

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Video surveillance systems for use in security applications –
Part 5: Data specifications and image quality performance for camera devices**

**Systèmes de vidéosurveillance destinés à être utilisés dans les applications de
sécurité –
Partie 5: Spécifications des données et performances de la qualité d'image pour
les dispositifs de caméra**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2018 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 21 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Video surveillance systems for use in security applications –
Part 5: Data specifications and image quality performance for camera devices**

**Systèmes de vidéosurveillance destinés à être utilisés dans les applications de
sécurité –
Partie 5: Spécifications des données et performances de la qualité d'image pour
les dispositifs de caméra**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 13.320

ISBN 978-2-8322-5763-0

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	7
INTRODUCTION.....	9
1 Scope.....	10
2 Normative references	10
3 Terms, definitions and abbreviations	11
3.1 Terms and definitions.....	11
3.2 Abbreviations	21
4 Description of video surveillance camera specification items	22
4.1 General.....	22
4.2 Camera.....	22
4.2.1 Image sensor.....	22
4.2.2 Maximum resolution.....	25
4.2.3 Minimum illumination	25
4.2.4 Signal to noise ratio (SNR, S/N ratio).....	26
4.2.5 White balance.....	26
4.2.6 Electronic shutter.....	27
4.2.7 Electronic sensitivity up (Slow shutter).....	27
4.2.8 Dynamic range (DR)	28
4.2.9 Visible dynamic range (VDR)	28
4.2.10 Infra-red illumination operating view distance	28
4.2.11 Day/Night mode (D/N).....	29
4.2.12 Internal image processing performance	29
4.3 Lens	30
4.3.1 Focal length.....	30
4.3.2 Relative aperture (F-number).....	30
4.3.3 Field of view	30
4.3.4 Image distortion.....	31
4.3.5 Iris control	31
4.3.6 Mount type	31
4.3.7 Image flare	32
4.4 Input / Output.....	32
4.4.1 Video output	32
4.4.2 Auto-iris lens output.....	32
4.5 Video output format	33
4.5.1 Image format standard.....	33
4.5.2 Colour representation	33
4.5.3 Output image pixel number	33
4.5.4 Output image resolution.....	34
4.6 Pan and tilt	34
4.6.1 Rotation angle	34
4.6.2 Rotation speed	34
4.6.3 Preset position function	35
4.6.4 Preset position accuracy.....	35
4.6.5 Audible noise.....	35
4.7 Network	36
4.7.1 Network interface.....	36
4.7.2 Image and video compression format.....	36



4.7.3	Bit rate control	36
4.7.4	Maximum frame rate	37
4.7.5	Maximum number of encoding streams	37
4.7.6	Multicast streaming	38
4.7.7	Maximum number of connections	38
4.7.8	Total encoding performance	38
4.7.9	Image stream delay (Latency)	38
4.7.10	Camera storage (Local storage)	39
4.7.11	Audio function	39
4.7.12	Network protocol	39
4.7.13	Camera time synchronization and localization	40
4.8	Network security	40
4.8.1	General description	40
4.8.2	Network authentication	40
4.8.3	Video authentication and watermarking	41
4.9	Other specifications	41
5	Measurement methods of video surveillance camera specification items	41
5.1	Setting of standard shooting condition	41
5.1.1	General	41
5.1.2	Common standard shooting condition	42
5.2	Video signal quantization level	44
5.2.1	General	44
5.2.2	Digital video signal quantization level	44
5.2.3	Other quantization levels	44
5.3	Measurement environment	44
5.3.1	General	44
5.3.2	Test chart	45
5.3.3	Software for measurement	48
5.4	Measuring methods	48
5.4.1	General	48
5.4.2	Resolution	48
5.4.3	Minimum illumination	56
5.4.4	Dynamic range	59
5.4.5	Visible dynamic range (VDR)	67
5.4.6	Infra-red illumination operating view distance	70
5.4.7	Image distortion	73
5.4.8	Image flare	77
5.4.9	Capture frame rate	84
Annex A (normative)	Sine wave star test chart	88
Annex B (informative)	Infra-red illuminator safety requirements according to IEC 62471	91
B.1	General	91
B.2	Declaration of the hazard distance	91
B.3	Other information to be declared	92
B.4	Item indication	92
B.5	Content indication	92
Annex C (informative)	Low light performance method	93
C.1	General	93
C.1.1	General	93

C.1.2	Test chart	93
C.1.3	Creation of the coloured dead leaves structure	94
C.1.4	Capturing a reference image.....	94
C.1.5	Capture of the test images.....	94
C.1.6	Image quality aspects affected by low light	94
C.1.7	Presentation of the results	96
C.2	Example for generating a single performance value from measured results.....	96
C.3	Description of test chart example	97
C.3.1	General	97
C.3.2	Chart sizes and background	98
C.3.3	Sine wave modulated starburst patterns	98
C.3.4	OECF patches	98
C.3.5	Colour patches	98
C.3.6	Dead leaves	100
C.3.7	Slanted edges and visual structures	101
C.3.8	Small sine wave modulated starburst patterns	101
C.3.9	Centre marks	101
Annex D (informative)	Streaming bit rate (bit-stream).....	102
D.1	General.....	102
D.2	Description	102
D.3	Uncompressed and compressed video streams.....	102
D.4	Content indication	103
D.4.1	General	103
D.4.2	Video streaming in a system	103
D.4.3	Network traffic analysis (NTA)	103
D.5	Measuring the video streaming	104
D.5.1	General	104
D.5.2	The procedure of measuring streaming bit rate in a system	104
Annex E (informative)	IP video latency measurement.....	107
E.1	General.....	107
E.2	Description	107
E.3	Visual perception of the latency	109
E.4	Measurement procedure for IP video latency	109
E.5	Content indication	110
Annex F (informative)	Motion blur measurement	111
F.1	General.....	111
F.2	Description	111
F.3	Projected pixel shift (PPS) due to moving objects	111
F.4	Content indication	111
F.5	Calculating the projected pixel shift of moving objects	112
F.6	Calculating the projected pixel shift of moving objects at various angles	113
F.7	Acceptable PPS	113
F.8	Test chart measuring of moving objects	114
Annex G (informative)	SD/HD test target example.....	118
Annex H (informative)	UL test chart implementations	119
Annex I (informative)	Explanation of image flare from light source within and outside of camera field of view	120
I.1	Image flare of light source within the field of view	120

I.2 Image flare of light source outside of the field of view	120
Bibliography.....	122

Figure 1 – Test set-up for reflective test chart.....	45
Figure 2 – Test set-up for transparent test chart	46
Figure 3 – Test set-up for fixture with lamps	47
Figure 4 – Alignment of the camera with the target plane using a mirror	48
Figure 5 – IEC 61146-1 No. 4 and No. 5 (Resolution chart).....	49
Figure 6 – ISO 12233:2000 Resolution test chart	50
Figure 7 – Sine wave modulated starburst pattern test chart	51
Figure 8 – The star is divided into eight segments for the analysis	53
Figure 9 – The star is analysed radius by radius, equivalent to frequency by frequency	53
Figure 10 – The pixels along a specific radius are located	54
Figure 11 – Digital code values as a function of the angle.....	54
Figure 12 – Calculation of the contrast of the sine curve	55
Figure 13 – Example of grey scale test chart	57
Figure 14 – Example of OECF transparent test chart	57
Figure 15 – Signal difference between white area and black surrounding.....	58
Figure 16 – Example of lamp fixture.....	60
Figure 17 – Possible arrangements of luminance levels	61
Figure 18 – Graphical presentation of results	67
Figure 19 – Example of signal level	69
Figure 20 – Graphical presentation of results.....	70
Figure 21 – White chart.....	71
Figure 22 – Camera positioning	71
Figure 23 – Video level	72
Figure 24 – Conversion measurement using electronic shutter.....	73
Figure 25 – Regular grid (solid lines) in the scene is distorted and the red diamonds mark the position of the intersections in the image produced by the camera	74
Figure 26 – Line grid pattern chart	75
Figure 27 – Schematic drawings for measuring the horizontal line distortion	77
Figure 28 – Schematic drawings for measuring the vertical line distortion	77
Figure 29 – Example test chart with multiple black areas (“Dot pattern chart”)	79
Figure 30 – Set-up of image flare device.....	80
Figure 31 – Image flare lamp for cameras with small field of view (large focal length)	81
Figure 32 – Image flare lamp for cameras with large field of view (short focal length)	81
Figure 33 – Evaluation area	83
Figure 34 – Frame rate test target.....	85
Figure A.1 – Sine wave test chart (multiple target version).....	88
Figure C.1 – An example for a multipurpose test chart with frame rate tester	93
Figure C.2 – An example for a multipurpose test chart	98
Figure D.1 – Network connection for video streaming measurement	105
Figure D.2 – An example graph of network traffic.....	106
Figure E.1 – Comparison of image compression and video compression.....	107

Figure E.2 – Example of GOP	108
Figure E.3 – Video latency	110
Figure F.1 – Motion blur due to moving objects	111
Figure F.2 – Calculation of projected pixel shift.....	112
Figure F.3 – Movement in various angles	113
Figure F.4 – Measuring of moving objects.....	115
Figure F.5 – Example of moving test chart	117
Figure G.1 – SD/HD test target example	118
Figure I.1 – Image flare from a light source within the camera field of view	120
Figure I.2 – Image flare from a light source outside of the camera field of view	121
Table 1 – Lighting condition	42
Table 2 – Relation of illuminance and luminance.....	43
Table 3 – Standard camera settings	43
Table 4 – Digital video signal quantization level	44
Table 5 – Camera settings for resolution.....	49
Table 6 – Camera settings for minimum illumination	56
Table 7 – Camera settings for dynamic range	59
Table 8 – Example results of dynamic range measurement.....	65
Table 9 – Camera settings for visible dynamic range	68
Table 10 – Camera settings for IR illumination operating view distance	70
Table 11 – Camera settings for image flare.....	78
Table 12 – Camera settings for capture frame rate	85
Table A.1 – Features of sine wave test chart	89
Table A.2 – Design of sine wave star test chart.....	90
Table C.1 – Results table of an example camera	96
Table C.2 – Results table of an example camera	97

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**VIDEO SURVEILLANCE SYSTEMS FOR USE
IN SECURITY APPLICATIONS –****Part 5: Data specifications and image
quality performance for camera devices**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62676-5 has been prepared by IEC technical committee 79: Alarm and electronic security systems.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
79/607/FDIS	79/609/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.  **Documents**
Document Sharing Hub

A list of all parts in the IEC 62676 series, published under the general title *Video surveillance systems for use in security applications*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

IEC Technical Committee 79 in charge of alarm and electronic security systems together with many governmental organizations, test houses and equipment manufacturers has defined a common framework for video surveillance transmission in order to achieve interoperability between products.

