
2.1.43	Field 2.043: Hair (HAI)	27
2.1.44	Field 2.044: Face (FAC)	27
2.1.45	Field 2.045: Languages Spoken (LAN)	27
2.1.46	Field 2.046: Photograph Number (PHO)	27
2.1.47	Field 2.047: Passport Number (PSP)	28
2. 048	Field 2.048: Marks etc (MAR)	28
2.1.49	Field 2.049: Occupation (OCC)	28
2.1.50	Field 2.050: Warning (WNG)	28
2.1.51	Field 2.051: Modus Operandi (MDO)	28
2.1.52	Field 2.052: Geographical Area of Crime (GAC)	28
2.1.53	Field 2.053: Geographical Search Area (GSA)	29

2.1.54	Field 2.054: Offence Type (OTY)	29
2.1.55	Field 2.055: Date of Offence (DOO)	29
2.1.56	Field 2.056: Date of Offence Range (DOR)	29
2.1.57	Field 2.057: Date of Offence Search Range (DSR)	30
2.1.58	Field 2.058: Time of Offence (TOO)	30
2.1.59	Field 2.059: Time of Offence Range (TOR)	30
2.1.60	Field 2.060: Time of Offence Search Range (TSR)	30
2.1.61	Field 2.061: Time Limit (TLM)	30
2.1.62	Field 2.062: ICPO/GS (ICP)	30
2.1.63	Field 2.063: Additional Information (INF)	31
2.1.64	Field 2.064: Respondents List (RLS)	31
2.1.65	Field 2.065: Recipient Countries (COU)	31
2.1.66	Field 2.066: Result (RES)	32
2.1.67	Field 2.067: Alert Flag (ALF)	32
2.1.68	Field 2.068: Target Criminal Flag (TCF)	32
2.1.69	Field 2.069: Identified Flag (IDF)	32
2.1.70	Field 2.070: Latent Priority Flag (MPF)	33
2.1.71	Field 2.071: Tie Up Flag (TUF)	33
2.1.72	Field 2.072: Rank (RNK)	33
2.1.73	Field 2.073: Date signature (DSG)	33
2.1.74	Field 2.074: Status/Error Message Field (ERM)	33
2.1.80	Field 2.080: Broadcast Request To (BRT)	35
2.1.83	Field 2.083: Finger Present (FPR)	35
2.1.85	Field 2.085: Additional Response Information (ARI)	35
4	Type-4 Logical Record: High Resolution Gray-Scale Image	36
4.1	Fields for Type-4 Logical Record	36
4.1.1	Field 4.001: Logical Record Length (LEN)	36
4.1.2	Field 4.002: Image Designation Character (IDC)	36
4.1.3	Field 4.003: Impression Type (IMP)	36
4.1.4	Field 4.004: Finger Position (FGP)	37
4.1.5	Field 4.005: Image Scanning Resolution (ISR)	37
4.1.6	Field 4.006: Horizontal Line Length (HLL)	37
4.1.7	Field 4.007: Vertical Line Length (VLL)	38
4.1.8	Field 4.008: Gray-scale Compression Algorithm (GCA)	38
4.1.9	Field 4.009: The Image	38
7	Type-7 Logical Record: User-defined Image	39
7.1	Fields for Type-7 Logical Record	39
7.1.1	Field 7.001: Logical Record Length (LEN)	39
7.1.2	Field 7.002: Image Designation Character (IDC)	39
7.1.3	Field 7.003: Image Type (IMT)	40
7.1.4	Field 7.004: Image Description (IMD)	40
7.1.5	Field 7.005: Pattern Classification (PCN)	41
7.1.6	Field 7.006: Image Capture Resolution (IMR)	41
7.1.7	Field 7.007: Horizontal Line Length (HLL)	41
7.1.8	Field 7.008: Vertical Line Length (VLL)	41
7.1.9	Field 7.009: Gray-scale Compression Algorithm (GCA)	42
7.1.10	Field 7.010: Image Data	42

8	Type-8 Logical Record: Signature Image	43
8.1	Fields for Type-8 Logical Record	43
8.1.1	Field 8.001: Logical Record Length (LEN)	43
8.1.2	Field 8.002: Image Designation Character (IDC)	43
8.1.3	Field 8.003: Signature Type (SIG)	43
8.1.4	Field 8.004: Signature Representation Type (SRT)	43
8.1.5	Field 8.005: Image Scanning Resolution (ISR)	43
8.1.6	Field 8.006: Horizontal Line Length (HLL)	44
8.1.7	Field 8.007: Vertical Line Length (VLL)	44
8.1.8	Field 8.008: Signature Data	44
9	Type-9 Logical Record: Minutiæ Record	45
9.1	Minutiæ and Other Information Descriptors	45
9.1.1	Minutia Type Identification	45
9.1.2	Minutia Numbering	45
9.1.3	Minutiæ Ridge Counts	45
9.1.4	Minutiæ Coordinate System	46
9.2	Fields for Type-9 Logical Record	47
9.2.1	Field 9.001: Logical Record Length (LEN)	47
9.2.2	Field 9.002: Image Designation Character (IDC)	48
9.2.3	Field 9.003: Impression Type (IMP)	48
9.2.4	Field 9.004: Minutiæ Format (FMT)	48
9.2.5	Field 9.005: Originating Fingerprint Reading System (OFR)	48
9.2.6	Field 9.006: Finger Position (FGP)	49
9.2.7	Field 9.007: Fingerprint Pattern Classification (FPC)	49
9.2.8	Field 9.008: Core Position (CRP)	49
9.2.9	Field 9.009: Delta(s) Position (DLT)	50
9.2.10	Field 9.010: Number of Minutiæ (MIN)	50
9.2.11	Field 9.011: Minutiæ Ridge Count Indicator (RDG)	50
9.2.12	Field 9.012: Minutiæ and Ridge Count Data (MRC)	50
9.2.12.1	Index Number	50
9.2.12.2	X, Y, and Theta Values	50
9.2.12.3	Quality Measure	51
9.2.12.4	Minutia Type Designation	51
9.2.12.5	Ridge Count Data	51
9.2.12.6	Record Separator	51
9.3	End of Type-9 Logical Record	51
9.4	Additional Minutiæ Records	51
10	Type-10 Logical Record: Facial and/or SMT Binary Image Record	52
10.1	Fields for Type-10 logical record	52
10.1.1	Field 10.001: Logical Record Length (LEN)	52
10.1.2	Field 10.002: Image Designation Character (IDC)	52
10.1.3	Field 10.003: Image Type (IMT)	53
10.1.4	Field 10.004: Source Agency / ORI (SRC)	53
10.1.5	Field 10.005: Photo Date (PHD)	54
10.1.6	Field 10.006: Horizontal Line Length (HLL)	54
10.1.7	Field 10.007: Vertical Line Length (VLL)	54

10.1.8	Field 10.008: Scale Units (SLC)	54
10.1.9	Field 10.009: Horizontal Pixel Scale (HPS)	54
10.1.10	Field 10.010: Vertical Pixel Scale (VPS)	54
10.1.11	Field 10.011: Compression Algorithm (CGA)	54
10.1.12	Field 10.012: Colorspace (CSP)	55
10.1.13	Field 10.013-.019: Reserved for Future Definition (RSV)	55
10.1.14	Field 10.020: Subject Pose (POS)	55
10.1.15	Field 10.021: Pose Offset Angle (POA)	55
10.1.16	Field 10.022: Photo Description (PXS)	56
10.1.17	Field 10.023-.039: Reserved for Future Definition (RSV)	56
10.1.18	Field 10.040: NCIC Designation Code (SMT)	56
10.1.19	Field 10.041: SMT Size (SMS)	60
10.1.20	Field 10.042: SMT Descriptors (SMD)	61
10.1.21	Field 10.043: Color (COL)	64
10.1.22	Field 10.044-199: Reserved for Future Definition (RSV)	64
10.1.23	Field 10.200-998: User Defined Fields (UDF)	64
10.1.24	Field 10.999: Image Data (DAT)	65
10.2	End of Type-10 Logical Record	65
10.3	Additional Facial & SMT Image Records	65
11	Type-13 variable-resolution latent image record	66
11.1	Fields for the Type-13 logical record	66
11.1.1	Field 13.001: Logical record length (LEN)	67
11.1.2	Field 13.002: Image designation character (IDC)	67
11.1.3	Field 13.003: Impression type (IMP)	67
11.1.4	Field 13.004: Source agency / ORI (SRC)	67
11.1.5	Field 13.005: Latent capture date (LCD)	67
11.1.6	Field 13.006: Horizontal line length (HLL)	68
11.1.7	Field 13.007: Vertical line length (VLL)	68
11.1.8	Field 13.008: Scale units (SLC)	68
11.1.9	Field 13.009: Horizontal pixel scale (HPS)	68
11.1.10	Field 13.010: Vertical pixel scale (VPS)	68
11.1.11	Field 13.011: Compression algorithm (CGA)	68
11.1.12	Field 13.012: Bits per pixel (BPX)	68
11.1.13	Field 13.013: Finger / palm position (FGP)	69
11.1.14	Field 13.014-019: Reserved for future definition (RSV)	69
11.1.15	Field 13.020: Comment (COM)	69
11.1.16	Field 13.021-199: Reserved for future definition (RSV)	69
11.1.17	Fields 13.200-998: User-defined fields (UDF)	69
11.1.18	Field 13.999: Image data (DAT)	69
11.2	End of Type-13 variable-resolution latent image record	70
11.3	Additional variable-resolution latent image records	70
12	Type-14 variable-resolution tenprint image record	71
12.1	Fields for the Type-14 logical record	71
12.1.1	Field 14.001: Logical record length (LEN)	72
12.1.2	Field 14.002: Image designation character (IDC)	72
12.1.3	Field 14.003: Impression type (IMP)	72
12.1.4	Field 14.004: Source agency / ORI (SRC)	72

12.1.5	Field 14.005: Tenprint capture date (TCD)	72
12.1.6	Field 14.006: Horizontal line length (HLL)	73
12.1.7	Field 14.007: Vertical line length (VLL)	73
12.1.8	Field 14.008: Scale units (SLC)	73
12.1.9	Field 14.009: Horizontal pixel scale (HPS)	73
12.1.10	Field 14.010: Vertical pixel scale (VPS)	73
12.1.11	Field 14.011: Compression algorithm (CGA)	73
12.1.12	Field 14.012: Bits per pixel (BPX)	74
12.1.13	Field 14.013: Finger position (FGP)	74
12.1.14	Field 14.014-019: Reserved for future definition (RSV)	74
12.1.15	Field 14.020: Comment (COM)	74
12.1.16	Field 14.021-199: Reserved for future definition (RSV)	74
12.1.17	Fields 14.200-998: User-defined fields (UDF)	74
12.1.18	Field 14.999: Image data (DAT)	74
12.2	End of Type-14 variable-resolution tenprint image record	75
12.3	Additional variable-resolution tenprint image records	75
13	Type-15 variable-resolution palmprint image record	76
13.1	Fields for the Type-15 logical record	76
13.1.1	Field 15.001: Logical record length (LEN)	77
13.1.2	Field 15.002: Image designation character (IDC)	77
13.1.3	Field 15.003: Impression type (IMP)	77
13.1.4	Field 15.004: Source agency/ORI (SRC)	77
13.1.5	Field 15.005: Palmprint capture date (PCD)	77
13.1.6	Field 15.006: Horizontal line length (HLL)	77
13.1.7	Field 15.007: Vertical line length (VLL)	78
13.1.8	Field 15.008: Scale units (SLC)	78
13.1.9	Field 15.009: Horizontal pixel scale (HPS)	78
13.1.10	Field 15.010: Vertical pixel scale (VPS)	78
13.1.11	Field 15.011: Compression algorithm (CGA)	79
13.1.12	Field 15.012: Bits per pixel (BPX)	79
13.1.13	Field 15.013: Palmprint position (PLP)	80
13.1.14	Field 15.014-019: Reserved for future definition (RSV)	80
13.1.15	Field 15.020: Comment (COM)	80
13.1.16	Field 15.021-199: Reserved for future definition (RSV)	80
13.1.17	Fields 15.200-998: User-defined fields (UDF)	80
13.1.18	Field 15.999: Image data (DAT)	80
13.2	End of Type-15 variable-resolution palmprint image record	81
13.3	Additional Type-15 variable-resolution palmprint image records	81
APPENDIX 1	ASCII Separator Codes	82
APPENDIX 2	Calculation of Alpha-Numeric Check Character	83
APPENDIX 3	Mnemonic Codes	84
A3.1	Mnemonics for Type-1 Logical Records	84
A3.2	Mnemonics for Types of Transaction (TOT)	84
A3.3	Mnemonics for Type-2 Logical Records	85
A3.4	Mnemonics for Type-4 Logical Records	86

A3.5	Mnemonics for Type-7 Logical Records	87
A3.6	Mnemonics for Type-8 Logical Records	87
A3.7	Mnemonics for Type-9 Logical Records	87
A3.8	Mnemonics for Type-10 Logical Records	88
A3.9	Mnemonics for Type-13 Logical Records	88
A3.10	Mnemonics for Type-14 Logical Records	89
A3.11	Mnemonics for Type-15 Logical Records	89
APPENDIX 4 JPEG File Interchange Format		90
APPENDIX 5 Character Codes		98
A5.1	7-bit ANSI code for information interchange	98
APPENDIX 6 Base-64 encoding scheme		99

GLOSSARY

AFR	Automatic Fingerprint Recognition
ANSI	American National Standards Institute
CRO	Criminal Record Office / Criminal Reference Number
FBI	Federal Bureau of Investigation
ISO	International Standards Organization
INT-I	Interpol Implementation
NIST	National Institute of Standards and Technology

ANSI/NIST STANDARD: DATA FORMAT FOR THE INTERCHANGE OF FINGERPRINT, FACIAL & SMT INFORMATION

Interpol Implementation

Introduction

In 1986 the American National Bureau of Standards published a standard to facilitate the interchange of fingerprint image information entitled "Data Format for the Interchange of Fingerprint Information" (ANSI/NBS-ICST 1-1986). Following a relatively exhaustive review procedure which included the UK Home Office and other US and Canadian law enforcement agencies, this was revised by the American National Institute of Standards and Technology (NIST) and issued as ANSI/NIST-CSL 1-1993. In 1997 the standard has been expanded to handle facial images and scar, mark and tattoo (SMT) image data. This expansion was issued as ANSI/NIST-ITL 1a-1997. In September 1998 both standards were revised and merged into the ANSI/NIST-ITL 1-2000 enhanced with additional field and record definitions.

As is often the case with standards such as these, it is defined fairly broadly so as to appeal to a large set of potential users. Hence, the standard provides some features not needed by some organizations. In addition, the standard also includes two user defined record types ("Type-2" and "Type-7") which are intentionally not defined within the standard, but rather are to be "user defined".

The present document, the Interpol Implementation (INT-I), has been written with the intention of supplementing the ANSI/NIST publication for the guidance of members of the International Criminal Police Organization.

The INT-I has been drafted noting the following general points:

1. **Openness** The INT-I has been drafted to ensure openness and hence any subsequent systems using the INT-I are assured the highest level of inter-operability.
2. **Non-intrusiveness** The INT-I has been drafted with a minimum level of mandatory requirements and many optional elements. There is no attempt to impose operational procedures and constraints on any system which conforms with the INT-I.
3. **Inter-operability** The INT-I allows for the transfer of fingerprint information between different systems. However, in a situation where there is an incompatibility between the two (transmitter and receiver), it is the responsibility of the transmitter to ensure that the transmitted data is re-formatted to comply with the receiving system.
4. **Wide usage** The INT-I has been designed to encompass the exchange of a wide variety of fingerprint information, and not just that required by an AFR system. For example, it is envisaged that the INT-I could be used to transfer information such as the impressions from wrists and toes.

It should be noted that the records described in the ANSI/NIST standard and INT-I are not intended for manual entry and interpretation: rather they are intended for transmission of information between computers.

It is also important to note that some TOTs, and fields within records, may not be appropriate for certain transactions between particular agencies. For example, many agencies may not allow a remote site to add a record to its database, or there may be national legal objections to sending respondent images over a wide area network before they had been verified. However, in the spirit of open standards, and with the aim of excluding only the absolute minimum of information exchange, all such transactions are specified in INT-I but with the expectation that they would be blocked by the systems involved.

The following section describes the general structure of the ANSI/NIST standard and goes on to describe the various record types (Type-1, Type-2, ...). In addition this section also details the use of each of the record types.

File Content Overview

A fingerprint file, as specified in the ANSI/NIST-ITL 1-2000 standard, consists of several logical records. There are sixteen types of record. Appropriate ASCII separation characters are used between each record and the fields and subfields within the records.

1. File header

This record contains routing information and information describing the structure of the rest of the file. This record type also defines the types of transaction which fall under the following broad categories:

- € ten-print services
- € scene-of-crime services
- € fingerprint image services and messaging
- € scar, mark, tattoo and facial image services
- € palm print services

It should be noted that the particular transaction types allowed in Section 1 are typical of the transactions carried out by Interpol members and may be different from those used elsewhere.

2. Descriptive text (user defined)

This record contains user-defined textual information of interest to the sending and receiving agencies. Section 2 describes the contents of the various fields and sub-fields within this record.

3. Low resolution gray-scale image

This record is used to exchange low resolution gray-scale (eight bit) fingerprint images sampled at 250 pixels/inch.

Records of this type will not be used by Interpol.

4. High resolution gray-scale image

This record is used to exchange high resolution gray-scale (eight bit) fingerprint images sampled at 500 to 520 pixels/inch. It is common practice to compress the fingerprint images using the WSQ algorithm. Other compression algorithms shall not be used.

5. Low resolution binary image

This record is used to exchange low resolution binary fingerprint images sampled at 250 pixels/inch.

Records of this type will not be used by Interpol.

6. High resolution binary image

This record is used to exchange high resolution binary fingerprint images sampled at 500 to 520 pixels/inch.

Records of this type will not be used by Interpol.

7. User-defined image

In earlier versions of this Implementation the type-7 record was intended for the exchange of fingerprint image data other than the conventional images of finger prints. At present the envisaged use is for the exchange of images such as soles and toes of feet, and also for sections of ten-print forms.

Starting with this version of INT-I the usage of Type-7 record for the exchange of latent and/or palmprint images is obsolete. To ensure backward compatibility the support of using Type-7 for latent and palmprint exchange shall be implemented in all newer systems too.

8. Signature image

This record is used to transmit the signature of the fingerprinting officer or the fingerprinted subject. The ANSI/NIST standard allows for the fingerprint image to be uncompressed binary, compressed binary or vectorized format.

9. Minutiæ record

Type-9 records are used to exchange ridge characteristics or minutiæ data. Their purpose is partly to avoid unnecessary duplication of AFR encoding processes and partly to allow the transmission of AFR codes which contain less data than the corresponding images.

10. Facial and/or SMT Binary Image Record

Type-10 records shall contain facial and/or SMT binary image data and related ASCII information pertaining to the specific image contained in this record. It shall be used to exchange both grayscale and color image data. Image data contained in the Type-10 record may be uncompressed or compressed.

11. Variable-Resolution Latent Image Record

Type-13 tagged field image records shall be used to exchange variable-resolution latent fingerprint and latent palmprint images together with textural alphanumerical information. The scanning resolution of the images shall be 500 pixels/inch with 256 gray-levels. If the quality of the latent image is sufficient it shall be compressed using WSQ-algorithm. If necessary the resolution of the images may be expanded to more than 500 pixels/inch and more than 256 gray-levels on bilateral agreement.

12. Variable-Resolution Tenprint fingerprint impressions

This record is used to exchange variable-Resolution resolution fingerprint images sampled at 500 or more pixels/inch and more than 256 gray-levels. This record shall only be used on bilateral agreement in addition to Type-4 records.

13. Variable-Resolution Palmprint Image Record

Type-15 tagged field image records shall be used to exchange variable-resolution palmprint images together with textural alphanumerical information. The scanning resolution of the images shall be 500 pixels/inch with 256 gray-levels. To minimize the amount of data all palmprint images shall be compressed using WSQ-algorithm. If necessary the resolution of the images may be expanded to more than 500 pixels/inch and more than 256 gray-levels on bilateral agreement.

Record format

A transaction file shall consist of one or more logical records. For each logical record contained in the file, several information fields appropriate to that record type shall be present. Each information field may contain one or more basic single-valued information items. Taken together these items are used to convey different aspects of the data contained in that field. An information field may also consist of one or more information items grouped together and repeated multiple times within a field. Such a group of information items is known as a subfield. An information field may therefore consist of one or more subfields of information items.

1. Information separators

In the tagged-field logical records (Type-1, Type-2, and Type-9 through Type-15), mechanisms for delimiting information are implemented by use of the four ASCII information separators. The de-limited information may be items within a field or subfield, fields within a logical record, or multiple occurrences of subfields. These information separators are defined in the standard ANSI X3.4. These characters are used to separate and qualify information in a logical sense. Viewed in a hierarchical relationship, the File Separator “FS” character is the most inclusive followed by the Group Separator “GS”, the Record Separator “RS”, and finally the Unit Separator “US” characters. Table 1 lists these ASCII separators and a description of their use within this standard.

Information separators should be functionally viewed as an indication of the type data that follows. The “US” character shall separate individual information items within a field or subfield. This is a signal that the next information item is a piece of data for that field or subfield. Multiple subfields within a field separated by the “RS” character signals the start of the next group of repeated information item(s). The “GS” separator character used between information fields signals the beginning of a new field preceding the field identifying number that shall appear. Similarly, the beginning of a new logical record shall be signaled by the appearance of the “FS” character.

These separators shall be in addition to any other symbols, punctuation, or delimiters as specified in this standard.

The four characters are only meaningful when used as separators of data items in the fields of the ASCII text records. There is no specific meaning attached to these characters occurring in binary image records and binary fields – they are just part of the exchanged data.

Normally, there should be no empty fields or information items and therefore only one separator character should appear between any two data items. The exception to this rule occurs for those instances where the data in fields or information items in a transaction are unavailable, missing, or optional, and the processing of the transaction is not dependent upon the presence of that particular data. In those instances, multiple and adjacent separator characters shall appear together rather than requiring the insertion of dummy data between separator characters.

Consider the definition of a field that consists of three information items. If the information for the second information item is missing, then two adjacent “US” information separator characters would occur between the first and third information items. If the second and third information items were both missing, then three separator characters should be used – two “US” characters in addition to the terminating field or subfield separator character. In general, if one or more mandatory or optional information items are unavailable for a field or subfield, then the appropriate number of separator character should be inserted.

It is possible to have side-by-side combinations of two or more of the four available separator characters. When data are missing or unavailable for information items, subfields, or fields, there must be one fewer separator characters present than the number of data items, subfields, or fields required.

