

# **Police Standard for Still Digital Image Capture and Data Interchange of Facial/Mugshot and Scar, Mark & Tattoo Images**

national **AGENCY** POLICING

May 2007

Version 2.0

**NOT PROTECTIVELY MARKED**

<i>Document Name</i>	Police Standard for Still Digital Image Capture and Data Interchange of Facial/Mugshot and Scar, Mark & Tattoo Images
<i>File Name</i>	<b>Capture and interchange standard for Facial and SMT images</b>
<i>Author</i>	Rana Islam – Identification Systems Engineer <a href="mailto:rana.islam@npia.pnn.police.uk">rana.islam@npia.pnn.police.uk</a>
<i>Enquiries to</i>	Geoff Whitaker – Head of Biometrics, Identification <a href="mailto:geoff.whitaker@npia.pnn.police.uk">geoff.whitaker@npia.pnn.police.uk</a> National Policing Improvement Agency New King’s Beam House 22 Upper Ground London SE1 9QY ☎ 020 8358 5580 ☎ 020 8358 5533

<i>Authorisation</i>	DCC Stephen M Long Approval of Version 1.6 on behalf of ACPO - 01/09/2006 Mr Colin McF Peebles Approval of Version 1.6 on behalf of ACPOS. - 28/08/2006
<i>Signed version held by</i>	Geoff Teale – FIND (Facial Images National Database) Project Manager <a href="mailto:geoffrey.teale@npia.pnn.police.uk">geoffrey.teale@npia.pnn.police.uk</a>

© NPPIA (National Policing Improvement Agency) 2007

The copyright in this work is vested in the NPPIA and the information contained herein is confidential. This work, either in whole or in part, must not be reproduced or disclosed to others or used for purposes other than that for which it is supplied, without the NPPIA’s prior written permission, or if any part hereof is furnished by virtue of a contract with a third party, as expressly authorised under that contract.

**NOT PROTECTIVELY MARKED**

<b>Description</b>	<b>Date</b>	<b>Version</b>
First draft.	04/03/2004	0.1
Added environmental requirements.	16/03/2004	0.2
Distributed for internal PITO review.	15/04/2004	0.3
Incorporated review comments from PITO reviewers.	20/04/2004	0.4
Issued for viewing by FIND Project Board on 30 <sup>th</sup> April 2004.	23/04/2004	0.5
Add image data requirements.	23/04/2004	0.6
Incorporated review comments from Colin Patton (PITO reviewer).	25/05/2004	0.7
Issued to Geoff Teale for distribution to members of FIND Project User Group.	26/05/2004	0.8
Incorporated review comments from various members of FIND Project User Group.	23/06/2004	0.9
Issued to Geoff Teale for distribution to police force champions.	23/06/2004	1.0
Incorporated references to Police Corporate Data Model (CorDM) in "Image Data Requirements" section and review comments from FIND project police force champions.	31/08/2004	1.1
Minor formatting changes. Issued to Geoff Teale for distribution to external reviewers.	06/09/2004	1.2
Incorporated review comments from various external reviews/police forces.	30/11/2004	1.3
Restructuring of document. Added Table 1 to provide document overview and readership.	01/12/2004	1.4
Issued to Geoff Teale for submission to ACPO.	09/12/2004	1.5
Approved by ACPO Council.	14/04/2005	1.6
<p>Added 'Rationale' cell to each requirement clause.</p> <p>Added Appendix A – "Sample Mugshot Images and Guidelines".</p> <p>Incorporated relevant updates from a number of published/proposed international standards.</p> <p>Minor formatting and wording changes throughout document.</p> <p>Amended section titles:</p> <ul style="list-style-type: none"> <li>• "Image Data Requirements" to "Image Data Guidelines"</li> <li>• "Minimum Number of Pixels" to "Image</li> </ul>	13/04/2007	1.7

<b>Description</b>	<b>Date</b>	<b>Version</b>
Resolution – Minimum Number of Pixels”. Major document restructure to improve readability; moved section 5 to Appendix B. Added source references to some requirements. Made updates for CorDM compliance by incorporating review comments from PITO’s ITAD Information Standards Team.		
National Policing Improvements Agency	01/05/2007	2.0

**Controlling Documentation**

The following source documentation was used to produce this "Police Standard for Still Digital Image Capture and Data Interchange of Facial/Mugshot and Scar, Mark & Tattoo Images":

<b>Description</b>	<b>Revision</b>
ANSI/NIST-ITL 1-2000, Data Format for the Interchange of Fingerprint, Facial, & Scar Mark & Tattoo (SMT) Information	
ANSI/NIST-ITL 1-2000, Data Format for the Interchange of Fingerprint, Facial, & Scar Mark & Tattoo (SMT) Information – Interpol Implementation	Version No. 4.20, December 19, 2003
NIST Best Practice Recommendation For The Capture Of Mugshots	Version 2.0, 1997
Annex D (Facial Image Format for Interoperable Data Interchange) of ICAO Technical Report - Biometrics Deployment of Machine Readable Travel Documents	Version 1.9
ISO/IEC FCD 19794-5, Biometric Data Interchange Formats – Part 5: Face Image Data	March 22, 2004
AAMVA DL/ID-2000, American Association of Motor Vehicle Administrators National Standard for the Driver License/Identification Card	
WINPHO Site Preparation Guide	
VIPER Remote Site Design Specification, PITO Document	Ref: S1.2.6, Version 1.6
UKPS Photo Guidelines for Passport Applications	
Guidelines for Producing High Quality Photographs for U.S. Travel Documents	
AMTEC Consulting Report – Options for Deploying FIND, PITO Reference AM/5235	
An Introduction to the Police Corporate Data Model (CorDM), Reference CorDM-IC-002	Version 2.0, December 2003
ISO/IEC FCD 19794-5, Biometric Data Interchange Formats– Part 5: Face Image Data	June 15, 2005
British standard BS ISO/IEC 19794-5:2005, Information technology – Biometric data interchange formats – Part 5: Face image data	

**NOT PROTECTIVELY MARKED**

Proposed ANSI/NIST-ITL 1-2007, Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information <i>Note this document also includes: Annex I - Best Practice Image Capture Requirements for SAP Levels 40, 50, and 51</i>	11 January 2007
INTERPOL "Recommendations For The Capture Of Mugshots"	2000
Quality Standards for the Capture, Storage and Display of Digital Mugshots in INPOL-Neu <i>Note: This standard is used by the German Bundeskriminalamt and was developed and extended from the INTERPOL "Recommendations For The Capture Of Mugshots", 2000</i>	Version 4.1
PITO Information Systems Strategy for the Police Service (ISS4PS) - Volume 1: Understanding ISS4PS. - Volume 2: Understanding ISS4PS.	Version 3

## Table of Contents

<b>1</b>	<b>INTRODUCTION</b>	<b>9</b>
1.1	PURPOSE	9
1.2	SCOPE	9
1.3	OWNERSHIP	9
1.4	OBJECTIVES	9
1.5	FUTURE CONSIDERATIONS	10
1.6	DOCUMENT OVERVIEW AND READERSHIP	10
1.7	OBTAINING THIS DOCUMENT ELECTRONICALLY	13
<b>2</b>	<b>DEFINITIONS, ACRONYMS AND ABBREVIATIONS</b>	<b>14</b>
<b>3</b>	<b>SCENE REQUIREMENTS</b>	<b>21</b>
3.1	PURPOSE	21
3.1.1	<i>Pose</i>	21
3.1.2	<i>Pose With and Without Eyeglasses</i>	23
3.1.3	<i>Expression</i>	23
3.1.4	<i>Lighting</i>	24
3.1.5	<i>Lighting for Eyeglasses</i>	25
3.1.6	<i>Background</i>	26
3.1.7	<i>Centring Full Frontal Face Images</i>	27
3.1.8	<i>Centring SMT Images</i>	28
<b>4</b>	<b>PHOTOGRAPHIC REQUIREMENTS</b>	<b>29</b>
4.1	PURPOSE	29
4.1.1	<i>Focus and Depth of Field</i>	29
4.1.2	<i>Focal Length</i>	30
4.1.3	<i>Exposure</i>	30
4.1.4	<i>Image Aspect Ratio</i>	31
4.1.5	<i>Shutter Speed</i>	32
4.1.6	<i>ISO Setting ("film speed")</i>	32
4.1.7	<i>Colour Balance (Calibration)</i>	32
<b>5</b>	<b>DIGITAL REQUIREMENTS</b>	<b>34</b>
5.1	PURPOSE	34
5.1.1	<i>Image Resolution - Minimum Number of Pixels</i>	34
5.1.2	<i>Colour Space</i>	35
5.1.3	<i>Pixel Aspect Ratio</i>	36
<b>6</b>	<b>IMAGE COMPRESSION AND INTERCHANGE FORMAT REQUIREMENTS</b>	<b>37</b>
6.1	PURPOSE	37

6.1.1 *Compression Algorithm* ..... 37

6.1.2 *Interchange Format*..... 37

**IMAGE DATA GUIDELINES**..... 39

7.1 PURPOSE ..... 39

7.2 CORDM DATA STANDARDS ..... 39

7.2.1 *Categories of Data to be Recorded* ..... 40

7.2.2 *Image Descriptive Data Items to be Recorded*..... 41

**APPENDIX A – SAMPLE MUGSHOT IMAGES AND GUIDELINES**..... 44

**APPENDIX B – GUIDANCE FOR SETTING UP AN IMAGE CAPTURE SYSTEM**..... 46

**PURPOSE** ..... 46

**THE ROOM - ENVIRONMENT** ..... 46

**THE ROOM – SIZE, LOCATION, AND USAGE**..... 46

• **THE ROOM - FACILITIES**..... 47

**List Tables**

Table 1: Requirements Categories Overview and Readership. .... 11

Table 2: Appendices Overview and Readership. .... 12

Table 3: Data Categories to be Recorded With an Image. .... 40

Table 4: Image Descriptive Data Items to be Recorded for Search and Retrieval.  
..... 42

## 1 Introduction

### 1.1 Purpose

The purpose of this document is to present the specifications for the Police Standard for Still Digital Image Capture and Data Interchange of Facial/Mugshot and Scar, Mark & Tattoo (SMT)<sup>1</sup> Images (referred to as “the Standard” from this point forward).