The IEC 62676 series of standards on video surveillance systems is divided into five independent parts:

Part 1: System requirements

Part 2: Video transmission protocols

Part 3: Analog and digital video interfaces

Part 4: Application guidelines

Part 5: Data specifications and image quality performance for camera devices

Each part offers its own clauses for the scope, normative references, definitions and requirements.

The purpose of this part of IEC 62676 is to specify representation and measuring methods of performance values to be described in materials such as instruction manuals, brochures and specifications of video surveillance camera equipment, and provide convenience for users, installers, integrators and maintenance companies, etc.

VIDEO SURVEILLANCE SYSTEMS FOR USE IN SECURITY APPLICATIONS –

Part 5: Data specifications and image quality performance for camera devices

1 Scope

This part of IEC 62676 defines recommendations and requirements for representation and measuring methods of performance values to be described in materials such as instruction manuals, brochures and specifications of video surveillance camera equipment.

This document consists of two parts. The first part is requirements for description of video surveillance camera specification items. The second part is requirements for measurement methods of video surveillance camera specification items.

A video surveillance camera's output can be analogue (e.g. composite video such as NTSC or PAL) or digital (e.g. compressed network output, uncompressed SDI (serial digital output), etc.).

2 Normative references

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

IEC 60825-1, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC 61146-1, *Video cameras (PAL/SECAM/NTSC) – Methods of measurement – Part 1: Non-broadcast single-sensor cameras*

IEC 62471, *Photobiological safety of lamps and lamp systems*

IEC 62676-1-2:2013, *Video surveillance systems for use in security applications – Part 1-2: System requirements – Performance requirements for video transmission*

IEC 62676-3, *Video surveillance systems for use in security applications – Part 3: Analog and digital video interfaces*

ISO 14524, *Photography – Electronic still picture cameras – Methods for measuring opto-electronic conversion functions (OECFs)*

ITU-R Recommendation BT.601, *Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios*

ITU-R Recommendation BT.709, *Parameter values for the HDTV standards for production and international programme exchange*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

3.1.1

4k

image size format with approximately 4 000 horizontal pixels defined as SMPTE 2036 (3840 × 2 160 UHDTV)

3.1.2

aperture

opening of lens diaphragm through which light passes

3.1.3

bit rate

amount of digital signal in a second

3.1.4

C/CS mount

lens physical mounting standards (C mount and CS mount) typically used for video surveillance cameras

Note 1 to entry: C mount is an older standard defined as one inch (25,4 mm) in diameter with 32 threads per inch and the flange back distance where an image is projected on a sensor is 17,526 mm.

Note 2 to entry: CS mount is a newer standard which uses the same diameter and thread of C mount, but the flange back distance is 12,5 mm.

3.1.5

colour temperature

measure of temperature of a heated surface which generates a radiant energy having the same spectral distribution generated from a blackbody of the same temperature

Note 1 to entry: Colour temperature is expressed in kelvins (K).

[SOURCE: IEC 60194:2015, 24.1355]

3.1.6

compression

process of reducing the size of data (image or video)

[SOURCE: IEC 62676-1-1:2013, 3.1.27, modified – In the definition, "data (image or video)" has replaced "a data (image) file".]

3.1.7

compression ratio

ratio of the uncompressed size of files, images or videos to the compressed size

Note 1 to entry: A high compression ratio means smaller image files and lower image quality and vice versa.

[SOURCE: IEC 62676-1-1:2013, 3.1.28, modified – In the definition, "files, images or videos" has replaced "files or images".]

3.1.8

contrast

<related to image> difference in visual luminance properties that makes an object (or its representation in an image) distinguishable from other objects and the background

Note 1 to entry: In visual perception of the real world, contrast is determined by the difference in the colour and brightness of the object and other objects within the same field of view.

[SOURCE: IEC 62676-1-1:2013, 3.1.33]

3.1.9

dome camera

camera mounted inside a dome, usually protecting it from outside influences

3.1.10

dynamic range

quotient of the signal from the maximum measurable indication of a quantity by the signal from the minimum measurable value of that quantity

[SOURCE: IEC 62232:2011, 3.15]

3.1.11

electronic shutter

arrangement in the camera changing its sensitivity by electronically controlling the exposure time of the image sensor

[SOURCE: IEC 62676-4:2014, 3.1.14]

3.1.12

encoding streams

series of consecutive encoded images or video from the same image source which are transmitted from one system component to another

[SOURCE: IEC 62676-1-1:2013, 3.1.77, modified – In the definition, "encoding streams" has replaced "image streams", "encoded images or video" has replaced "images".]

3.1.13

exposure control

electronic control of the time needed to expose image sensor pixels to light

Note 1 to entry: For "live" video stream the default exposure is typically 1/25 s or 1/30 s.

3.1.14

exposure time

length of time for which image sensor pixels are exposed to light

3.1.15

flare

light falling on an image, in an imaging system, which does not emanate from the subject point

Note 1 to entry: Flare is also sometimes referred to as veiling glare.

Note 2 to entry: See also image flare (3.1.30).

3.1.16

frame

<related to image format> full frame of video as acquired in progressive mode or as combination of two interlaced fields together

[SOURCE: IEC 62676-2-1:2013, 3.1.20, modified – The specific context "<related to image format>" is added.]

3.1.17

frame rate

number of frames per second

3.1.18**F-number**

iris opening of a lens defined as a ratio between the focal length of the lens and its iris opening

Note 1 to entry: It is typically a number larger than 1 (e.g. F1.4, F2, F2.8) and indicates the amount of light coming through the lens where a lens with lower F-number transmits more light than a lens with higher numbers.

3.1.19**gain**

camera function to amplify the electronic signal

3.1.20**gamma correction**

correction of the linear response of a camera to compensate for the monitor screen non-linear response

Note 1 to entry: It is measured with the exponential value of the curve describing the non-linearity. A typical monochrome monitor's gamma is 2,2, and a camera needs to be set to the inverse value of 2,2 (which is 0,45) for the overall system to respond linearly (i.e. unity).

3.1.21**global shutter**

image read-out method of the image sensor where the exposure timing of all visible lines is the same

Note 1 to entry: Global shutter is a term associated with the CMOS image sensors where the image read-out is usually sequential, i.e. line by line, which produces the so-called "rolling shutter" effect. If the read-out is non-sequential, i.e. all visible lines are read out at the same time, it is called "global shutter".

3.1.22**group of pictures****GOP**

set of video images in an encoded video stream consisting of reference images (I-frames), predicted images (P-frames) and bi-directional images (B-frames)

3.1.23**H.264**

ISO/IEC 14496-10, MPEG-4 Part 10 standard, also named Advanced Video Coding (AVC), supporting video compression (coding) from low bit-rate network streaming applications to HD video applications with near-lossless coding for network-friendly video representation

[SOURCE: IEC 62676-1-2:2013, 3.1.33, modified – In the definition, "ISO/IEC 14496-10, " is added.]

3.1.24**H.265**

ISO/IEC 23008-2, MPEG-H Part 2 standard, also named High Efficiency Video Coding (HEVC), that provides about double the data compression ratio of H.264 at the same image quality

3.1.25**high definition****HD**

image size format expressing sizes higher than standard definition (SD) television with aspect ratio of 16:9 defined as SMPTE ST 296 (1280 × 720) and SMPTE ST 274 (1920 × 1080)

Note 1 to entry: Number of pixels in the image above HD, such as 4k, is defined in SMPTE ST 2036-1.

3.1.26

illumination

<related to image sensor> level of illumination (illuminance) at the image sensor

[SOURCE: IEC 62676-1-1:2013, 3.1.66, modified – In the definition, "sensor" has replaced "device".]

3.1.27

illumination

<related to scene> level of illumination (illuminance) on the area to be kept under surveillance

[SOURCE: IEC 62676-1-1:2013, 3.1.66]

3.1.28

image

visual representation of a scene viewed by a camera

Note 1 to entry: In this document the term image includes multiple images in an image stream.

[SOURCE: IEC 62676-1-1:2013, 3.1.67]

3.1.29

image distortion

distortion of a scene projected on a sensor which deviates from the appearance of the same image as seen by a human eye

3.1.30

image flare

unwanted increase in signal of an output processed image or video resulting from light detected by an image sensor that does not emanate from a corresponding subject point

Note 1 to entry: This includes light from inside and outside the field of view.

3.1.31

image processing

method to change or analyse (digital) images with algorithms or (software) procedures

EXAMPLE Compression and encryption of images, methods for image content analysis.

[SOURCE: IEC 62676-1-1:2013, 3.1.73]

3.1.32

image quality

measurement of how accurately an observed image represents a real object as a collection of sharpness, brightness, colour reproduction, visual resolution, evenness of illumination, contrast, geometry, etc.

[SOURCE: IEC 62676-1-1:2013, 3.1.78]

3.1.33

interlaced scanning

scanning system for video whereby the even lines of a picture are scanned first and transmitted as field 1 and then the odd lines are scanned and transmitted as field 2

Note 1 to entry: The two fields make up a frame and the field and scanning rate are therefore twice the frame rate.

3.1.34**IR cut-filter**

optical device placed in front of an image sensor of a camera which cuts out the invisible infra-red wavelengths of a projected image which is required for colour cameras in order to reproduce natural colours as the human eye sees

3.1.35**IR spectrum**

spectrum of frequencies (wavelengths) which are beyond the visible red wavelength (around 700 nm) which is typically invisible to human eyes

3.1.36**iris**

variable aperture mechanism which regulates the amount of light passing through the lens onto the image sensor of the VSS camera

[SOURCE: IEC 62676-4:2014, 3.1.23]

3.1.37**JPEG**

common standard for image compression, defined by the Joint Photographic Experts Group based on Discrete Cosine Transformation

Note 1 to entry: The JPEG file format is defined by the ISO/IEC 10918 series.

[SOURCE: IEC 62676-1-1:2013, 3.1.83, modified – In the definition, "based on Discrete Cosine Transformation" is added.]

3.1.38**JPEG-2000**

common standard for image compression, more recent than JPEG (3.1.37), defined by the Joint Photographic Experts Group, based on wavelet compression

3.1.39**latency**

<related to network delay> time that elapses between the initiation of a network request for data and the start of the actual data transfer

[SOURCE: IEC 62676-1-2:2013, 3.1.52, modified – The specific context "<related to network delay>" is added.]