Table 1: Separators Used in NIST Data Files

Code	Type	Description	Hexadecimal Value	Decimal Value
US	Unit Separator	Separates information items	1F	31
RS	Record Separator	Separates subfields	1E	30
GS	Group Separator	Separates fields	1D	29
FS	File Separator	Separates logical records	1C	28

2. Record layout

For tagged-field logical records (Type-1, Type-2, Type-9, Type-10, and Type-13 through Type-16), each information field that is used shall be numbered in accordance with this standard. The format for each field shall consist of the logical record type number followed by a period ".", a field number followed by a colon ":", followed by the information appropriate to that field. The tagged-field number can be any one-to nine-digit number occurring between the period "." and the colon ":". It shall be interpreted as an unsigned integer field number. This implies that a field number of "2.123:" is equivalent to and shall be interpreted in the same manner as a field number of "2.000000123:".

NOTE: For purposes of illustration throughout this document, a three-digit number shall be used for enumerating the fields contained in each of the tagged-field logical records described herein. Field numbers will have the form of "TT.xxx:" where the "TT" represents the one- or two-character record type followed by a period. The next three characters comprise the appropriate field number followed by a colon. Descriptive ASCII information or the image data follows the colon.

Logical Type-1, Type-2, and Type-9 records contain only ASCII textual data fields. The entire length of the record (including field numbers, colons, and separator characters) shall be recorded as the first ASCII field within each of these record types. The ASCII File Separator "FS" control character (signifying the end of the logical record or transaction) shall follow the last byte of ASCII information and shall be included in the length of the record.

In contrast to the tagged-field concept, the Type-3 through Type-8 records contain only binary data recorded as ordered fixed-length binary fields. The entire length of the record shall be recorded in the first four-byte binary field of each record. For these binary records, neither the record number with its period, nor the field identifier number and its following colon, shall be recorded. Furthermore, as all the field lengths of these six records are either fixed or specified, none of the four separator characters ("US", "RS", "GS", or "FS") shall be interpreted as anything other than binary data. For these binary records, the "FS" character shall not be used as a record separator or transaction terminating character.

The Type-10 and Type-13 through Type-15 tagged-field image records combine ASCII fields with a single binary image field. Each ASCII field contains a numeric field identifier and its descriptive data. The last physical field in a tagged-field image record shall always be numbered 999 and shall contain the image data placed immediately following the colon (":") of the field identifier. The record length field shall contain the length of the record. The ASCII File Separator "FS" control character shall follow the last byte of the compressed or uncompressed image data. The "FS" character shall signify the end of the logical record or transaction and shall be included as part of the record length.

3. International character sets

All of the fields in the Type-1 transaction record must be recorded using the 7-bit ASCII code, which is the default character set code within a transaction. In order to effect data and transaction interchanges between non-English based agencies, a technique is available to encode information using character sets other than 7-bit ASCII. Fields from the Type-1 logical record and ASCII "LEN", "IDC" and "SYS" text fields must still be encoded using 7-bit ASCII. But all other

designated text fields can be encoded using alternate character sets. The general mechanism for accomplishing this provides for backward compatibility with existing readers, supports multiple character sets in a single text string, and handles internationally accepted character sets and text order conventions such as ISO character sets and Unicode.

To switch character sets within a transaction, the Type-1 record shall contain a field listing the Directory of Character Sets (DCS) used in the transaction. The DCS is an ordered list of 3 information items containing an identifying code, the name of an international character set, and its version. The code for a specific character set and other special codes shall be embedded in the transaction to signal the conversion to a different international character set. The ASCII Start-of-Text "STX" character (0x02) followed by the equal sign "=" is used to signal the change to an alternate character set defined by the specific DCS code that follows. The entire Start-of-Text sequence is terminated by a single instance of the ASCII End-of-Text "ETX" character (0x03). This alternate character set will remain active until a closing "ETX" character is encountered or the next ASCII information separator character is encountered.

The base-64 encoding scheme, found in email, shall be used for converting non-ASCII text into ASCII form. Annex C describes the use of the base-64 system. By convention, any language or character set text string following the Start-of-Text character sequence will be base-64 encoded for subsequent processing.

The field number including the period and colon, for example "2.001:", in addition to the "US", "RS", "GS", and "FS" information separators shall appear in the transaction as 7-bit ASCII characters without conversion to base-64 encoding.

All text between the STX sequence and the closing ETX character shall be encoded in base-64 notation. This is true even when the 7-bit ASCII character set is specified.

1 Type-1 Logical Record: the File Header

This record describes the structure of the file, the type of the file, and other important information.

The character set used for Type-1 fields shall contain only the 7-bit ANSI code for information interchange.

1.1 Fields for Type-1 Logical Record

1.1.1 Field 1.001: Logical Record Length (*LEN*)

This field contains the total count of the number of bytes in the whole Type-1 logical record. The field begins with "1.01:", followed by the total length of the record including every character of every field and the information separators.

1.1.2 Field 1.002: Version Number (*VER*)

To ensure that users know which version of the ANSI/NIST standard is being used, this four byte field specifies the version number of the standard being implemented by the software or system creating the file. The first two bytes specify the major version reference number, the second two the minor revision number. For example, the original 1986 Standard would be considered the first version and designated "0100" while the present standard is "0300".

1.1.3 Field 1.003: File Content (*CNT*)

This field lists each of the records in the file by record type and the order in which the records appear in the logical file. It consists of one or more subfields, each of which in turn contains two information items describing a single logical record found in the current file. The subfields are entered in the same order in which the records are recorded and transmitted.

The first information item in the first subfield is "1", to refer to this Type-1 record. It is followed by a second information item which contains the number of other records contained in the file. This number is also equal to the count of the remaining subfields of field 1.003.

Each of the remaining subfields is associated with one record within the file, and the sequence of subfields corresponds to the sequence of records. Each subfield contains two items of information. The first is to identify the Type of the record. The second is the record's IDC which is generally in the range 0-16 (one Type-1, one or two Type-2, and 14 Type-4), but could be much higher if additional records are included. The "US" character shall be used to separate the two information items.

1.1.4 Field 1.004: Type of Transaction (TOT)

This field contains a three letter mnemonic designating the type of the transaction. These codes are different from those used by other implementations of the standard.

IRQ: Image Request. This transaction allows the fingerprint officer to retrieve fingerprints, palmprints and scenes of crime latents from an image database. It contains only sufficient information to enable the system to make a unique identification of the required prints or latents. For latents the Case Number (CNO), Sequence Number (SQN) and Latent Identifier (MID) must be specified, while for prints one of the following must be specified: Criminal Reference Number (CRO), Other Reference Number (ORN) or Miscellaneous Reference Number (MN1 to MN5).

IMR: Image Response. This transaction is for the transmission of a print or latent image from a collection, often in response to an IRQ transaction. The Type-2 record may contain textual information relevant to the image.

CPS: Criminal Print-to-Print Search. This transaction is a request for a search of a record relating to a criminal offence against a Prints database. If the person's prints are not already in the remote system they must be included as images in the file.

NPS: Non-Criminal Print-to-Print Search. This transaction is a request for a search against a Prints database that falls outside the scope of a CPS transaction. If the person's prints are not already in the remote system they must be included as images in the file.

MPS: Latent-to-Print Search. This transaction is used when a latent is to be searched against a Prints database. If the latent is not already in the remote system, it must be included as an image in the file.

PMS: Print-to-Latent Search. This transaction is used when a set of prints is to be searched against an Unidentified Latent database. If the person's prints are not already in the remote system they must be included as images in the file. If they are already present in the remote system, they may instead be specified by one of the unique identification numbers in the Type-2 record.

MMS: Latent-to-Latent Search. In this transaction the file contains a latent which is to be searched against an Unidentified Latent database in order to establish links between various scenes of crime. If the latent is not already in the remote system, it must be included as an image in the file.

DBS: Database Search. This transaction is intended primarily as a means of searching a remote image database, and only contains a Type-1 and a Type-2 record. The Type-2 record specifies the textual parameters for a fingerprint, latent or photo search. The result of the search is an SRE transaction which lists those fingerprints, latents or photos that meet the search criteria. The images can then be retrieved using an IRQ or an PHR request.

SRE: Search Results. This transaction contains a Type-1 and Type-2 record which detail the results of the search. The way fields are interpreted will depend on the original search request and to whom the search request was sent. If the SRE transaction is coming from an AFR system, the AFR system will specify a list of potential matches in the Respondents List (RLS).

Additional information regarding the search, such as images and signatures can be attached to the record using Type-4, Type-7, Type-8 or Type-10 records.

USA: Add Latent to Unidentified Latents Collection. Besides containing the image of the latent being added to the database, or the image of a complete lift or photograph, the file includes a Type-2 record in which information is transmitted about the latent.

In some circumstances, a full lift or photograph of a sequence of latents is to be transmitted from one system to another, by agreement with both parties and not in response to an IRQ. In such circumstances the following apply:

- ∄ Any block on USA transactions must be removed.
- ∄ The image of the original must be transmitted as a Type-7 Record, captured at high resolution.

USR: Remove Latent from Unidentified Latents Collection. This transaction contains, besides the Type-1 record, only a Type-2 record in which enough information is given to uniquely specify the latent.

ATP: Add To Print Collection. This transaction is used for sending a complete set of prints (fingerprints and/or palmprints) or an entire fingerprint form to a remote site, as a new record or to replace an existing record. The FIB field (Fingerprint Identification Byte) of the Type-2 record identifies the reason for fingerprinting. The other fields in the record can be used to specify other details about the fingerprinted subject which may be stored by the AFR system or the image database.

In certain circumstances complete ten-print forms are to be transmitted from one system to another, by agreement with both parties and not in response to an IRQ. In such circumstances the following apply:

- ∄ Any block on ATP transactions must be removed.
- ∄ A Type-7 Record must be transmitted which contains an image of the full ten-print form. Field 7.04 (IMD) must be "47".

SUP: Substitute Print(s) Into Existing Print-Collection. During this transaction individual print(s) are transmitted to replace those in an existing ten-print and/or palm-print.

DFP: Delete From Print Collection. This transaction is used to remove a complete record from a Print collection. Like the USR, this transaction only contains a Type-1 and a Type-2 record with enough information to uniquely identify the relevant record.

DIP: Disregard Individual Print(s) Update. This transaction advises the receiving agency that print(s) supplied by a previous SUP transaction should no longer be used.

CPR: Criminal Subject Photo Request. This transaction allows the police officer to retrieve a photo set from an image database. Each set of photos contains one or more photos of a subject posed from different views and other photos linked to the person (e.g. tattoos, scars). The Type-2 Record of this transaction contains only sufficient information to enable the system to make a unique identification of the person. One of the following should be specified: Criminal Reference

Number (CRO), Other Reference Number (ORN) or Miscellaneous Reference Number (MN1 to MN5).

PHR: Photo Response. This transaction is for the transmission of a photo set from a collection, often in response to a CPR transaction. The Type-2 record may contain textual information relevant to the photo.

APC: Add To Print Collection. This transaction is used for sending a complete set of photos and if required a complete set of fingerprints to a remote site, as a new record or to replace an existing record. The FIB field (Fingerprint Identification Byte) of the Type-2 record identifies the reason for taking fingerprints and/or photos. The other fields in the record can be used to specify other details about the person which may be stored in the database.

DPC: Delete From Photo Collection. This transaction is used to remove a complete set of photos from a photo collection. Like the USR and DFP, this transaction only contains a Type-1 and a Type-2 record with enough information to uniquely identify the relevant record.

CPP: Criminal Photo-to-Photo Search. This transaction is a request for an automated search of a photo set relating to a criminal offence against a Photo database.

NPP: Non-Criminal Photo-to-Photo Search. This transaction is a request for an automated search against a Photo database that falls outside the scope of a CPP transaction.

UPR: Update Request. This transaction is used to update the alphanumerical and/or image data of one database record. This transaction must contain a Type-1 and a Type-2 record with enough information to uniquely identify the relevant record. The identification should be based on the information transmitted within CNO, MID, CRN, ORN and/or MN1-MN5 fields.

ERR: Error Message. This transaction is generated if the remote system has difficulty performing the transaction, e.g. if the unique reference number specified for an IRQ does not exist, or if a particular search is not allowed on the system. The Type-2 record will contain the error message. Which error messages are generated in what circumstances is an issue for the system designer.

The definition of these transactions implies that what appears to the officer performing a search as one transaction may, in fact, involve a number of separate transactions between the officer's workstation and the remote site.

It is likely that a system would be designed to block transactions initiated by a remote agency unless it had been specifically authorized by a senior user of the receiving agency.

One limitation of the standard is that it is not permissible for the file to have more than one transaction field. Thus if, say, a latent is to be searched against both the latents database and the prints database, two separate files must be sent.

Table 1.1 lists which records are permissible in the various transactions.

Table 1.1: Permissible Codes in Transactions

Transaction Type	Logical Record Type									
	1	2	4	7	8	9	10	13	14	15
IRQ	M	M	-	-	-	-	-	-	-	-
IMR	M	M	O*	O*	O	-	-	O*	O ³	O*
CPS	M	M	O	O	O	-	-	-	O ³	-
NPS	M	M	O	O	O	-	-	O	O ³	-
MPS	M	M	O ¹	O ¹	-	O	-	O ¹	-	-
PMS	M	M	O	O	O	-	-	-	O ³	O
MMS	M	M	O ¹	O ¹	-	O	-	O ¹	-	-
DBS	M	M	-	-	-	-	-	-	-	-
SRE	M	M	O	O	O	-	O	O	O ³	O
USA	M	M	O ²	O ²	-	-	-	O ²	-	-
USR	M	M	-	-	-	-	-	-	-	-
ATP	M	M	O*	O	O	-	-	-	O ³	O*
SUP	M	M	O*	-	-	-	-	-	O ³	O*
DFP	M	M	-	-	-	-	-	-	-	-
DIP	M	M	-	-	-	-	-	-	-	-
CPR	M	M	-	-	-	-	-	-	-	-
PHR	M	M	-	-	-	-	M	-	-	-
APC	M	M	O	O	O	-	M	-	O ³	O
DPC	M	M	-	-	-	-	-	-	-	-
CPP	M	M	-	-	-	-	M	-	-	-
UPR	M	M	O ¹	O ¹	O	O	O	O ¹	O ³	O
NPP	M	M	-	-	-	-	M	-	-	-
ERR	M	M	-	-	-	-	-	-	-	-

Key: M = Mandatory

O = Optional

O* = At least one of these Logical Record Types must be included in this transaction type.

O¹ = The usage of Type-4 or Type-7 for the exchange of latent images is obsolete. If the remote system is compliant to this version of INT-I Type-13 records shall be used for latent transmissions.

O² = At least one of these Logical Record Types must be included in this transaction type. The usage of Type-4 or Type-7 for the exchange of latent images is obsolete. If the remote system is compliant to this version of INT-I Type-13 records shall be used for latent transmissions.

O³ = If fingerprint images are send within Type-14 records it is mandatory to send these images within Type-4 records, too.

- = Not allowed

1.1.5 Field 1.005: Date of Transaction (DAT)

This field indicates the date on which the transaction was initiated and must conform to the ISO standard notation of

YYYYMMDD

where YYYY is the year, MM is the month and DD is the day of the month. Leading zeros are used for single figure numbers. For example, "19931004" represents the 4 October 1993.

1.1.6 Field 1.006: Priority (PRY)

This optional field defines the priority, on a level of 1 to 9, with which the request is to be treated. "1" is the highest priority and "9" (the default if no priority field is present) the lowest. It is up to the receiving agency to define its policy on how each priority level is interpreted.

1.1.7 Field 1.007: Destination Agency Identifier (DAI)

This field specifies the destination agency for the transaction.

It consists of two information items in the following format

CC/agency.

The first information item contains the Interpol Country Code, defined in ISO 3166, two alpha-numeric characters long. The second item, *agency*, is a free text identification of the agency, up to a maximum of 32 alpha-numeric characters.

Destination Agency Identifier "ZZ/ALL" is reserved for transactions which shall be distributed by Interpol AFIS to all Interpol member states.

1.1.8 Field 1.008: Originating Agency Identifier (ORI)

This field specifies the file originator and has the same format as the DAI (Field 1.007).

1.1.9 Field 1.009: Transaction Control Number (TCN)

This is a control number for reference purposes. It should be generated by the computer and have the following format:

YYSSSSSSSA

where YY is the year of the transaction, SSSSSSSS is an eight-digit serial number, and A is a check character generated by following the procedure given in Appendix 2. The originating agency has to ensure that the TCN is unique and that no other transaction of the agency will have the same TCN.

Where a TCN is not available, the field, YYSSSSSSSS, is filled with zeros and the check character generated as above.

1.1.10 Field 1.010: Transaction Control Response (TCR)

Where a request was sent out, to which this is the response, this optional field will contain the transaction control number of the request message. It therefore has the same format as TCN (Field 1.009).

Where a TCR is not available, the field, YYSSSSSSSS, is filled with zeros and the check character generated as in TCN (Field 1.009).

1.1.11 Field 1.011: Native Scanning Resolution (NSR)

This field specifies the normal scanning resolution of the system supported by the originator of the transaction. It allows the recipient of a search request to send the response(s) at either the minimum (or default) scanning rate of 19.68 pixels/mm (500 pixels/inch) or, if it has the ability, at the scanning rate of the system which made the request. The resolution is specified as two numeric digits followed by the decimal point and then two more digits (e.g. "20.00").

If both recipient and sender use the same native sampling resolution it may be more efficient and less error prone if both systems exchange images at their native sampling resolution rather than using the default rate specified in the standard.

The current ANSI/NIST standard allows any sampling rate from 500 to 520 pixels/inch, but the intention is for new systems to adopt 500 pixels/inch or 19.68 pixels/mm.

For applications other than fingerprint where resolution is not a factor or not applicable (such a facial or SMT image) this field shall be set to "00.00".

1.1.12 Field 1.012: Nominal Transmitting Resolution (NTR)

This five-byte field specifies the nominal transmitting resolution for the images being transmitted. The resolution is expressed in pixels/mm in the same format as NSR (Field 1.011)

For applications other than fingerprint where resolution is not a factor or not applicable (such a facial or SMT image) this field shall be set to "00.00".

1.1.13 Field 1.013: Domain name (DOM)

This mandatory field identifies the domain name for the user-defined Type-2 logical record implementation. If present, the domain name may only appear once within a transaction. It shall consist of one or two information items. The first information item will uniquely identify the agency, entity, or implementation used for formatting the tagged fields in the Type-2 record. An optional second information item will contain the unique version of the particular implementation. For this version of the Interpol-Implementation the value of the field shall be "INT-I{US}4.21{GS}".

1.1.14 Field 1.014: Greenwich mean time (GMT)

This mandatory field provides a mechanism for expressing the date and time in terms of universal Greenwich Mean Time (GMT) units. The GMT field contains the universal date that will be in addition to the local date contained in Field 1.005 (DAT). Use of the GMT field eliminates local time inconsistencies encountered when a transaction and its response are transmitted between two places separated by several time zones. The GMT provides a universal date and 24-hour clock time independent of time zones. It is represented as "CCYYMMDDHHMMSSZ", a 15-character string that is the concatenation of the date with the GMT and concludes with a "Z". The "CCYY" characters shall represent the year of the transaction, the "MM" characters shall be the tens and units values of the month, and the "DD" characters shall be the tens and units values of the day of the month, the "HH" characters represent the hour, the "MM" the minute, and the "SS" represents the second. The complete date shall not exceed the current date.

Field 1.015: Directory of character sets (DCS)

This optional field is a directory or list of character sets other than 7-bit ASCII that may appear within this transaction. This field shall contain one or more subfields, each with three information items. The first information item is the three-character identifier for the character set index number that references an associated character set throughout the transaction file. The second information item shall be the common name for the character set associated with that index number, the optional third information item is the specific version of the character set used. Table 1.2 lists the reserved named character sets and their associated 3-character index numbers. The "US" character shall separate the first information item from the second and the second from the third. The "RS" separator character shall be used between the subfields.

Table 1.2: Directory of character sets

Character set index	Character set name	Description
000	ASCII	7-bit English (Default)
001	ASCII	8-bit Latin
002	UNICODE	16-bit
003-127		Reserved for ANSI/NIST future use
128-999		User-defined character sets

2 Type-2 Logical Record: Descriptive Text

The structure of most of this record is not defined by the ANSI/NIST standard. The record contains information of specific interest to the agencies sending or receiving the file. To ensure that communicating fingerprint systems are compatible the INT-I requires that only the fields listed below are contained within the record. This document specifies which fields are mandatory and which optional, and also defines the structure of the individual fields.

Currently the numbers 001 to 085 have been assigned to specific fields. Numbers 086 to 199 are reserved for future additions to the INT-I. The fields above 2.200 are outside the scope of the INT-I and may be used for national requirements or by system implementers for information specific to their systems.

A file may contain only a small subset of these fields, depending on the transaction taking place.

The character set used for the first Type-2 record shall contain only the 7-bit ANSI code for information interchange. If the transaction contains a second Type-2 record this one may be used for information exchange with other character sets defined within Field 1.015.

2.1 Fields for Type-2 Logical Record

Fields 2.001 to 2.003 are mandatory in all records. They give essential information about the record.

2.1.1 Field 2.001: Logical Record Length (LEN)

This mandatory field contains the length of this Type-2 record, and specifies the total number of bytes including every character of every field contained in the record and the information separators.

2.1.2 Field 2.002: Image Designation Character (IDC)

The IDC contained in this mandatory field is an ASCII representation of the IDC as defined in the file content field of the Type-1 record.

2.1.3 Field 2.003: System Information (SYS)

This field is mandatory and contains four bytes which indicate which version of the INT-I this particular Type-2 record complies with. This feature gives the INT-I the ability to evolve as necessary while still allowing a system to process transactions generated by a system complying with an older version of the INT-I.

The first two bytes specify the major version number, the second two the minor revision number. For example, this implementation is version 4 revision 22 and would be represented as "0422".

Fields 2.004 and 2.005 contain general information regarding the file. Their use is optional in most transactions.

2.1.4 Field 2.004: Date of Record (DAR)

This specifies the date, in ISO format, on which the record was first created, and is formatted according to the ISO standard

YYYYMMDD

where YYYY is the year, MM is the month, and DD is the day, as explained in DAT (Field 1.005). This field will probably be generated automatically.

2.1.5 Field 2.005: Date of Last Update (DLU)

This specifies the most recent date on which the data was changed in the record. The field is formatted in the ISO standard of

YYYYMMDD

where YYYY is the year, MM is the month, and DD is the day, as explained in DAT (Field 1.005). Like Date of Record (see above) this field would be generated by the system when the fingerprint record is amended.

Fields 2.006 to 2.016 are reference information which give information about the nature of the file and its contents. They are, in general, optional, although some are mandatory for certain transactions.

2.1.6 Field 2.006: Send Copy To (SCT)

This field indicates to the receiver to send the response of the transaction to other stations. It consists of one or more subfields, each having the format of DAI (Field 1.007), namely up to two alpha-numeric characters for the Interpol Country Code and up to 32 alpha-numeric characters of free text.

2.1.7 Field 2.007: Case Number (CNO)

This is a number assigned by the local fingerprint bureau to a collection of latents found at a scene-of-crime. The following format is adopted:

CC/*number*

where CC is the Interpol Country Code, two alpha-numeric characters in length, and the *number* complies with the appropriate local guidelines and may be up to 32 alpha-numeric characters long.