This document draws on pre-existing work and is intended as a practical way forward. It does not mandate the implementation of the specifications contained herein.

### 1.2 Scope

The Standard specifies the requirements for the capture of Facial/Mugshot and SMT images. It also defines the image compression and interchange format requirements for the exchange of captured images and associated image data.

### 1.3 Ownership

This Standard document is proposed by the NPIA for the police services of England, Wales and Scotland. The NPIA will, at the direction of ACPO and ACPOS act as the custodians of the Standard and ensure it remains relevant. Ultimate ownership of the Standard must however reside with ACPO and ACPOS.

### 1.4 Objectives

The Standard has the following objectives:

- To allow for the capture, storage and display of images of sufficient quality to be used for:
  - Detailed human examination whereby the examiner is able to ascertain small and/or distinguishing features that may be used to verify identity; and
  - Human verification of identity by comparison of persons against facial and/or SMT images.
- To be forward-looking and working towards specifications for achieving:
  - Computer automated identification (one-to-many searches); and
  - Computer automated verification (one-to-one searches).
- To provide a set of guidelines and recommendations that can be implemented through use of currently available digital imaging systems.
- To define a **minimum** standard that the majority of existing police force facial and SMT images already meet (or can meet by minimal improvements

---

<sup>1</sup> Also known as Mark, Feature and Injury

to working practices) and thereby provide the basis for achieving images of sufficient quality to be used for detailed human examination and human verification of identity.

- To define recommendations for a higher level standard to achieve capture and storage of images of sufficient quality to be used for computer automated identification and computer automated verification, for which compliance is currently optional, but which would become mandatory as the Standard matures.
- To support interoperability between Facial/Mugshot Imaging systems.

## 1.5 Future Considerations

In response to a mandate from ACPO, work is currently underway within the NPIA to investigate the use of automatic facial recognition technology with mugshot images. The image requirements for automated identification are somewhat different to those for human identification, and it is not yet clear how such technology could best be used.

However, if automated face recognition is to be widely deployed across the police service, it is likely that this Standard will need to be updated in the future to include higher resolution images, multiple pose angles and/or 3D facial image capture, especially if there is a requirement to be able to search images from surveillance/CCTV cameras.

Such a capability is still some years away and the technology for large scale deployment of automated face recognition in such circumstances is not yet mature. The NPIA's Biometrics Team are currently working with both academic researchers and suppliers to drive this area forward, and will ensure that this Standard is updated as appropriate in order that the police service is in a position to take advantage of the technology as and when it is ready to be deployed.

For those interested in learning more about this topic please refer to the following PITO report entitled: *Automated Face Recognition: Applications within Law Enforcement - A Market and Technology Review, October 2006, Version 1.0*. This report can be obtained by contacting the NPIA's Biometrics Team .

## 1.6 Document Overview and Readership

The requirements for the Standard presented within this document fall into one of the following requirements categories:

- Scene Requirements
- Photographic Requirements
- Digital Requirements
- Image Compression and Interchange Format Requirements
- Image Data Guidelines

Table 1 below provides a general overview of the requirements categories, an indication of the intended readership and the sections of the document which relate to each.

In addition to the requirements are appendices intended to offer practical guidance:

- Appendix A is a quick reference offering visual guides as to what might cause an image to be non-compliant with the Standard, as well as a summary of the Standard’s requirements.
- Appendix B offers some suggestions as to how a facial image capture system might be set up. Note that these are not requirements, and are merely intended to aid in the setup of such a system rather than to dictate.

Table 2 provides a general overview of each Appendix and an indication of the intended readership.

**Table 1: Requirements Categories Overview and Readership.**

<b>Requirements category</b>	<b>General purpose</b>	<b>Suggested readership</b>	<b>Applicable sections</b>
Scene Requirements	Specifies the various scene requirements for the capture of Full Frontal Face and/or SMT images.	Individuals responsible for the physical capture and storage of images  Individuals responsible for the physical setup and maintenance of image capture systems	All of section 3
Photographic Requirements	Specifies the various photographic requirements for the capture of Full Frontal Face and/or SMT images.	Individuals responsible for the physical setup and maintenance of image capture systems	All of section 4
Digital Requirements	Specifies the various requirements for the digital properties of Full Frontal Face and/or SMT images.	Individuals responsible for the physical setup and maintenance of image capture systems	All of section 5
Image Compression and Interchange Format Requirements	Specifies the image compression requirements and interchange format requirements for images and associated data.	Individuals responsible for the physical setup and maintenance of image capture systems	All of section 6
Image Data Guidelines	Provides an outline of the data that should be recorded with each Facial and/or SMT image that is intended for storage purposes and which may aid in the process of searching for, and retrieving, such images for the purpose of, for example, identification, intelligence and	Individuals responsible for the physical setup and maintenance of image capture systems  Individuals responsible for the physical capture and storage of images	All of section 7

Requirements category	General purpose	Suggested readership	Applicable sections
	investigation.		

**Table 2: Appendices Overview and Readership.**

Guidance category	General purpose	Suggested readership
Appendix A : Sample Mugshot Images and Guidelines	Provides a quick reference offering visual guides as to what might cause an image to be non-compliant with the Standard, as well as a summary of the Standard’s requirements.	Individuals responsible for the physical capture and storage of images
Appendix B: Guidance for Setting up an Image Capture System	Provides an indication of the basic environmental requirements that should be considered when setting up an image capture system.	Individuals responsible for the physical setup and maintenance of image capture systems

## NOT PROTECTIVELY MARKED

With the exception of "Image Data Guidelines" (section 7), the following format is used to express requirements in each of the requirements categories:

<b>Enforcement:</b>	
<b>Applies to image type(s):</b>	
<b>Requirement (as a minimum):</b>	
<b>Rationale:</b>	
<b>Quality Assurance:</b>	
<b>Requirement (as a medium to long term):</b>	

The "**Enforcement**" cell indicates whether the requirement for the Standard is "Mandatory" or "Recommended". A Mandatory enforcement denotes that the requirement must be implemented in order to adhere to the Standard. A Recommended enforcement denotes that the requirement is a recommendation and does not have a significant impact on the adherence to the Standard if it is not implemented (i.e. failure to comply will not *necessarily* result in a non-compliant image).

The "**Applies to image type(s)**" cell indicates which type(s) of image the requirement applies to. An image type may be a "Facial Image"; a "Full Body Profile Image" or a "SMT Image".

The "**Requirement (as a minimum)**" cell specifies the minimum requirement needed to achieve compliance with this standard. The enforcement qualifier (i.e. Mandatory or Recommended) is directly associated with this requirement.

The "**Rationale**" cell specifies the reasoning behind the given requirement (i.e. why the requirement exists and why it should be implemented in a given manner).

The "**Quality Assurance**" cell suggests techniques or measures that may be applied for ensuring compliance of the requirement to the Standard.

The "**Requirement (as a medium to long term)**" cell highlights any identified medium to long term requirements that may need to be implemented for the future business needs of law enforcement agencies and/or to facilitate developments within the facial biometrics field.

### 1.7 Obtaining This Document Electronically

This document can be obtained via the internet at the following location <http://www.npia.org.uk/products/FIND.php>.

## 2 Definitions, Acronyms and Abbreviations

For the purpose of this Standard the following definitions, acronyms and abbreviations apply:

### **2D Image**

A 2D image refers to a conventional digital image containing data points (pixel values) that vary in two perpendicular directions (namely X and Y), across from left to right and top to bottom.

### **3D Image**

A 3D image differs from a conventional 2D image (as defined above) in that it also contains data points that vary in a third direction (namely Z) also perpendicular to X and Y. Visually, this may be perceived as a set of points coming out of a page, hence providing depth (or range) information. With this additional data, features in the image (for example, length of the nose) which are not available in a 2D full face image can improve both automated and manual identification. For example, the image might be rotated and tilted so that it can be viewed from any angle.

### **ACPO**

Abbreviation for: the Association of Chief Police Officers.

### **ACPOS**

Abbreviation for: the Association of Chief Police Officers in Scotland.

### **Aperture**

The opening in a camera lens through which light passes; measured in f-stops.

### **ANSI**

Abbreviation for: the American National Standards Institute, Inc.

### **Colour Balance**

The accuracy with which the colours captured in the image match those present in the original scene.

### **Colour Space**

A colour model plus a colour mapping function. The colour space defines the range of colours that can be captured/displayed/reproduced. There can be many different types of colour space, depending on the application being used.

### **Compression**

A process for reducing the number of bits needed to represent source image data. Compression can take one of two forms; lossy compression (some detail is sacrificed when reducing the size of the source image), and lossless compression (the data is compressed as much as possible with no loss of detail whatsoever). See definitions for JPEG and JPEG 2000.

### **Contact Lens**

A thin plastic lens designed to fit over the cornea, usually for the correction of refractive error.

### **Cornea**

The transparent surface that covers the pupil and iris and provides most of the eye's optical power.

### **Continuous Tone Image**

An image whose components have more than one bit per pixel.

### **CorDM**

Abbreviation for: the Corporate Data Model. A Corporate Data Model developed by PITO (and now maintained by the NPfA) for the police service (on behalf of ACPO) within England, Wales and Northern Ireland.

### **CRO Number**

Abbreviation for: the Criminal Records Office Number. A unique number associated with each individual criminal record held on the PNC Names Application and allocated following the creation of a new fingerprint record on the UK national police fingerprint system (IDENT1).

### **Diffused Lighting**

Lighting that is low or moderate in contrast, such as that found on an overcast day and which does not cast any strong shadows.

### **Digital**

Any data that is composed of a discrete sample or collection of discrete samples that are represented as finite numbers.

### **DNA**

Abbreviation for: Deoxyribonucleic Acid.