3.1.40**latency**

<related to system delay> measure of the time delay between the live action in front of the camera and the view on the monitors

Note 1 to entry: Latency (related to system delay mostly originated from video encoding and decoding) is a cumulative effect of network latency and encoding/decoding video compressed stream, of which the latter is usually more significant. An example of a measuring method is described in Annex E.

3.1.41**local tone mapping**

image processing technique to map luminance signal level according to the histogram which expands the apparent visual contrast of the image

Note 1 to entry: Local tone mapping does not expand the actual dynamic range but improves the visibility by adjusting local contrast. Wide dynamic range (3.1.94) is a camera technology that expands the actual dynamic range.

3.1.42

luminance

<related to video signal> portion of a video signal which carries the brightness and contrast information

[SOURCE: ISO/IEC 14165-321:2009, 3.1.19, modified – The specific context "<related to video signal>" is added.]

3.1.43

luminance

<related to light> photometric measure of the luminous intensity per unit area of light travelling in a given direction

Note 1 to entry: Luminance is expressed in units of candelas per square metre (cd/m^2).

[SOURCE: IEC 62087-1:2009, 3.1.4, modified – The specific context "<related to light>" is added.]

3.1.44

lux

light unit for measuring illumination

Note 1 to entry: It is defined as the illumination of a surface when the luminous flux of 1 lumen falls on an area of 1 m^2 . It is also known as lumen per square metre.

3.1.45

monotonicity

property where the output always increases or remains constant and never decreases as the input increases

3.1.46

megapixel

MP

image consisting of a total pixel number of 1 million or more effective pixels

3.1.47

MPEG

common standard used for coding and compression of moving images, defined by Moving Picture Experts Group in different versions

EXAMPLE MPEG-2 and MPEG-4.

[SOURCE: IEC 62676-1-1:2013, 3.1.93]

3.1.48

M-JPEG

video compression format in which each image frame is compressed separately in JPEG

3.1.49

multi-exposure

camera function that combines multiple images from different exposure timings to enhance the camera performance

3.1.50

neutral density filter

ND filter

optical device that reduces the light intensity in the visible wavelength region

[SOURCE: IEC 62087-3:2015, 3.1.10]

3.1.51
opto-electronic conversion function
OECF

relationship between input luminance and output levels for an opto-electronic image capture system

3.1.52
optical axis

axis that goes through the middle of the optical system, perpendicular to the optical elements

3.1.53
optical density

logarithmic ratio of the intensity of transmitted light to the intensity of the light passing through the refractive substance

3.1.54
pan/tilt/zoom
PTZ

camera or function which refers to controlling a movable camera from a control point (typically with a PTZ keyboard, mouse, or touch-screen) to pan (left/right), tilt (up/down) and zoom (in/out)

Note 1 to entry: Such a control may also include a focus near/far and iris open/close functions.

3.1.55
patch

individual segment of a test chart consisting of multiple patches with various density of reflectance or transmittance

3.1.56
pincushion distortion

optical distortions of a lens when projecting an image on a sensor that appear like a pincushion (parallel lines appear projected towards the inside of the image centre)

3.1.57
pixel

smallest possible element of an image that contains information about luminance and colour

Note 1 to entry: Acronym for picture element.

[SOURCE: IEC 62676-1-1:2013, 3.1.107, modified – In the definition, "that contains information about luminance and colour" is added.]

3.1.58
Power over Ethernet
PoE

method of sending power from the network switch, over Ethernet copper cable, to the IP device (typically a network camera)

Note 1 to entry: PoE is standardized in IEEE 802.3af and IEEE 802.3at.

3.1.59
privacy mask

camera function blocking out or obscuring areas of an image for privacy reasons

[SOURCE: IEC 62676-1-1:2013, 3.1.115, modified – In the term, "mask" has replaced "masking". In the definition, "camera function" has been added before "blocking out".]

3.1.60

progressive scanning

scanning system for video whereby each next line is scanned after the previous in consecutive order

3.1.61

quantization level

number of levels used in converting analogue signal into digital

Note 1 to entry: Since digital signals are always processed and described in the binary system, the quantization levels are typically expressed as a power of two, so that an 8-bit system is equal to 256 levels of quantization, and a 10-bit system is equal to 1 024 levels of quantization.

3.1.62

quantum efficiency

efficiency of converting number of photons into electrons

Note 1 to entry: Quantum efficiency is expressed as a percentage.

3.1.63

radiated spectrum

wavelength of frequencies (spectrum) radiated with a particular light source

3.1.64

reflectance

property which reflects the incoming light

3.1.65

resolution

<related to visual resolution> measure of the ability of a camera or video systems to reproduce detail from the original scene or image

3.1.66

resolution

<related to format> description of the size of a digital image in pixels (e.g. 720P, 1080P, 640 × 480), pixels per inch or number of pixels of a video-frame, monitoring device, printout

3.1.67

rolling shutter

image read-out method of the image sensor where the exposure timing of visible lines is sequential, i.e. line by line

Note 1 to entry: Rolling shutter produces unnatural distortions of moving objects.

3.1.68

saturation

device characteristic exhibited when a further change in the input signal produces no additional change, or progressively less change, in the output

[SOURCE: IEC 61888:2002, 3.19]

3.1.69

sensitivity

camera capability to detect light in the scene

Note 1 to entry: Sensitivity is measured in lux [lx].

Note 2 to entry: It is not the capability to detect light at the sensor module.

3.1.70**sharpness**

image quality factor that determines the amount of detail an imaging system can reproduce

3.1.71**shooting condition**

conditions under which a camera system is set up to measure various parameters

3.1.72**signal clipping**

electronic method of removing excessive signal levels in video, typically referring to bright details in a picture such as sun, headlights or reflections of them

3.1.73**signal to noise ratio****SNR****S/N ratio**

ratio between the signal strength and the noise levels in an audio or video signal

Note 1 to entry: Signal to noise ratio is typically expressed in decibels (dB).

3.1.74**sine-based**

changes in a periodical function or pattern that occur gradually as a sine wave function

3.1.75**S mount**

lens physical mount typically used for smaller form factor PCB (printed circuit board) or “board” cameras

Note 1 to entry: S mount lens uses M12 thread with 0,5 mm pitch and does not have flange back regulations.

3.1.76**spatial frequency response****SFR**

measurement which uses slanted edges of a test chart's objects and describes the transfer functions of a camera system

3.1.77**specification item**

item specified in a camera specification data sheet

3.1.78**sRGB**

RGB colour space standard for use on monitors, printers and the Internet

Note 1 to entry: sRGB is standardized as IEC 61966-2-1.

3.1.79**standard camera settings**

common settings for measuring the performance and image quality of the camera

3.1.80**standard definition****SD**

image size format based on analogue television formats basically in 4:3 aspect ratio and sampled in 13,5 MHz with 720 horizontal pixels

3.1.81

standard deviation

positive square root of the variance

[SOURCE: IEC GUIDE 115:2007, 3.8]

3.1.82

target plane

plane that passes through the chart plane which a camera observes

3.1.83

test target

visible marker or plate that possesses patterns of colours or grey scale which provides a visual reference for camera adjustment or measurement

3.1.84

transmittance

ratio between the amount of light passing through a transparent area and the amount of light before the transparent area entry

3.1.85

tungsten illuminants

light sources which have tungsten filament that produces light, typically with colour temperature of 3 200 K

3.1.86

TV lines

specification of an analogue camera's or monitor's horizontal resolution power where horizontal is defined as the maximum number of alternating light and dark vertical lines that can be resolved per picture height

3.1.87

TV field

interlaced television image which consists of only odd or only even lines

3.1.88

TV frame

combination of two TV fields based on the interlaced scanning (even and odd lines)

3.1.89

uncompressed

base band digital signal that has not undergone image or video compression

3.1.90

video authentication

method embedding data into video to ensure the integrity of the video

3.1.91

wedge pattern

pattern that typically consists of black lines on a white background which get narrower as they come closer to each other on a test chart

Note 1 to entry: The wedge pattern is used for resolution measurement.

3.1.92

white balance

electronic process used in video cameras to retain the appearance of colours as seen by the human eye under light of different colour temperatures

3.1.93**white chart**

test chart that is uniformly white

3.1.94**wide dynamic range****WDR**

camera technology that expands the actual dynamic range and improves the visibility of dark and bright areas in one scene.

3.2 Abbreviations

CCD	charge coupled device
CIF	common intermediate format
CIE	Commission Internationale de l'Éclairage (International Commission on Illumination)
CMOS	complementary metal oxide semiconductor
dB	decibel
DHCP	dynamic host configuration protocol
DNS	domain name system
DVI	digital visual interface
FPS	frames per second (frame rate)
FTP	file transfer protocol
GB	gigabytes
GOP	group of pictures
GPU	graphical processing unit
HD	high definition
HDMI	high definition multimedia interface
HTTP	hypertext transfer protocol
IEEE	Institute of Electrical and Electronics Engineers
IP	internet protocol
IR	infra-red
ISO	International Organization for Standardization
JPEG	Joint Photographic Experts Group
kB	kilobytes
kb/s	kilobits per second
LED	light emitting diode
MB	megabytes
Mb/s	megabits per second
MP	megapixel
MPEG	Moving Picture Experts Group
MTF	modulation transfer function
ND	neutral density
NTP	network time protocol
NTSC	National Television System Committee
OECF	opto-electronic conversion function
PAL	phase alternating line

PTZ	pan/tilt/zoom
SD	standard definition
SDI	serial digital interface
SFR	spatial frequency response
SHA	secure hash algorithm
S/N	signal to noise
SMTP	simple mail transfer protocol
SNR	signal to noise ratio
SSL	secure socket layer
TCP/IP	transmission control protocol / internet protocol
UDP	user datagram protocol
VGA	video graphic array
VSS	video surveillance system
WDR	wide dynamic range

4 Description of video surveillance camera specification items

4.1 General

For video surveillance cameras, including analogue and digital output cameras, network cameras and others with or without PTZ functionality, common items that should be specified in the product documentation such as datasheets are listed. If any of the description items below are specified for the camera, it shall be done according to the requirements of this document.

Description items without a referenced standard or not listed at all in this document should be specified according to other published international standards, including a reference to these standards.

4.2 Camera

4.2.1 Image sensor

4.2.1.1 Description

This indicates a device which converts an optical image into an electrical signal. Usually it is a solid state image acquisition device that has many photoelectric conversion elements placed on the surface where optical image is converted into electrical signal. The electrical signal is then read out in sequence.

4.2.1.2 Item indication

[Image Sensor]

4.2.1.3 Content indication

4.2.1.3.1 Type

This indicates an image sensor by type as a symbolic number, which is a legacy diagonal dimension in inches as an idiomatic description. Inches, using the symbol of double prime ("), may be used as a historical expression for optical format size.