This field allows the system to identify latents associated with a particular crime.

2.1.8 *Field 2.008: Sequence Number (SQN)*

This specifies each sequence of latents within a case. It can be up to four numeric characters long.

A sequence is a latent or series of latents which are grouped together for the purposes of filing and/or searching. This definition implies that even single latents will still have to be assigned a sequence number.

In the case of search requests the field is included for identification purposes: if the remote system is an AFR system it can use the case number, sequence number and latent identifier to determine whether it already has an AFR encoding of the latent.

This field together with MID (Field 2.009) may be included to identify a particular latent within a sequence.

2.1.9 *Field 2.009: Latent Identifier (MID)*

This specifies the individual latent within a sequence. The value is a single letter, with 'A' assigned to the first latent, 'B' to the second, and so on up to a limit of 'J'.

This field is used analog to the latent sequence number discussed in the description for SQN (Field 2.008).

2.1.10 *Field 2.010: Criminal Reference Number (CRN)*

This is a unique reference number assigned by a national agency to an individual who is charged for the first time with committing an offence. Within one country no individual ever has more than one CRN, or shares it with any other individual. However, the same individual may have Criminal Reference Numbers in several countries, which will be distinguishable by means of the country code.

The CRN field consists of at least one subfield, which in turn consists of two information items. The following format is adopted for each subfield:

CC/number

where CC is the Interpol Country Code, two alpha-numeric characters in length, and the *number* complies with the appropriate national guidelines of the issuing agency, and may be up to 32 alpha-numeric characters long.

In the case of CPS transactions, the fingerprint officer may believe that he/she already knows the CRN (e.g. as the result of a name check). This field will then specify that CRN, and will allow a verification to be carried out before a print-to-print search on the complete database is initiated.

In the case of PMS searches this field may be used to specify the CRN of the person whose ten-prints are to be searched against an Unidentified Latents collection. This may be useful if the remote system has already encoded and filed the individual's prints.

In an SRE transaction in which the identity of the subject is certain, the CRN is of that individual. For example, Agency A might initiate an SRE transaction, in response to a CPS from Agency B, after an Agency A fingerprint expert has examined the fingerprints and identified the individual. System design should ensure that the response makes clear what has been done.

Similarly, for an IRQ the field may be used to find a given individual's prints in the collection. In this case the responding IMR may contain the same CRN.

2.1.11 Field 2.011: Other Reference Number (ORN)

This is a unique reference number for a ten-print set which does not have a CRN. It is very similar in format and function to CRN (Field 2.010). The field consists of at least one subfield, which in turn consists of two information items. The following format is adopted for each subfield:

CC/type_number/ref_number

where CC is the Interpol Country Code, two alpha-numeric characters in length, *type_number* consists of up to 32 alpha-numeric characters of free text defining the type of reference number, and *ref_number* complies with the appropriate national guidelines of the issuing agency, and may be up to 32 alpha-numeric characters long.

2.1.12 Field 2.012: Miscellaneous Identification Number (MN1)

Any miscellaneous identification numbers may be entered in this and the following four fields (MN1 to MN5). Each of these fields may have a maximum length of 32 alpha-numeric characters.

2.1.13 Field 2.013: Miscellaneous Identification Number (MN2)

2.1.14 Field 2.014: Miscellaneous Identification Number (MN3)

2.1.15 Field 2.015: Miscellaneous Identification Number (MN4)

2.1.16 Field 2.016: Miscellaneous Identification Number (MN5)

Fields 2.017 to 2.025 are used to give information about specific images involved in the transaction. For this reason, if the fingerprints were not taken at the same session each must have as many subfields as there are images in the file. These subfields form a list of data, each

consecutive element relating to the respective image in the file. The requirement for these fields depends upon the transaction being undertaken.

2.1.17 Field 2.017: Finger Number (FNU)

This field consists of a number of subfields.

The first subfield consists of one of the letters T, F or I, which have the following meaning:

- T All ten rolled fingerprints were obtained at the same session (the usual circumstance), and the descriptive fields are associated with all ten images.
- F All 14 fingerprints, including both rolled and plain, were obtained at the same session, and the descriptive fields are associated with all 14 images.
- I The separate prints are specified individually. Each subfield after the first contains a finger number from FGP (Field 4.04) or an image description from IMD (Field 7.04).

If the first subfield is I then any of Fields 2.018 to 2.025 inclusive which are used will contain a number of subfields, each relating to the respective image in this FNU field.

2.1.18 Field 2.018: Fingerprint Identification Byte (FIB)

This field consists of one subfield for each corresponding subfield in FNU (Field 2.017)

Each subfield contains two characters which are used to indicate the reason for fingerprinting. It has one of the following values:

00	Caution
01	Charge
02	Prison
03	Composite Indicator
04	Suspect not Charged
05	Immigration
06	Asylum
07	Elimination
08	Police Officer
09	Scene of Crime Officer
10	Other reason

In the case of "10", RFP (Field 2.021) can be used to give a more detailed description.

In search transactions the field specifies the nature of a transmitted set of ten-prints. In SRE and IMR responses the field will specify the nature of the ten-prints being examined and will therefore effectively echo the original search or image retrieval request.

2.1.19 Field 2.019: Date Fingerprinted (DPR)

This field consists of one subfield for each corresponding subfield in FNU (Field 2.017), and is intended to be used for both prints and latents.

For prints this field contains the date on which the subject was fingerprinted and refers to the date on which the prints included in the transaction were taken.

For latents this field specifies the date on which the latent was inspected at the scene of the crime by a scene examiner.

The format is the ISO standard of

YYYYMMDD

where YYYY is the year, MM is the month, and DD is the day, as explained in DAT (Field 1.005).

2.1.20 Field 2.020: Time of Fingerprinting (TOF)

This field consists of one subfield for each corresponding subfield in FNU (Field 2.017), and is intended for use with prints.

It specifies the time at which fingerprints were taken. The format is

HHMM

where HH is a two digit hour reference and MM a similar minute reference. Standard twenty-four hour clock notation will be used (e.g. "0730", "1752" etc). Midnight should be recorded as either "2359" or "0001", instead of "2400" or "0000".

2.1.21 Field 2.021: Reason Fingerprinted (RFP)

This field consists of one subfield for each corresponding subfield in FNU (Field 2.017).

It is an alpha-numeric field with a maximum length of 128 alpha-numeric characters and is to allow the human operator to enter an extra message, for example giving further details of the reason for fingerprinting or information about how a search is to be carried out.

2.1.22 Field 2.022: Place Of Arrest (POA)

This field consists of one subfield for each corresponding subfield in FNU (Field 2.017).

Each subfield specifies the place of arrest, or the place where the fingerprints were taken, in the same format as DAI (Field 1.007).

2.1.23 Field 2.023: Owning Bureau (OBU)

This field consists of one subfield for each corresponding subfield in FNU (Field 2.017), and is intended for use with both prints and latents. The format of the field is the same as that used in POA (Field 2.022) and DAI (Field 1.007).

2.1.24 Field 2.024: Date of Notice (DON)

This field consists of one subfield for each corresponding subfield in FNU (Field 2.017). It specifies the Date of Notice of the record.

The format is according to the ISO standard of

YYYYMMDD

where YYYY is the year, MM the month and DD the day, as explained in DAT (Field 1.005).

2.1.25 Field 2.025: Station Inputting Latent (SIM)

This field specifies the local office inputting the latent. Its format is the same as DAI (Field 1.007).

Fields 2.026 to 2.028 are used to specify information about image quality and the type of pattern classification used. The precise definition of these fields is to be determined and will be published in a future revision of the INI-I.

2.1.26 Field 2.026: Quality Measure (QLM)

This field contains at least one subfield. Each subfield contains two information items: the first is the IDC code of the finger or palm to which this subfield refers, and the second is a quality measure assigned either by the fingerprint examiner or automatically by the system.

The quality measure is defined as a numeric value beginning with 0 for the poorest quality and 100 for the best quality.

e.g. 2.026:4<US>60<RS>6<US>80<GS>

A quality measure below 50 shall force a manual verification if the destination system performs automated coding and/or classification.

2.1.27 Field 2.027: Coarse Classification of Patterns (CCP)

This field contains at least one subfield. Each subfield contains at least two information items: the first is the IDC code of the finger to which this image refers, and the second is the character

representing the coarse classification. Each subsequent information item specifies a further coarse classification of the fingerprint, which permits allowances. The coarse classification is represented by an alpha-numeric character, but the precise classification to be employed is yet to be determined.

2.1.28 *Field 2.028: Fine Classification of Patterns (FCP)*

This represents the detailed code for the fingerprint pattern class. It contains a number of subfields where each subfield contains at least three information items. The first information item is the IDC of the relevant image. The second is either S or F, recommending whether the pattern is for filing or searching. The third is a character string with between 1 and 4 alpha-numeric characters containing the fine classification. If the fine classification is doubtful, more than one fine classification may follow the IDC code.

The precise classification to be employed is yet to be determined.

Fields 2.029 to 2.051 are used in several transactions to convey personal information relating to the file. This information is generally used for filing purposes, although there are some cases where this personal information may be used for searches.

2.1.29 *Field 2.029: Nominal File (NLF)*

This field consists of two subfields. The first subfield is a single byte. The value of the first subfield is « 0 » if the data contained in fields 2.030 to 2.051 is transmitted within this Type 2 record. The value of the first subfield is « 1 » if the data is transmitted using a Formatted Message. If the first subfield is « 0 » then the second subfield is blank. If the first subfield is « 1 » then the second contains a reference to the Formatted Message in free text, up to 32 alpha-numeric characters.

2.1.30 *Field 2.030: Name (NAM)*

This field contains the names of the subject. The format is:

family_name/name/name/ . . .

For instance Charles Peter Bell would appear as "BELL/CHARLES/PETER". If only the family name (surname) is known then this is followed by a single slash. The entire field is limited to 64 characters including the slashes. Spaces, apostrophes, hyphens and full stops that occur within a component name should be entered as such. If the name is longer than 64 characters the 64th character should be a plus sign. The plus sign can only be used in the final position.

2.1.31 *Field 2.031: Maiden Name (MNA)*

The format of this field is identical to NAM (Field 2.030), and is limited to 64 characters including the slashes. Spaces, apostrophes, hyphens and full stops that occur within a component

name should be entered as such. If the name is longer than 64 characters the 64th character should be a plus sign. The plus sign can only be used in the final position.

2.1.32 Field 2.032: Address (ADD)

This field contains the address of the subject, in free text up to 128 alpha-numeric characters.

2.1.33 Field 2.033: True Identity (TRU)

This field contains information on how the individual's true identity was determined. It consists of two information items in the following format:

A/description

The first information item contains a single binary digit, A, which is "0" (the default value) if true identity has not been established, or "1" if a positive result to an investigation has been obtained. The *description* consists of 128 characters of free text, describing the manner in which the true identity was established.

2.1.34 Field 2.034: Aliases (AKA)

If present this field consists of at least one subfield. Each subfield is formatted as NAM (Field 2.030). Its use is identical to NAM.

2.1.35 Field 2.035: Date of Birth (DOB)

This field specifies the date of birth in ISO format:

YYYYMMDD

where YYYY is the year, MM is the month, and DD is the day, as explained in DAT (Field 1.005).

2.1.36 Field 2.036: Date of Birth Range (DBR)

Sometimes it will not be possible to specify the date of birth exactly. In such circumstances a date of birth range may be specified. The Format of the field is

YYYYMMDDQYYYYMMDD

where the two strings YYYYMMDD are the two ISO dates defining the range, and Q is a qualifier, whose value is always 4, separating the two dates. Thus if the range is between 1st December 1995 and 31st January 1996, the field value will be « 19951201419960131 ».

The dates may include the wildcard character *, which can be used both if the start or end of the period is uncertain (eg. « *****419940101 ») and if the dates cannot be specified exactly (eg. 1992****419930101 »).

2.1.37 Field 2.037: Place of Birth (POB)

This field consists of up to three information items and specifies the place of birth.

The format is

CC/country/town

where CC is the Interpol Country Code, two alpha-numeric characters long, *country* is the free text equivalent, up to 32 characters long, and *town* is the free text name of the town of birth, up to 32 characters long.

2.1.38 Field 2.038: Nationality (NAT)

This field consists of up to two information items and specifies the nationality of the fingerprinted subject.

The format is

CC/nationality

where CC is the Interpol Country Code, two alpha-numeric characters long, and *nationality* is the free text equivalent, up to 32 characters long.

2.1.39 Field 2.039: Sex (SEX)

This is a single letter code representing the sex of the subject:

female	F
male	M
not certain	U

2.1.40 Field 2.040: Color (COL)

This is a single letter code representing the color of the fingerprinted subject. It is a one letter code:

white	W
non-white	N
not certain	U

2.1.41 Field 2.041: Height (HGT)

This field specifies the subject's height. The first letter indicates whether the height is in feet and inches or in centimeters:

- F The units are imperial, i.e. feet and inches
- M The height is defined in centimeters.

The first letter is followed by a three-digit number (including leading zeros) representing the height. For an imperial measure the first digit indicates the feet whilst the second and third digits represent the inches which may range from 00-11. For instance, for a person 5ft 8in (173 cm) tall this field would be either "F508" or "M173".

2.1.42 Field 2.042: Build (BLD)

This field is up to 32 characters long, and contains a free-text description of the subject's build.

2.1.43 Field 2.043: Hair (HAI)

This field is up to 32 characters long, and contains a free-text description of the color and style of the subject's hair.

2.1.44 Field 2.044: Face (FAC)

This field is up to 256 characters long, and contains a free-text description of the subject's face.

2.1.45 Field 2.045: Languages Spoken (LAN)

This field consists of up to ten subfields, each of which consists of two information items, and specifies the languages spoken by the fingerprinted subject.

The format of each subfield is free text up to 32 characters long.

2.1.46 Field 2.046: Photograph Number (PHO)

This field consists of two subfields, the first subfield being a single character.

If no photograph of the subject is available then the subfield contains "0" and the second subfield is empty. If a photograph is available then the first subfield contains "1".

The second subfield is up to 32 alpha-numeric characters long, and contains the reference number of the photograph.

2.1.47 Field 2.047: Passport Number (PSP)

This field contains a passport number and is up to 32 alpha-numeric characters long.

2.048 Field 2.048: Marks etc (MAR)

This field consists of up to 16 subfields, each being 64 alpha-numeric characters of free text describing marks, scars and tattoos of the fingerprinted subject. If images of the marks, scars and/or tattoos exists they should be included as Type 10 records within the transaction.

2.1.49 Field 2.049: Occupation (OCC)

This field contains a free text description of the subject's occupation, and is up to 64 characters long.

2.1.50 Field 2.050: Warning (WNG)

This is a free text field, up to 32 alpha-numeric characters, warning if the subject is dangerous (e.g. carries firearms, violent, etc.)

2.1.51 Field 2.051: Modus Operandi (MDO)

This field contains a free text description of the subject's normal modus operandi, and is up to 64 characters long.

Fields 2.052 to 2.063 are search criteria. In most cases, it is possible to allow a range of values to be specified within a type of criterion as well as exact values. Special fields are included to allow this. In these cases, either, but not both, of the fields may be used to search on the basis of a particular aspect.

2.1.52 Field 2.052: Geographical Area of Crime (GAC)

This field indicates the geographical area in which the crime was committed. The field consists of one or more information items in the following format:

CC/area/GIS.

The first item contains the Interpol Country Code, two alpha-numeric characters long. The second, *area*, is a free text identification of the area, up to a maximum of 256 alpha-numeric characters, and may include the actual address at which the offence was committed. The third (optional) item, up to 16 alpha-numeric characters long, can contain a reference number as generated by a Geographical Information System. The format of the number is unspecified.

2.1.53 Field 2.053: Geographical Search Area (GSA)

This field is split into one or more subfields, each specifying a geographical region as two information items in the following format:

CC/area

where CC is the Interpol Country Code, two alpha-numeric characters long, and the second information item, *area*, is a free text identification of the area, up to a maximum of 32 alpha-numeric characters.

If omitted in a latent search, then the system should ensure that the geographical search area defaults to the area specified in GAC (Field 2.052).

The field may also be present in search and image responses, when the field would be simply a copy of that appearing in the original request transaction.

2.1.54 Field 2.054: Offence Type (OTY)

This field identifies the type of crime committed. It consists of up to seven subfields, each of which is free text up to 64 alpha-numeric characters long.

2.1.55 Field 2.055: Date of Offence (DOO)

This field specifies the date in ISO format (YYYYMMDD) on which the offence was committed. In searches it may be used interchangeably with DOR (Field 2.056).

If present in a search it records the date on which the crime was committed.

2.1.56 Field 2.056: Date of Offence Range (DOR)

Sometimes it will not be possible to specify the date of the offence exactly. In such circumstances a date of offence range may be specified. The format of the field is

YYYYMMDDQYYYYMMDD

where the two strings YYYYMMDD are the two ISO dates defining the range, and Q is a qualifier, whose value is always "4", separating the two dates. Thus if the range is between 1st December 1995 and 31st January 1996, the field value will be "19951201419960131".

The dates may include the wildcard character *, which can be used both if the start or end of the period is uncertain (e.g. "*****419940101") and if the dates cannot be specified exactly (e.g. "1992****419930101").

The use of the field is similar to that of DOO (Field 2.055).

2.1.57 Field 2.057: Date of Offence Search Range (DSR)

This field has the same format as DOR (Field 2.056), including the same wildcarding mechanism. It is analogous to GSA (Field 2.053) and can be used to specify a search range. Only prints or latents whose DOO or DOR (Fields 2.055 and 2.056 respectively) lie within the listed date range will be included in the search.

2.1.58 Field 2.058: Time of Offence (TOO)

This field specifies the time at which the offence was thought to be committed. The format is the same as TOF (Field 2.020).

2.1.59 Field 2.059: Time of Offence Range (TOR)

When it is not possible to specify the exact time of the crime, a range of time may be recorded, similarly to DOR (Field 2.056).

The format of this range is

HHMMQHMM

where the strings HHMM are the two four-figure time references defining the range, as used in TOF (Field 2.020), and Q is a qualifier, whose value is always "4", separating the two times.

2.1.60 Field 2.060: Time of Offence Search Range (TSR)

This field has the same format as TOR (Field 2.059). It is analogous to GSA (Field 2.053) and can be used to specify a search range. Only prints or latents whose TOO or TOR (Fields 2.058 and 2.059 respectively) lie within the listed date range will be included in the search.

2.1.61 Field 2.061: Time Limit (TLM)

If there is a time limit within which a prosecution is to be processed then this field contains the latest date by which the results must be received. Its format is the ISO standard notation, as in DAT (Field 1.005).

2.1.62 Field 2.062: ICPO/IGS (ICP)

This field consists of a single binary digit: "0" if the request has not been sent to the Interpol General Secretariat, or "1" if it has been sent.

2.1.63 Field 2.063: Additional Information (INF)

This field, consisting of 32 alpha-numeric characters, gives a contact point (e.g. name, phone number) for further information about the request.

Fields 2.064 to 2.066 contain information regarding the response to an inquiry, and their presence is highly dependent upon the type of transaction being undertaken. It should be noted that local legislation or guidelines may prohibit the transmission of images which have not been verified. Thus the procedure adopted may be for the local agency to provide resources to verify respondents before initiating a response to the remote agency, and to return only confirmed matches.

2.1.64 Field 2.064: Respondents List (RLS)

This field contains at least two subfields. The first subfield describes the type of search that has been carried out, using the three-letter mnemonics which specify the transaction type in TOT (Field 1.004).

The second subfield contains a single character. An "I" shall be used to indicate that a HIT has been found and an "N" shall be used to indicate that no matching cases have been found (NOHIT).

The third subfield contains the sequence identifier for the candidate result and the total number of candidates separated by a slash. Multiple messages will be returned if multiple candidates exist.

In case of a possible HIT the fourth subfield shall contain the score up to six digits long. If the HIT has been verified the value of this subfield shall be "999999"

Example: "CPS{RS}I{RS}001/005{RS}10205{GS}"

In some implementations legal constraints or local guidelines will mandate that the field is restricted to the number of verified respondents only.

If the remote AFR system does not assign scores, then a score of zero should be used at the appropriate point.

2.1.65 Field 2.065: Recipient Countries (COU)

When a search is to be carried out against the databases of a number of countries, this field provides confirmation on which have actually been searched. It consists of a number of subfields, each of which consists of two information items. The first contains the two character Interpol Country Code of the country whose database was to be searched. The second is a single binary digit: "0" if the search was not carried out and "1" if the search was carried out.

2.1.66 Field 2.066: Result (RES)

This field contains up to 128 alpha-numeric characters of free text, giving the address to which the response to a transaction should be sent, if this is to be done other than electronically using an ANSI/NIST message.

Fields 2.067 to 2.071 are flags whose presence prompts an action to be taken regarding some part of the transaction. In all cases they are optional and their use may be limited to certain transactions.

2.1.67 Field 2.067: Alert Flag (ALF)

The alert flag is to indicate who should be informed if a match is made involving the latent or print. It contains three information items in the following format:

CC/agency/additional_information

CC is the Interpol Country Code, two alpha-numeric characters long. The second item, *agency*, is a free text identification of the agency, up to a maximum of 32 alpha-numeric characters. The third is a 128 alpha-numeric string in which extra information might be added, e.g. a contact person or a telephone number. This item is not intended to be interpreted by computer.

A possible use for this field is to indicate a terrorist or a violent criminal.

2.1.68 Field 2.068: Target Criminal Flag (TCF)

This indicates whether the subject is considered to be somebody likely to commit an offence and whose fingerprints should always be included in a search irrespective of the defined search scope. The field has one of two possible values:

- 0 The subject is not a target criminal
- 1 The subject is a target criminal

If the field is not present a default value of 0 is assumed. The main use of the field is in submitting images to an AFR system for a search or to an image database for filing.

2.1.69 Field 2.069: Identified Flag (IDF)

This field indicates that a given individual has left latents in various areas which have been successfully matched. The field consists of one or more subfields each of which refers to an identified case. The first three information items in a subfield define the geographical area in which the matching latent was found, in the same format as GAC (Field 2.049). The fourth information item, which is optional, is the case number of the identified latent.

2.1.70 Field 2.070: Latent Priority Flag (MPF)

This is the latent equivalent of a TCF (Field 2.068) flag. It indicates that the latent is connected with a particularly serious crime and that it should always be included in any searches of an Unidentified Latents database. The flag takes one of two values:

- 0 The latent is not a priority latent
- 1 The latent is a priority latent

2.1.71 Field 2.071: Tie Up Flag (TUF)

This field is used to indicate that the latent to which it refers has been connected with one or more other latents. Each subfield refers to one of these other latents and consists of up to four information items relating to it: GAC, CNO, SQN, and MID (Fields 2.049, 2.007, 2.008 and 2.009 respectively) or MN1 to MN5 (Fields 2.014 to 2.018). The flag shall be set, in both inquiry and respondent latents, after a successful latent-to latent search.

Fields 2.072 to 2.073 are included only if there is a Type-8 Logical Record, i.e. a signature image.