### **Encoding Process**

A process for the extraction of feature data from an image for automated matching purposes.

### **Exif**

Exchangeable Image File format is a specification for the image file format used by digital cameras. It was created by the Japan Electronic Industry Development Association. The specification uses the existing JPEG TIFF and RIFF WAVE file formats, with the addition of specific metadata tags. Note that it is not supported in JPEG 2000 or PNG.

### **Exposure**

In photographic terms this is the product of the *intensity* of the light and the *time* it is allowed to act on the digital camera sensor or film.

### **Facial Image**

An electronic colour image based representation of the portrait of a person with sufficient resolution for both human examination and automated facial identification. The image includes the full head (with all hair in most cases), as well as the neck, ears and shoulders. In this document the term is used interchangeably with Full Frontal Face Image and Mugshot Image.

### **FIND**

Abbreviation for: the Facial Images National Database. FIND is the planned National Facial Images Database that will allow the police service in England, Wales and Scotland to receive, store and retrieve facial images (Mugshots) including the ability to receive, store and retrieve marks and features. These images would normally have been captured in a custody environment.

### **Full Body Profile Image**

An electronic colour image based representation of the full body (i.e. a frontal image from head to toe) of a person with sufficient resolution for visual examination.

### **Full Frontal Face Image**

See definition for Facial Image

### **Focal Length**

The distance between the film (or digital camera sensor) and the optical centre of the lens when the lens is focused on infinity. The focal length of the lens on most adjustable cameras is marked in millimetres on the lens mount.

### **FS Code**

Abbreviation for: Force and Station Code. A reference used within the PNC for identifying the police force area and the individual police station within the force area. It is made up of two numbers (identifying the force) followed by two characters (identifying the station).

### **Human Examination**

The process of careful human comparison of a facial image with either a person or another facial image to ascertain the identity of the respective person by a detailed examination of facial features.

### **Human Verification**

The process of human comparison of a Facial Image with a person or another facial image to confirm the identity of the respective person in a short time period. This is sometimes referred to as one-to-one (1:1) comparison.

### **Identification**

The process of searching through a list of Facial Images to find possible matches to an input image. This is sometimes referred to as one-to-many (1:N) comparison. This may be a manual or an automated process.

### **ICAO**

Abbreviation for: the International Civil Aviation Organization.

### **IEC**

Abbreviation for: the International Electrotechnical Commission.

### **Image**

A representation that encodes the luminance and texture of an object in a given lighting environment. In this document the term is used to refer to Facial, Mugshot; Full Body Profile; and/or SMT Images. Within this document – unless otherwise stated – 'Image' will refer to a 2-dimensional (2D) image.

### **Image Aspect Ratio**

The Width-to-Height aspect ratio of a captured image.

### **Image Compression**

The process of reducing the size of a data file (see Compression).

### **Interchange Format**

The representation of compressed image data for exchange between application environments.

### **Iris**

The round, pigmented membrane surrounding the pupil of the eye, having muscles that adjust the size of the pupil to regulate the amount of light entering the eye.

**IPS**

Abbreviation for: the Identity and Passport Service (which also includes the former United Kingdom Passport Agency - UKPA).

**ISO**

Abbreviation for: the International Organization for Standardization.

**ISO Setting**

The ISO setting controls a camera's sensitivity to light. The lower the setting, the slower the response of the sensor (or film) to light. Higher ISO settings indicate a higher sensitivity to light, so less time is needed to expose a picture. Most digital cameras provide a facility to adjust the ISO setting to allow the user to select higher shutter speeds and/or smaller apertures, according to circumstances.

**ISS4PS**

Abbreviation for: the Information Systems Strategy for the Police Service. Developed by PITO (and now maintained by the NPIA), ISS4PS is an ACPO strategy prepared for the police service outlining an increased role for IT in information systems to help meet the Government's aim of modernising policing.

**ITU**

Abbreviation for: the International Telecommunication Union.

**JFIF**

Abbreviation for: JPEG File Interchange Format. JFIF is a minimal file format, which enables JPEG bit streams to be exchanged between a wide variety of platforms and applications.

**JPEG**

JPEG is one of two preferred compression standards (the other being JPEG 2000) for continuous tone images. It was published in 1993 as ISO 10918-1 and ITU-TT.81. It was produced by the Joint Photographic Experts Group.

**JPEG 2000**

JPEG 2000 is the latest series of compression standards for continuous tone images. It was produced by the Joint Photographic Experts Group and published in 2000 as ISO 15444.

**Left Head Turn Image**

An electronic colour image based representation of the portrait of a person where the head is turned towards the left at a 45 degree or 90 degree turn with sufficient resolution for human examination.

**Lens**

One or more pieces of optical glass or similar material designed to collect and focus rays of light to form a sharp image on the film or digital camera sensor.

**Metadata**

Metadata is information about a particular data set (which in this context could be a Mugshot Image) which may describe, for example, how, when, and by whom it was received, created, accessed, and/or modified and how it is formatted. Some metadata, such as file dates and sizes, can easily be seen by users; other metadata can be hidden or embedded in the data set itself and may not be easily accessible. It is frequently referred to by the less informative shorthand phrase "data about data," and can also describe the content, quality, condition, history, and other characteristics of the data.

### **Mugshot Image**

An electronic colour image based representation of the portrait of a person with sufficient resolution for human examination as well as reliable computer facial identification. The image includes the full head with all hair in most cases, as well as neck and shoulders. In this document the term is used interchangeably with Facial image and Full Frontal Face image.

### **Neutral Grey Card**

A grey test card without any hue, typically of 18% reflectance, used to set up and calibrate photographic lighting systems and cameras.

### **NIST**

Abbreviation for: the U.S. National Institute of Standards and Technology.

### **NPIA**

The National Policing Improvement Agency is the organisation that has taken over from PITO as of 1<sup>st</sup> of April 2007 to support self-improvement across the police service and to drive forward the Home Secretary's national critical programmes detailed in the National Community Safety Plan.

### **Nominal**

The descriptive details (name, age, sex, colour and height) of a named person (subject) to which an individual record refers.

### **PACE**

Abbreviation for: the Police and Criminal Evidence Act 1984.

### **PITO**

Abbreviation for: the Police Information Technology Organisation. Note that PITO ceased to exist at the end of March 2007 and has now been replaced by the NPIA (see NPIA).

### **Pixel**

A pixel is a picture element - one of an  $n$  by  $m$  matrix of picture elements, where  $n$  is the number of pixels in the horizontal direction and  $m$  is the number in the vertical direction.

### **Pixel Aspect Ratio**

The 'Width-to-Height' ratio for the pixels that make up a captured image. A 1:1 pixel aspect ratio means a sampled image will have the same number of pixels *per unit length* in the vertical dimension as it does in the horizontal dimension. Often quoted as ppi (pixels per inch) or ppm (pixels per millimetre).

### **PNC**

Abbreviation for: the Police National Computer.

### **PNC Names Application**

Criminal Names Database Application held on the PNC.

### **PNCID Number**

Abbreviation for Police National Computer Identification Number. A unique system generated reference number issued to each record in the PNC Names Application.

### **Portrait**

A photograph of a person. The portrait will include the full head with all hair in most cases, as well as neck and top of shoulders. See definition for Full Frontal Face.

### **Red Eye**

An unwanted artefact on a facial image whereby light (often from a flash gun mounted on the camera) is reflected back from the rear of the eye resulting in the subject's eyes appearing to be red in the image. This can usually be avoided by moving the light source(s) away from the camera.

### **Region Of Interest (ROI)**

This is a portion of a JPEG-encoded image that is marked with the intention of its being less compressed than the rest of the image, so that fewer artefacts and inaccuracies will appear in this region. An obvious example of where this is of use is in facial images, where the face is marked as a region of interest but the background is not, as compression artefacts in the background are far less of a problem.

### **RGB**

Red, Green, Blue used to represent colour pixels comprised of a specified number of bits to represent each of these primary colour components.

### **Right Head Turn Image**

An electronic colour image based representation of the portrait of a person where the head is turned towards the right at a 45 degree or 90 degree turn with sufficient resolution for human examination.

### **Shutter Speed**

The camera's shutter speed is a measurement of how long its shutter remains open as the picture is taken. The slower the shutter speed, the longer the exposure time.

### **SLR**

Abbreviation for: Single Lens Reflex (as used when referring to a type of camera).

### **SMT**

Abbreviation for: Scar, Mark and Tattoo.

### **sRGB**

sRGB (Standard RGB) colour space is a standardised RGB colour space created cooperatively by Hewlett-Packard and Microsoft Corporation for use on monitors, printers, and the Internet. It has been endorsed by the World Wide Web Consortium (W3C) and other industry players, is also well accepted by open-source graphics and image editing applications such as the GIMP (GNU Image Manipulation Program) and is used in proprietary and open graphics file formats such as JPEG. The aim of this colour space is to complement the current colour management strategies by enabling a method of handling colour in the operating systems, device drivers and the Internet that utilises a simple and robust device independent colour definition. This is to provide good quality and backward compatibility with minimum transmission and system overhead. Based on a calibrated colorimetric RGB colour space well suited to Cathode Ray Tube (CRT) monitors, television, scanners, digital cameras, and printing systems, such a space can be supported with minimum cost to software and hardware vendors.

### **Still Image**

A static photograph.

### **Three-Point Balanced Lighting**

A lighting arrangement for subject illumination which consists of (a minimum of) three point balanced illumination. Two points of illumination should be placed at approximately 45 degrees on either side of the subject's face, the third point should be placed so as to uniformly illuminate the background.

### **UML**

Abbreviation for: Unified Modelling Language™ (UML). This is an industry standard language for specifying, visualising, constructing, and documenting the artefacts of software systems.

### **Verification**

The process of ascertaining that two images or image inputs represent the same person. Also known as one-to-one (1:1) matching. This may be a manual or an automated process.

### **XML**

Abbreviation for: Extensible Mark-up Language. A text format designed to ease data exchange and publishing.

### **XMP**

Abbreviation for: eXtensible Metadata Platform (designed by Adobe).