A charge transfer drive system and semi-conductor technology type should be indicated.

EXAMPLE 1: 1/3 type Interline Transfer (IT) CCD

EXAMPLE 2: 1/2,5 type CMOS

EXAMPLE 3: 1/4" CMOS

4.2.1.3.2 Image scanning area

This indicates the scanning size of an effective image area of an image sensor. It is indicated by dimensions in horizontal and vertical directions, in millimetres. As a conventional idiomatic description, it may be called the diameter of an image pickup tube (originally "inch"). The relation between the idiomatic descriptions and general dimensions are as below:

- 1/2 Type (6,4 mm × 4,8 mm);
- 1/3 Type (4,8 mm × 3,6 mm);
- 1/4 Type (3,6 mm × 2,7 mm).

It should be indicated by horizontal (H) × vertical (V) dimensions of an image size (effective image scanning area) in millimetres.

It may be described with the idiomatic descriptions in parallel.

Inches, using the symbol of double prime ("), may be used as a historical expression for optical format size.

NOTE Some megapixel sensors can have multiples of different scanning areas depending upon the selected video format and the mode of reading pixels.

EXAMPLE 1: 6,4 mm (H) × 4,8 mm (V) (1/2 Type, 4:3 mode)

EXAMPLE 2: 4,8 mm (H) × 3,6 mm (V) (1/3 Type, 4:3 SD mode)

EXAMPLE 3: 5,70 mm (H) × 4,28 mm (V) (1/2,5", 4:3 5MP mode)

EXAMPLE 4: 4,22 mm (H) × 2,38 mm (V) (1/2,5", 16:9 HD mode)

4.2.1.3.3 Pixel number

This indicates the number of pixels on the surface of an image sensor, comprising photoactive and non-photoactive pixels.

The number of effective pixels indicates the number of pixels participating in the actual photoelectric conversion. The total number of pixels is a sum of the effective pixels and the pixels for synchronizing, blanking and optical black function around the effective area.

- Approximate number of effective pixels: a rounded number of the product of the number of horizontal pixels and the number of vertical pixels.
- Number of effective pixels: the actual product number of horizontal and vertical pixels (H × V) an electronic picture is made of, produced by the sensor.
- Total number of pixels: usually is not indicated, but may be accompanied by the number of effective pixels.

EXAMPLE 1: Total number of pixels: 811 (H) × 508 (V) ≈ 410 000 pixels

Effective number of pixels: 768 (H) × 494 (V) ≈ 380 000 pixels

EXAMPLE 2: Total number of pixels: 2751 (H) × 2003 (V) ≈ 5,5 MP,

Effective number of pixels (5MP mode): 2592 (H) × 1944 (V) ≈ 5 MP

Effective number of pixels (1080HD mode): 1920 (H) × 1080 (V) ≈ 2,1 MP

4.2.1.3.4 Television system

This indicates the rules related to the colour modulation method of analogue television signal, its scanning method and the frequency.

- Colour: NTSC
- Colour: PAL

EXAMPLE 1: Colour PAL, 625/50i (50 interlaced TV fields)

EXAMPLE 2: Colour NTSC, 525/59,94i (59,94 interlaced TV fields)

4.2.1.3.5 Colour television image pickup system

This indicates the method for acquiring a colour signal in a camera from the optical image.

It is described with the number of image sensors to be used, colour arrangement of filters, etc.

In video surveillance a single sensor is mostly used, while in broadcast there are three-sensor (R, G and B) cameras also.

- The number of image sensors (one or three).
- Colour coding method, or Colour Filter Array (CFA).

EXAMPLE 1: Single image sensor, Complementary (CYGM) colour filter array

EXAMPLE 2: Single image sensor, Bayer (RGB) colour filter array

4.2.1.3.6 Capture frame rate

This indicates the number of frames that can be captured and read from an image sensor per second. For analogue systems a TV frame is composed of two TV fields, which are based on the interlaced scanning (even and odd lines). For digital systems, a frame is composed of all active pixels making a single image unless it is interlaced scanning, e.g. 1080i.

Measuring method is described in 5.4.9.

- Frame rate shall be indicated in frames per second [fps].
- When the frame rate varies depending on the imaging mode, such as cropping, the condition(s) shall be indicated.

EXAMPLE 1: 29,97 fps

EXAMPLE 2: 30 fps (VGA) 15 fps (720-HD, when all pixels are read out.)

4.2.1.3.7 Scanning system

This indicates the predetermined sequential method of reading pixels to convert signals from two-dimensional information (optical image) into an electrical signal in the image sensor.

EXAMPLE 1: 2:1 Interlaced scanning

EXAMPLE 2: Progressive scanning

4.2.1.3.8 Scanning frequency

This indicates the frequencies of horizontal and vertical scanning of the sensor pixels in order to produce the electrical video signal.

Frequencies of horizontal and vertical scanning shall be expressed in hertz [Hz].

EXAMPLE: Horizontal: 15,734 kHz, Vertical: 59,94 Hz

4.2.1.3.9 Shutter mode

This indicates the capture timing of the image sensor. Typical CMOS sensors may have capture timing difference relative to the scanning frequency, which could result in “Rolling shutter” effect.

EXAMPLE 1: Global shutter

EXAMPLE 2: Rolling shutter

4.2.2 Maximum resolution

4.2.2.1 Description

This indicates a numeric value that describes the limit of detail visibility of the object. It is described by number of horizontal and vertical lines that can be resolved. Horizontal resolution is defined by the number of vertical lines relative to the image height. If a value varies depending on a camera setting, the setting condition should be indicated.

Measuring method is described in 5.4.2.

4.2.2.2 Item indication

[Resolution] or [Maximum Resolution]

4.2.2.3 Content indication

The horizontal resolution and vertical resolution shall be indicated by number of lines (equal to lw/ph: line width per picture height). For analogue cameras, it may be expressed as TV lines. The resolution of the centre and the average of the four corners shall be indicated.

EXAMPLE 1: Centre – Horizontal 600 lines, Vertical 600 lines

Corner – Horizontal 450 lines, Vertical 450 lines

EXAMPLE 2: (Analogue camera):

Centre – Horizontal 480 TV lines, Vertical 360 TV lines

Corner – Horizontal 360 TV lines, Vertical 270 TV lines

NOTE 1 This item represents the “Visual resolution”, which is the output result of the camera including the performance of lens, image sensor and signal processing, etc. and which is described in “lines” or “TV lines” to express how much the camera can actually resolve. In contrast, the Digital output (e.g. network camera, HDMI, SDI, etc.) expressed in pixels such as VGA(640 × 480) or HD(1280 × 720), which actually is the “Format resolution”, describes the numeric value sampled but does not include the actual performance of components in the camera, and can differ from the result of “Visual resolution”. Pixels of the image sensor are described in 4.2.1.3.3 and pixels of the output image size are described in 4.5.3. The output signal resolution which can be different from the image sensor pixel is described in 4.5.4 in “lines”.

NOTE 2 In IEC 62676-4, the required object size to monitor or detect etc. is expressed in “pixels”, which relates in this document precisely to the maximum resolution in “lines”.

4.2.3 Minimum illumination

4.2.3.1 Description

This indicates the minimum visible light illumination necessary, expressed in lux, to obtain specified contrast of the video output level (expressed in %) at which an object can be determined, while producing no less than 25 fps (30 fps). If the camera offers a Day/Night mode the minimum illumination shall be specified for Colour- and Black&White-Mode separately

Measuring method is described in 5.4.3.

4.2.3.2 Item indication

[Minimum Illumination]

4.2.3.3 Content indication

It shall be expressed in lux [lx] accompanied by F-number value of the lens, the accumulation (exposure) time, and measuring condition, all of which shall be indicated for visible light. The minimum illumination of a camera shall be specified at 30 % contrast (signal level difference between the white and black signal of the test chart), with electronic shutter equal to or shorter than 1/25 s (40 ms) or 1/30 s (33,3 ms). Contrary to the older standards, where the absolute output level was specified, the amplitude/contrast (difference between white and black) of the output level shall be measured in order to take into account the camera's AGC and to avoid adding set-up (black level) to artificially improve the minimum illumination number.

Since the colour temperature of the light source influences the result, it should be indicated.

For cameras offering true Day/Night mode by mechanically removing the IR cut-filter, the sensitivity should be expressed in lux as measured with a lux-meter for the visible part of the radiated spectrum. Since a camera sensor with removed IR cut-filter has extended sensitivity in the IR spectrum, by stating the light source equivalent colour temperature, relative to a black body radiator, for example 3 100 K for a halogen lamp, the IR part of the spectrum is also given.

EXAMPLE 1: Min. illumination 2,0 lx (F1,8, 1/25 [s], Colour temp. 3 100 K)

EXAMPLE 2: Min. illumination 1,0 lx (Day Mode), 0,03 lx (Night Mode), F1,4, 1/30 [s],
Colour temp. 3 100 K

4.2.4 Signal to noise ratio (SNR, S/N ratio)

4.2.4.1 Description

This indicates a ratio of rated video signal level voltage (S) to the noise level voltage (N) included in a video output signal.

4.2.4.2 Item indication

[SNR] or [S/N Ratio]

4.2.4.3 Content indication

It shall be expressed in dB (decibel) as equal to or better than a specified value.

EXAMPLE: SNR ≥ 48 dB

4.2.5 White balance

4.2.5.1 Description

This indicates the function of a colour camera to adjust colour balance to appear natural to the human eye, according to light sources. It is the function of the camera image processing algorithm to make colour adjustment of the scene illuminated with various colour temperature light sources so that when a white object is seen, it is reproduced white irrespective of the light sources.

4.2.5.2 Item indication

[White Balance]

4.2.5.3 Content indication

Adjustment method should be specified by different modes, such as fully automatic, manual or one-push set-up.

Indicate the tracking range of colour temperature in which white balance can be adjusted automatically.

EXAMPLE: Automatic: ATW (Auto Tracking White Balance) 3 200 K to 6 000 K, one-push
 Manual: R/B variable
 Fixed: 3 200 K, indoor, outdoor

4.2.6 Electronic shutter

4.2.6.1 Description

This indicates the capability of electronically controlling the electronic shutter (exposure time) for the accumulation of light in the image sensor.

4.2.6.2 Item indication

[Electronic Shutter]

4.2.6.3 Content indication

Specify accumulation time (electronic shutter or exposure time).

When the electronic shutter is expressed as OFF, the actual electronic shutter shall be indicated.