2.1.72 Field 2.072: Rank (RNK)

This field consists of up to 16 alpha-numeric characters, and contains a free text description of the rank or grade of the officer providing the signature.

2.1.73 Field 2.073: Date signature (DSG)

This field contains the date at which the signature was written, and will probably be supplied automatically by the system. It is in the same ISO format as DAR (Field 2.004).

Finally, field 2.074 is included to allow the passing of status and error messages. Its use is limited to Error Transactions (ERR), during which it is mandatory. It must not be present in any other transaction.

2.1.74 Field 2.074: Status/Error Message Field (ERM)

This field contains error messages resulting from transactions, which will be sent back to the requester as part of an Error Transaction.

Numeric Code (1-3)	Meaning (5-128)
001	ERROR: RECORD NOT FOUND
002	ERROR: RECORD ALREADY EXISTS

Numeric Code (1-3)	Meaning (5-128)
003	ERROR: UNAUTHORISED ACCESS
101	MANDATORY FIELD MISSING
102	INVALID RECORD TYPE
103	UNDEFINED FIELD
104	EXCEED THE MAXIMUM OCCURRENCE
105	INVALID NUMBER OF SUBFIELDS
106	FIELD LENGTH TOO SHORT
107	FIELD LENGTH TOO LONG
108	FIELD IS NOT A NUMBER AS EXPECTED
109	FIELD NUMBER VALUE TOO SMALL
110	FIELD NUMBER VALUE TOO BIG
111	INVALID CHARACTER
112	INVALID DATE
113	INVALID TIME
114	INVALID DATE OR TIME
115	INVALID ITEM VALUE
116	INVALID TYPE OF TRANSACTION
117	INVALID RECORD DATA
201	ERROR: INVALID TCN
501	ERROR: INSUFFICIENT FINGERPRINT QUALITY
502	ERROR: MISSING FINGERPRINTS
503	ERROR: FINGERPRINT SEQUENCE CHECK FAILED
999	ERROR: ANY OTHER ERROR. FOR FURTHER DETAILS CALL DESTINATION AGENCY.

Error messages in the range between 100 and 199:

These error messages are related to the validation of the ANSI/NIST records and defined as:

<error_code 1>: IDC <idc_number 1> FIELD <field_id 1> <dynamic text 1> LF
 <error_code 2>: IDC <idc_number 2> FIELD <field_id 2> <dynamic text 2>...

where

- error_code is a code uniquely related to a specific reason (see table)
- field_id is the ANSI/NIST field number of the incorrect field (e.g. 1.01, 2.001, ...) in the format <record_type>.<field_id>.<sub_field_id>
- dynamic text is a more detailed dynamic description of the error
- LF is a Line Feed separating errors if more then one error is encountered

Example:

106: ICD 15 FIELD 1.09 SIZE 8 < MIN SIZE 11 {LF}

109: IDC 0 FIELD 2.001.0 VALUE 0 < MIN VALUE 2

This field is mandatory for error transactions.

2.1.80 Field 2.080: Broadcast Request To (BRT)

This field shall indicate that the receiver of a request shall distribute it to multiple destination agencies. The field consists of several subfields containing the agency names as described in Field 1.007 (DAI).

2.1.83 Field 2.083: Finger Present (FPR)

This field shall give information about missing fingerprints. It may consist of one or more subfields containing the Finger Number (FGP, see table 4.2) two digits long and information about the finger:

Descriptor	Code
Amputation	XX
Unable to print (e.g., bandaged)	UP
No information about missing finger	NA

Example: "01{US}XX{RS}08{US}UP{RS}10{US}NA{GS}"

2.1.85 Field 2.085: Additional Response Information (ARI)

This field, consisting of up to 2048 alpha-numeric characters of free text, shall be used to give further information about the result of a search back to the requester.

This field is mandatory if the descriptive or fingerprint data of a HIT may not be sent within a SRE transaction.

4 Type-4 Logical Record: High Resolution Gray-Scale Image

It should be noted that Type-4 records are binary rather than ASCII in nature. Therefore each field is assigned a specific position within the record, which implies that all fields are mandatory.

The standard allows both image size and resolution to be specified within the record. It requires Type-4 Logical Records to contain fingerprint image data that are being transmitted at a nominal pixel density of 500 to 520 pixels per inch. The preferred rate for new designs is at a pixel density of 500 pixels per inch or 19.68 pixels per mm. 500 pixels per inch is the density specified by the INT-I, except that similar systems may communicate with each other at a non-preferred rate, within the limits of 500 to 520 pixels per inch.

For a system to comply with the INT-I it is necessary (although not sufficient) that it can send and receive fingerprints as Type-4 records.

4.1 Fields for Type-4 Logical Record

4.1.1 Field 4.001: Logical Record Length (LEN)

This four-byte field contains the length of this Type-4 record, and specifies the total number of bytes including every byte of every field contained in the record.

4.1.2 Field 4.002: Image Designation Character (IDC)

This is the one-byte binary representation of the IDC number given in the header file.

4.1.3 Field 4.003: Impression Type (IMP)

The impression type is a single-byte field occupying the sixth byte of the record.

Table 4.1 - Finger Impression Type

Code	Description
0	Live-scan of plain fingerprint
1	Live-scan of rolled fingerprint
2	Non-live scan impression of plain fingerprint captured from paper
3	Non-live scan impression of rolled fingerprint captured from paper
4	Latent impression captured directly
5	Latent tracing
6	Latent photo
7	Latent lift
8	Swipe
9	Unknown

4.1.4 **Field 4.004: Finger Position (FGP)**

This fixed-length field of 6 bytes occupies the seventh through twelfth byte positions of a Type-4 record. It contains possible finger positions beginning in the left most byte (byte 7 of the record). The known or most probable finger position is taken from the following table. Up to five additional fingers may be referenced by entering the alternate finger positions in the remaining five bytes using the same format. If fewer than five finger position references are to be used the unused bytes are filled with binary 255. To reference all finger positions code 0, for unknown, is used.

Table 4.2 - Finger position code and maximum size

Finger position	Finger code	Width (mm)	Length (mm)
Unknown	0	40.0	40.0
Right thumb	1	45.0	40.0
Right index finger	2	40.0	40.0
Right middle finger	3	40.0	40.0
Right ring finger	4	40.0	40.0
Right little finger	5	33.0	40.0
Left thumb	6	45.0	40.0
Left index finger	7	40.0	40.0
Left middle finger	8	40.0	40.0
Left ring finger	9	40.0	40.0
Left little finger	10	33.0	40.0
Plain right thumb	11	30.0	55.0
Plain left thumb	12	30.0	55.0
Plain right four fingers	13	70.0	65.0
Plain left four fingers	14	70.0	65.0

For scene of crime latents only the codes 0 to 10 should be used.

4.1.5 **Field 4.005: Image Scanning Resolution (ISR)**

This one-byte field occupies the 13th byte of a Type-4 record. If it contains "0" then the image has been sampled at the preferred scanning rate of 19.68 pixels/mm (500 pixels per inch). If it contains "1" then the image has been sampled at an alternative scanning rate as specified in the Type-1 record.

4.1.6 **Field 4.006: Horizontal Line Length (HLL)**

This field is positioned at bytes 14 and 15 within the Type-4 record. It specifies the number of pixels contained in each scan line. The first byte will be the most significant.

4.1.7 *Field 4.007: Vertical Line Length (VLL)*

This field records in bytes 16 and 17 the number of scan lines present in the image. The first byte is the most significant.

4.1.8 *Field 4.008: Gray-scale Compression Algorithm (GCA)*

This one-byte field specifies the gray-scale compression algorithm used to encode the image data. A binary zero indicates that no compression algorithm has been used. In this case pixels are recorded in left to right, top to bottom fashion. The FBI will maintain a registry relating non-zero numbers to compression algorithms. The INT-I will use the same allocation of numbers.

4.1.9 *Field 4.009: The Image*

This field contains a byte stream representing the image. Its structure will obviously depend on the compression algorithm used.

7 Type-7 Logical Record: User-defined Image

Type-7 records are intended for user-defined image information relating to the subject of a transaction. For Interpol purposes this logical record is likely to fall into two categories, either:

∄ High resolution image data of the

- palms of the hands
- fingertips
- soles and toes of the feet

or

∄ Other image data.

The category to which each record belongs is defined by IMT (Field 7.003).

When used for Category-1 data, there may be multiple Type-7 records in a file. These records contain high resolution image data that have been captured at the nominal scanning resolution of 500 pixels per inch. They are quantised to eight-bits (ie. 256-level grey scale), a value of zero being used to define a black pixel and an unsigned value of 255 to define a white pixel.

When used for Category-2 data there may be up to six of these Type-7 records in a file. The scanning resolution used to capture the data is specified by IMR (Field 7.006).

When there are one or more Type-7 logical records, entries are provided in ten ordered and unnumbered mandatory fields. The first nine are fixed in length and total 33 bytes. These nine fields precede the image data contained in field 7.010

7.1 *Fields for Type-7 Logical Record*

7.1.1 *Field 7.001: Logical Record Length (LEN)*

This four-byte field contains the length of the logical record, specifying the total number of bytes including every byte of all the fields contained in the record.

7.1.2 *Field 7.002: Image Designation Character (IDC)*

The fifth byte contains the one-byte binary representation of the IDC recorded in CNT (Field 1.003). It is used to identify the image data.

7.1.3 **Field 7.003: Image Type (IMT)**

The sixth byte contains a one-byte identifier which specifies whether the image is of Category-1 (palm, finger-tips, sole and toe data) or Category-2 (other) data. The permissible values of this field are:

- 1 Category-1
- 2 Category-2

7.1.4 **Field 7.004: Image Description (IMD)**

This one-byte field occupies the seventh byte position of a Type-7 record. The field contains a code selected from the following table.

Table 7.1 - Image Description

Image description	Code
unknown	20
palm print, left hand	21
outside edge, left hand	22
inside edge, left hand	23
wrist, left hand	24
palm print, right hand	25
outside edge, right hand	26
inside edge, right hand	27
wrist, right hand	28
sole, left foot	29
toes, left foot	30
sole, right foot	31
toes, right foot	32
part 1 of a ten-print form	41
part 2 of a ten-print form	42
part 3 of a ten-print form	43
part 4 of a ten-print form	44
part 5 of a ten-print form	45
part 6 of a ten-print form	46
the complete ten-print form	47
other image	50
fingertip of right thumb	60
fingertip of right index finger	61
fingertip of right middle finger	62
fingertip of right ring finger	63
fingertip of right little finger	64
fingertip of left thumb	65
fingertip of left index finger	66
fingertip of left middle finger	67
fingertip of left ring finger	68
fingertip of left little finger	69

7.1.5 Field 7.005: Pattern Classification (PCN)

When the Type-7 record is used for Category-1 image data, this field, of length ten bytes, contains the pattern classification of the image, in any agreed format. If no classification is to be included in the record, then these ten bytes contain binary zeros.

When the Type-7 record is used for Category-2 image data, these ten bytes contain zeros.

7.1.6 Field 7.006: Image Capture Resolution (IMR)

This field of length eleven bytes consists of three subfields, starting at byte number 18.

When the Type-7 record is used for Category-1 image data, this field contains binary zeros.

When the Type-7 record is used for Category-2 image data, the three subfields consist of:

- 1 The scanning resolution of the captured image in pixels per 100mm (2 bytes)
- 2 The number of bytes which represent each pixel, up to a maximum of four (1 byte)
- 3 The value defining white pixels and the value defining black pixels (4 bytes each, most significant first, unused bytes filled with zeros)

Scanning resolution is specified in units of pixels per 100mm using two bytes, the first being the most significant. For example 7,176 represents $(256*7)+176 = 1968$, equivalent to 19.68 pixels per mm (500 pixels per inch).

7.1.7 Field 7.007: Horizontal Line Length (HLL)

This two-byte field occupies the 29th and 30th byte positions of the Type-7 record. It is used to specify the number of pixels contained in a single line scan of the image. The first byte is the most significant.

7.1.8 Field 7.008: Vertical Line Length (VLL)

This two-byte field occupies the 31st and 32nd byte positions of the Type-7 record. It is used to specify the number of scan lines contained in the image. The first byte is the most significant.

7.1.9 Field 7.009: Gray-scale Compression Algorithm (GCA)

This one-byte field occupies the 33rd byte of the record. It is used to specify the type of gray-scale compression algorithm used (if any). A binary zero denotes no compression. In this case the scan sequence is left to right and top to bottom. Otherwise, the contents of this field is a binary representation of the number allocated to the particular compression technique used by the interchange parties. The FBI will maintain a registry relating these numbers to the compression algorithms. Interpol will use the same allocation of numbers.

7.1.10 Field 7.010: Image Data

This field contains a byte stream representing all of the gray-scale image data. It commences at the 34th byte of the record.

8 Type-8 Logical Record: Signature Image

The Type-8 record is used to transmit a signature in the record. This signature may be either of the officer taking the fingerprints or of the fingerprinted subject. The signature is represented in uncompressed binary, compressed binary or vectorized format. Like the other records containing image information the structure is binary, which implies that record fields take a fixed position and all fields are mandatory.

The following explains the meaning of the individual fields.

8.1 Fields for Type-8 Logical Record

8.1.1 Field 8.001: Logical Record Length (LEN)

The first four bytes of the Type-8 record contain the length of the record expressed as the total number of bytes, including every byte of all eight fields of the record.

8.1.2 Field 8.002: Image Designation Character (IDC)

The fifth byte of the record contains a binary representation of the IDC recorded in CNT (Field 1.003).

8.1.3 Field 8.003: Signature Type (SIG)

The sixth byte contains the signature type field. The permissible values of this field are:

- 0 The signature is that of the fingerprinted subject
- 1 The signature is that of the fingerprinting officer.

8.1.4 Field 8.004: Signature Representation Type (SRT)

This field indicates how the signature is stored, and is located at the seventh byte of the record. The permissible values of this field are:

- 0 The image is uncompressed
- 1 The image is compressed
- 2 The image is vector data.

8.1.5 Field 8.005: Image Scanning Resolution (ISR)

This field gives the image scanning resolution in pixels per mm. One byte is required, in the eighth position of the Type-8 record.

The format is a binary zero if the minimum scanning resolution is used and a one if the native scanning resolution is used. A zero shall also be recorded if the image is in vector format.

8.1.6 *Field 8.006: Horizontal Line Length (HLL)*

This field occupies the ninth and 10th byte of the Type-8 record. For binary images it specifies the number of pixels per scan line in the image. For vectorized signature data both bytes contain the value "0000 0000". The first byte is the most significant.

8.1.7 *Field 8.007: Vertical Line Length (VLL)*

This two-byte field indicates the number of scan lines present in a binary image and is positioned at bytes 11 and 12 within the record. As with HLL (Field 8.006) it contains zeros if the signature is in vector representation. The first byte is the most significant.

8.1.8 *Field 8.008: Signature Data*

This field contains the image data in uncompressed binary, compressed binary or vectorized form according to the entry in SRT (Field 8.004). Binary images are compressed according to the ANSI/EIA-538-1988 facsimile compression algorithm (FAX Group 4 standard).

Vectorized image data specify a list of vectors describing the pen position and pen pressure of line segments within the signature. Each vector is five bytes in length and contains the unsigned binary X position (two bytes, most significant first), the unsigned binary Y position (two bytes, most significant first) and the pen pressure (1 byte). A pressure value of "0000 0000" indicates the end of a line (i.e. pen up), while "0000 0001" to "1111 1110" indicate a range of pressures from the least recordable up to the maximum recordable pressure for the input device. The end of the vector list is indicated by a value of "1111 1111".

The origin of the image is the bottom left hand corner and X,Y positions are expressed units of 0.01mm.

9 Type-9 Logical Record: Minutiæ Record

Type-9 records shall contain ASCII text describing minutiæ and related information encoded from a finger or palm. For a tenprint search transaction, there may be up to ten of these Type-9 records in a file, each of which shall be for a different finger. There may be up to four of these records for palm print searches. The Type-9 record shall also be used to exchange the minutiæ information from latent finger or palm images between similar or different systems.

9.1 *Minutiæ and Other Information Descriptors*

9.1.1 *Minutia Type Identification*

This standard defines four identifier characters that are used to describe the minutia type. These are listed in Table 9.1. A ridge ending shall be designated Type A. It occurs at the point on a fingerprint or palm print that a friction ridge begins or ends without splitting into two or more continuing ridges. The ridge must be longer than it is wide. A bifurcation shall be designated Type B. It occurs at the point that a ridge divides or splits to form two ridges that continue past the point of division for a distance that is at least equal to the spacing between adjacent ridges at the point of bifurcation. A minutia shall be designated Type C, a compound type, if it is either a trifurcation (a single ridge that splits into three ridges) or a crossover (two ridges that intersect). If a minutia cannot be clearly categorized as one of the above three types, it shall be designated as undetermined, Type D.

Table 9.1 - Minutia types

Type	Description
A	Ridge ending
B	Bifurcation
C	Compound (trifurcation or crossover)
D	Type undetermined

9.1.2 *Minutia Numbering*

Each minutia shall be identified by an index number that is assigned to it. The numbering shall begin at “1” and be incremented by “1” for as many times as there are minutiæ encountered. This allows each minutia to be uniquely identified.

9.1.3 *Minutiæ Ridge Counts*

Ridge counts may be made from each minutia in a fingerprint or palm print to certain other neighboring minutiæ. When this occurs, ridge counts between designated minutiæ shall be associated with the applicable index numbers so as to ensure maintenance of the proper relationships. Rules for identifying neighboring minutiæ and the method to be used for counting the intervening ridge crossings is not part of this standard and shall remain unique to each vendor’s AFIS.

9.1.4 *Minutiæ Coordinate System*

The relative position of minutiæ entered in Type-9 records shall be expressed as positive integers in units of 0.01 mm (0.00039 in) in a Cartesian coordinate system located in Quadrant 1. In this coordinate system, values of X increase from left to right and values of Y increase from bottom to top.

For encoded minutiæ from fingerprints, values of both X and Y are equal to or greater than "0000" and are less than "5000". This range of units converts to 5 cm (1.97") in both the horizontal and vertical directions. If the conversion to this coordinate system is from a system that normally centers the fingerprint image during the registration process, that center position shall be assigned the values X = 2500, Y = 2500. Figure 2 illustrates the defined coordinate system for a fingerprint.

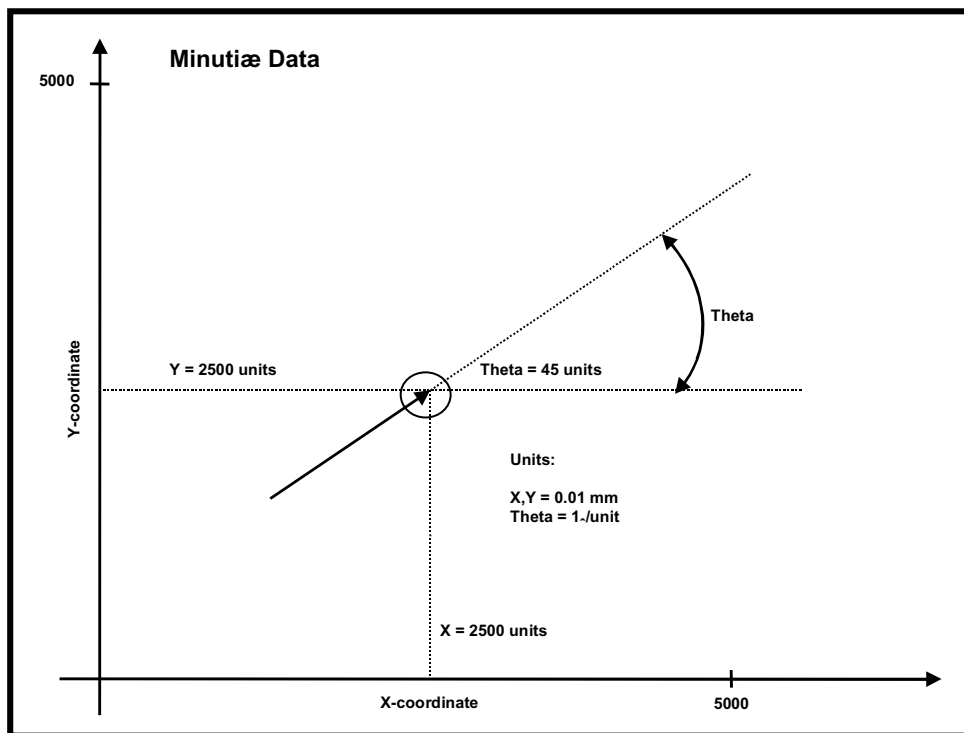
For encoded minutiæ from a palm print, values of both X and Y are equal to or greater than "0000" and are less than "14000" and "21000" respectively. This range of units converts to 14 cm (5.51") in the horizontal and 21 cm (8.27") in the vertical directions.

The relative orientation, Theta, of a ridge ending, a bifurcation, a compound or a minutia of undetermined type shall be expressed as positive integers in units of degrees from "0" to "359" degrees. Theta shall be the angle between the horizontal axis of the coordinate system and the direction that a ridge ending points, assuming that a ridge ending is analogous to a pointing finger. A ridge ending that is formed by a ridge lying parallel to the X axis, and ending in the direction of increasing values of X, shall have an orientation of zero degrees. Counterclockwise rotation of this ridge about the ridge ending shall cause the value of Theta to increase. In navigational terms, a ridge ending pointing due east has a direction of zero degrees, due north 90 degrees and so forth.

A bifurcation may be converted to a ridge ending by logical inversion, i.e., transposing the identity of ridges and valleys. The orientation of a bifurcation is expressed as if this inversion had occurred. This convention causes no significant change in the orientation of a minutia if it appears as a ridge ending in one impression of a fingerprint and as a bifurcation in another impression of the same fingerprint.

No orientation shall be assigned to a compound type minutiæ; therefore, a value of "000" shall be entered for Theta in the Type-9 logical record entry.

The exact features or characteristics of a minutia that are used to establish its position and orientation are system dependent and outside the scope of this standard.



Picture 9.1 - Minutiae coordinate system

9.2 Fields for Type-9 Logical Record

All fields of the Type-9 records shall be recorded as ASCII text. No binary fields are permissible in this tagged-field record. The first twelve ASCII fields of the Type-9 logical record provide a common or generic manner of encoding minutiae and other characteristic data. These fields are formatted in accordance with the conventions described above.

This logical record type can also be used to accommodate a variety of methods used by AFIS vendors for encoding minutiae data according to their particular requirements. The numbered fields of the Type-9 logical record are partitioned into registered blocks of tagged-fields starting at Field-13. Each AFIS vendor has a block of uniquely numbered fields reserved for the encoding of minutiae and other characteristic data required for their feature vector. Each specific vendor implementation must contain the first four fields described below. The remaining numbered fields of the feature vector are vendor dependent and encoded according to their own conventions. None of the fields from Field-5 through Field-12 described below are required to be present in specific vendor implementations.

9.2.1 Field 9.001: Logical Record Length (LEN)

This mandatory ASCII field shall contain the length of the logical record specifying the total number of bytes, including every character of every field contained in the record.