### 3 Scene Requirements

#### 3.1 Purpose

This section specifies the various scene requirements for the capture of images.

**Note:** Where the capture, retention and use of images are for operational policing (i.e. necessary for preventing, detecting or investigating crime), the provisions of the Police and Criminal Evidence Act 1984 (PACE) and the Code of Practice for the identification of persons by police officers (PACE Code D) should be applied.

##### 3.1.1 Pose

<b>Enforcement:</b>	<b>Mandatory</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial Image</li> </ul>
<b>Requirement (as a minimum):</b>	The Full Frontal Face image shall be captured.
<b>Rationale:</b>	This is a mandatory subject pose if subjects are to be identified by their Mugshot image, either by a human, or (and especially) by automated software.
<b>Quality Assurance:</b>	<p>Ensure the captured image:</p> <ul style="list-style-type: none"> <li>• Includes the full head with all hair in most cases, as well as neck, shoulders and ears;</li> <li>• Shows the subject looking directly at the camera;</li> <li>• Shows the subject facing square on to the camera, not looking over one shoulder or tilted, and showing both edges of the subject's face clearly; and</li> <li>• Clearly shows the iris and pupil of the subject's eyes (where possible). Exceptions to this are for a subject that is wearing an eye patch, tinted eyeglasses or coloured contact lens.</li> </ul> <p><u>Rotation of the head</u></p> <p>Rotation of the head should be less than +/- 5 degrees from frontal in every direction - up/down, rotated left/right, and tilted left/right.</p> <p><u>Long hair</u></p> <p>If a subject has long hair that obscures a region of the face and/or ears, the hair should be tied back or positioned so as to prevent this.</p> <p><u>Head covering</u></p> <p>Head coverings should be removed when capturing Facial images. However the provisions for removal of head coverings</p>

	<p>will need to be assessed in accordance with the current Police and Criminal Evidence Act 1984 (PACE).</p> <p><u>Tinted eyeglasses</u></p> <p>If the iris and pupil of the subject's eyes is obscured/not visible due to the subject wearing tinted eyeglasses, a separate Full Frontal Face image should be captured without eyeglasses. See section 3.1.2 (Pose With and Without Eyeglasses) for further details.</p> <p><u>Contact lenses</u></p> <p>If a subject is wearing contact lenses that are coloured or which have a design that obscures the natural eye features (iris and pupil) the data to be recorded (as part of storing Facial images) should include information such as the colour of the contact lens for each eye and an indication of the natural eye colour (if possible). See section 7 (Image Data Guidelines) for further details.</p>
<p><b>Requirement (as a medium to long term):</b></p>	<p>The following two requirements are presented as information only. They are stated here as possible future requirements in order to facilitate business needs of law enforcement agencies and to facilitate developments within the facial biometrics field.</p> <p>1) In addition to the Full Frontal Face image, the following images shall be captured:</p> <ul style="list-style-type: none"> <li>• a Left Head Turn image (approximately 90 degree);</li> <li>• a Right Head Turn image (approximately 90 degree);</li> <li>• a Left Head Turn image (approximately 45 degree);</li> <li>• a Right Head Turn image (approximately 45 degree);</li> <li>• a downward facing image (approximately 20 to 45 degree) to mimic CCTV captured image; and</li> <li>• a upward facing image (approximately 20 to 45 degree);</li> </ul> <p>2) A Full Body Profile image (i.e. from head to toe) shall be captured as an additional image type.</p> <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>• For Full Body Profile Images: <ul style="list-style-type: none"> <li>○ As a guide Full Body Profile images should be captured with a minimum image resolution of 333 pixels in the horizontal direction by 800 pixels in the vertical direction.</li> <li>○ The camera should be positioned sufficiently faraway from the subject so as to avoid distortion of the image (as a guide preferably 3 metres or more).</li> </ul> </li> </ul>

### 3.1.2 Pose With and Without Eyeglasses

<b>Enforcement:</b>	<b>Mandatory</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial Image</li> </ul>
<b>Requirement (as a minimum):</b>	<p>For subjects who normally wear eyeglasses the following images shall be captured:</p> <ul style="list-style-type: none"> <li>• a Full Frontal Face image without eyeglasses; and</li> <li>• a Full Frontal Face image with eyeglasses.</li> </ul>
<b>Rationale:</b>	<p>Eyeglasses may cause glare while the image is being taken, and so an image with the subject not wearing them is required. In addition, an image taken without eyeglasses may help automated facial recognition software identify a subject.</p>
<b>Quality Assurance:</b>	<p>Ensure:</p> <ul style="list-style-type: none"> <li>• the frame of the eyeglasses does not cover any part of the subject's eye; and</li> <li>• no (or minimal) lighting reflections are visible on the eyeglasses of the captured image.</li> </ul> <p>See section 3.1.5 (Lighting for Eyeglasses) for details of how to illuminate (or minimise) lighting reflections on eyeglasses.</p>
<b>Requirement (as a medium to long term):</b>	<p>Where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1), it would be advantageous if each image can be captured with and without eyeglasses.</p>

### 3.1.3 Expression

<b>Enforcement:</b>	<b>Recommended</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial Image</li> <li>• Full Body Profile Image</li> </ul>
<b>Requirement (as a minimum):</b>	<p>The facial expression of the subject should be neutral (non-smiling) with both eyes open and mouth closed.</p>
<b>Rationale:</b>	<p>Both pose and expression of the subject will strongly affect performance of automated face recognition systems. These recommendations will give best results from such systems.</p>
<b>Quality Assurance:</b>	<p>Every effort should be made to ensure the facial expression of the subject is neutral. Particular attention should be paid to avoid the following examples of non-recommended expressions:</p> <ul style="list-style-type: none"> <li>• A smile where the inside of the mouth is exposed (jaw</li> </ul>

	<p>open).</p> <ul style="list-style-type: none"> <li>• A deliberate/intentional smile.</li> <li>• Raised eyebrows.</li> <li>• Closed eyes.</li> <li>• Eyes looking away from the camera.</li> <li>• Squinting.</li> <li>• Frowning.</li> <li>• Hair covering eyes.</li> <li>• Frame of eyeglasses covering part of the eye.</li> </ul>
<b>Requirement (as a medium to long term):</b>	This requirement should be adhered to where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1).

*3.1.4 Lighting*

<b>Enforcement:</b>	<b>Recommended</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial Image</li> <li>• SMT Image</li> <li>• Full Body Profile Image</li> </ul>
<b>Requirement (as a minimum):</b>	An appropriate lighting solution shall be employed to uniformly illuminate the image being captured and the background.
<b>Rationale:</b>	Correct lighting of the subject will allow consistent looking images which will facilitate their use in, for example witness albums. Furthermore this will allow automated face recognition systems to function effectively, and help eliminate distractions in the image for visual examination.
<b>Quality Assurance:</b>	<p>When capturing Full Frontal Face images ensure:</p> <ul style="list-style-type: none"> <li>• The lighting is equally distributed on each side of the face and from top to bottom.</li> <li>• The region of the face, from the crown (top of natural hairline or top of visible head if balding) to the base of the chin, and from ear-to-ear, is clearly visible and free of shadows.</li> <li>• There are no shadows across the subject’s face as a result of head covering which cannot be removed for religious reasons.</li> <li>• There are no shadows (caused by the brow) in the eye-sockets.</li> <li>• The iris and pupil of the eyes are clearly visible (every effort should be made to avoid “red-eye”).</li> </ul>

**NOT PROTECTIVELY MARKED**

	<ul style="list-style-type: none"> <li>• There are no shadows visible on the background.</li> <li>• No visible “hot spots” (glare) on the face (typically appear on the cheeks and forehead) or the background.</li> <li>• The lighting intensity is sufficient to meet the photographic requirements detailed in section 4 with regard to Shutter Speed and ISO Setting.</li> </ul> <p>When capturing SMT images ensure:</p> <ul style="list-style-type: none"> <li>• there is no (or minimal) shadows and/or hot spots on the image or the background.</li> </ul> <p>Note:</p> <ul style="list-style-type: none"> <li>• Uniformity of illumination of Facial/SMT image being captured and the background may be accomplished by:             <ul style="list-style-type: none"> <li>○ using Three-Point Balanced Lighting sources. A single bare “point” light source, such as a camera flash, is not recommended;</li> <li>○ avoiding natural (e.g. day light), fluorescent and coloured (e.g. yellow, red etc) lighting and</li> <li>○ avoiding ‘mixed’ lighting from different types of light sources.</li> </ul> </li> <li>• Appropriate diffused lighting techniques such as umbrella lighting may be employed and positioned to minimise:             <ul style="list-style-type: none"> <li>○ shadows and/or hot spots on the Facial/SMT image being captured; and</li> <li>○ shadows and/or hot spots on the background.</li> </ul> </li> </ul>
<p><b>Requirement (as a medium to long term):</b></p>	<p>This requirement should be adhered to where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1).</p>

*3.1.5 Lighting for Eyeglasses*

<p><b>Enforcement:</b></p>	<p><b>Recommended</b></p>
<p><b>Applies to image type(s):</b></p>	<ul style="list-style-type: none"> <li>• Facial Image</li> </ul>
<p><b>Requirement (as a minimum):</b></p>	<p>Where a Full Frontal Face image is captured with the subject wearing eyeglasses, there shall be no (or minimal) lighting reflections on the eyeglasses.</p>
<p><b>Rationale:</b></p>	<p>Automated face recognition systems may have trouble detecting eye points if there is significant lighting reflection on eyeglasses.</p>
<p><b>Quality Assurance:</b></p>	<p>Elimination or reduction in reflective lighting in eyeglasses can typically be achieved by increasing the angle between the lighting, subject and camera to 45 degrees or more.</p>

## NOT PROTECTIVELY MARKED

	The requirement and quality assurance guidelines in Section 3.1.4 (Lighting) should be employed.
<b>Requirement (as a medium to long term):</b>	This requirement should be adhered to where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1).