EXAMPLE 1: 1/15 s, 1/30 s, 1/60 s, 1/100 s, 1/250 s, 1/1 000 s

EXAMPLE 2: Auto/Manual (1/15 s, 1/30 s, 1/60 s, 1/100 s, 1/250 s, 1/1 000 s)

EXAMPLE 3: OFF (1/30 s), 1/100 s

4.2.7 Electronic sensitivity up (Slow shutter)

4.2.7.1 Description

This indicates a value that increases sensitivity by extending accumulation of light in an image sensor, combining light of adjacent pixels in an image sensor, or adding up frame/field signal in a memory.

4.2.7.2 Item indication

[Electronic Sensitivity Up] or [Slow Shutter]

4.2.7.3 Content indication

Specify the value or electronic shutter.

Indicate if the resolution changes by combining pixels.

EXAMPLE 1: Sensitivity scale factor 4 times, electronic shutter 1/15 s

EXAMPLE 2: Twice, 4 times, 8 times, 16 times

EXAMPLE 3: 1/30 s, 1/15 s, 1/7,5 s

4.2.8 Dynamic range (DR)

4.2.8.1 Description

This indicates the ratio between the highest illumination which produces unclipped detailed image, just below the saturation level, and the lowest illumination, just equal to the noise level. Scene details with the same amplitude as the noise are assumed to be just noticeable. The absolute output level that results from the lowest illumination is not of importance for the dynamic range, but is a major parameter for the visible dynamic range (see 4.2.9). These highest and lowest illuminations have to be reproduced simultaneously in one scene. Dynamic Range depends on the sensor design, its quantum efficiency and pixel size, number of exposures and its exposure range, the temperature and the optic quality of the lens used. Also, there are technologies that expand the dynamic range usually named as wide dynamic range (WDR). Dynamic range is expressed as a pure ratio or in decibels (dB) with 10-base logarithmic value.

Measuring method is described in 5.4.4.

4.2.8.2 Item indication

[Dynamic Range]

4.2.8.3 Content indication

Indicate in dB (decibel) or times.

EXAMPLE: Dynamic Range 80 dB or 10 000 times.

4.2.9 Visible dynamic range (VDR)

4.2.9.1 Description

This indicates the ratio between the highest illumination which produces unclipped detailed image, just below the saturation level, and the lowest illumination that can be output at 50 %. This output level of 50 % is chosen such that it is bright enough to produce usable picture and is therefore a good measure for the VDR. The signal to noise ratio of this lowest illumination is not of importance for the VDR, but it is a major parameter for the dynamic range (see 4.2.8). These highest and lowest illuminations have to be reproduced simultaneously in the same scene. Visible dynamic range depends on the sensor design, its quantum efficiency and pixel size, number of exposures and its exposure range, the temperature and the optic quality of the lens used. It is expressed as a pure ratio or in decibels (dB) with 10-base logarithmic value.

Measuring method is described in 5.4.5.

4.2.9.2 Item indication

[Visible Dynamic Range]

4.2.9.3 Content indication

Indicate in dB (decibel) or times.

EXAMPLE: Visible Dynamic Range 48 dB or 256 times.

4.2.10 Infra-red illumination operating view distance

4.2.10.1 Description

This indicates a distance between a camera and an object necessary to obtain specified video output level only using an infra-red (IR) illuminator built into a camera. This measurement

method is based upon the image sensor's base material, and that the IR illuminator's wavelength matches the sensitivity of the image sensor.

Measuring method is described in 5.4.6.

4.2.10.2 Item indication

[Infra-Red Illumination Operating View Distance]

4.2.10.3 Content indication

Measured viewing distances may be indicated by a representative figure when having multiple measured results as "TYP level" (typical level). Also LED wavelengths should be indicated in nanometres (nm) to state visibility of the IR LED clearly. Lens specifications shall be indicated jointly in the case of a lens exchangeable camera.

EXAMPLE: Viewing Distance (Centre) 10 m (TYP level)

Viewing Distance (Corner) 5 m (TYP level)

(LED wavelengths 850 nm, F1,4, f = 12 mm)

4.2.11 Day/Night mode (D/N)

4.2.11.1 Description

This indicates the capability of the camera moving the IR cut-filter mechanically when changing from colour to black & white in low light and from black & white to colour in bright light.

4.2.11.2 Item indication

[Day/Night mode]

4.2.11.3 Content indication

Indicate the mechanism of IR cut-filter for Day/Night mode. If the IR cut-filter is mechanically moved, it can be expressed as True Day/Night Mode.

EXAMPLE 1: Day/Night Mode

EXAMPLE 2: True Day/Night Mode – mechanical IR cut-filter removal

EXAMPLE 3: Digital Day/Night Mode (non-mechanical)

4.2.12 Internal image processing performance

4.2.12.1 Description

The capability of the camera hardware to process images with the help of imaging algorithms to improve quality such as noise reduction, sharpening, image stabilization, multi-exposure, video analytics, etc.

4.2.12.2 Item indication

[Image Processing Performance]

4.2.12.3 Content indication

EXAMPLE: 600 MP/s

4.3 Lens

4.3.1 Focal length

4.3.1.1 Description

Distance from the second principle plane of a lens to the point where light-rays coming from infinity, and parallel to the optical axis, are focusing.

4.3.1.2 Item indication

[Focal Length]

4.3.1.3 Content indication

It is expressed as f [mm]

EXAMPLE: Focal Length $f = 2$ mm to 10 mm

4.3.2 Relative aperture (F-number)

4.3.2.1 Description

The relative aperture, also designated as F-number, is the ratio of the effective diameter of a lens (entrance pupil) to its focal length.

4.3.2.2 Item indication

[Aperture Ratio]

4.3.2.3 Content indication

$F = f / D$, where f is focal length and D is the diameter of the entrance pupil.

EXAMPLE 1: Aperture Ratio 1:1,4

EXAMPLE 2: F1,4

EXAMPLE 3: F1,6 (Wide) to F4,7 (Tele)

EXAMPLE 4: 1:1,8 (Fixed)

4.3.3 Field of view

4.3.3.1 Description

The Field of View (FOV) describes the region seen by a sensor and depends on the sensor size and the focal length of the optical system. Usually, the FOV is calculated for the diagonal, but it can also be reported for the horizontal field of view (HFOV) and the vertical field of view (VFOV) directions.

4.3.3.2 Item indication

[Field of View]

4.3.3.3 Content indication

It is often provided as an angle of view [$^{\circ}$] and can be calculated with

$$\text{FOV} = 2 \arctan (\text{SensorSize} / 2f),$$

where SensorSize is in millimetres, and f is the lens focal length in millimetres.

EXAMPLE 1: Diagonal FOV 122°

EXAMPLE 2: Horizontal: 104°, Vertical: 85°

4.3.4 Image distortion

4.3.4.1 Description

Geometric distortion that basically derives from the variation of magnification in the image field.

Measuring method is described in 5.4.7.

4.3.4.2 Item indication

[Image Distortion]

4.3.4.3 Content indication

Percentage difference between a point on a regular grid around the centre of an image and the distance of the point to the centre in a real image.

EXAMPLE: Image Distortion: 10 %

4.3.5 Iris control

4.3.5.1 Description

This indicates the lens iris control mechanism.

4.3.5.2 Item indication

[Iris Control]

4.3.5.3 Content indication

Indicate the iris control type for the lens.

EXAMPLE 1: DC driven iris

EXAMPLE 2: Video driven iris

EXAMPLE 3: Manual

4.3.6 Mount type

4.3.6.1 Description

This indicates the lens mechanical mount type used for the camera system.

4.3.6.2 Item indication

[Mount type]

4.3.6.3 Content indication

Indicate the mount types for the lens.

EXAMPLE 1: C/CS mount

EXAMPLE 2: CS mount

EXAMPLE 3: S mount

4.3.7 Image flare

4.3.7.1 Description

Unwanted increase of signal in the image plane of an optical system, caused by the scattering and reflection of a proportion of the radiation (light) which enters the system through its normal entrance aperture where the radiation may be from inside or outside the field of view of the system.

Measuring method is described in 5.4.8.

4.3.7.2 Item indication

[Image Flare]

4.3.7.3 Content indication

Indicate the signal level increase in dark areas on the test chart as a percentage of the diffuse white signal from the white areas on the test chart.

EXAMPLE: Image Flare: 8 %

4.4 Input / Output

4.4.1 Video output

4.4.1.1 Description

This indicates the output of a video signal, from a camera. If digital video is referred to, the format and connectivity should be indicated. If analogue video is referred to, such as composite video signal, the format, output level and impedance should be indicated.

Any video output for installation purpose that is used mainly for view angle adjustment, focus adjustment, etc. shall be indicated as “monitor output”.

Compliant Video Signal interfaces, specifications and measuring method shall refer to IEC 62676-3.

4.4.1.2 Item indication

[Video Output] or [Monitor Output]

4.4.1.3 Content indication

Signal type, level, output impedance, connector type, location, etc.

EXAMPLE 1: PAL VBS 1,0Vp-p 75 Ω

EXAMPLE 2: NTSC 1,0Vp-p 75 Ω

EXAMPLE 3: DVI/HDMI (1080iHD)

EXAMPLE 4: SDI (3 Gb/s)

4.4.2 Auto-iris lens output

4.4.2.1 Description

This indicates an output for control of an auto-iris lens. Control method or video signal and supply voltage shall be indicated.

4.4.2.2 Item indication

[Auto-iris Lens Output]

4.4.2.3 Content indication

Specify auto-iris control types and connector types

EXAMPLE 1: Video output VS 1,0 Vp-p

Supply voltage 9 V DC

Connector 4P

EXAMPLE 2: DC output

Connector 4P

4.5 Video output format

4.5.1 Image format standard

4.5.1.1 Description

This indicates the basic image formats and digital sampling system, if applicable for HD. The supported SMPTE standards shall be listed.

4.5.1.2 Item indication

[Image Format Standard]

4.5.1.3 Content indication

Indicate the supported image or video format standards such as SMPTE standards.

EXAMPLE: SMPTE 274M-2008 , 1920 × 1080, Progressive, 16:9

SMPTE 296M-2001, 1280 × 720, Progressive, 16:9

4.5.2 Colour representation

4.5.2.1 Description

This indicates which colour representation system the camera complies to.

4.5.2.2 Item indication

[Colour Representation]

4.5.2.3 Content indication

Indicate the supported standards for colour representation.

EXAMPLE: colour representation: ITU-R BT.709

4.5.3 Output image pixel number

4.5.3.1 Description

This indicates the number of pixels of the data of a single output image.

4.5.3.2 Item indication

[Output image pixel number]

4.5.3.3 Content indication

Indicate the abbreviation of a general image format, or horizontal and vertical pixel numbers.