9.2.2 **Field 9.002: Image Designation Character (IDC)**

This mandatory two-byte field shall be used for the identification and location of the minutiae data. The IDC contained in this field shall match the IDC found in the file content field of the Type-1 record.

9.2.3 **Field 9.003: Impression Type (IMP)**

This mandatory one-byte field shall describe the manner by which the fingerprint image information was obtained. The ASCII value of the proper code as selected from Table 9.2 shall be entered in this field to signify the impression type.

Table 9.2 - Finger impression Type

Code	Description
0	Live-scan of plain fingerprint
1	Live-scan of rolled fingerprint
2	Non-live scan impression of plain fingerprint captured from paper
3	Non-live scan impression of rolled fingerprint captured from paper
4	Latent impression captured directly
5	Latent tracing
6	Latent photo
7	Latent lift

9.2.4 **Field 9.004: Minutiae Format (FMT)**

This mandatory one-byte field shall be used to indicate whether the remainder of the record adheres to the standard or is user-defined. This field shall contain an "S" to indicate that the minutiae are formatted as specified by the standard Type-9 logical record field descriptions using location information and other conventions described above. A standard Type-9 logical record will use Field-5 through Field-12 as described below. This field shall contain a "U" to indicate that the minutiae are formatted in vendor-specific terms and conforms to the vendor's implementation and required characteristic or feature data. Even though information is encoded in accordance with a specific vendor's implementation, all data fields of the Type-9 record must remain as ASCII text fields.

9.2.5 **Field 9.005: Originating Fingerprint Reading System (OFR)**

The originator's designation or name for the particular fingerprint or palm print reading system that generated this record shall be placed in the first information item of this field. The second information item of this field shall be a single character to indicate the method by which the minutiae data was read, encoded, and recorded. The following coding shall be used: (1) "A", if the data was automatically read, encoded, and recorded without any possibility of human editing; (2) "U", if human editing was possible but unneeded; (3) "E", if the data was automatically read but manually edited before encoding and recording; (4) "M", if the data was manually read. The

third information item is an optional, two-character, user-generated subsystem designator that uniquely identifies the originator's equipment.

9.2.6 Field 9.006: Finger Position (FGP)

This mandatory field shall contain a character designating the finger position that produced information in this Type-9 record. If the exact finger position cannot be determined, multiple finger positions may be entered, separated by the RS character. Entries from Table 6 or Table 19 list the codes that shall be used for each fingerprint or palmprint.

9.2.7 Field 9.007: Fingerprint Pattern Classification (FPC)

This mandatory field shall contain the fingerprint pattern classification code. It shall contain two information items. The first information item shall indicate the source of the specific pattern classification code. It may be one chosen from Table 9.3 or may be a user-defined classification code. This item shall contain a "T" to indicate that the pattern classification code is from Table 9.3, or a "U" to indicate that the code is user-defined. The second information item of this field shall contain the pattern classification code chosen from Table 8 or a specific user-defined code. When it is not possible to uniquely identify the fingerprint class, reference fingerprint classes may be used and shall be separated by the "RS" character.

Table 9.3 - Pattern Classification

Description	Code
Plain arch	PA
Tented arch	TA
Radial loop	RL
Ulnar loop	UL
Plain whorl	PW
Central pocket loop	CP
Double loop	DL
Accidental whorl	AW
Whorl, type not designated	WN
Right slant loop	RS
Left slant loop	LS
Scar	SR
Amputation	XX
Unknown or unclassifiable	UN

9.2.8 Field 9.008: Core Position (CRP)

If this eight-character field is used, it shall contain the X and Y coordinate position of the core of a fingerprint. The X and Y values shall be coded as a single 8-digit integer number comprised of the 4-digit X-coordinate concatenated with the 4-digit Y-coordinate using a format of XXXXYYYY.

9.2.9 Field 9.009: Delta(s) Position (DLT)

If this eight-character field is used, it shall contain the X and Y positional coordinates of each delta that is present on the fingerprint. The X and Y values shall be recorded in the same manner as was done for the core position coordinates. Multiple occurrences of delta positions shall be separated by the "RS" separator.

9.2.10 Field 9.010: Number of Minutiæ (MIN)

If there is an "S" in Field 9.004 to indicate the standard minutiæ encoding format, then this mandatory textual field shall contain the count of the number of minutiæ recorded for this fingerprint or palmprint.

9.2.11 Field 9.011: Minutiæ Ridge Count Indicator (RDG)

This mandatory single-character field shall be used to indicate the presence of minutiæ ridge count information. A "0" in this field indicates that no ridge count information is available. A "1" indicates that ridge count information is available.

9.2.12 Field 9.012: Minutiæ and Ridge Count Data (MRC)

This variable field length shall contain all of the individual minutiæ and ridge count data associated with the current fingerprint impression. It shall be comprised of as many subfields as there are minutiæ stated in the minutiæ count in Field 9.010. Each subfield shall be devoted to a single minutia and shall consist of multiple information items. The first two information items shall always appear; the appearance of others is system dependent. The information items are identified in the order that they shall appear. All information items shall be separated from the subsequent items by the US separator character.

9.2.12.1 Index Number

The first information item shall be the index number, which shall be initialized to "1" and incremented by "1" for each additional minutia in the fingerprint. This index number serves to identify each individual minutia.

9.2.12.2 X, Y, and Theta Values

For minutiæ encoded from fingerprints, the X and Y coordinates (two 4-digit values ranging from zero upward), and the Theta value (a 3-digit value between 000 and 359) shall comprise the second required information item. These three values shall be coded and recorded as a single 11-digit integer number corresponding to the concatenated X, Y, and Theta values, in that order.

For minutiæ encoded from palmprints, the X and Y coordinates (two 5-digit values ranging from zero upward), and the three-digit Theta value shall comprise the second required information

item. These three values shall be coded and recorded as a single 13-digit integer number corresponding to the concatenated X, Y, and Theta values, in that order.

9.2.12.3 Quality Measure

If present, the third information item is an optional quality measure. Values shall range from "0" to "63". The value "0" shall indicate a manually encoded minutia. The value "1" shall indicate that no method of indicating a confidence level is available. Values between "2" and "63" shall indicate decreasing levels of confidence, with "2" meaning the greatest confidence.

9.2.12.4 Minutia Type Designation

The fourth information item is an optional minutia type designation. This shall be a single alphabetic character as chosen from Table 9.1.

9.2.12.5 Ridge Count Data

The fifth information item is optional ridge count data. It shall be formatted as a series of subitems, each consisting of a minutia number and a ridge count. This information shall be conveyed by listing the identity (index number) of the distant minutia followed by a comma, and the ridge count to that distant minutia. Subitems shall be separated by a US character. This subitem may be repeated as many times as required for each minutia (subfield).

9.2.12.6 Record Separator

A Record Separator character, "RS", shall be used at the end of the information items to introduce the first information item concerning data for the next minutia. The process shall be continued until all of the minutiae and ridge data have been entered into the field.

9.3 End of Type-9 Logical Record

Immediately following the last information field in the Type-9 logical record, an FS separator shall be used to separate it from the next logical record. This FS character shall replace the "GS" character separator that is normally used between information fields.

9.4 Additional Minutiæ Records

Up to nine more fingers may be described within the logical file. For each additional finger, a Type-9 logical record, and an "FS" separator is required.

10 Type-10 Logical Record: Facial and/or SMT Binary Image Record

Type-10 records shall contain facial and/or SMT binary image data and related ASCII information pertaining to the specific image contained in this record. It shall be used to exchange both grayscale and color image data. Image data contained in the Type-10 record may be uncompressed or compressed.

10.1 Fields for Type-10 logical record

When there are one or more Type-10 logical records, entries shall be provided in ordered numbered fields. For each field of the Type-10 record, Table 10.1 summarizes the condition code as being mandatory (M) or optional (O), the field number, the field name, character type, size and occurrence limits, and the maximum size in bytes of the field. The two entries in the Field Size Per Occurrence include all character separators used in the field. The Maximum Byte Count includes the field number, the information, and all the character separators. Fields containing entries in the IMG column are only applicable to that image type. An entry of "FAC" applies to a mugshot or facial image, and an entry of "SMT" applies to scar, a mark, or a tattoo image. The following paragraphs describe the data contained in each of the fields for the Type-10 logical record. Each field shall begin with a seven character ASCII identifier of the form "10.xxx:". The first two characters are the record type followed by a period. The next three characters are the appropriate field number followed by a colon. Descriptive ASCII information or the binary image data follows the seven character identifier.

10.1.1 Field 10.001: Logical Record Length (LEN)

This mandatory ASCII field shall contain the total count of the number of bytes in the Type-10 logical record. Field 10.001 shall specify the length of the record including every character of every field contained in the record and the information separators. The "GS" character shall separate the length code of Field 10.001 from the next field.

10.1.2 Field 10.002: Image Designation Character (IDC)

This mandatory one to four byte ASCII field shall be used to identify the facial or SMT image data contained in the record. This IDC shall match the IDC found in the file content (CNT) field of the Type-1 record.

Table 10.1 - Type-10 facial and SMT record layout

Ident	Cond. code	Field Number	Field Name	IMG	Char type	Field size per occurrence		Occur count		Max byte count
						min.	max.	min	max	
LEN	M	10.001	LOGICAL RECORD LENGTH		N	4	8	1	1	15
IDC	M	10.002	IMAGE DESIGNATION CHARACTER		N	2	5	1	1	12
IMT	M	10.003	IMAGE TYPE		A	5	7	1	1	14

Ident	Cond. code	Field Number	Field Name	IMG	Char type	Field size per occurrence		Occur count		Max byte count
						min.	max.	min	max	
SRC	M	10.004	SOURCE AGENCY / ORI		AN	6	35	1	1	42
PHD	M	10.005	PHOTO DATE		N	9	9	1	1	16
HLL	M	10.006	HORIZONTAL LINE LENGTH		N	4	5	1	1	12
VLL	M	10.007	VERTICAL LINE LENGTH		N	4	5	1	1	12
SLC	M	10.008	SCALE UNITS		N	2	2	1	1	9
HPS	M	10.009	HORIZONTAL PIXEL SCALE		N	3	5	1	1	12
VPS	M	10.010	VERTICAL PIXEL SCALE		N	3	5	1	1	12
CGA	M	10.011	COMPRESSION ALGORITHM		A	5	7	1	1	14
CSP	M	10.012	COLOR SPACE		A	4	5	1	1	12
RSV	-	10.013 10.019	RESERVED FOR FUTURE INCLUSION		--	--	--	--	--	--
POS	O	10.020	SUBJECT POSE	FAC	A	2	2	0	1	9
POA	O	10.021	POSE OFFSET ANGLE	FAC	N	2	5	0	1	12
PXS	O	10.022	PHOTO DESCRIPTION	FAC	A	4	21	0	9	196
RSV	-	10.023 10.039	RESERVED FOR FUTURE INCLUSION		--	--	--	--	--	--
SMT	M	10.040	NCIC DESIGNATION CODE	SMT	A	4	11	1	3	40
SMS	O	10.041	SCAR/MARK/TATTOO SIZE	SMT	N	4	6	0	1	13
SMD	O	10.042	SMT DESCRIPTORS	SMT	AN	16	51	0	9	466
COL	O	10.043	COLORS PRESENT	SMT	A	4	21	0	9	196
RSV	-	10.044 10.199	RESERVED FOR FUTURE INCLUSION		--	--	--	--	--	--
UDF	O	10.200 10.998	USER DEFINED FIELDS		--	--	--	--	--	--
DAT	M	10.999	IMAGE DATA		B	2	5,000,001	1	1	5,000,008

Key for condition code: M = Mandatory; O = Optional

Key for character type: N = Numeric; A = Alphabetic; AN = Alphanumeric; B = Binary

10.1.3 Field 10.003: Image Type (IMT)

This mandatory ASCII field is used to indicate the type of image contained in this record. It shall contain "FACE", "SCAR", "MARK", or "TATTOO" to indicate a face, scar, mark or tattoo image.

10.1.4 Field 10.004: Source Agency / ORI (SRC)

This mandatory ASCII field shall contain the identification of the administration or organization that originally captured the facial image contained in the record. Normally, the Originating Agency Identifier (ORI) of the agency that captured the image will be contained in this field. It consists of two information items in the following format

CC/agency.

The first information item contains the Interpol Country Code, two alpha-numeric characters long. The second item, *agency*, is a free text identification of the agency, up to a maximum of 32 alpha-numeric characters.

10.1.5 Field 10.005: Photo Date (PHD)

This mandatory ASCII field shall contain the date that the facial or SMT image contained in the record was captured. must conform to the ISO standard notation of

YYYYMMDD

where YYYY is the year, MM is the month and DD is the day of the month. Leading zeros are used for single figure numbers. For example, "19931004" represents the 4 October 1993. The complete date must be a legitimate date.

10.1.6 Field 10.006: Horizontal Line Length (HLL)

This mandatory ASCII field shall contain the number of pixels contained on a single horizontal line of the transmitted image.

10.1.7 Field 10.007: Vertical Line Length (VLL)

This mandatory ASCII field shall contain the number of horizontal lines contained in the transmitted image.

10.1.8 Field 10.008: Scale Units (SLC)

This mandatory ASCII field shall specify the units used to describe the image sampling frequency (pixel density). A "1" in this field indicates pixels per inch, or a "2" indicates pixels per centimeter. A "0" in this field indicates no scale is given. For this case, the quotient of HPS/VPS gives the pixel aspect ratio.

10.1.9 Field 10.009: Horizontal Pixel Scale (HPS)

This mandatory ASCII field shall specify the pixel density used in the horizontal direction providing the SLC contains a "1" or a "2". Otherwise, it indicates the horizontal component of the pixel aspect ratio.

10.1.10 Field 10.010: Vertical Pixel Scale (VPS)

This mandatory ASCII field shall specify the pixel density used in the vertical direction providing the SLC contains a "1" or a "2". Otherwise, it indicates the vertical component of the pixel aspect ratio.

10.1.11 Field 10.011: Compression Algorithm (CGA)

This mandatory ASCII field shall specify the algorithm used to compress the color or grayscale image. An entry of "NONE" in this field indicates that the data contained in this record is

uncompressed. For those images that are to be compressed, the preferred method for the compression of facial and SMT images is specified by the baseline mode of the JPEG algorithm. The data shall be formatted in accordance with the JPEG File Interchange Format, Version 1.02 (JFIF). An entry of "JPEGB" indicates that the scanned or captured image was compressed using baseline JPEG. An entry of "JPEGL" indicates that the lossless mode of the JPEG algorithm was used to compress the image. If the image is captured in grayscale, then only the luminescence component will be compressed and transmitted.

10.1.12 Field 10.012: Colorspace (CSP)

This mandatory ASCII field shall contain the color space used to exchange the image. For compressed images, the preferred colorspace using baseline JPEG and JFIF is YCbCr to be coded as "YCC". An entry of "GRAY" shall be used for all grayscale images. This field shall contain "RGB" for uncompressed color images containing non-interleaved red, green, and blue pixels in that order. All other colorspace are undefined.

10.1.13 Field 10.013-.019: Reserved for Future Definition (RSV)

These fields are reserved for inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored.

10.1.14 Field 10.020: Subject Pose (POS)

This optional field is to be used for the exchange of facial image data. When included, this field shall contain a one ASCII character code selected from Table 10.2 to describe the pose of the subject. For the angled pose entry "A", field 10.021 shall contain the offset angle from the full face orientation.

Table 10.2 - Subject pose

Pose description	Pose code
Full Face Frontal	F
Right Profile (90 degree)	R
Left Profile (90 degree)	L
Angled Pose	A

10.1.15 Field 10.021: Pose Offset Angle (POA)

This field shall only be used for the exchange of facial image data if Field 10.020 (POS) contains an "A" to indicate an angled pose of the subject. This field should be omitted for a full face or a profile. This ASCII field specifies the pose position of the subject at any possible orientation within a circle. Its value shall be to a nearest degree.

The offset angle shall be measured from the full-face pose position and have a range of values from -180 degrees to +180 degrees. A positive angle is used to express the angular offset as the subject rotates from a full-face pose to their right (approaching a left profile). A negative angle is

used to express the angular offset as the subject rotates from a full-face pose to their left (approaching a right profile). If the entry in the POS field is an "F", "L", or "R", the contents of this field are ignored.

10.1.16 Field 10.022: Photo Description (PXS)

This optional ASCII field shall be used for the exchange of facial image data. When present, it shall describe special attributes of the captured facial image. Attributes associated with the facial image may be selected from Table 10.3 and entered in this field.

Table 10.3 - Photo descriptors

Facial image attribute	Attribute code
Subject Wearing Glasses	GLASSES
Subject Wearing Hat	HAT
Subject Wearing Scarf	SCARF
Physical Characteristics	PHYSICAL
Other Characteristics	OTHER

Physical characteristics, such as "*FRECKLES*" may be entered as a subfield consisting of two information items. The first is "*PHYSICAL*" followed by the "*US*" separator, followed by the characteristic as listed in Part 4 Section 13 of the Eighth (or current) Edition of the NCIC Code Manual, July 14, 1999 (see table 10.4a). The "*OTHER*" category is used to enter unlisted or miscellaneous attributes of the facial image. This information shall be entered as a two information item subfield. The first is "*OTHER*" followed by the "*US*" separator, followed by the unformatted text used to describe the attribute. Multiple attributes and subfields may be listed but must be separated by the "*RS*" character.

10.1.17 Field 10.023-.039: Reserved for Future Definition (RSV)

These fields are reserved for inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored.

10.1.18 Field 10.040: NCIC Designation Code (SMT)

This field is mandatory for a Type-10 record containing SMT image data. It is used to identify a general location of the captured scar, mark, or tattoo image. The contents of this field will be an entry chosen from Part 4 Section 13 of the Eighth (or current) Edition of the NCIC Code Manual, July 14, 1999 (see table 10.4b - 10.4e). The captured image can encompass an area larger than that specified by a single NCIC body part code for the particular image type. This situation can be accommodated by listing multiple NCIC codes separated by the "*RS*" separator character. In this case the primary code is listed first.

For the "marks" category, the NCIC manual lists the common locations for needle track marks. The body location codes listed for scars shall be used for other body part locations or other types of marks not listed in the NCIC Code Manual.

Table 10.4a - Other Physical Characteristics

Item/Location	Code
Bald/Balding	BALD
Cleft chin	CLEFT CHIN
Dimple, Chin	DIMP CHIN
Dimples, left cheek (face)	DIMP L CHK
Dimples, right cheek (face)	DIMP R CHK
Freckles	FRECKLES
Hair implants	HAIR IMPL
Pierced abdomen	PRCD ABDMN
Pierced back	PRCD BACK
Pierced ear, one, nonspecific	PRCD EAR
Pierced ears	PRCD EARS
Pierced left ear	PRCD L EAR
Pierced right ear	PRCD R EAR
Pierced Eyebrow, nonspecific	PRCD EYE
Pierced Left Eyebrow	PRCD L EYE
Pierced Right Eyebrow	PRCD R EYE
Pierced genitalia	PRCD GNTLS
Pierced lip, nonspecific	PRCD LIP
Pierced lip, upper	PRCD ULIP
Pierced lip, lower	PRCD LLIP
Pierced nipple, nonspecific	PRCD NIPPL
Pierced nipple, left	PRCD L NIP
Pierced nipple, right	PRCD R NIP
Pierced nose	PRCD NOSE
Pierced Tongue	PRCD TONGU
Stutters	STUTTERS
Transsexual (Miscellaneous Field should indicate what the individual was at birth and what they are at the time the record is entered in NCIC. [Example: Born male - had surgery and is now female.])	TRANSSXL
Transvestite	TRANSVST

Table 10.4b - Scars (SC)

Item/Location	Code	Item/Location	Code
Abdomen	SC ABDOM	Foot, nonspecific	SC FOOT
Ankle, nonspecific	SC ANKL	Foot, left	SC L FT
Ankle, left	SC L ANKL	Foot, right	SC R FT
Ankle, right	SC R ANKL	Forearm, nonspecific	SC F ARM
Arm, nonspecific	SC ARM	Forearm, left	SC LF ARM
Arm, left	SC L ARM	Forearm, right	SC RF ARM
Arm, right (Use the MIS Field to further describe location)	SC R ARM	Forehead	SC FHD
Arm, left upper	SC UL ARM	Groin area	SC GROIN
Arm, right upper	SC UR ARM	Hand, nonspecific	SC HAND
Back	SC BACK	Hand, left	SC L HND
Breast, nonspecific	SC BREAST	Hand, right	SC R HND

Item/Location	Code	Item/Location	Code
Breast, left	SC L BRST	Head, nonspecific (Use the MIS Field to further describe location)	SC HEAD
Breast, right	SC R BRST	Hip, nonspecific	SC HIP
Buttock, nonspecific	SC BUTTK	Hip, left	SC L HIP
Buttock, left	SC L BUTTK	Hip, right	SC R HIP
Buttock, right	SC R BUTTK	Knee, nonspecific	SC KNEE
Calf, nonspecific	SC CALF	Knee, left	SC L KNEE
Calf, left	SC L CALF	Knee, right	SC R KNEE
Calf, right	SC R CALF	Leg, nonspecific	SC LEG
Cheek (face), nonspecific	SC CHK	Leg, left, nonspecific	SC L LEG
Cheek (face), left	SC L CHK	Leg, right, nonspecific (Use the MIS Field to further describe location)	SC R LEG
Cheek (face), right	SC R CHK	Lip, nonspecific	SC LIP
Chest	SC CHEST	Lip, lower	SC LOW LIP
Chin	SC CHIN	Lip, upper	SC UP LIP
Ear, nonspecific	SC EAR	Neck	SC NECK
Ear, left	SC L EAR	Nose	SC NOSE
Ear, right	SC R EAR	Penis	SC PENIS
Elbow, nonspecific	SC ELBOW	Pockmarks	POCKMARKS
Elbow, left	SC L ELB	Shoulder, nonspecific	SC SHLD
Elbow, right	SC R ELB	Shoulder, left	SC L SHLD
Eyebrow, nonspecific	SC EYE	Shoulder, right	SC R SHLD
Eyebrow, left/left eye area	SC L EYE	Thigh, nonspecific	SC THGH
Eyebrow, right/right eye area	SC R EYE	Thigh, left	SC L THGH
Face, nonspecific (Use the MIS Field to further describe location)	SC FACE	Thigh, right	SC R THGH
Finger, nonspecific	SC FGR	Wrist, nonspecific	SC WRIST
Finger(s), left hand	SC L FGR	Wrist, left	SC L WRIST
Finger(s), right hand	SC R FGR	Wrist, right	SC R WRIST

Table 10.4c - Needle ("Track") Marks (NM)

Item/Location	Code	Item/Location	Code
Arm, left	NM L ARM	Hand, left	NM L HND
Arm, right	NM R ARM	Hand, right	NM R HND
Buttock, left	NM L BUTTK	Leg, left	NM L LEG
Buttock, right	NM R BUTTK	Leg, right	NM R LEG
Finger(s), left hand	NM L FGR	Thigh, left	NM L THIGH
Finger(s), right hand	NM R FGR	Thigh, right	NM R THIGH
Foot, left	NM L FOOT	Wrist, left	NM L WRIST
Foot, right	NM R FOOT	Wrist, right	NM R WRIST