### 3.1.6 Background

<b>Enforcement:</b>	<b>Mandatory</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"><li>• Facial Image</li><li>• SMT Image</li><li>• Full Body Profile Image</li></ul>
<b>Requirement (as a minimum):</b>	The subject whose Facial Image, Full Body Profile Image and/or SMT Image is being captured shall be positioned in front of a plain, smooth, flat background with an 18% shade of grey.
<b>Rationale:</b>	18% grey is the recommended shade of colour as specified by the NIST Best Practice Recommendation For The Capture Of Mugshots v2 <sup>2</sup> . The BS ISO/IEC 19794-5:2005 standard (clause A.2.4.4) states that a typical background to enhance machine-assisted face recognition performance is 18% grey. A standard background will also assist in consistent looking images, for example where Facial Images are required for witness albums.
<b>Quality Assurance:</b>	<p>A recommended 18% shade of grey colour to use is defined as the British Standard code BS4800 BS00A01 (Pebble Grey Vinyl Matte).</p> <p>A Kodak or other neutral gray card or densitometer may be used to verify the 18% grey reflectance requirement. If the background is painted, matte paint should be used as opposed to any form of gloss paint. This is because matte paint is not as shiny as gloss and will minimise reflective lighting from the background.</p> <p>The subject should be positioned roughly two feet (70cm) in front of the background.</p> <p>Ensure:</p> <ul style="list-style-type: none"><li>• the background completely fills the frame behind the image being captured;</li><li>• the background is regularly maintained and cleaned;</li><li>• the background does not include any additional objects (furniture, people etc) when capturing an image;</li><li>• the boundary between the head and the background is clearly identifiable.</li></ul>

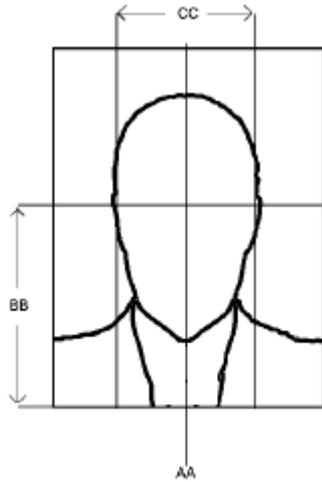
<sup>2</sup> Text located at [http://www.itl.nist.gov/iad/894.03/face/bpr\\_mug3.html](http://www.itl.nist.gov/iad/894.03/face/bpr_mug3.html)

	<ul style="list-style-type: none"> <li>no shadows are visible on the background behind the image; and</li> <li>the requirement and quality assurance guidelines in Section 3.1.4 (Lighting) are employed.</li> </ul>
<b>Requirement (as a medium to long term):</b>	This requirement should be adhered to where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1).

*3.1.7 Centring Full Frontal Face Images*

<b>Enforcement:</b>	<b>Mandatory</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>Facial Image</li> </ul>
<b>Requirement (as a minimum):</b>	<p>The head should be centred in the Full Frontal Face image with the nose horizontally centred.</p> <p>See Figure 1: Centring Full Frontal Face Image.</p>
<b>Rationale:</b>	This both helps automated face recognition systems to perform effectively, and allows JPEG 'region of interest' (ROI) encoding to be used easily.
<b>Quality Assurance:</b>	<p>The Full Frontal Face Image being captured shall be positioned to satisfy all of the following conditions:</p> <ul style="list-style-type: none"> <li>The approximate horizontal midpoints of the mouth and of the bridge of the nose shall lie on an imaginary vertical straight line positioned at the horizontal centre of the image. See line AA in Figure 1.</li> <li>An imaginary horizontal line through the centre of the subject's eyes shall be located at approximately the 55% point of the vertical distance up from the bottom edge of the captured image. See line BB in Figure 1. <ul style="list-style-type: none"> <li>The width of the subject's head shall occupy approximately 50% of the width of the total image width. This width shall be the horizontal distance between the midpoints of two imaginary vertical lines. Each imaginary line shall be drawn between the upper and lower lobes of each ear and shall be positioned where the external ear connects to the head. See lines CC in Figure 1.</li> </ul> </li> </ul> <p>The entire head, neck, shoulders and ears should be clearly visible in a Full Frontal Face Image being captured.</p>
<b>Requirement (as a medium to long term):</b>	Where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1), every effort should be made to capture the image in the centre of the frame.

**Figure 1: Centring Full Frontal Face Image.**



*3.1.8 Centring SMT Images*

<b>Enforcement:</b>	<b>Recommended</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>SMT Image</li> </ul>
<b>Requirement (as a minimum):</b>	The entire SMT image should be clearly visible and as near to the centre of the frame as possible.
<b>Rationale:</b>	Aids in the identification, by the examiner, of the pictured scar, mark, or tattoo.
<b>Quality Assurance:</b>	If appropriate a ruler may be placed in such an image to illustrate its relative dimensions.
<b>Requirement (as a medium to long term):</b>	None

## 4 Photographic Requirements

### 4.1 Purpose

This section specifies the various photographic requirements for the capture of images.

#### 4.1.1 Focus and Depth of Field

<b>Enforcement:</b>	<b>Mandatory</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial Image</li> <li>• SMT Image</li> <li>• Full Body Profile Image</li> </ul>
<b>Requirement (as a minimum):</b>	The subject's captured Full Frontal Face Image, Full Body Profile image and/or SMT image shall always be in focus.
<b>Rationale:</b>	Aids in the identification, by the human examiner or an automated face recognition system of the captured image. This is essential for automated facial recognition software to function correctly.
<b>Quality Assurance:</b>	<p>Ensure:</p> <ul style="list-style-type: none"> <li>• Full Frontal Face Images are in focus from the tip of the nose to the ears and chin to crown; and</li> <li>• SMT Images are in focus (in their entirety if possible).</li> </ul> <p><b>Note:</b></p> <ul style="list-style-type: none"> <li>• If as a result of ensuring focus the background behind the image being captured becomes out of focus, this is not a problem as the emphasis is on the focus of the image.</li> <li>• If a SMT image cannot be captured in it's entirety or be kept in focus, owing to the image extending over a large part of the body or around curved surfaces, a single image should be captured that shows a part of the image in a broad as possible range which does not include the curved part of the body's surface and is in focus.</li> </ul>
<b>Requirement (as a medium to long term):</b>	This requirement should be adhered to where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1).

4.1.2 Focal Length

<b>Enforcement:</b>	<b>Recommended</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial Image</li> <li>• SMT Image</li> <li>• Full Body Profile Image</li> </ul>
<b>Requirement (as a minimum):</b>	The focal length of the camera should be sufficient to minimise distortion of the image.
<b>Rationale:</b>	If the camera is too close to the subject distortion of the image can occur.
<b>Quality Assurance:</b>	For most digital cameras a focal length of between 70 to 100mm is recommended. (This equates to a camera to subject distance of around 1.5M or greater).
<b>Requirement (as a medium to long term):</b>	This requirement should be adhered to where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1).

4.1.3 Exposure

<b>Enforcement:</b>	<b>Recommended</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial Image</li> <li>• SMT Image</li> </ul>
<b>Requirement (as a minimum):</b>	For each patch of skin on the subject's face and/or the SMT image, the gradations in textures shall be clearly visible.
<b>Rationale:</b>	This is so there will be no saturation on the image which will aid the identification by a human examiner or an automated face recognition system.
<b>Quality Assurance:</b>	<p>Ensure there is no saturation (over or under exposure) on the image being captured.</p> <p>Note that in digital image capture, slight under exposure is preferable to over exposure. This is because under exposed images are easier to correct in post processing than over exposed images.</p>
<b>Requirement (as a medium to long term):</b>	This requirement should be adhered to where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1).

4.1.4 Image Aspect Ratio

<b>Enforcement:</b>	<b>Mandatory</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial</li> <li>• SMT Image</li> </ul>
<b>Requirement (as a minimum):</b>	The Width:Height aspect ratio of captured Full Frontal Face and/or SMT images shall be 1:1.25 (i.e. 4:5).
<b>Rationale:</b>	This is a very practical image aspect ratio, given that the Mugshot image will generally be a little taller than it is wide. It is also recommended by the NIST Best Practice Recommendation For The Capture Of Mugshots v2 <sup>3</sup> , and recommended by the BS ISO/IEC 19794-5:2005 standard (clause A.3.2.1).
<b>Quality Assurance:</b>	<p>Note:</p> <ul style="list-style-type: none"> <li>• Digital SLR cameras and 35mm wet film cameras have an image aspect ratio of 2:3 and as a result images from these devices will need to be cropped. This must be taken into account when setting up the camera.</li> </ul>
<b>Requirement (as a medium to long term):</b>	<p>Along with a higher overall image resolution (see medium to long term requirement of section 5.1.1), an image aspect ratio of 3:4 should be used in the capture of Facial images. This is mainly a practical consideration, as most modern compact digital cameras' default image aspect ratio is 3:4.</p> <p>In addition, this is the recommended image aspect ratio as specified in the NIST "enhanced best practice recommendation" (EBPR)<sup>4</sup>, for level 40 SAP (Subject Acquisition Profile) images.</p> <p><b>Note:</b></p> <p>This level 40 SAP describes an enhanced Facial image type that would be desirable to move to in the future, to further improve the quality of Full Frontal Face images. The current requirements specified within this Standard for Facial Images are equivalent to those regarded by NIST as achieving level 30 SAP (i.e. they adhere to the NIST Best Practice Recommendation For The Capture Of Mugshots v2).</p> <p>For backward compatibility it is anticipated that the FIND system will be capable of accepting both level 30 and 40 SAP Facial Images for the foreseeable future.</p>

<sup>3</sup> Text located at [http://www.itl.nist.gov/iad/894.03/face/bpr\\_mug3.html](http://www.itl.nist.gov/iad/894.03/face/bpr_mug3.html)

<sup>4</sup> Proposed ANSI/NIST-ITL 1-2007, Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information, 11 January 2007. Note this document also includes: Annex I - Best Practice Image Capture Requirements for SAP Levels 40, 50, and 51.