- In case of an original format, this shall be stated, and horizontal and vertical pixel numbers shall be specified.
- If more than one size is available, they shall be listed.
- If pixel numbers differ depending on different compression formats, the compression format shall also be specified.

EXAMPLE: JPEG: 1280 × 960, VGA (640 × 480), QVGA (320 × 240), 1280 × 720 (image cropped)

MPEG-4: 4CIF (704 × 576), CIF (352 × 288)

4.5.4 Output image resolution

4.5.4.1 Description

This indicates the resolution of the output image of the camera which may be filtered, re-formatted or re-sampled from the original pixel number of the image sensor.

4.5.4.2 Item indication

[Output Image Resolution]

4.5.4.3 Content indication

The horizontal resolution and vertical resolution shall be indicated by number of lines.

EXAMPLE: Horizontal resolution: 300 lines, Vertical resolution: 200 lines

4.6 Pan and tilt

4.6.1 Rotation angle

4.6.1.1 Description

This indicates maximum rotation angle.

4.6.1.2 Item indication

[Rotation Angle]

4.6.1.3 Content indication

EXAMPLE: Horizontal: ±175° with the front as 0°

Vertical: Up 20° to down 60° or +20° to -60° with a horizontal view as 0°

Pan Range 360° continuous rotation

4.6.2 Rotation speed

4.6.2.1 Description

This indicates rotation speed when pan or tilt is operating. In general, it should be indicated if it is proportional speed depending on the inclination of PTZ joystick. The maximum achievable speed when using preset positioning should also be indicated.

4.6.2.2 Item indication

[Rotation Speed]

4.6.2.3 Content indication

EXAMPLE: Horizontal rotation speed 180°/s, vertical rotation speed 90°/s.

Variable Pan/Tilt Speed 0,2°/s to 120°/s

Pre-position Speed 120°/s

Proportionality Pan /Tilt to Zoom 1:1

Optical Zoom Movement Speed < 5 s (Wide to Far)

4.6.3 Preset position function

4.6.3.1 Description

This indicates the function to store a position of pan/tilt, zoom/focus position of lens, camera setting condition, etc.

4.6.3.2 Item indication

[Preset Function]

4.6.3.3 Content indication

Indicate the function capable of storing or the number of stored items. It should also indicate the speed of achieving preset positions, combining pan, tilt and zoom functions.

EXAMPLE: Pan/tilt position, zoom/focus position 256 positions

120°/s preset recalls

Max. number of tours, presets and duration: 2 tours, 32 presets, 30 min.

4.6.4 Preset position accuracy

4.6.4.1 Description

This indicates the accuracy of returning to a preset position and placement of a privacy mask.

4.6.4.2 Item indication

[Preset Position Accuracy], [Privacy Mask Accuracy]

4.6.4.3 Content indication

EXAMPLE: $\pm 0,5^\circ$, $\pm 0,01^\circ$

4.6.5 Audible noise

4.6.5.1 Description

This indicates the noise during pan tilt zoom operation.

4.6.5.2 Item indication

[Audible Noise]

4.6.5.3 Content indication

EXAMPLE: < 65 dBmW

4.7 Network

4.7.1 Network interface

4.7.1.1 Description

This indicates the method for connecting to a network.

4.7.1.2 Item indication

[Network Interface]

4.7.1.3 Content indication

Indicate the standard, type, connector, etc.

EXAMPLE 1: LAN

Standard IEEE 802.3

Type 10BASE-T, 100BASE-TX, 1000BASE-T

Connector RJ-45

EXAMPLE 2: Wireless LAN

Standard IEEE 802.11a, b, g

4.7.2 Image and video compression format

4.7.2.1 Description

This indicates the format of the compression in order to reduce the amount of digital video data for recording or transmission, etc. Image compressions work in two dimensions ($H \times V$), and the result is a compressed image expressed in kilobytes [kB] or megabytes [MB]. Video compressions work in three dimensions ($H \times V \times \text{time}$), and the result is a compressed video stream expressed in kilobits per second [kb/s] or megabits per second [Mb/s].

4.7.2.2 Item indication

[Video Compression Format] or [Image Compression Format]

4.7.2.3 Content indication

Indicate the abbreviation of the format according to the related international standard. If more than one format is available, they shall be listed.

NOTE See a list of compression formats published as international standards in IEC 62676-1-1:2013, 6.1.3.6.

EXAMPLE: JPEG, JPEG-2000, MPEG-2, MPEG-4, H.264, H.265, M-JPEG, raw format, uncompressed

4.7.3 Bit rate control

4.7.3.1 Description

This indicates a function to control the image or video compression ratio.

It mainly consists of Constant Bit Rate control (CBR) that keeps the bit rate constant, irrespective of the amount of moving content within the camera view, by varying the compression ratio or frame rate, etc. and Variable Bit Rate control (VBR) that maintains the

compression ratio by varying the amount of video data depending upon the moving content within the camera view.

4.7.3.2 Item indication

[Bit Rate Control]

4.7.3.3 Content indication

Indicate Constant Bit Rate control (CBR)/Variable Bit Rate control (VBR) switchable capability, bit rate setting, etc.

- For MPEG and M-JPEG, the bit rate control should indicate the amount of bits in a second. A ratio of how much the maximum bit rate exceeds the set bit rate may be indicated.
- For JPEG, a unit time should be indicated, unless the unit time of the bit rate control is 1 s.

EXAMPLE 1: JPEG: Bit rate control is available.

(Unit time for controlling amount is 1,5 s)

MPEG-4: Bit rate setting available. 64 kb/s to 6 Mb/s

EXAMPLE 2: 64 kb/s, 128 kb/s, 256 kb/s, 512 kb/s, 1 024 kb/s, 2 048 kb/s, 4 096 kb/s

/unlimited CBR function available

EXAMPLE 3: Constant Bit Rate control setting is available.

128 kb/s to 4 Mb/s (Maximum data over set value: within 10 %)

EXAMPLE 4: M-JPEG: Bit rate control is available.

4.7.4 Maximum frame rate

4.7.4.1 Description

This indicates the maximum number of image frames per second.

4.7.4.2 Item indication

[Maximum Frame Rate]

4.7.4.3 Content indication

[Maximum Frame Rate]

EXAMPLE 1: 30 frames/s

EXAMPLE 2: 15 fps

4.7.5 Maximum number of encoding streams

4.7.5.1 Description

This indicates the maximum number of parallel encoding streams the camera can output into the network with the same or different qualities (resolution and frame rates) at the same time. If the maximum frame rate or resolution cannot be applied, this shall also be specified.

4.7.5.2 Item indication

[Maximum Number of Encoding Streams]

4.7.5.3 Content indication

EXAMPLE 1: MPEG-4 2 simultaneous outputs, 12 fps 720p

EXAMPLE 2: MPEG-4 2 streams (4CIF), JPEG (4CIF) 1 stream

4.7.6 Multicast streaming

4.7.6.1 Description

This indicates the support of multicast streams according to IEC 62676-1-2:2013, 6.6.

4.7.6.2 Item indication

[Multicast Streaming Support]

4.7.6.3 Content indication

EXAMPLE: H.264 2 streams ≤ 6 Mb/s (1080HD) + 2 Multicast Streams supported

4.7.7 Maximum number of connections

4.7.7.1 Description

This indicates the maximum number of concurrent connections and video the camera is able to offer at the same time to clients using the unicasting method.

4.7.7.2 Item indication

[Maximum Number of Connections]

4.7.7.3 Content indication

EXAMPLE: Maximum Number of Connections: 3

4.7.8 Total encoding performance

4.7.8.1 Description

The total capability of the camera hardware to encode multiple image streams as combination of frame rate and resolution shall be specified.

4.7.8.2 Item indication

[Encoder Performance]

4.7.8.3 Content indication

EXAMPLE: 250 MP/s 8 streams @ 1080p15 (8 × 1920 × 1080 × 15)

(1 stream @ 4k 30fps (1 × 3840 × 2160 × 30))

4.7.9 Image stream delay (Latency)

4.7.9.1 Description

This indicates the overall delay of an image from capturing to display. The minimum and maximum latency of a camera image in the IP network related to its settings, e.g. for Video compression and de-compression method, bit rate, fps, etc., shall be specified.

NOTE An example of measuring method is described in Annex E.

4.7.9.2 Item indication

[IP Delay]

4.7.9.3 Content indication

EXAMPLE: IP Delay: Minimum 110 ms, Maximum 240 ms

4.7.10 Camera storage (Local storage)

4.7.10.1 Description

This indicates the capability of local storage in the camera.

4.7.10.2 Item indication

[Camera storage] or [Local Storage]

4.7.10.3 Content indication

EXAMPLE: SD card 2 GB, SDHC card 16 GB

4.7.11 Audio function

4.7.11.1 Description

This indicates audio related functions.

4.7.11.2 Item indication

[Audio Function]

4.7.11.3 Content indication

The function is divided into audio input and audio output. Indicate information such as method, connector type, impedance, audio I/O signal voltages (line level or microphone level), encoding method with supported sampling rates, etc.

Indicate the abbreviation of the encoding method according to the related international standard. If more than one format is available, they shall be listed.

NOTE See a list of internationally standardized audio encoding formats in IEC 62676-1-1:2013, 6.1.3.6.

EXAMPLE: Audio input Microphone built in.

Audio output RCA pin jack, output impedance 600 Ω , line level (–10 dBV)

Audio compression AAC, G.711, 64 kb/s

4.7.12 Network protocol

4.7.12.1 Description

This indicates the communication protocol to communicate among devices on a network.

The procedure is defined for each function such as file transfer or mail transmission, etc.

The product documentation shall list the communication protocols supported by the camera according to IEC 62676-1-2:2013, Clauses 6 to 12. The widely known abbreviations listed in IEC 62676 should be used.

4.7.12.2 Item indication

[Network Protocol]

4.7.12.3 Content indication

List the abbreviation of the network protocol.

EXAMPLE: IEC 62676-2-3, TCP/IP, UDP/IP, HTTP, FTP, SMTP, DNS, DHCP, NTP

4.7.13 Camera time synchronization and localization

4.7.13.1 Description

This indicates the ability of the network camera to individually synchronize its internal clock to a Time reference (time zone) of the recorder, where the camera stream might be stored, or to the computer or decoder where the camera stream is being decoded and viewed.

4.7.13.2 Item indication

[Time Synchronization]

4.7.13.3 Content indication

The Time Synchronization shall comply with Network Time Protocol (NTP) standard.

The Time localization ability of the camera shall state the ability of the camera to individually adjust the clock to the current Time reference and daylight savings scheme.