Table 10.4d - Tattoos (TAT)

Item/Location	Code	Item/Location	Code
Abdomen	TAT ABDOM	Forearm, nonspecific	TAT FARM
Ankle, nonspecific	TAT ANKL	Forearm, left	TAT LF ARM

Item/Location	Code	Item/Location	Code
Ankle, left	TAT L ANKL	Forearm, right	TAT RF ARM
Ankle, right	TAT R ANKL	Forehead	TAT FHD
Arm, nonspecific	TAT ARM	Full Body (Use only when the entire body - arms, legs, chest, and back are covered with tattoos.)	TAT FLBODY
Arm, left	TAT L ARM	Groin Area	TAT GROIN
Arm, right (Use the MIS Field to further describe location)	TAT R ARM	Hand, nonspecific	TAT HAND
Arm, left upper	TAT UL ARM	Hand, left	TAT L HND
Arm, right upper	TAT UR ARM	Hand, right	TAT R HND
Back	TAT BACK	Head, nonspecific (Use the MIS Field to further describe location)	TAT HEAD
Breast, nonspecific	TAT BREAST	Hip, nonspecific	TAT HIP
Breast, left	TAT L BRST	Hip, left	TAT L HIP
Breast, right	TAT R BRST	Hip, right	TAT R HIP
Buttocks, nonspecific	TAT BUTTK	Knee, nonspecific	TAT KNEE
Buttock, left	TAT L BUTK	Knee, left	TAT L KNEE
Buttock, right	TAT R BUTK	Knee, right	TAT R KNEE
Calf, nonspecific	TAT CALF	Leg, nonspecific	TAT LEG
Calf, left	TAT L CALF	Leg, left	TAT L LEG
Calf, right	TAT R CALF	Leg, right (Use the MIS Field to further describe location)	TAT R LEG
Cheek (face), nonspecific	TAT CHEEK	Lip, nonspecific	TAT LIP
Cheek (face), left	TAT L CHK	Lip, lower	TAT LW LIP
Cheek (face), right	TAT R CHK	Lip, upper	TAT UP LIP
Chest	TAT CHEST	Neck	TAT NECK
Chin	TAT CHIN	Nose	TAT NOSE
Ear, nonspecific	TAT EAR	Penis	TAT PENIS
Ear, left	TAT L EAR	Shoulder, nonspecific	TAT SHLD
Ear, right	TAT R EAR	Shoulder, left	TAT L SHLD
Elbow, nonspecific	TAT ELBOW	Shoulder, right	TAT R SHLD
Elbow, left	TAT L ELBOW	Thigh, nonspecific	TAT THGH
Elbow, right	TAT R ELBOW	Thigh, left	TAT L THGH
Face, nonspecific (Use the MIS Field to further describe location)	TAT FACE	Thigh, right	TAT R THGH
Finger, nonspecific	TAT FNGR	Wrist, nonspecific	TAT WRS
Finger(s), left hand	TAT L FGR	Wrist, left	TAT L WRS
Finger(s), right hand	TAT R FGR	Wrist, right	TAT R WRS
Foot, nonspecific	TAT FOOT		
Foot, left	TAT L FOOT		
Foot, right	TAT R FOOT		

Table 10.4e - Removed Tattoos (RTAT)

Item/Location	Code	Item/Location	Code
Abdomen	RTAT ABDM	Forearm, nonspecific	RTAT FARM
Ankle, nonspecific	RTAT ANKL	Forearm, left	RTAT LFARM
Ankle, left	RTAT LANKL	Forearm, right	RTAT RFARM
Ankle, right	RTAT RANKL	Forehead	RTAT FHD
Arm, nonspecific	RTAT ARM	Full Body (Use only when the entire	RTAT FLBOD

Item/Location	Code	Item/Location	Code
		body - arms, legs, chest, and back are covered with tattoos.)	
Arm, left	RTAT L ARM	Groin Area	RTAT GROIN
Arm, right (Use the MIS Field to further describe location)	RTAT R ARM	Hand, nonspecific	RTAT HAND
Arm, left upper	RTAT ULARM	Hand, left	RTAT L HND
Arm, right upper	RTAT URARM	Hand, right	RTAT R HND
Back	RTAT BACK	Head, nonspecific (Use the MIS Field to further describe location)	RTAT HEAD
Breast, nonspecific	RTAT BRST	Hip, nonspecific	RTAT HIP
Breast, left	RTAT LBRST	Hip, left	RTAT L HIP
Breast, right	RTAT RBRST	Hip, right	RTAT R HIP
Buttocks, nonspecific	RTAT BUTTK	Knee, nonspecific	RTAT KNEE
Buttock, left	RTAT LBUTK	Knee, left	RTAT LKNEE
Buttock, right	RTAT RBUTK	Knee, right	RTAT RKNEE
Calf, nonspecific	RTAT CALF	Leg, nonspecific	RTAT LEG
Calf, left	RTAT LCALF	Leg, left	RTAT L LEG
Calf, right	RTAT RCALF	Leg, right (Use the MIS Field to further describe location)	RTAT R LEG
Cheek (face), nonspecific	RTAT CHEEK	Lip, nonspecific	RTAT LIP
Cheek (face), left	RTAT L CHK	Lip, lower	RTAT LWLIP
Cheek (face), right	RTAT R CHK	Lip, upper	RTAT UPLIP
Chest	RTAT CHEST	Neck	RTAT NECK
Chin	RTAT CHIN	Nose	RTAT NOSE
Ear, nonspecific	RTAT EAR	Penis	RTAT PENIS
Ear, left	RTAT L EAR	Shoulder, nonspecific	RTAT SHLD
Ear, right	RTAT R EAR	Shoulder, left	RTAT LSHLD
Elbow, nonspecific	RTAT ELBOW	Shoulder, right	RTAT RSHLD
Elbow, left	RTAT L ELB	Thigh, nonspecific	RTAT THGH
Elbow, right	RTAT R ELB	Thigh, left	RTAT LTHGH
Face, nonspecific (Use the MIS Field to further describe location)	RTAT FACE	Thigh, right	RTAT RTHGH
Finger, nonspecific	RTAT FNGR	Wrist, nonspecific	RTAT WRS
Finger(s), left hand	RTAT L FGR	Wrist, left	RTAT LWRS
Finger(s), right hand	RTAT R FGR	Wrist, right	RTAT RWRS
Foot, nonspecific	RTAT FOOT		
Foot, left	RTAT LFOOT		
Foot, right	RTAT RFOOT		

10.1.19 Field 10.041: SMT Size (SMS)

This optional field shall contain the dimensions of the scar, mark or tattoo. It shall consist of two information items. The height shall be the first information item followed by the "US" separator character followed by the width. Each dimension shall be entered to the nearest centimeter.

10.1.20 Field 10.042: SMT Descriptors (SMD)

This optional field is used to describe the content of the SMT image. It shall consist of one or more subfields. Each subfield shall contain three or four information items that provide progressively detailed information describing the total image or a portion of the image.

The first information item of each subfield shall identify the source of the SMT. It shall contain "SCAR" to indicate healed scar tissue that was the result an accident or medical procedure. An entry of "MARK" shall be used for the pattern resulting from needle or "Track" marks. For either case the second and third information items shall contain "OTHER" and "MISC" and the fourth information item shall contain a textual description or other information concerning the scar or mark pattern.

For deliberately applied or drawn images, the first information item will contain "TATTOO" to indicate a common tattoo or indelible image resulting from the pricking of the skin with a coloring matter; "CHEMICAL" if the image was created by the use of chemicals to burn the image into the skin; "BRANDED" if the image was burned into the skin using a branding iron or other form of heat; or "CUT" if the image was caused by incision of the skin.

The second information item shall be the general class code of tattoo chosen from Table 10.5. For each general class of tattoo, there are several defined subclasses. The third information item of the subfield shall be the appropriate subclass code selected from Tables 10.6a - 10.6h which lists the various subclasses of tattoos for each of the general classes.

The final and optional information item in this subfield shall be an ASCII text string that provides additional qualifiers to describe the image or portion of the image. For example, to fully describe a tattoo, there may be a class description of "ANIMAL", with a subclass description of "DOG", and qualified by "golden retriever with an overbite". The "US" separator character will be used between information items.

An SMT image consisting of several parts or sub-images shall use multiple subfields, separated by the "RS" separator, to fully describe the various parts or features found in the total image. The first subfield shall describe the most predominant feature or sub-image contained in the SMT image. Subsequent subfields shall describe additional portions of the image that are not part of the main or central focal point of the image. For example, a tattoo consisting of a man with a snake on the arm being followed by a dog may contain three subfields - one describing the man, a second describing the snake, and a third describing the dog.

Table 10.5 - Tattoo classes

Class description	Class code
Human Forms and Features	HUMAN
Animals and Animal Features	ANIMAL
Plants	PLANT
Flags	FLAG
Objects	OBJECT
Abstractions	ABSTRACT
Insignias & Symbols	SYMBOL
Other Images	OTHER

Table 10.6a - Human tattoo subclasses

Subclass	Subclass code
Male Face	MFACE
Female Face	FFACE
Abstract Face	ABFACE
Male Body	MBODY
Female Body	FBODY
Abstract Body	ABBODY
Roles (Knight, Witch, man, etc.)	ROLES
Sports Figures (Football Player, Skier, etc.)	SPORT
Male Body Parts	MBPART
Female Body Parts	FBPART
Abstract Body Parts	ABBPART
Skulls	SKULL
Miscellaneous Human Forms	MHUMAN

Table 10.6b - Animal tattoo subclasses

Subclass	Subclass code
Cats & Cat Heads	CAT
Dogs & Dog Heads	DOG
Other Domestic Animals	DOMESTIC
Vicious Animals (Lions, Tigers, Wolves, etc.)	VICIOUS
Horses (Donkeys, Mules, etc.)	HORSE
Other Wild Animals	WILD
Snakes	SNAKE
Dragons	DRAGON
Birds (Cardinal, Hawk, etc.)	BIRD
Spiders, Bugs, and Insects	INSECT
Abstract Animals	ABSTRACT
Animal Parts	PARTS
Miscellaneous Animal Forms	MANIMAL

Table 10.6c - Plant tattoo subclasses

Subclass	Subclass code
Narcotics	NARCOTICS
Red Flowers	REDFL
Blue Flowers	BLUEFL
Yellow Flowers	YELFL
Drawings of Flowers	DRAW
Rose	ROSE
Tulip	TULIP
Lily	LILY
Miscellaneous Plants, Flowers, Vegetables	MPLANT

Table 10.6d - Flags tattoo subclasses

Subclass	Subclass code
American Flag	USA
State Flag	STATE
Nazi Flag	NAZI
Confederate Flag	CONFED
British Flag	BRIT
Miscellaneous Flags	MFLAG

Table 10.6e - Objects tattoo subclasses

Subclass	Subclass code
Fire	FIRE
Weapons (Guns, Arrows, etc.)	WEAP
Airplanes	PLANE
Boats, Ships, and Other Vessels	VESSEL
Trains	TRAIN
Cars, Trucks, and Vehicles	VEHICLE
Mythical (Unicorns, etc.)	MYTH
Sporting Objects (Football, Ski, Hurdles, etc.)	SPORT
Water & Nature Scenes (Rivers, Sky, Trees, etc.)	NATURE
Miscellaneous Objects	MOBJECTS

Table 10.6f - Abstract tattoo subclasses

Subclass	Subclass code
Figure(s)	FIGURE
Sleeve	SLEEVE
Bracelet	BRACE
Anklet	ANKLET
Necklace	NECKLC
Shirt	SHIRT
Body Band	BODBND
Head Band	HEDBND
Miscellaneous Abstract	MABSTRACT

Table 10.6g - Symbols tattoo subclasses

Subclass	Subclass code
National Symbols	NATION
Political Symbols	POLITIC
Military Symbols	MILITARY
Fraternal Symbols	FRATERNAL
Professional Symbols	PROFESS
Gang Symbols	GANG
Miscellaneous Symbols	MSYMBOLS

Table 10.6h - Other tattoo subclasses

Subclass	Subclass code
Wording (Mom, Dad, Mary, etc.)	WORDING
Freeform Drawings	FREEFRM
Miscellaneous Images	MISC

10.1.21 Field 10.043: Color (COL)

This optional field shall contain one subfield corresponding to each subfield contained in Field 10.042. Each subfield shall contain one or more information items that list the color(s) of the tattoo or part of the tattoo. For each subfield, the first information item in the subfield shall be the predominant color chosen from Table 10.7. Additional colors for the sub-field shall be entered as information items in the subfield separated by the "US" separator character.

Table 10.7 - Other tattoo subclasses

Color Description	Color Code
Black	BLACK
Brown	BROWN
Gray	GRAY
Blue	BLUE
Green	GREEN
Orange	ORANGE
Purple	PURPLE
Red	RED
Yellow	YELLOW
White	WHITE
Multi-colored	MULTI
Outlined	OUTLINE

10.1.22 Field 10.044-199: Reserved for Future Definition (RSV)

These fields are reserved for inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored.

10.1.23 Field 10.200-998: User Defined Fields (UDF)

These fields are user-definable fields. Their size and content shall be defined by the user and be in accordance with the receiving agency. If present they shall contain ASCII textual information.

10.1.24 Field 10.999: Image Data (DAT)

This field shall contain all of the grayscale or color data from a face, scar, mark, tattoo, or other image. It shall always be assigned field number 999 and must be the last physical field in the record. For example, "10.999:" is followed by image data in a binary representation.

Each pixel of uncompressed grayscale data shall be quantized to eight bits (256 gray levels) contained in a single byte. Uncompressed color image data shall be expressed as 24 bit RGB pixels. The first byte shall contain the eight bits for the red component of the pixel, the second byte shall contain the eight bits for the green component of the pixel, and the third byte shall contain the last eight bits for the blue component of the pixel. If compression is used, the pixel data shall be compressed in accordance with the compression technique specified in the GCA field. If the JPEG algorithm is to be used to compress the data, this field shall be encoded using the JFIF format specification.

10.2 End of Type-10 Logical Record

For the sake of consistency, immediately following the last byte of data from field 10.999 an "FS" separator shall be used to separate it from the next logical record. This separator must be included in the length field of the Type-10 record.

10.3 Additional Facial & SMT Image Records

Additional Type-10 records may be included in the file. For each additional facial or SMT image, a complete Type-10 logical record together with the "FS" separator is required.

11 Type-13 variable-resolution latent image record

The Type-13 tagged-field logical record shall contain image data acquired from latent images. These images are intended to be transmitted to agencies that will automatically extract or provide human intervention and processing to extract the desired feature information from the images.

Information regarding the scanning resolution used, the image size, and other parameters required to process the image, are recorded as tagged-fields within the record.

Table 11.1 - Type-13 variable-resolution latent record layout

Ident	Cond. code	Field Number	Field Name	Char type	Field size per occurrence		Occur count		Max byte count
					min.	max.	min	max	
LEN	M	13.001	LOGICAL RECORD LENGTH	N	4	8	1	1	15
IDC	M	13.002	IMAGE DESIGNATION CHARACTER	N	2	5	1	1	12
IMP	M	13.003	IMPRESSION TYPE	A	2	2	1	1	9
SRC	M	13.004	SOURCE AGENCY / ORI	AN	6	35	1	1	42
LCD	M	13.005	LATENT CAPTURE DATE	N	9	9	1	1	16
HLL	M	13.006	HORIZONTAL LINE LENGTH	N	4	5	1	1	12
VLL	M	13.007	VERTICAL LINE LENGTH	N	4	5	1	1	12
SLC	M	13.008	SCALE UNITS	N	2	2	1	1	9
HPS	M	13.009	HORIZONTAL PIXEL SCALE	N	2	5	1	1	12
VPS	M	13.010	VERTICAL PIXEL SCALE	N	2	5	1	1	12
CGA	M	13.011	COMPRESSION ALGORITHM	A	5	7	1	1	14
BPX	M	13.012	BITS PER PIXEL	N	2	3	1	1	10
FGP	M	13.013	FINGER POSITION	N	2	3	1	6	25
RSV		13.014 13.019	RESERVED FOR FUTURE DEFINITION	--	--	--	--	--	--
COM	O	13.020	COMMENT	A	2	128	0	1	135
RSV		13.021 13.199	RESERVED FOR FUTURE DEFINITION	--	--	--	--	--	--
UDF	O	13.200 13.998	USER-DEFINED FIELDS	--	--	--	--	--	--
DAT	M	13.999	IMAGE DATA	B	2	--	1	1	--

Key for character type: N = Numeric; A = Alphabetic; AN = Alphanumeric; B = Binary

11.1 Fields for the Type-13 logical record

The following paragraphs describe the data contained in each of the fields for the Type-13 logical record.

Within a Type-13 logical record, entries shall be provided in numbered fields. It is required that the first two fields of the record are ordered, and the field containing the image data shall be the last physical field in the record. For each field of the Type-13 record, Table 11.1 lists the "condition code" as being mandatory "M" or optional "O", the field number, the field name, character type, field size, and occurrence limits. Based on a three digit field number, the maximum byte count size for the field is given in the last column. As more digits are used for

the field number, the maximum byte count will also increase. The two entries in the “field size per occurrence” include all character separators used in the field. The “maximum

byte count” includes the field number, the information, and all the character separators including the “GS” character.

11.1.1 Field 13.001: Logical record length (LEN)

This mandatory ASCII field shall contain the total count of the number of bytes in the Type-13 logical record. Field 13.001 shall specify the length of the record including every character of every field contained in the record and the information separators.

11.1.2 Field 13.002: Image designation character (IDC)

This mandatory ASCII field shall be used to identify the latent image data contained in the record. This IDC shall match the IDC found in the file content (CNT) field of the Type-1 record.

11.1.3 Field 13.003: Impression type (IMP)

This mandatory one- or two-byte ASCII field shall indicate the manner by which the latent image information was obtained. The appropriate latent code choice selected from Table 4.1 (finger) or Table 13.2 (palm) shall be entered in this field.

11.1.4 Field 13.004: Source agency / ORI (SRC)

This mandatory ASCII field shall contain the identification of the administration or organization that originally captured the facial image contained in the record. Normally, the Originating Agency Identifier (ORI) of the agency that captured the image will be contained in this field. It consists of two information items in the following format

CC/agency.

The first information item contains the Interpol Country Code, two alpha-numeric characters long. The second item, *agency*, is a free text identification of the agency, up to a maximum of 32 alpha-numeric characters.

11.1.5 Field 13.005: Latent capture date (LCD)

This mandatory ASCII field shall contain the date that the latent image contained in the record was captured. The date shall appear as eight digits in the format CCYYMMDD. The CCYY characters shall represent the year the image was captured; the MM characters shall be the tens and units values of the month; and the DD characters shall be the tens and units values of the day in the month. For example, 20000229 represents February 29, 2000. The complete date must be a legitimate date.

11.1.6 Field 13.006: Horizontal line length (HLL)

This mandatory ASCII field shall contain the number of pixels contained on a single horizontal line of the transmitted image.

11.1.7 Field 13.007: Vertical line length (VLL)

This mandatory ASCII field shall contain the number of horizontal lines contained in the transmitted image.

11.1.8 Field 13.008: Scale units (SLC)

This mandatory ASCII field shall specify the units used to describe the image sampling frequency (pixel density). A "1" in this field indicates pixels per inch, or a "2" indicates pixels per centimeter. A "0" in this field indicates no scale is given. For this case, the quotient of HPS/VPS gives the pixel aspect ratio.

11.1.9 Field 13.009: Horizontal pixel scale (HPS)

This mandatory ASCII field shall specify the integer pixel density used in the horizontal direction providing the SLC contains a "1" or a "2". Other-wise, it indicates the horizontal component of the pixel aspect ratio.

11.1.10 Field 13.010: Vertical pixel scale (VPS)

This mandatory ASCII field shall specify the integer pixel density used in the vertical direction pro-viding the SLC contains a "1" or a "2". Otherwise, it indicates the vertical component of the pixel aspect ratio.

11.1.11 Field 13.011: Compression algorithm (CGA)

This mandatory ASCII field shall specify the algorithm used to compress grayscale images. An entry of "NONE" in this field indicates that the data contained in this record is uncompressed. For those images that are to be losslessly compressed, this field shall contain the preferred method for the compression of latent fingerprint images. For grayscale images, the domain registrar shall maintain a registry of compression techniques and corresponding codes that may be used as they become available.

11.1.12 Field 13.012: Bits per pixel (BPX)

This mandatory ASCII field shall contain the number of bits used to represent a pixel. This field shall contain an entry of "8" for normal grayscale values of "0" to "255". Any entry in this field greater than "8" shall represent a grayscale pixel with increased precision.

11.1.13 Field 13.013: Finger / palm position (FGP)

This mandatory tagged-field shall contain one or more the possible finger or palm positions that may match the latent image. The decimal code number corresponding to the known or most probable finger position shall be taken from Table 4.2 or the most probable palm position from Table 13.3 and entered as a one- or two-character ASCII subfield. Additional finger and/or palm positions may be referenced by entering the alternate position codes as subfields separated by the "RS" separator character. The code "0", for "Unknown Finger", shall be used to reference every finger position from one through ten. The code "20", for

"Unknown Palm", shall be used to reference every listed palmprint position.

11.1.14 Field 13.014-019: Reserved for future definition (RSV)

These fields are reserved for inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored.

11.1.15 Field 13.020: Comment (COM)

This optional field may be used to insert comments or other ASCII text information with the latent image data.

11.1.16 Field 13.021-199: Reserved for future definition (RSV)

These fields are reserved for inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored.

11.1.17 Fields 13.200-998: User-defined fields (UDF)

These fields are user-definable fields. Their size and content shall be defined by the user and be in accordance with the receiving agency. If present they shall contain ASCII textual information.

11.1.18 Field 13.999: Image data (DAT)

This field shall contain all of data from a captured latent image. It shall always be assigned field number 999 and must be the last physical field in the record. For example, "13.999:" is followed by image data in a binary representation.

Each pixel of uncompressed grayscale data shall normally be quantized to eight bits (256 gray levels) contained in a single byte. If the entry in BPX Field 13.012 is greater or less than "8", the number of bytes required to contain a pixel will be different. If compression is used, the pixel data shall be compressed in accordance with the compression technique specified in the GCA field.

11.2 *End of Type-13 variable-resolution latent image record*

For the sake of consistency, immediately following the last byte of data from field 13.999 an “FS” separator shall be used to separate it from the next logical record. This separator must be included in the length field of the Type-13 record.

11.3 *Additional variable-resolution latent image records*

Additional Type-13 records may be included in the file. For each additional latent image, a complete Type-13 logical record together with the “FS” separator is required.

12 Type-14 variable-resolution tenprint image record

The Type-14 tagged-field logical record shall contain and be used to exchange tenprint fingerprint image data. Rolled and plain fingerprint impressions shall be acquired from a tenprint card or from a live-scan device. Captured images are intended to be transmitted to agencies that will automatically extract the desired feature information from the images for matching purposes.