4.1.5 Shutter Speed

<b>Enforcement:</b>	<b>Recommended</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial Image</li> <li>• SMT Image</li> <li>• Full Body Profile Image</li> </ul>
<b>Requirement (as a minimum):</b>	The camera shutter speed shall be sufficiently fast so as to prevent blurring of the image due to movement of either the subject or the camera.
<b>Rationale:</b>	To ensure image detail is accurately captured.
<b>Quality Assurance:</b>	As a guide the shutter speed should be of one over the focal length of the lens or faster, for example for a 70mm lens a shutter speed of 1/70 <sup>th</sup> of a second or faster is preferred.
<b>Requirement (as a medium to long term):</b>	This requirement should be adhered to where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1).

4.1.6 ISO Setting ("film speed")

<b>Enforcement:</b>	<b>Mandatory</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial Image</li> <li>• SMT Image</li> <li>• Full Body Profile Image</li> </ul>
<b>Requirement (as a minimum):</b>	Where the ISO speed setting on the camera is adjustable, it shall be set to the lowest value.
<b>Rationale:</b>	To avoid electronic "noise" from camera sensor being introduced into the image (thereby causing grainy images).
<b>Quality Assurance:</b>	As a guide a value of 200 or lower as the ISO Setting is preferred.
<b>Requirement (as a medium to long term):</b>	This requirement should be adhered to where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1).

4.1.7 Colour Balance (Calibration)

<b>Enforcement:</b>	Recommended
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial Image</li> <li>• SMT Image</li> <li>• Full Body Profile Image</li> </ul>
<b>Requirement</b>	As part of setting up an image capture system, the colour

**NOT PROTECTIVELY MARKED**

<b>(as a minimum):</b>	balance setting on the camera (where available) should be adjusted to ensure the colours are accurately captured.
<b>Rationale:</b>	To avoid images with colour tints (i.e. too much red, too much blue etc).
<b>Quality Assurance:</b>	The colour balance of the camera may calibrated using the 18% grey background.
<b>Requirement (as a medium to long term):</b>	This requirement should be adhered to where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1).

## 5 Digital Requirements

### 5.1 Purpose

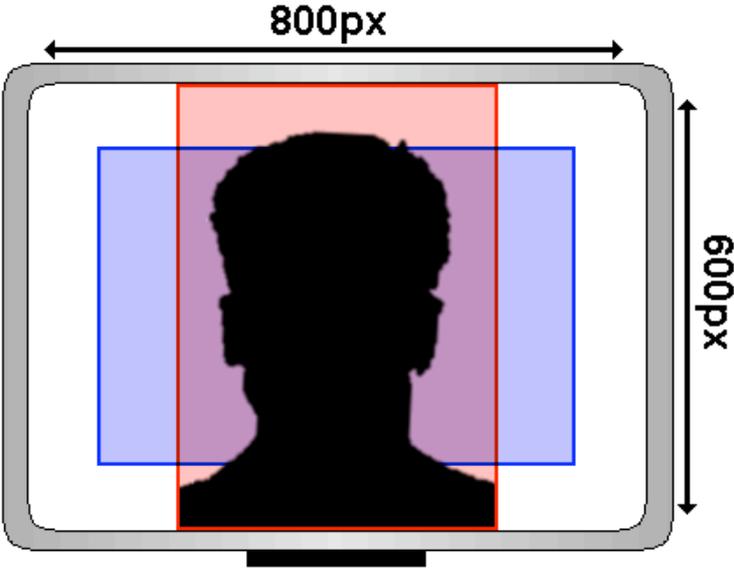
This section specifies the various requirements for the digital properties of images being captured.

#### 5.1.1 Image Resolution - Minimum Number of Pixels

<b>Enforcement:</b>	<b>Mandatory</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial Image</li> <li>• SMT Image</li> </ul>
<b>Requirement (as a minimum):</b>	The <b>minimum</b> image resolution of Full Frontal Face and/or SMT Images shall be 480 pixels in the horizontal direction by 600 pixels in the vertical direction.
<b>Rationale:</b>	<p>Allows images of sufficient quality to be captured for the purposes of facial recognition by automated software.</p> <p>This target minimum image resolution is acknowledged by the NIST Best Practice Recommendation For The Capture Of Mugshots v2<sup>5</sup>.</p>
<b>Quality Assurance:</b>	<p>It should be noted that the image quality will be improved as the number of pixels in both directions is increased. However, as images are captured with an increased number of pixels, the 1:1.25 (4:5) Width:Height image aspect ratio shall be maintained.</p> <p>Two considerations must be noted regarding this aspect of the recommendation:</p> <ul style="list-style-type: none"> <li>• First, the normal orientation of most available cameras is the landscape format, which specifies a greater number of pixels in the horizontal than in the vertical direction. Unless these cameras capture at least 600 pixels in the vertical direction, it may be necessary to rotate the camera 90 degrees.</li> <li>• Second, the 480x600 capture format exceeds the VGA display format of 640x480. Therefore, at a minimum, an SVGA specification of 800x600 pixels will be required to optimally display the Facial Image. The image will occupy less than the total number of available horizontal pixels.</li> </ul>

---

<sup>5</sup> Text located at [http://www.itl.nist.gov/iad/894.03/face/bpr\\_mug3.html](http://www.itl.nist.gov/iad/894.03/face/bpr_mug3.html)

	 <p style="text-align: center;"> <span style="color: red;">■</span> Image capture size  <span style="color: blue;">■</span> 640x480 screen resolution         </p>
<p><b>Requirement (as a medium to long term):</b></p>	<p>Along with an image aspect ratio of 3:4, (see medium to long term requirement of section 4.1.4), in the medium term a target minimum image resolution of 600 x 800 (horizontal x vertical) pixels, (progressing to 768 x 1024 pixels) will be preferred for the capture of Facial Images. This enhanced resolution offers a better quality of the image to be captured, and most modern digital cameras are capable of taking images with this resolution as standard.</p> <p>Note that in the longer term, the image resolution of 768 x 1024 pixels will become the recommended minimum resolution as specified in the NIST "enhanced best practice recommendation" (EBPR)<sup>6</sup>, for level 40 SAP (Subject Acquisition Profile).</p> <p>See the notes contained within the medium to long term requirement of section 4.1.4 for further explanation of level 40 SAP.</p>

5.1.2 Colour Space

<p><b>Enforcement:</b></p>	<p><b>Mandatory</b></p>
<p><b>Applies to image type(s):</b></p>	<ul style="list-style-type: none"> <li>• Facial Image</li> <li>• SMT Image</li> </ul>

<sup>6</sup> Proposed ANSI/NIST-ITL 1-2007, Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information, 11 January 2007. Note this document also includes: Annex I - Best Practice Image Capture Requirements for SAP Levels 40, 50, and 51.

	<ul style="list-style-type: none"> <li>• Full Body Profile Image</li> </ul>
<b>Requirement (as a minimum):</b>	Full Frontal Face and SMT Images shall be represented as 24-bit RGB colour space where for every pixel eight (8) bits will be used to represent each of the Red, Green and Blue components.
<b>Rationale:</b>	sRGB is the preferred colour space for Facial Images (as recommended by ANSI and ISO clause 7.4.2.3). This is to ensure colour images exchanged between differing systems can be correctly displayed in a device independent manner.
<b>Quality Assurance:</b>	Device profiling and colour management should conform to the current version of the International Colour Consortium (ICC) profile specification which can be can be downloaded from the ICC website <a href="http://www.color.org">www.color.org</a> .
<b>Requirement (as a medium to long term):</b>	This requirement should be adhered to where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1).

*5.1.3 Pixel Aspect Ratio*

<b>Enforcement:</b>	Recommended
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial Image</li> <li>• SMT Image</li> <li>• Full Body Profile Image</li> </ul>
<b>Requirement (as a minimum):</b>	Digital cameras and scanners used to capture Full Frontal Face and SMT Images shall use square pixels with a pixel aspect ratio of 1:1.
<b>Rationale:</b>	This is the most practical pixel aspect ratio for use with computer monitors, as well as automated face recognition systems.
<b>Quality Assurance:</b>	Note: Some video cameras do not meet this requirement for the pixel aspect ratio. As such some processing of the image may be necessary to correct this, for example through interpolation.
<b>Requirement (as a medium to long term):</b>	This requirement should be adhered to where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1).

## 6 Image Compression and Interchange Format Requirements

### 6.1 Purpose

This section specifies the image compression requirements and interchange format requirements of images and associated data.

#### 6.1.1 Compression Algorithm

<b>Enforcement:</b>	<b>Mandatory</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial</li> <li>• SMT Image</li> <li>• Full Body Profile Image</li> </ul>
<b>Requirement (as a minimum):</b>	<p>The algorithm used to compress Full Frontal Face Images, Full Body Profile Images and/or SMT Images shall conform to either:</p> <ul style="list-style-type: none"> <li>• the JPEG Sequential baseline (ISO/IEC 10918, Part1) mode of operation and formatted in the JPEG File Interchange Format (JFIF).</li> <li>• The JPEG 2000 Part-1 Code Stream Format (ISO/IEC 15444-1, Part 1) and formatted in the JPEG 2000 file format.</li> </ul>
<b>Rationale:</b>	JPEG and JPEG 2000 formats allow very good compression of photographic images, with minimal deterioration (artefacts) appearing in the image. This allows human examiners to see the Mugshot Image clearly, and automated face recognition systems to function effectively.
<b>Quality Assurance:</b>	The degree of compression (compression ratio) should be set to the lowest level in the case of original JPEGs, and to lossless where JPEG2000 compression is used. This is so that important image content is not lost or obscured by image imperfections which do not correspond to the original image being compressed.
<b>Requirement (as a medium to long term):</b>	<p>In the longer term the current intention is that the JPEG2000 format will be used with lossless compression mode to avoid any loss of image quality whatsoever.</p> <p>This requirement should be adhered to where additional images of a subject are captured (such as those described as medium to long term requirement in section 3.1.1).</p>