NOTE A recorder/computer/decoder can have cameras attached that are placed in more than one time zone where the current date and time of the capture of the camera stream (image/video) is recorded.

If the camera time is not preserved by the camera's internal battery (once it has been set in a system), it shall be disclosed.

The Camera Time overlay function on the camera output image shall be indicated if available with the possibility of turning off.

EXAMPLE: Time Synchronization: NTP time server, Battery backup

Local Day Light Saving available, Time/Date on-screen overlay ON/OFF.

4.8 Network security

4.8.1 General description

This indicates the access control or data tampering prevention function, etc. to prevent any illegal access, hacking of video data/setting page of a network camera from an unauthorized third party according to IEC 62676-1-2:2013, Clause 12 and IEC 62676-2-3:2013, Clause 22.

4.8.2 Network authentication

4.8.2.1 Description

This indicates the access control functions.

Recommended international standards are described in IEC 62676-1-2:2013, Clause 12.

4.8.2.2 Item indication

[Network Authentication]

4.8.2.3 Content indication

List the access control or data tampering prevention functions offered by the network camera based on the international standards described in IEC 62676-1-2.

EXAMPLE: Host authentication (IP address), user authentication (ID, password), encryption (IPsec, SSL, HTTPS, SFTP), device authentication (IEEE 802.1X)

NOTE There is a network security risk if the default ID/password is used. Notifying installers and end-users to change default ID/password will reduce risks. Also, deactivating unsecure protocols such as telnet, ftp, http and eliminating passwords embedded in program source code (hard-coded) will reduce risks.

4.8.3 Video authentication and watermarking

4.8.3.1 Description

This indicates how video authentication is realized and which methods of IEC 62676-1-2:2013, Clause 12 and IEC 62676-2-3:2013, Clause 22 are offered. The methods of validating the authenticity of video should make use of digital signatures, where hashes are embedded in the video stream. The hashes are checksums of the video stream, which are encrypted or signed by the private certificate key of the device.

4.8.3.2 Item indication

[Video Authentication]

4.8.3.3 Content indication

EXAMPLE: MD5 Message-digest with 128-bit hash value.

SHA-1 160-bit hash value.

SHA-256 256-bit (32-byte) hash

4.9 Other specifications

Items below shall follow related standards:

- power supply;
- power consumption;
- operating temperature;
- operating humidity;
- dimensions;
- mass (weight);
- vibration resistance;
- vandal resistance and water and dust resistance;
- wind resistance;
- certifications and approvals.

5 Measurement methods of video surveillance camera specification items

5.1 Setting of standard shooting condition

5.1.1 General

When a performance test of a video surveillance camera is carried out, the following standard measurement conditions shall be set.

5.1.2 Common standard shooting condition

5.1.2.1 Lighting condition

Lighting condition is expressed in Table 1.

Table 1 – Lighting condition

Item	Condition
Colour temperature of light source	3 100 K $\pm$ 100 K
Illuminance of reflective test chart	1 000 lx $\pm$ 50 lx
Maximum luminance of transparent test chart	318 cd/m ² $\pm$ 16 cd/m ²
Non-uniformity of illuminance or luminance ^a	5 % or lower
^a Max-Ave /Ave < 0,05 and Min-Ave /Ave < 0,05	

The colour temperature is defined based on halogen lamp. If light source characteristics differ, it should be indicated.

It is necessary to choose a suitable lens for a measurement to reduce non-uniformity of the luminance between the centre and the corners, because luminous transmittance changes by an incidence angle as for a transparent chart.

Recommendable horizontal field of view is 30° (incidence angle 15°) or less.

Measure the illuminance by a Reflected Light Meter (lux-meter) at the centre of the transparent test chart.

5.1.2.2 Environmental condition

Measurement shall be at a room temperature of 23 °C $\pm$ 2 °C.

Camera shall be run for at least 30 minutes before testing.

5.1.2.3 Relation of illuminance and luminance

Brightness of a luminous body of surface-emitting light is expressed with luminance (cd/m²). A light-box is a luminous body, so that its luminance is expressed with these units.

On the other hand, illuminance is light falling on an illuminated object and is expressed in lux (lx).

When the conditions of distance and the direction to a luminous body are constant, the illuminance is measured in correlation with the luminance, so the illuminance values are acceptable as an approximation using the formula below.

The relations of luminance (L_v : cd/m²) and illuminance (E_v : lx) are referred to the following expression.

$$L_v = (\rho/\pi) \times E_v$$

ρ : Transmittance (= reflectance)

π : Pi (3,1415...)

Relation of illuminance and luminance is expressed in Table 2.

Table 2 – Relation of illuminance and luminance

Item	Symbol	Definition	Unit
Luminous intensity	I	Luminous power per unit solid angle	[cd]
Illuminance	E_v	$E_v = \phi_v / A$ ϕ_v : luminous power [lm] A: surface area [m ²]	[lx] ([lm/m ²])
Luminance	L_v	$L_v = I / A \theta = I / (A \times \cos \theta)$ I : luminous intensity of a surface A in perpendicular direction [cd] A θ : appearance of a light source area in a direction at an angle θ relative to the normal [m ²] (Lambertian surface)	[cd/m ²]

5.1.2.4 Field angle

The horizontal and vertical image frame markers of the test chart shall be set to cover the full effective screen.

5.1.2.5 Lens iris

Adjust the F-number to obtain the rated video output.

5.1.2.6 Standard camera settings

Unless otherwise stated at the particular measurements, the camera settings shall be as expressed in Table 3.

Table 3 – Standard camera settings

Item	Camera setting
AGC	ON
White balance	Best setting
Maximum exposure time	40 ms or 33,3 ms (state condition)
Frame rate	Highest available, but no more than 30 frames per second (to be noted)
Output image pixel number	Set to the maximum pixel number
Video compression format	Uncompressed ^a
Video compression ratio	Uncompressed ^a
Focus	Optimal setting
^a When "Uncompressed" is not available, choose the setting for minimum compression (best image quality) and report the compression setting with the results.	

NOTE The output of video surveillance cameras often includes image compression, to reduce the size of the image files and allow more images to be stored. The use of image compression can significantly affect resolution and other measurements. Some cameras have switches that allow the camera to operate in various compression or output image pixel number modes.

For any condition that cannot be set according to Table 3, initial value (factory default) of the camera should be applied. Any other setting not listed in Table 3 shall be initial value (factory default). Settings different from standard settings shall be reported.

5.2 Video signal quantization level

5.2.1 General

Definition of the quantization level for digital video signals of a video surveillance camera.

5.2.2 Digital video signal quantization level

The quantization level of digital video signals of a video surveillance camera shall be based on international standards for video signals, i.e. ITU-R Recommendation BT.601 or BT.709, as expressed in Table 4. The video level of 100 % shall be equivalent to the analogue video signal level of 700 mV for PAL and HD or 714 mV for NTSC.

Table 4 – Digital video signal quantization level

Video level		Digital video signal quantization level (decimal number)	
		8-bit system	10-bit system
Full-scale		0 to 255	0 to 1023
Luminance	0 [%] black level	16	64
	100 [%] white level	235	940
	50 [%] level	126	502
Colour-difference	Zero-point	128	512
	Range	16 to 240	64 to 960
Code limit	Video output signal range	1 to 254	1 to 1019
	Prohibited range (0 and 255 cannot be used for any other purpose except for representing synchronization signals.)	0, 255	0 to 3 and 1020 to 1023
White clip range		236 to 254	941 to 1019

5.2.3 Other quantization levels

If the quantization level is not based on ITU-R Recommendation BT.601 or BT.709, the quantization level standard shall be specified.

5.3 Measurement environment

5.3.1 General

When the performance tests of video surveillance cameras are carried out, the measurement environment shall consist of a test chart, measuring equipment such as waveform monitor and/or vector-scope, and if required measuring method software for measurement.

NOTE For network cameras, equipment to bridge IP to digital output, e.g. SDI, HDMI, is available in the market to interface television/broadcast measuring equipment.

The camera shall be tested fully assembled, e.g. dome cameras shall be tested with the dome cover. Network cameras shall be tested with the shortest connection, e.g. one network switching hub.

For cameras with interchangeable lens, e.g. box cameras shipped without lens, the lens used for measurement should be reported.

5.3.2 Test chart

5.3.2.1 General

Test charts specified further in the measuring method below are examples and if the same result can be obtained, a similar test chart can be used.

When using a reflective type of test chart the equipment shall be placed as in Figure 1.

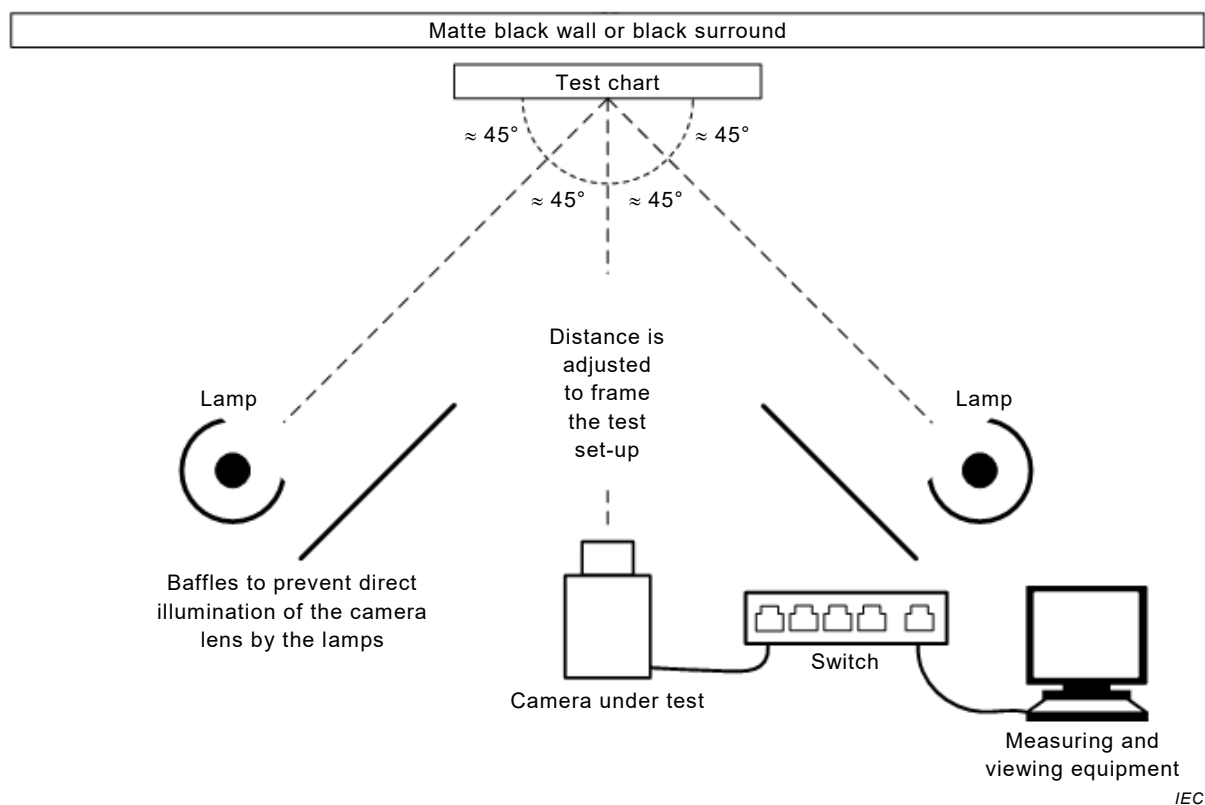


Figure 1 – Test set-up for reflective test chart

When using a transparent test chart the equipment shall be placed as in Figure 2.