Textual information regarding the scanning resolution used, the image size and other parameters or comments required to process the image are recorded as tagged-fields within the record.

12.1 Fields for the Type-14 logical record

The following paragraphs describe the data contained in each of the fields for the Type-14 logical record.

Within a Type-14 logical record, entries shall be provided in numbered fields. It is required that the first two fields of the record are ordered, and the field containing the image data shall be the last physical field in the record. For each field of the Type-14 record, Table 12.1 lists the “condition code” as being mandatory “M” or optional “O”, the field number, the field name, character type, field size, and occurrence limits. Based on a three digit field number, the maximum byte count size for the field is given in the last column. As more digits are used for the field number, the maximum byte count will also increase. The two entries in the “field size per occurrence” include all character separators used in the field. The “maximum byte count” includes the field number, the information, and all the character separators including the “GS” character.

Table 12.1 – Type-14 variable-resolution tenprint record layout

Ident	Cond. code	Field Number	Field Name	Char type	Field size per occurrence		Occur count		Max byte count
					min.	max.	min	max	
LEN	M	14.001	LOGICAL RECORD LENGTH	N	4	8	1	1	15
IDC	M	14.002	IMAGE DESIGNATION CHARACTER	N	2	5	1	1	12
IMP	M	14.003	IMPRESSION TYPE	A	2	2	1	1	9
SRC	M	14.004	SOURCE AGENCY / ORI	AN	6	35	1	1	42
TCD	M	14.005	TENPRINT CAPTURE DATE	N	9	9	1	1	16
HLL	M	14.006	HORIZONTAL LINE LENGTH	N	4	5	1	1	12
VLL	M	14.007	VERTICAL LINE LENGTH	N	4	5	1	1	12
SLC	M	14.008	SCALE UNITS	N	2	2	1	1	9
HPS	M	14.009	HORIZONTAL PIXEL SCALE	N	2	5	1	1	12
VPS	M	14.010	VERTICAL PIXEL SCALE	N	2	5	1	1	12
CGA	M	14.011	COMPRESSION ALGORITHM	A	5	7	1	1	14
BPX	M	14.012	BITS PER PIXEL	N	2	3	1	1	10
FGP	M	14.013	FINGER POSITION	N	2	3	1	6	25
RSV		14.014 14.019	RESERVED FOR FUTURE DEFINITION	--	--	--	--	--	--
COM	O	14.020	COMMENT	A	2	128	0	1	128
RSV		14.021 14.199	RESERVED FOR FUTURE DEFINITION	--	--	--	--	--	--

Ident	Cond. code	Field Number	Field Name	Char type	Field size per occurrence		Occur count		Max byte count
					min.	max.	min	max	
UDF	O	14.200 14.998	USER-DEFINED FIELDS	--	--	--	--	--	--
DAT	M	14.999	IMAGE DATA	B	2	--	1	1	--

Key for character type: N = Numeric; A = Alphabetic; AN = Alphanumeric; B = Binary

12.1.1 Field 14.001: Logical record length (LEN)

This mandatory ASCII field shall contain the total count of the number of bytes in the Type-14 logical record. Field 14.001 shall specify the length of the record including every character of every field contained in the record and the information separators.

12.1.2 Field 14.002: Image designation character (IDC)

This mandatory ASCII field shall be used to identify the tenprint fingerprint image contained in the record. This IDC shall match the IDC found in the file content (CNT) field of the Type-1 record.

12.1.3 Field 14.003: Impression type (IMP)

This mandatory one-byte ASCII field shall indicate the manner by which the tenprint image information was obtained. The appropriate code selected from Table 4.1 shall be entered in this field.

12.1.4 Field 14.004: Source agency / ORI (SRC)

This mandatory ASCII field shall contain the identification of the administration or organization that originally captured the facial image contained in the record. Normally, the Originating Agency Identifier (ORI) of the agency that captured the image will be contained in this field. It consists of two information items in the following format

CC/agency.

The first information item contains the Interpol Country Code, two alpha-numeric characters long. The second item, *agency*, is a free text identification of the agency, up to a maximum of 32 alpha-numeric characters.

12.1.5 Field 14.005: Tenprint capture date (TCD)

This mandatory ASCII field shall contain the date that the tenprint image was captured. The date shall appear as eight digits in the format CCYYMMDD. The CCYY characters shall represent the year the image was captured; the MM characters shall be the tens and units values of the month; and the DD characters shall be the tens and units values of the day in the month. For

example, the entry 20000229 represents February 29, 2000. The complete date must be a legitimate date.

12.1.6 Field 14.006: Horizontal line length (HLL)

This mandatory ASCII field shall contain the number of pixels contained on a single horizontal line of the transmitted image.

12.1.7 Field 14.007: Vertical line length (VLL)

This mandatory ASCII field shall contain the number of horizontal lines contained in the transmitted image.

12.1.8 Field 14.008: Scale units (SLC)

This mandatory ASCII field shall specify the units used to describe the image sampling frequency (pixel density). A "1" in this field indicates pixels per inch, or a "2" indicates pixels per centimeter. A "0" in this field indicates no scale is given. For this case, the quotient of HPS/VPS gives the pixel aspect ratio.

12.1.9 Field 14.009: Horizontal pixel scale (HPS)

This mandatory ASCII field shall specify the integer pixel density used in the horizontal direction providing the SLC contains a "1" or a "2". Other-wise, it indicates the horizontal component of the pixel aspect ratio.

12.1.10 Field 14.010: Vertical pixel scale (VPS)

This mandatory ASCII field shall specify the integer pixel density used in the vertical direction providing the SLC contains a "1" or a "2". Otherwise, it indicates the vertical component of the pixel aspect ratio.

12.1.11 Field 14.011: Compression algorithm (CGA)

This mandatory ASCII field shall specify the algorithm used to compress grayscale images. An entry of "NONE" in this field indicates that the data contained in this record is uncompressed. For those images that are to be compressed, this field shall contain the preferred method for the compression of tenprint fingerprint images. For grayscale images, the domain registrar maintains a registry of acceptable compression techniques and corresponding codes that may be used as they become available.

12.1.12 Field 14.012: Bits per pixel (BPX)

This mandatory ASCII field shall contain the number of bits used to represent a pixel. This field shall contain an entry of “8” for normal grayscale values of “0” to “255”. Any entry in this field greater than or less than “8” shall represent a grayscale pixel with increased or decreased precision respectively.

12.1.13 Field 14.013: Finger position (FGP)

This mandatory tagged-field shall contain finger position that matches the tenprint image. The decimal code number corresponding to the known or most probable finger position shall be taken from Table 4.2 and entered as a one- or two-character ASCII subfield. Table 4.2 also lists the maximum image area that can be transmitted for each of the fourteen possible finger positions. Additional finger positions may be referenced in the transaction by entering the alternate finger positions as subfields separated by the “RS” separator character. The code "0", for "Unknown Finger", shall be used to reference every finger position from one through ten.

12.1.14 Field 14.014-019: Reserved for future definition (RSV)

These fields are reserved for inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored.

12.1.15 Field 14.020: Comment (COM)

This optional field may be used to insert comments or other ASCII text information with the tenprint image data.

12.1.16 Field 14.021-199: Reserved for future definition (RSV)

These fields are reserved for inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored.

12.1.17 Fields 14.200-998: User-defined fields (UDF)

These fields are user-definable fields. Their size and content shall be defined by the user and be in accordance with the receiving agency. If present they shall contain ASCII textual information.

12.1.18 Field 14.999: Image data (DAT)

This field shall contain all of the data from a captured tenprint image. It shall always be assigned field number 999 and must be the last physical field in the record. For example, “14.999:” is followed by image data in a binary representation.

Each pixel of uncompressed grayscale data shall normally be quantized to eight bits (256 gray levels) contained in a single byte. If the entry in BPX Field 14.012 is greater or less than “8”, the number of bytes required to contain a pixel will be different. If compression is used, the pixel data shall be compressed in accordance with the compression technique specified in the CGA field.

12.2 *End of Type-14 variable-resolution tenprint image record*

For the sake of consistency, immediately following the last byte of data from field 14.999 an “FS” separator shall be used to separate it from the next logical record. This separator must be included in the length field of the Type-14 record.

12.3 *Additional variable-resolution tenprint image records*

Additional Type-14 records may be included in the file. For each additional tenprint image, a complete Type-14 logical record together with the “FS” separator is required.

13 Type-15 variable-resolution palmprint image record

The Type-15 tagged-field logical record shall contain and be used to exchange palmprint image data together with fixed and user-defined textual information fields pertinent to the digitized image. Information regarding the scanning resolution used, the image size and other parameters or comments required to process the image are recorded as tagged-fields within the record. Palmprint images transmitted to other agencies will be processed by the recipient agencies to extract the desired feature information required for matching purposes.

The image data shall be acquired directly from a subject using a live-scan device, or from a palmprint card or other media that contains the subject's palmprints.

Any method used to acquire the palmprint images shall be capable of capturing a set of images for each hand. This set shall include the writer's palm as a single scanned image, and the entire area of the full palm extending from the wrist bracelet to the tips of the fingers as one or two scanned images. If two images are used to represent the full palm, the lower image shall extend from the wrist bracelet to the top of the interdigital area (third finger joint) and shall include the thenar, and hypothenar areas of the palm. The upper image shall extend from the bottom of the interdigital area to the upper tips of the fingers. This provides an adequate amount of overlap between the two images that are both located over the interdigital area of the palm. By matching the ridge structure and details contained in this common area, an examiner can confidently state that both images came from the same palm.

As a palmprint transaction may be used for different purposes, it may contain one or more unique image areas recorded from the palm or hand. A complete palmprint record set for one individual will normally include the writer's palm and the full palm image(s) from each hand. Since a tagged-field logical image record may contain only one binary field, a single Type-15 record will be required for each writer's palm and one or two Type-15 records for each full palm. Therefore, four to six Type-15 records will be required to represent the subject's palmprints in a normal palmprint transaction.

13.1 *Fields for the Type-15 logical record*

The following paragraphs describe the data contained in each of the fields for the Type-15 logical record.

Within a Type-15 logical record, entries shall be provided in numbered fields. It is required that the first two fields of the record are ordered, and the field containing the image data shall be the last physical field in the record. For each field of the Type-15 record, Table 13.1 lists the "condition code" as being mandatory "M" or optional "O", the field number, the field name, character type, field size, and occurrence limits. Based on a three digit field number, the maximum byte count size for the field is given in the last column. As more digits are used for the field number, the maximum byte count will also increase. The two entries in the "field size per occurrence" include all character separators used in the field. The "maximum byte count" includes the field number, the information, and all the character separators including the "GS" character.

13.1.1 Field 15.001: Logical record length (LEN)

This mandatory ASCII field shall contain the total count of the number of bytes in the Type-15 logical record. Field 15.001 shall specify the length of the record including every character of every field contained in the record and the information separators.

13.1.2 Field 15.002: Image designation character (IDC)

This mandatory ASCII field shall be used to identify the palmprint image contained in the record. This IDC shall match the IDC found in the file content (CNT) field of the Type-1 record.

13.1.3 Field 15.003: Impression type (IMP)

This mandatory one-byte ASCII field shall indicate the manner by which the palmprint image information was obtained. The appropriate code selected from Table 13.2 shall be entered in this field.

13.1.4 Field 15.004: Source agency/ORI (SRC)

This mandatory ASCII field shall contain the identification of the administration or organization that originally captured the facial image contained in the record. Normally, the Originating Agency Identifier (ORI) of the agency that captured the image will be contained in this field. It consists of two information items in the following format

CC/agency.

The first information item contains the Interpol Country Code, two alpha-numeric characters long. The second item, *agency*, is a free text identification of the agency, up to a maximum of 32 alpha-numeric characters.

13.1.5 Field 15.005: Palmprint capture date (PCD)

This mandatory ASCII field shall contain the date that the palmprint image was captured. The date shall appear as eight digits in the format CCYYMMDD. The CCYY characters shall represent the year the image was captured; the MM characters shall be the tens and units values of the month; and the DD characters shall be the tens and units values of the day in the month. For example, the entry 20000229 represents February 29, 2000. The complete date must be a legitimate date.

13.1.6 Field 15.006: Horizontal line length (HLL)

This mandatory ASCII field shall contain the number of pixels contained on a single horizontal line of the transmitted image.

13.1.7 Field 15.007: Vertical line length (VLL)

This mandatory ASCII field shall contain the number of horizontal lines contained in the transmitted image.

13.1.8 Field 15.008: Scale units (SLC)

This mandatory ASCII field shall specify the units used to describe the image sampling frequency (pixel density). A "1" in this field indicates pixels per inch, or a "2" indicates pixels per centimeter. A "0" in this field indicates no scale is given. For this case, the quotient of HPS/VPS gives the pixel aspect ratio.

13.1.9 Field 15.009: Horizontal pixel scale (HPS)

This mandatory ASCII field shall specify the integer pixel density used in the horizontal direction providing the SLC contains a "1" or a "2". Other-wise, it indicates the horizontal component of the pixel aspect ratio.

13.1.10 Field 15.010: Vertical pixel scale (VPS)

This mandatory ASCII field shall specify the integer pixel density used in the vertical direction providing the SLC contains a "1" or a "2". Otherwise, it indicates the vertical component of the pixel aspect ratio.

Table 13.1 – Type-15 variable-resolution palmprint record layout

Ident	Cond. code	Field Number	Field Name	Char type	Field size per occurrence		Occur count		Max byte count
					min.	max.	min	max	
LEN	M	15.001	LOGICAL RECORD LENGTH	N	4	8	1	1	15
IDC	M	15.002	IMAGE DESIGNATION CHARACTER	N	2	5	1	1	12
IMP	M	15.003	IMPRESSION TYPE	N	2	2	1	1	9
SRC	M	15.004	SOURCE AGENCY / ORI	AN	6	35	1	1	42
PCD	M	15.005	PALMPRINT CAPTURE DATE	N	9	9	1	1	16
HLL	M	15.006	HORIZONTAL LINE LENGTH	N	4	5	1	1	12
VLL	M	15.007	VERTICAL LINE LENGTH	N	4	5	1	1	12
SLC	M	15.008	SCALE UNITS	N	2	2	1	1	9
HPS	M	15.009	HORIZONTAL PIXEL SCALE	N	2	5	1	1	12
VPS	M	15.010	VERTICAL PIXEL SCALE	N	2	5	1	1	12
CGA	M	15.011	COMPRESSION ALGORITHM	AN	5	7	1	1	14
BPX	M	15.012	BITS PER PIXEL	N	2	3	1	1	10
PLP	M	15.013	PALMPRINT POSITION	N	2	3	1	1	10
RSV		15.014 15.019	RESERVED FOR FUTURE INCLUSION	--	--	--	--	--	--
COM	O	15.020	COMMENT	AN	2	128	0	1	128
RSV		15.021 15.199	RESERVED FOR FUTURE INCLUSION	--	--	--	--	--	--

Ident	Cond. code	Field Number	Field Name	Char type	Field size per occurrence		Occur count		Max byte count
					min.	max.	min	max	
UDF	O	15.200 15.998	USER-DEFINED FIELDS	--	--	--	--	--	--
DAT	M	15.999	IMAGE DATA	B	2	--	1	1	--

Table 13.2 - Palm Impression Type

Description	Code
Live-scan palm	10
Nonlive-scan palm	11
Latent palm impression	12
Latent palm tracing	13
Latent palm photo	14
Latent palm lift	15

13.1.11 Field 15.011: Compression algorithm (CGA)

This mandatory ASCII field shall specify the algorithm used to compress grayscale images. An entry of "NONE" in this field indicates that the data contained in this record is uncompressed. For those images that are to be compressed, this field shall contain the preferred method for the compression of tenprint fingerprint images. For grayscale images, the domain registrar maintains a registry of acceptable compression techniques and corresponding codes that may be used as they become available.

13.1.12 Field 15.012: Bits per pixel (BPX)

This mandatory ASCII field shall contain the number of bits used to represent a pixel. This field shall contain an entry of "8" for normal grayscale values of "0" to "255". Any entry in this field greater than or less than "8" shall represent a grayscale pixel with increased or decreased precision respectively.

Table 13.3 - Palm Codes, Areas & Sizes

Palm Position	Palm code	Image area (mm ²)	Width (mm)	Height (mm)
Unknown Palm	20	28387	139.7	203.2
Right Full Palm	21	28387	139.7	203.2
Right Writer s Palm	22	5645	44.5	127.0
Left Full Palm	23	28387	139.7	203.2
Left Writer s Palm	24	5645	44.5	127.0
Right Lower Palm	25	19516	139.7	139.7
Right Upper Palm	26	19516	139.7	139.7
Left Lower Palm	27	19516	139.7	139.7
Left Upper Palm	28	19516	139.7	139.7
Right Other	29	28387	139.7	203.2

Palm Position	Palm code	Image area (mm ²)	Width (mm)	Height (mm)
Left Other	30	28387	139.7	203.2

13.1.13 Field 15.013: Palmprint position (PLP)

This mandatory tagged-field shall contain the palmprint position that matches the palmprint image. The decimal code number corresponding to the known or most probable palmprint position shall be taken from Table 13.3 and entered as a two-character ASCII subfield. Table 13.3 also lists the maximum image areas and dimensions for each of the possible palmprint positions.

13.1.14 Field 15.014-019: Reserved for future definition (RSV)

These fields are reserved for inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored.

13.1.15 Field 15.020: Comment (COM)

This optional field may be used to insert comments or other ASCII text information with the palmprint image data.

13.1.16 Field 15.021-199: Reserved for future definition (RSV)

These fields are reserved for inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored.

13.1.17 Fields 15.200-998: User-defined fields (UDF)

These fields are user-definable fields. Their size and content shall be defined by the user and be in accordance with the receiving agency. If present they shall contain ASCII textual information.

13.1.18 Field 15.999: Image data (DAT)

This field shall contain all of the data from a captured palmprint image. It shall always be assigned field number 999 and must be the last physical field in the record. For example, "15.999:" is followed by image data in a binary representation. Each pixel of uncompressed grayscale data shall normally be quantized to eight bits (256 gray levels) contained in a single byte. If the entry in BPX Field 15.012 is greater or less than 8, the number of bytes required to contain a pixel will be different. If compression is used, the pixel data shall be compressed in accordance with the compression technique specified in the CGA field.

13.2 *End of Type-15 variable-resolution palmprint image record*

For the sake of consistency, immediately following the last byte of data from field 15.999 an “FS” separator shall be used to separate it from the next logical record. This separator must be included in the length field of the Type-15 record.

13.3 *Additional Type-15 variable-resolution palmprint image records*

Additional Type-15 records may be included in the file. For each additional palmprint image, a complete Type-15 logical record together with the “FS” separator is required.

APPENDIX 1 ASCII Separator Codes

ASCII Position ¹	Description
FS 1/12	Separates logical records of a file.
GS 1/13	Separates fields of a logical record.
RS 1/14	Separates the subfields of a record field.
US 1/15	Separates individual information items of the field or subfield.

¹ This is the position as defined in the ASCII standard.

APPENDIX 2 Calculation of Alpha-Numeric Check Character

For TCN and TCR (Fields 1.09 and 1.10):

The number corresponding to the check character is generated using the following formula:

$$(YY * 10^8 + SSSSSSSS) \text{ Modulo } 23$$

Where YY and SSSSSSSS are the numerical values of the last two digits of the year and the serial number respectively.

The check character is then generated from the look-up table given below.

For CRO (Field 2.010)

The number corresponding to the check character is generated using the following formula:

$$(YY * 10^6 + NNNNNN) \text{ Modulo } 23$$

Where YY and NNNNNN are the numerical values of the last two digits of the year and the serial number respectively.

The check character is then generated from the look-up table given below.