#### 6.1.2 Interchange Format

<b>Enforcement:</b>	<b>Mandatory</b>
<b>Applies to image type(s):</b>	<ul style="list-style-type: none"> <li>• Facial Image</li> </ul>

**NOT PROTECTIVELY MARKED**

	<ul style="list-style-type: none"> <li>• SMT Image</li> </ul>
<b>Requirement (as a minimum):</b>	The interchange of Frontal Face and SMT Images, together with textual information pertinent to the image, shall conform to Type-10 facial and SMT Image record layout of the ANSI/NIST-ITL 1-2000, Data Format for the Interchange of Fingerprint, Facial & Scar Mark & Tattoo Information – Interpol Implementation.
<b>Rationale:</b>	<p>A standard format for data interchange is necessary in order for image management a systems to exchange data with interfacing systems. The ANSI/NIST Data Format for the Interchange of Fingerprint, Facial &amp; Scar Mark &amp; Tattoo Information is a commonly used standard to exchange data between applicable systems. In addition, this format is applicable for the exchange of data with systems and parties external to the UK Police, for example, the Immigration Automated Fingerprint System (IAFS) and the Federal Bureau of Investigation (FBI) based in the USA. This standard will be the preferred format when Facial Images are exchanged in conjunction with fingerprint data. In practical terms this may not affect most local Force image management systems, but may be applicable to some specialist areas that regularly have international dealings (e.g. Serious Crimes Bureau - SCB).</p> <p>It is anticipated that an internal Police interchange format for local Force image management systems to exchange Facial Images and associated data with the central FIND system will be developed. This will use an XML based approach following CorXML guidelines (see Image Data Guidelines, section 7).</p>
<b>Quality Assurance:</b>	<p>The latest version of the ANSI/NIST-ITL 1-2000, Data Format for the Interchange of Fingerprint, Facial &amp; Scar Mark &amp; Tattoo Information – Interpol Implementation can be downloaded from:</p> <p><a href="http://www.interpol.int/Public/Forensic/fingerprints/RefDoc/">http://www.interpol.int/Public/Forensic/fingerprints/RefDoc/</a></p>
<b>Requirement (as a medium to long term):</b>	The ANSI/NIST Data Format for the Interchange of Fingerprint, Facial & Scar Mark & Tattoo Information data interchanges standard is currently under revision and any modifications required as a result to this Standard will be reflected in subsequent versions.

## Image Data Guidelines

### 7.1 Purpose

This section provides an outline of the data that should be recorded with each image type which is intended for storage purposes and which may aid in the process of searching and retrieving the images for the purpose of, for example, identification, intelligence and investigation.

**Note:**

The requirements within this section are not exhaustive or mandatory and should be viewed in conjunction with the latest version of the Police Corporate Data Model (CorDM).

### 7.2 CorDM Data Standards

It is recommended that the recording of data for images within a police image capture/retrieval system is compliant with the CorDM Data Standards. The rationale for making this recommendation is to ensure that the recording and subsequent usage of image data is aligned with the vision for the future of the Information Systems Strategy (ISS) for the police service within England, Wales and Northern Ireland, as set out within the ACPO ISS4PS (Information Systems Strategy for the Police Service).

The following abstract (taken from the CorDM Website) highlights the purpose and scope of CorDM:

*The vision for the future of the Information Systems Strategy (ISS) for the Police Service within England, Wales and Northern Ireland was set out within the ACPO ISS4PS. The vision defines an integrated information environment that maximises the benefit of information management across internal Police and other organisation boundaries.*

*One of the cornerstones of the ISS was the development of a Corporate Data Model (CorDM). The scope of the CorDM is to provide a logical data model that will cover all of the business within the Police Service. The CorDM, written in UML (the Unified Modelling Language), provides structure, definitions and standards for the data. It also provides Constrained Values tables and atomic XML definitions. It should be noted that development of the CorDM is still in progress. The CorDM forms part of a Business Model of the Police service, a complete Business Model would include business processes and organisation charts.*

The above abstract and further details regarding the CorDM can be obtained from the following website:

- <http://iss4ps.police.uk/implementing/cordm/>

*7.2.1 Categories of Data to be Recorded*

There are distinct data categories that should be recorded with each image type.

For the purpose of this Standard, Table 3 below illustrates some of the possible data categories that should be recorded with an image that is to be held on a police image capture/retrieval system.

**Table 3: Data Categories to be Recorded With an Image.**

<b>Data Category</b>	<b>Details/Examples of Data Entry</b>	<b>Purpose of Recording Data</b>
Reference data	<p>Identifiers that help to uniquely link the Mugshot Image to national records, for example PNCID Number and CRO Number.</p> <p>Data that records when the Mugshot Image was acquired, for example Arrest/Summons Number and Photo taken date/time/location.</p> <p>Data that links the Mugshot Image back to the originating source, for example Police force/station code (FS Code) or an identifier for the agency that originally captured the image. Additionally where appropriate a custody reference number and local force photo unique reference number should be recorded.</p> <p>Data that records details of the supervising person who obtained the image, for example photographing personnel name/ID or police worker reference number or collar ID.</p>	<p>To aid in the process of retrieving associated data held on a discrete system. For example, custody and arrest information may be retrievable from the PNC Names Application via the PNCID Number.</p> <p>To provide relevant information of an image upon its retrieval (e.g. date and location of where image was captured).</p> <p>To be able to fulfil obligations under the Data Protection Act.</p>
Data describing the person (subject) in the Mugshot Image.	<p>The descriptive details of a subject, for example:</p> <ul style="list-style-type: none"> <li>- Name;</li> <li>- Age/Date of Birth;</li> <li>- Gender;</li> <li>- Ethnic Appearance</li> <li>- Height</li> </ul>	<p>To be used as search parameters for retrieving stored images with matching demographic or nominal data.</p>

Image descriptive data	The descriptive details of each captured/stored image (see Table 4 for details).	To be used as search parameters for retrieving stored images with matching image descriptive data.
Data recorded to manage digital still Images	<p>Technical details relating to the Image capture process, for example:</p> <ul style="list-style-type: none"> <li>- Compression algorithm used</li> <li>- Compression level</li> <li>- Digital camera manufacturer and model</li> <li>- Camera capture setting (e.g. exposure time)</li> </ul>	<p>To provide information that would be used by applications that may control transformations of images.</p> <p>Note:</p> <ol style="list-style-type: none"> <li>1. It should be noted that many modern digital cameras automatically store Exif information, relating to the image (for example. camera make/model, image resolution, date/time photo taken), inside JPEG image files for photos they have taken. One of the long-term goals of this Standard is to have a standard set of 'metadata' values stored with every image taken. Many image file formats support the embedding of such metadata inside the image file itself, which would be the ideal way to accomplish this. As such, the retention of Exif information inside image files is to be encouraged.</li> <li>2. However, Exif cannot be embedded in JPEG2000 format image files, so it is not a comprehensive enough solution. A promising technology that is being considered for future metadata storage is XMP, a generic framework for storing metadata on many different types of information. This could be extended to images taken for the FIND database, allowing custom Mugshot Image related data (for example, subject's demographic data and PNC ID and CRO number) to be stored inside the image file. With this long-term goal in mind, it is strongly encouraged that useful metadata be stored with any image files, and if it is not embedded (i.e. by Exif or XMP), then it should be managed alongside the image file.</li> </ol>

*7.2.2 Image Descriptive Data Items to be Recorded*

It is beyond the scope of this Standard to fully discuss each data category identified in Table 3 or to present the data definitions for every data item. However it is appropriate to provide an overview of the data items that shall be recorded within the category of image descriptive data, as they will provide a mechanism by which images that are captured and stored in a database will be searched and retrieved.

Table 4 provides details of the image descriptive data items that should be recorded for images. It is recommended that reference to the latest version of the CorDM is made in order to identify a comprehensive list of data items and their type and format to be recorded with each Mugshot Image.

It should be noted that the data items referred to in Table 4 are not exhaustive and are intended as a minimum set. Furthermore these data items do not necessarily address all the data items that have to be recorded for interoperability purposes as such data items will depend on the interchange format.

**Table 4: Image Descriptive Data Items to be Recorded for Search and Retrieval.**

<b>Image Descriptive Data Item</b>	<b>Details of Data to be Entered Within the Data Item.</b>	<b>Applies to Image Record Type (Facial/SMT/Full Body Profile)</b>
Image Type	The type of image contained within a record: <ul style="list-style-type: none"> <li>- Facial Image;</li> <li>- SMT Image;</li> <li>- Full Body Profile Image</li> </ul>	Facial/SMT/Full Body Profile
Subject Image Profile	The profile description of the captured image: <ul style="list-style-type: none"> <li>- Full Frontal Face;</li> <li>- Left Head Turn image (90 degree);</li> <li>- Right Head Turn image (90 degree);</li> <li>- Left Head Turn image (45 degree);</li> <li>- Right Head Turn image (45 degree);</li> <li>- Downward Facing image (between 20 and 45 degree); and</li> <li>- Upward Facing image (between 20 and 45 degree);</li> </ul>	Facial
Facial Photo Description	The minimum set of attributes of the captured Facial Image: <ul style="list-style-type: none"> <li>- Facial skin tone (complexion);</li> <li>- Eye colour - natural (left);</li> <li>- Eye colour - natural (right);</li> <li>- Subject wearing eye patch (left);</li> <li>- Subject wearing eye patch (right);</li> <li>- Subject wearing contact lens;                             <ul style="list-style-type: none"> <li>- Eye colour - with contact lens (left);</li> <li>- Eye colour - with contact lens (right);</li> </ul> </li> </ul>	Facial

**NOT PROTECTIVELY MARKED**

	<ul style="list-style-type: none"> <li>- Subject wearing Glasses;</li> <li>- Hair colour (natural);</li> <li>- Hair colour (Artificial);</li> <li>- Hair features;</li> <li>- Hair type;</li> <li>- Facial hair type; and</li> <li>- Facial expression</li> </ul>	
Location on Body of SMT	<p>The general location on the body of the captured SMT Image.</p> <p><b>Note:</b></p> <p>The data entry for this data item may be chosen from Part 4, Section 13 of the Eighth (or current) Edition of the National Crime Information Center (US) Code Manual. July 14, 1999.</p>	SMT
SMT Size	<p>The dimensions (height and width) to the nearest centimetre of the SMT Image.</p>	SMT
SMT Descriptors	<p>The description of the content of the SMT Image, e.g.</p> <ul style="list-style-type: none"> <li>- Source of the image as being a Scar, Mark or Tattoo Image;</li> <li>- For Tattoo Images, the general class and any subclass;</li> <li>- Textual description concerning the image; and</li> <li>- Colours associated with the image</li> </ul> <p><b>Note:</b></p> <p>The data entry for this data item may be in accordance with field 10.042 ("SMT Descriptors") and 10.043 ("Color") of Type-10 facial and SMT record layout as defined within the ANSI/NIST-ITL 1-2000, Data Format for the Interchange of Fingerprint, Facial &amp; Scar Mark &amp; Tattoo Information – Interpol Implementation.</p>	SMT

## Appendix A – Sample Mugshot Images and Guidelines

### Scene requirements

The subject's face shall:

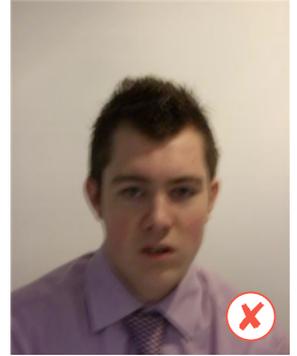
- Be shown clearly in a full frontal profile
- Not be covered
- **Not** be tilted up, down, left or right
- **Not** be 'rolled' (i.e. tilted from a 90° angle)
- Include the subject's full head with hair, as well as neck and shoulders



**Bad pose (head tilted)**



**Non-neutral expression**



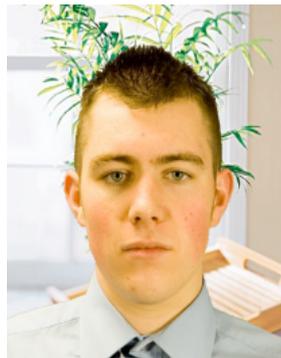
**Non-uniform lighting**

The subject should not be wearing head covering(s), except for religious reasons. Any further provisions for removal of head coverings are to be assessed in accordance with the Police and Criminal Evidence Act 1984 (PACE).

The subject's eyes shall be clearly visible and not obscured.

The subject's expression should be neutral; they must **not** be (e.g.):

- Smiling/frowning
- Raising eyebrows
- Closing eyes
- Opening mouth
- Looking away from the camera



**Noisy background**



**Background not 18% grey**



**Too close**

Lighting shall be uniform (coming equally from all front angles).

There should be no (or minimal) lighting reflection from eyeglasses.

The background shall be:

- Smooth/flat
- **Not** 'noisy'; e.g. containing other objects or distractions
- Roughly an 18% shade of grey, i.e. British Standard colour code BS4800 BS00A01 (Pebble Grey Vinyl Matte)
- Roughly uniform in colour
- Free of shadows



**Too far**



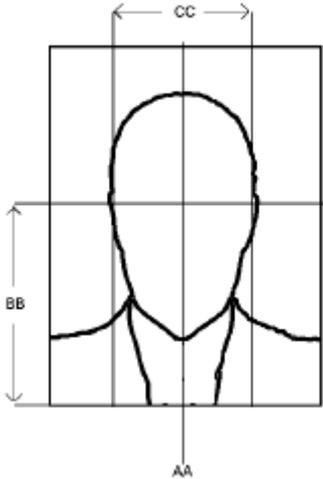
**Off-centre**



**COMPLIANT**

There shall be no 'hot spots' / glare on any part of the face (typically appears on the cheeks and forehead).

The subject's face shall be positioned in the image as illustrated by the following diagram:



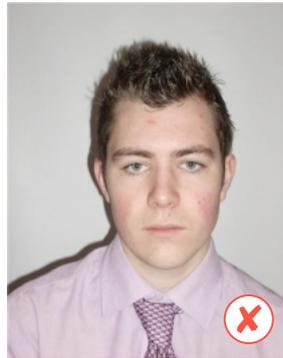
Head at 50% of image width (CC), middle of mouth and bridge of nose centred horizontally (AA), centre of eyes 55% up from bottom of image (BB).

**Photographic requirements**

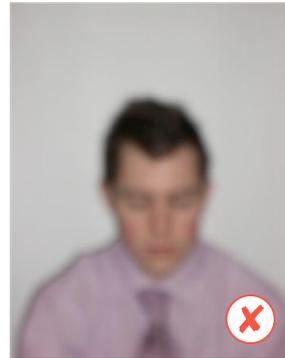
The subject's face shall be in focus.

For each patch of skin on the subject's face and/or the SMT image, the gradations in textures must be clearly visible (i.e. no over- or under-saturation).

The aspect ratio of the Mugshot Image must be 1:1.25 (4:5).



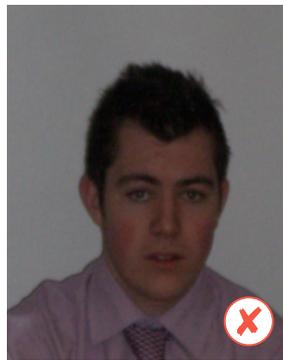
Background shadow



Not in focus



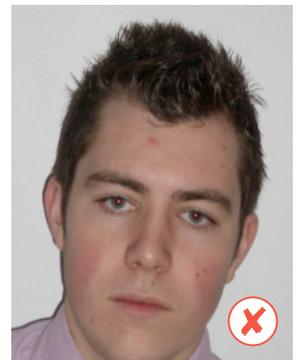
Over-saturated



Too dark



Too bright



Rolled / tilted

Blurred image due to camera shake ?



COMPLIANT

Wrong colour balance ?

## Appendix B – Guidance for Setting up an Image Capture System

### Purpose

This section is intended to provide an indication of the basic environmental requirements that should be considered when setting up an image capture system.

### Notes:

- The requirements within this section are not exhaustive or mandatory and should be viewed as a guide in conjunction with the other sections of this Standard document.
- Health and safety issues need to be addressed under local and national rules/laws when setting up an image capture system.
- The vendor of the system should be in a position to provide advice and/or support most of the considerations outlined within this section.

### The Room - Environment

The following environmental requirements should be considered when installing an image capture system in a particular room:

- The room should be well ventilated with no abrupt changes in temperature or humidity (even when the photo lights and other equipment are on).
- The relative humidity within the room should be at a suitable level that does not cause condensation.
- The room should not have any exposure to chemicals or direct sunlight.

### The Room – Size, Location, and Usage

The following requirements should be considered when selecting a room for installing an image capture system:

- The dimension of the room is dependent on the specific layout of the system equipment. Consideration should be given to the distances between the subject and the equipment (camera, workstation etc), the number of people present during the image capture process (operator of the system, solicitor etc).
- When deciding on a location for the system, consideration should be given to human traffic patterns, location of doors, windows, room usage and other things that may disrupt the image capture process. It would be advantageous if the room is used solely for the capture of images.
- If possible the room housing the system should be located close to other related business process areas (e.g. custody suit, fingerprinting and DNA sampling facilities) so as to speedup the image capture process and related business activities.

- **The Room - Facilities**

The following room facilities requirements should be considered when installing an image capture system in a specific room:

Electrical Power

- It is recommended that expert advice be sought for ensuring all necessary electrical power requirements are identified and addressed. For example, consideration should be given to the appropriate positioning of electrical power sockets for individual equipment.

Decoration

- The decorations of the room (including the colour and texture of walls, doors, ceiling and carpet or other types of flooring) should not cause unnecessary reflections and/or brightness across the image area. If possible, consider painting the ceiling and all walls in the 18% shade of grey (as for the image background requirement detailed in section 3.1.6) as this will considerably reduce the scatter of unwanted reflections and/or brightness.

Blackout

- No natural light should be used for photo illumination. This can be achieved by ensuring windows near the system are outfitted with blackout curtains or some other blackout technique.

Lighting

- Do not use overhead fluorescent lights or natural light for photo illumination.
- Where fluorescent lights are in a position to cast light on a subject, they should be turned off or the bulbs removed.
- Lighting solutions should be considered on a case-by-case basis. For example, illumination may be accomplished using a minimum of Three-Point Balanced Lighting solution.
- 'Mixed' lighting (i.e. from different types of light source) should be avoided.
- The use of 'cool running lights' may be appropriate to prevent the room getting too hot if the lights are likely to be on for extended periods.

**Note:** See section 3.1.4 (Lighting) for further details concerning lighting.

Warning/Indicator Light

- A warning/indicator light (e.g. a red coloured light) should be positioned outside the entrance(s) of the room with a message informing people that the room is in use.

## NOT PROTECTIVELY MARKED

### The Work Area

- Careful consideration should be given to the physical security of all the equipment (e.g. appropriate housing for the equipment should be used to prevent malicious damage).
- The work surface must be large enough and strong enough to support all of the necessary equipment that has to be positioned on it (e.g. laser printer, monitor, keyboard etc).
- The camera should be securely mounted to a suitable surface.
- The work area should be located approximately eight feet from the subject being photographed.
- The work surface should be level.
- The workstation must not be positioned within the field of view of the camera.

### Photo Backdrop

- The backdrop should be matte painted (preferred) with an 18% shade of grey. Matte paint is more appropriate than any form of gloss paint as it is not shiny and would minimise reflective lighting from the background.
- Commercially available 18% grey screens can be used as an alternative to painting the walls. Some of these also have the capability to be retracted when not in use.

**Note:** See section 3.1.6 (Background) for further details concerning background.

### Stool

- If the subject is required to sit when a Full Frontal Face image is being captured, an adjustable stool that is secured to the floor at roughly two feet (70cm) in front of the background should be used. An adjustable stool is recommended as it can be adjusted to compensate for different heights of subjects.

<End of Document>