Check Character Look-up Table

1-A	9-J	17-T
2-B	10-K	18-U
3-C	11-L	19-V
4-D	12-M	20-W
5-E	13-N	21-X
6-F	14-P	22-Y
7-G	15-Q	0-Z
8-H	16-R	

APPENDIX 3 Mnemonic Codes

A3.1 Mnemonics for Type-1 Logical Records

mnemonic	field	para
CNT	File Content	1.003
DAI	Destination Agency Identifier	1.007
DAT	Date of Transaction	1.005
DCS	Directory of Character Sets	1.015
DOM	Domain Name	1.013
GMT	Greenwich Mean Time	1.014
LEN	Logical Record Length	1.001
NSR	Native Scanning Resolution	1.011
NTR	Nominal Transmitting Resolution	1.012
ORI	Originating Agency Identifier	1.008
PRY	Priority	1.006
TCN	Transaction Control Number	1.009
TCR	Transaction Control Response	1.010
TOT	Type of Transaction	1.004
VER	Version Number	1.002

A3.2 Mnemonics for Types of Transaction (TOT)

mnemonic	transaction type
APC	Add to Print Collection (incl. Photo)
ATP	Add to Print Collection
CPP	Criminal Photo-to-Photo Search
CPS	Criminal Print-to-Print Search
CPR	Criminal Subject Photo Request
DBS	Database Search
DFP	Delete from Print Collection
DIP	Disregard Individual Print Update
DPC	Delete Form Photo Collection
ERR	Error Message
IMR	Image Response
IRQ	Image Request
MMS	Latent-to-Latent Search
MPS	Latent-to-Print Search
NPP	Non-Criminal Photo-to-Photo Search
NPS	Non-Criminal Print-to-Print Search
PHR	Photo Response
PMS	Print-to-Latent Search
SRE	Search Results
SUP	Substitute Prints into Existing Ten-Print
UPR	Update Request

mnemonic	transaction type
USA	Add Latent to Unidentified Latent Collection
USR	Remove Latent from Unidentified Latent Collection

A3.3 Mnemonics for Type-2 Logical Records

mnemonic	field	para
ADD	Address	2.032
AKA	Aliases	2.034
ALF	Alert Flag	2.067
ARI	Additional Response Information	2.085
BLD	Build	2.042
BRT	Broadcast Request To	2.080
CCP	Coarse Classification of Patterns	2.027
CNO	Case Number	2.007
COL	Color	2.040
COU	Recipient Countries	2.065
CRN	Criminal Reference Number	2.010
DAR	Date of Record	2.004
DBR	Date of Birth Range	2.036
DLU	Date of Last Update	2.005
DOB	Date of Birth	2.035
DON	Date of Notice	2.024
DOO	Date of Offence	2.055
DOR	Date of Offence Range	2.056
DPR	Date Fingerprinted	2.019
DSG	Date Signature	2.073
DSR	Date of Crime Search Range	2.057
ERM	Status/Error Message Field	2.074
FAC	Face	2.044
FCP	Fine Classification of Patterns	2.028
FIB	Fingerprint Identification Byte	2.018
FNU	Finger Number	2.017
FPR	Finger Present	2.083
GAC	Geographical Area of Crime	2.052
GSA	Geographical Search Area	2.053
HAI	Hair	2.043
HGT	Height	2.041
ICP	ICPO/GS	2.062
IDC	Image Designation Character	2.002
IDF	Identified Flag	2.069
INF	Additional Information	2.063
LAN	Languages Spoken	2.045
LEN	Logical Record Length	2.001
MAR	Latents etc	2.048
MDO	Modus Operandi	2.051
MID	Latent Identifier	2.009

mnemonic	field	para
MN1	Miscellaneous Identification Number	2.012
MN2	Miscellaneous Identification Number	2.013
MN3	Miscellaneous Identification Number	2.014
MN4	Miscellaneous Identification Number	2.015
MN5	Miscellaneous Identification Number	2.016
MNA	Maiden Name	2.031
MPF	Latent Priority Flag	2.070
NAM	Name	2.030
NAT	Nationality	2.038
NLF	Nominal File	2.029
OBU	Owning Bureau	2.023
OCC	Occupation	2.049
ORN	Other Reference Number	2.011
OTY	Offence Type	2.054
PHO	Photograph Number	2.046
POA	Place Of Arrest	2.022
POB	Place of Birth	2.037
PSP	Passport Number	2.047
QLM	Quality Measure	2.026
RES	Result	2.066
RFP	Reason Fingerprinted	2.021
RLS	Respondents List	2.064
RNK	Rank	2.072
SCT	Send Copy To	2.006
SEX	Sex	2.039
SIM	Station Inputting Latent	2.025
SQN	Sequence Number	2.008
SYS	System Information	2.003
TCF	Target Criminal Flag	2.068
TLM	Time Limit	2.061
TOF	Time of Fingerprint	2.020
TOO	Time of Offence	2.058
TOR	Time of Offence Range	2.059
TRU	True Identity	2.033
TSR	Time of Crime Search Range	2.060
TUF	Tie Up Flag	2.071
WNG	Warning	2.050

A3.4 Mnemonics for Type-4 Logical Records

mnemonic	field	para
FGP	Finger Position	4.004
GCA	Grey-scale Compression Algorithm	4.008
HLL	Horizontal Line Length	4.006
IDC	Image Designation Character	4.002
IMP	Impression Type	4.003

mnemonic	field	para
ISR	Image Scanning Resolution	4.005
LEN	Logical Record Length	4.001
VLL	Vertical Line Length	4.007

A3.5 Mnemonics for Type-7 Logical Records

mnemonic	field	para
GCA	Grey-scale Compression Algorithm	7.009
HLL	Horizontal Line Length	7.007
IDC	Image Designation Character	7.002
IMD	Image Description	7.004
IMR	Image Capture Resolution	7.006
IMT	Image Type	7.003
LEN	Logical Record Length	7.001
PCN	Pattern Classification	7.005
VLL	Vertical Line Length	7.008

A3.6 Mnemonics for Type-8 Logical Records

mnemonic	field	para
HLL	Horizontal Line Length	8.006
IDC	Image Designation Character	8.002
ISR	Image Scanning Resolution	8.005
LEN	Logical Record Length	8.001
SIG	Signature Type	8.003
SRT	Signature Representation Type	8.004
VLL	Vertical Line Length	8.007

A3.7 Mnemonics for Type-9 Logical Records

mnemonic	field	para
CRP	Core Position	9.008
DLT	Delta(s) Position	9.009
FGP	Finger Position	9.006
FMT	Minutiæ	9.004
FPC	Fingerprint Pattern Classification	9.007
IDC	Image Designation Character	9.002
IMP	Impression Type	9.003
LEN	Logical Record Length	9.001
MIN	Number of Minutiæ	9.010
MRC	Minutiæ and Ridge Count Data	9.011
OFR	Originating Fingerprint Reading System	9.005
RDG	Minutiæ Ridge Count Indicator	9.012

A3.8 Mnemonics for Type-10 Logical Records

mnemonic	field	para
CGA	Compression Algorithm	10.011
COL	Color	10.043
CSP	Colorspace	10.012
HLL	Horizontal Line Length	10.006
HPS	Horizontal Pixel Scale	10.009
IDC	Image Designation Character	10.002
IMT	Image Type	10.003
LEN	Logical Record Length	10.001
PHD	Photo Date	10.005
POA	Pose Offset Angle	10.021
POS	Subject Pose	10.020
PXS	Photo Description	10.022
RSV	Reserved	
SLC	Scale Units	10.008
SMD	SMT Descriptors	10.042
SMS	SMT Size	10.041
SMT	NCIC Designation Code	10.040
SRC	Source Agency	10.004
UDF	User Defined Fields	
VLL	Vertical Line Length	10.007
VPS	Vertical Pixel Scale	10.010

A3.9 Mnemonics for Type-13 Logical Records

mnemonic	field	para
BPX	Bits per Pixel	13.012
CGA	Compression Algorithm	13.011
COM	Comment	13.020
DAT	Image Data	13.999
FGP	Finger Position	13.013
HLL	Horizontal Line Length	13.006
HPS	Horizontal Pixel Scale	13.009
IDC	Image Designation Character	13.002
IMP	Impression Type	13.003
LCD	Latent Capture Data	13.005
LEN	Logical Record Length	13.001
RSV	Reserved	
SLC	Scale Units	13.008
SRC	Source Agency	13.004
UDF	User Defined Fields	
VLL	Vertical Line Length	13.007
VPS	Vertical Pixel Scale	13.010

A3.10 Mnemonics for Type-14 Logical Records

mnemonic	field	para
BPX	Bits per Pixel	14.012
CGA	Compression Algorithm	14.011
COM	Comment	14.020
DAT	Image Data	14.999
FGP	Finger Position	14.013
HLL	Horizontal Line Length	14.006
HPS	Horizontal Pixel Scale	14.009
IDC	Image Designation Character	14.002
IMP	Impression Type	14.003
LEN	Logical Record Length	14.001
RSV	Reserved	
SLC	Scale Units	14.008
SRC	Source Agency	14.004
TCD	Tenprint Capture Date	14.005
UDF	User Defined Fields	
VLL	Vertical Line Length	14.007
VPS	Vertical Pixel Scale	14.010

A3.11 Mnemonics for Type-15 Logical Records

mnemonic	field	para
BPX	Bits per Pixel	15.012
CGA	Compression Algorithm	15.011
COM	Comment	15.020
DAT	Image Data	15.999
HLL	Horizontal Line Length	15.006
HPS	Horizontal Pixel Scale	15.009
IDC	Image Designation Character	15.002
IMP	Impression Type	15.003
LEN	Logical Record Length	15.001
PCD	Palmpoint Capture Date	15.005
PLP	Palmpoint Position	15.013
RSV	Reserved	
SLC	Scale Units	15.008
SRC	Source Agency	15.004
UDF	User Defined Fields	
VLL	Vertical Line Length	15.007
VPS	Vertical Pixel Scale	15.010

APPENDIX 4 JPEG File Interchange Format

JPEG File Interchange Format

Version 1.02

September 1, 1992

1 408 944-6300

Fax: +1 408 944-6314

E-mail: eric@c3.pla.ca.us

Why a File Interchange Format

JPEG File Interchange Format (JFIF) is a minimal file format, which enables JPEG bitstreams to be exchanged between a wide variety of platforms and applications. This minimal format does not include any of the advanced features found in the TIFF JPEG specification or any application specific file format. The only purpose of this simplified format is to allow the exchange of JPEG compressed images.

JPEG File Interchange Format features

- ∉ Uses JPEG compression
- ∉ Uses JPBG interchange format compressed image representation
- ∉ PC or Mac or UNIX workstation compatible
- ∉ Standard color space: one or three components. For three components YCbCr (CCIR 601-256 levels)
- ∉ APP0 marker used to specify Units, X pixel density, Y pixel density, thumbnail
- ∉ APP0 marker also used to specify JFIF extensions
- ∉ APP0 mater also used to specify application-specific information

JPEG Compression

Although any JPEG process is supported by the syntax of the JFIF it is strongly recommended that the JPEG baseline process be used for the purposes of file interchange. This ensures maximum compatibility with all applications supporting JPEG. JFIF conforms to the JPEG Draft International Standard (ISO DIS 10917-1).

The JFIF is entirely compatible with the standard JPEG interchange format; the only additional requirement is the mandatory presence of the APP0 marker right after the SOI marker. Note that the JPEG interchange format requires (as does JFIF) all table specifications used in the encoding process be coded in the bitstream prior to their use.

Compatible across Platforms

The JFIF is compatible across platforms: for example, it can use any resource forks supported by the Macintosh and by PCs or workstations, but not just one platform.

Standard color Space

The color space to be used is YCbCr as defined by CCIR 601(256 levels). The RGB components calculated by linear conversion from YCbCr shall not be gamma corrected (gamma = 1.0). If only one component is used, that component shall be Y.

APP0 marker is used to identify JPEG FIF

- ∄ The APP0 marker is used to identify a JPEG FIF file.
- ∄ The JPEG FIF APP0 marker is mandatory right after the SOI marker.
- ∄ The JFIF APP0 marker is identified by a zero terminated string: “*JFIF*”.
- ∄ The APP0 can be used for any other purpose by the application provided it can be distinguished from the JFIF APP0.
- ∄ The JFIF APP0 marker provides information which is missing from the JPEG stream: version number, X and Y pixel density (dots per inch or dots per cm), pixel aspect ratio (derived from X and Y pixel density), thumbnail.

APP0 marker used to specify JFIF extensions

Additional APP0 marker segment(s) can optionally be used to specify JFIF extensions. If used, these segments must immediately follow the JFIF APP0 marker. Decoders should skip any unsupported JFIF extension segments and continue decoding.

The JFIF extension APP0 marker is identified by a zero terminated string: “*JFXX*”. The JFIF extension APP0 marker segment contains a 1-byte code, which identifies the extension. This version, version 1.02, has only one extension defined: an extension for defining thumbnails stored in formats other than 24-bit RGB.

APP0 marker used for application-specific information

Additional APP0 marker segments can be used to hold application-specific information which does not affect the decodability or displayability of the JFIF file. Application-specific APP0 marker segments must appear after the JFIF APP0 and any JFXX APP0 segments. Decoders should skip any unrecognized application-specific APP0 segments.

Application-specific APP0 marker segments are identified by a zero terminated string which identifies the application (not “*JFIF*” or “*JFXX*”). This string should be an organization name or company trademark. Generic strings such as dog, cat, tree, etc. should not be used.

Conversion to and from RGB

Y, Cb, and Cr are converted from R, G, and B as defined in CCIR Recommendation 601 but are normalized so as to occupy the full 256 levels of an 8-bit binary encoding. More precisely:

$$\begin{aligned}Y &= 256 * E'_y \\ Cb &= 256 * [E'_{Cb}] + 128 \\ Cr &= 256 * [E'_{Cr}] + 128\end{aligned}$$

where the E'_y , E'_{Cb} and E'_{Cr} are defined as in CCIR 601. Since values of E'_y have a range of 0 to 1.0 and those for E'_{Cb} and E'_{Cr} have a range of -0.5 to +0.5, Y , Cb , and Cr must be clamped to 255 when they are maximum value.

RGB to YCbCr Conversion

YCbCr (256 levels) can be computed directly from 8-bit RGB as follows:

$$\begin{aligned}Y &= 0.299 R + 0.587G + 0.114B \\ Cb &= -0.1687 R - 0.3313 G + 0.5 B + 128 \\ Cr &= 0.5R - 0.4177 G - 0.0813 B + 128\end{aligned}$$

NOTE - Not all image file formats store image samples in the order $R_0, G_0, B_0, \dots R_n, G_n, B_n$. Be sure to verify the sample order before converting an RGB file to JFIF.

YCbCr to RGB Conversion

RGB can be computed directly from YCbCr (256 levels) as follows:

$$\begin{aligned}R &= Y + 1.402 (Cr - 128) \\ G &= Y - 0.34414 (Cb - 128) - 0.71414 (Cr - 128) \\ B &= Y + 1.772 (Cb - 128)\end{aligned}$$

Image Orientation

In JFIF files, the image orientation is always top-down. This means that the first image samples encoded in a JFIF file are located in the upper left hand corner of the image and encoding proceeds from left to right and top to bottom. Top-down orientation is used for both the full resolution image and the thumbnail image.

The process of converting an image file having bottom-up orientation to JFIF must include inverting the order of all image lines before JPEG encoding.

Spatial Relationship of Components

Specification of the spatial positioning of pixel samples within components relative to the samples of other components is necessary for proper image post processing and accurate image presentation. In JFIF files, the position of the pixels in subsampled components are defined with respect to the highest resolution component. Since components must be sampled orthogonally (along rows and columns), the spatial position of the samples in a given subsampled component may be determined by specifying the horizontal and vertical offsets of the first sample, i.e. the sample in the upper left corner, with respect to the highest resolution component.

The horizontal and vertical offsets of the first sample in a subsampled component, $Xoffset_i$ [0,0] and $Yoffset_i$ [0,0], are defined to be:

X'FF', SOI

X'FF', APP0, length, identifier, version, units, Xdensity, Ydensity, Xthumbnail, Ythumbnail, (RGB)_n

length	(2 bytes)	Total APP0 field byte count, including the byte count value (2 bytes), but excluding the APP0 marker itself
identifier	(5 bytes)	= X'4A', X'46', X'49', X'46', X'00' This zero terminated string ("JFIF") Uniquely identifies this APP0 marker. This string shall have zero parity (bit 7=0).
version	(2 bytes)	= X'0102' The most significant byte is used for major revisions, the least significant byte for minor revisions. Version 1.02 is the current released revision.
units	(1 byte)	Units for the X and Y densities units = 0: no units, X and Y specify the pixel units = 1: X and Y are dots per inch units = 2: X and Y are dots per cm
Xdensity	(2 bytes)	Horizontal pixel density
Ydensity	(2 bytes)	Vertical pixel density
Xthumbnail	(1 byte)	Thumbnail horizontal pixel count
Ythumbnail	(1 byte)	Thumbnail vertical pixel count
(RGB) _n	(3n bytes)	Packed (24-bit) RGB values for the thumbnail pixels, n = Xthumbnail * Ythumbnail

[Optional JFIF extension APP0 marker segment(s) - see below]X 'FF', SOFn, length, frame parameters

Number of components	Nf	= 1 or 3
1st component	C1	= 1 = Y component
2nd component	C2	= 2 = Cb component
3rd component	C3	= 3 = Cr component

X 'FF', EOI**JFIF Extension APP0 Marker Segment**

Immediately following the JFIF APP0 marker segment may be a JFIF extension APP0 marker. This JFIF extension APP0 marker segment may only be present for JFIF versions 1.02 and above. The syntax of the JFIF extension APP0 marker segment is:

X 'FF', APP0, Length, identifier, extension code, extension data

length	(2 bytes)	Total APP0 field byte count, including the byte count value (2 bytes), but excluding the APP0 marker itself
identifier	(5 bytes)	= X '4A', X '461', X '58', X '58', X '00' This zero terminated string ("JFXX") uniquely identifies this APP0 marker. This string shall have zero parity (bit 7 = 0).
extension_code	(1 byte)	= Code which identifies the extension. In this version, the following extensions are defined: = X '10' Thumbnail coded using JPEG = X '11' Thumbnail stored using 1 byte/pixel = X '13' Thumbnail stored using 3 bytes/pixel
extension_data	(variable)	= The specification of the remainder of the JFIF extension APP0 marker segment varies with the extension. See below for a specification of extension_data for each extension.

JFIF Extension: Thumbnail coded using JPEG

This extension supports thumbnails compressed using JPEG. The compressed thumbnail immediately follows the extension-code (X '10') in the extension_data field and the length of the compressed data must be included in the JFIF extension APP0 marker length field.

The syntax of the `extension_data` field conforms to the syntax for interchange format defined in Annex B of ISO DIS 10917-1. However, no "JFIF" or "JFXX" marker segments shall be present. As in the full resolution image of the JFIF file, the syntax of `extension_data` constrains parameters in the frame header as defined below:

X 'FF', SOI

X'FF'. SOFn, length, frame parameters

Number of components $N_f = 1$ or 3

1st component $C_1 = 1 = Y$ component

2nd component $C_2 = 2 = Cb$ component

3rd component $C_3 = 3 = Cr$ component

X 'FF', EOI

JFIF Extension: Thumbnail stored using one byte per pixel

This extension supports thumbnails stored using one byte per pixel and a color palette in the `extension_data` field. The syntax of `extension_data` is:

Xthumbnail	(1 byte)	Thumbnail horizontal pixel count
Ythumbnail	(1 byte)	Thumbnail vertical pixel count
palette	(768 bytes)	24-bit RGB pixel values for the color palette. The RGB values define the colors represented by each value of an 8-bit binary encoding (0 - 255).
(pixel) _n	(n bytes)	8-bit values for the thumbnail pixels $n = X_{\text{thumbnail}} * Y_{\text{thumbnail}}$

JFIF Extension: Thumbnail stored using three bytes per pixel

This extension supports thumbnails stored using three bytes per pixel in the `extension_data` field. The syntax of `extension_data` is:

Xthumbnail	(1 byte)	Thumbnail horizontal pixel count
Ythumbnail	(1 byte)	Thumbnail vertical pixel count
(RGB) _n	(3n bytes)	Packed (24-bit) RGB values for the thumbnail pixels, $n = X_{\text{thumbnail}} * Y_{\text{thumbnail}}$

Useful tips

- € You can identify a JFIF file by looking for the following sequence: X'FF', SOI, X'FF', APP0, <2 bytes to be skipped>, "JFIF", X'00'.
- € If you use APP0 elsewhere, be sure not to have the strings "JFIF" or "JFXX" right after the APP0 marker.
- € If you do not want to include a thumbnail, just program Xthumbnail = Ythumbnail = 0. be sure to check the version number in the special APP0 field. In general, if the major version number of the JFIF file matches that supported by the decoder, the file will be decodable.
- € If you only want to specify a pixel aspect ratio, put 0 for the units field in the special APP0 field. Xdensity and Ydensity can then be programmed for the desired aspect ratio.
- € Xdensity = 1, Ydensity = 1 will program a 1:1 aspect ratio. Xdensity and Ydensity should always be non-zero.

APPENDIX 5 Character Codes

A5.1 7-bit ANSI code for information interchange

ASCII Character Set										
+	0	1	2	3	4	5	6	7	8	9
30				!	"	#	\$	%	&	'
40	()	*	+	,	-	.	/	0	1
50	2	3	4	5	6	7	8	9	:	;
60	<	=	>	?	@	A	B	C	D	E
70	F	G	H	I	J	K	L	M	N	O
80	P	Q	R	S	T	U	V	W	X	Y
90	Z	[\]	^	_	`	a	b	c
100	d	e	f	g	h	i	j	k	l	m
110	n	o	p	q	r	s	t	u	v	w
120	x	y	z	{	 	}	~			

APPENDIX 6 Base-64 encoding scheme

The base-64 Content-Transfer-Encoding is designed to represent arbitrary sequences of octets in a form that need not be humanly readable. The encoding and decoding algorithms are simple, but the encoded data is consistently only about 33 percent larger than the unencoded data. This encoding is virtually identical to the one used in Privacy Enhanced Mail (PEM) applications, as defined in RFC 1421. The base-64 encoding is adapted from RFC 1421, with one change: base-64 eliminates the "*" mechanism for embedded clear text.

A 65-character subset of US-ASCII is used, enabling 6 bits to be represented per printable character. (The extra 65th character, "=", is used to signify a special processing function.)

NOTE: This subset has the important property that it is represented identically in all versions of ISO 646, including US ASCII and all characters in the subset are also represented identically in all versions of EBCDIC. Other popular encodings, such as the encoding used by the uuencode utility and the base-85 encoding specified as part of Level 2 PostScript, do not share these properties, and thus do not fulfill the portability requirements a binary transport encoding for mail must meet.

The encoding process represents 24-bit groups of input bits as output strings of 4 encoded characters. Proceeding from left to right, concatenating 3 8-bit input groups forms a 24-bit input group. These 24 bits are then treated as 4 concatenated 6-bit groups, each of which is translated into a single digit in the base-64 alphabet. When encoding a bit stream via the base-64 encoding, the bit stream must be presumed to be ordered with the most significant bit first. That is, the first bit in the stream will be the high-order bit in the first byte, and the eighth bit will be the low-order bit in the first byte, and so on.

Each 6-bit group is used as an index into an array of 64 printable characters. The character referenced by the index is placed in the output string. These characters, identified in Table C1, below, are selected so as to be universally representable, and the set excludes characters with particular significance to SMTP (e.g., ".", CR, LF) and to the encapsulation boundaries defined in this document (e.g., "-").

The output stream (encoded bytes) must be represented in lines of no more than 76 characters each. All line breaks or other characters not found in Table C1 must be ignored by decoding software. In base-64 data, characters other than those in Table C1, line breaks, and other white space probably indicate a transmission error, about which a warning message or even a message rejection might be appropriate under some circumstances.

Value / Encoding	Value / Encoding	Value / Encoding	Value / Encoding
0 / A	17 / R	34 / I	51 / z
1 / B	18 / S	35 / j	52 / 0
2 / C	19 / T	36 / k	53 / 1
3 / D	20 / U	37 / l	54 / 2
4 / E	21 / V	38 / m	55 / 3
5 / F	22 / W	39 / n	56 / 4
6 / G	23 / X	40 / o	57 / 5
7 / H	24 / Y	41 / p	58 / 6

Value / Encoding	Value / Encoding	Value / Encoding	Value / Encoding
8 / I	25 / Z	42 / q	59 / 7
9 / J	26 / a	43 / r	60 / 8
10 / K	27 / b	44 / s	61 / 9
11 / L	28 / c	45 / t	62 / +
12 / M	29 / d	46 / u	63 / /
13 / N	30 / e	47 / v	
14 / O	31 / f	48 / w	(pad) / =
15 / P	32 / g	49 / x	
16 / Q	33 / h	50 / y	

Special processing is performed if fewer than 24 bits are available at the end of the data being encoded. A full encoding quantum is always completed at the end of a body. When fewer than 24 input bits are available in an input group, zero bits are added (on the right) to form an integral number of 6-bit groups. Padding at the end of the data is performed using the '=' character. Since all base-64 input is an integral number of octets, only the following cases can arise: (1) the final quantum of encoding input is an integral multiple of 24 bits; here, the final unit of encoded output will be an integral multiple of 4 characters with no "=" padding, (2) the final quantum of encoding input is exactly 8 bits; here, the final unit of encoded output will be two characters followed by two "=" padding characters, or (3) the final quantum of encoding input is exactly 16 bits; here, the final unit of encoded output will be three characters followed by one "=" padding character.

Because it is used only for padding at the end of the data, the occurrence of any '=' characters may be taken as evidence that the end of the data has been reached (without truncation in transit). No such assurance is possible, however, when the number of octets transmitted was a multiple of three.

Any characters outside of the base-64 alphabet are to be ignored in base-64-encoded data. The same applies to any illegal sequence of characters in the base-64 encoding, such as "=====" .

Care must be taken to use the proper octets for line breaks if base-64 encoding is applied directly to text material that has not been converted to canonical form. In particular, text line breaks must be converted into CRLF sequences prior to base-64 encoding. The important thing to note is that this may be done directly by the encoder rather than in a prior cannibalization step in some implementations.

NOTE: There is no need to worry about quoting apparent encapsulation boundaries within base-64-encoded parts of multipart because no hyphen characters are used in the base-64 encoding.