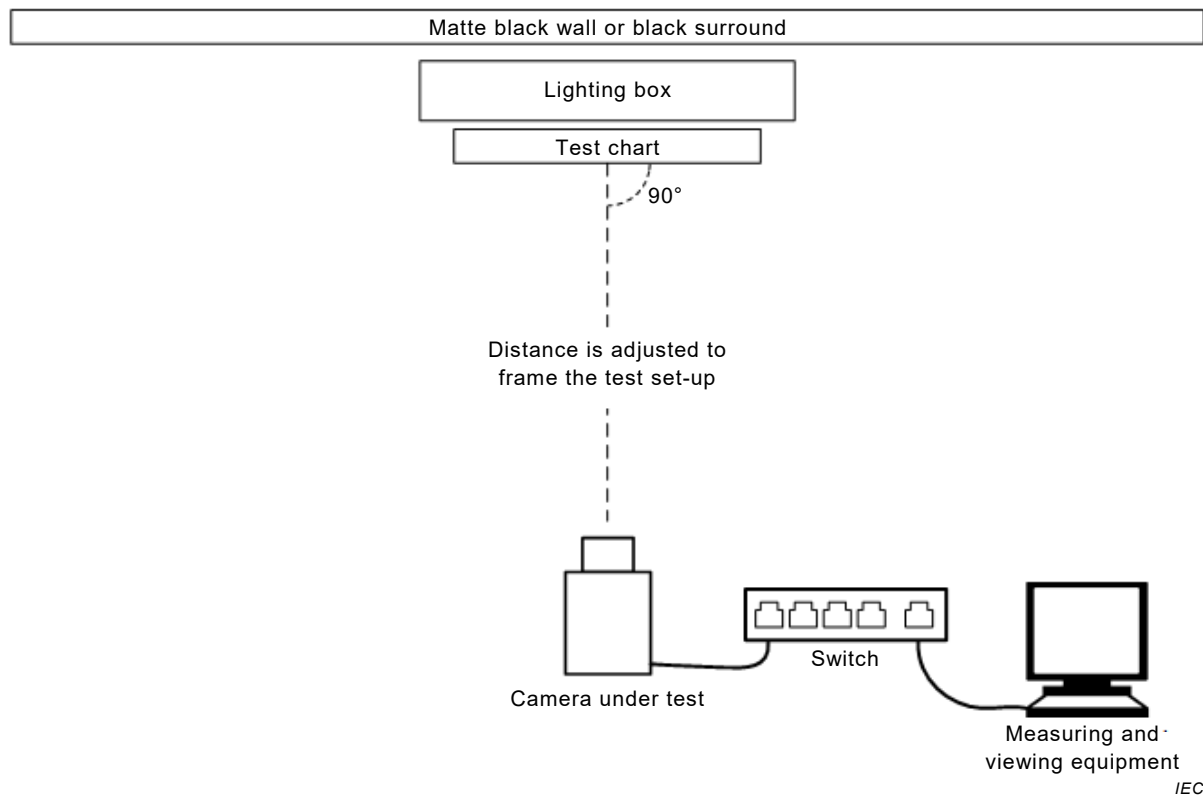


Figure 2 – Test set-up for transparent test chart

When using a fixture with lamps the equipment shall be placed as in Figure 3.

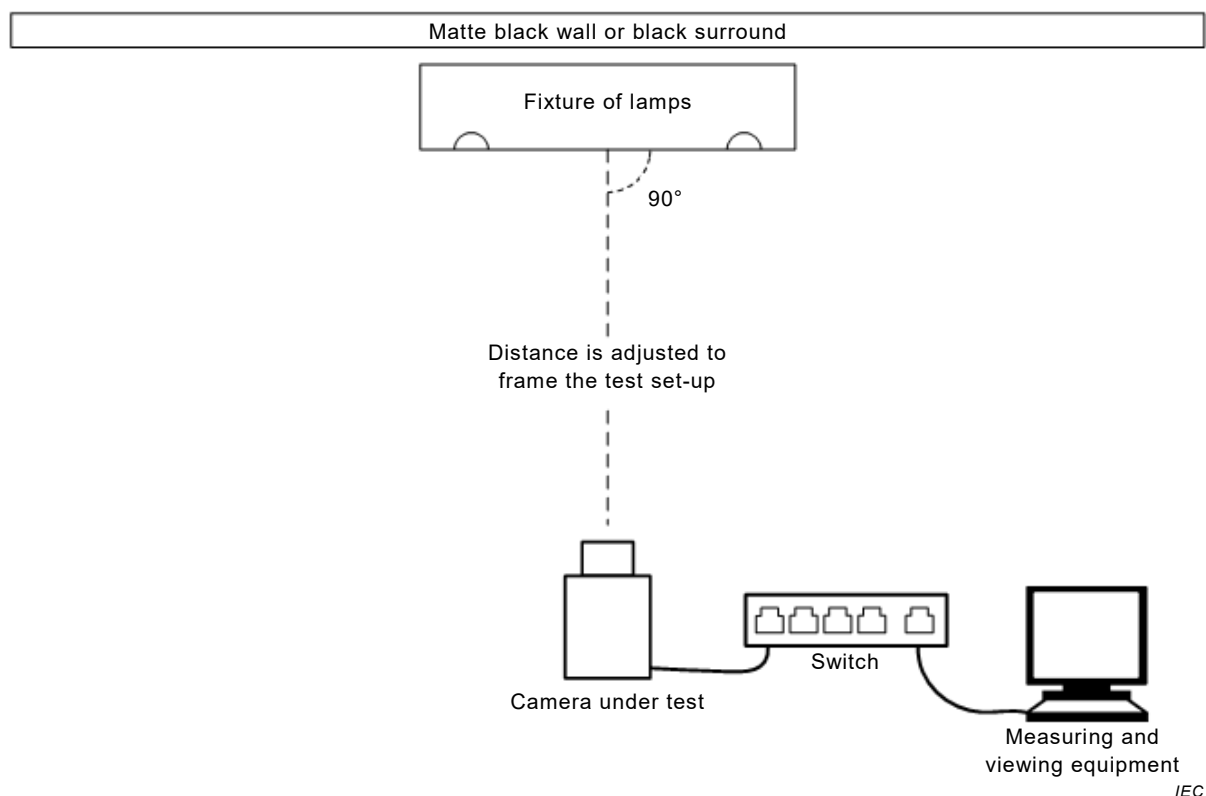


Figure 3 – Test set-up for fixture with lamps

The area surrounding the test target should be of very low reflectance, to minimize image flare light.

The test target should be shielded from any stray light.

The camera lens should be optimally focused on the test target.

The light sources should be located so as to minimize the occurrence of specular reflections off the surface of the target when viewed by the camera under test.

5.3.2.2 Positioning of the camera

The chart shall be orthogonal to the optical axis. The alignment can be performed by using a mirror placed on the target plane (i.e. parallel to the target plane), as shown in Figure 4.

Pan, tilt, and laterally displace the camera position to the left, right, up, and down until the centre point of the taking lens in the viewfinder image is positioned at the image centre.

The camera shall be positioned to properly frame the test target. The camera focus should be set either by using the camera autofocus system, or by performing a series of image captures at varying focus settings, and selecting the focus setting that provides the highest average modulation level. Alternatively a live image with zoom function can also be used to accurately focus on the target. Auto focus accuracy is often limited and this limitation might have an impact on the results.

The camera lens iris (if adjustable) and the exposure time should be adjusted to provide a near maximum signal level from the white test target areas. The settings shall not result in signal clipping in either the white or black areas of the test chart, or regions of edge transitions.

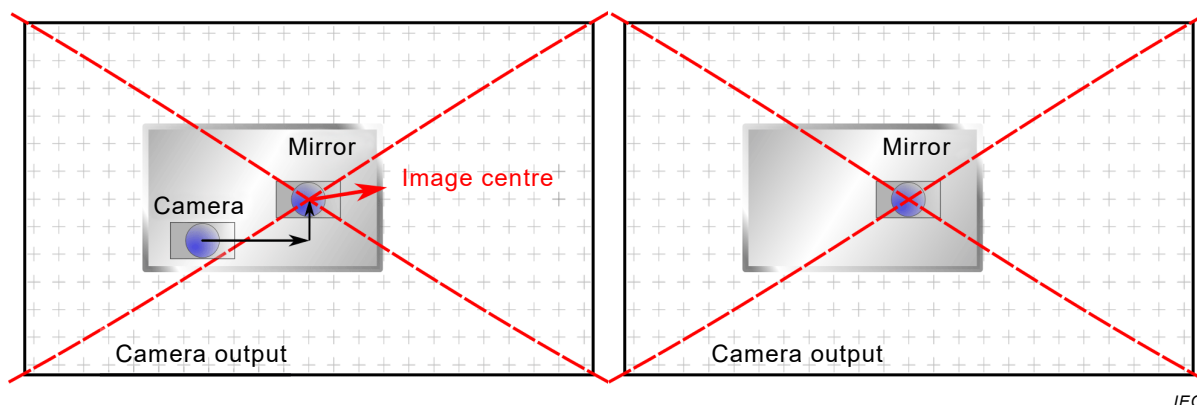


Figure 4 – Alignment of the camera with the target plane using a mirror

5.3.3 Software for measurement

5.3.3.1 General

The following method shall be used to display and measure image data of a video surveillance camera in a uniform environment.

5.3.3.2 Image display

Viewer software attached to the video surveillance camera shall be installed or downloaded to a PC, and run to display images of the video surveillance camera. The monitor shall be calibrated for visual inspection of images.

5.3.3.3 Image measurement

Using measurement software, measurement results shall be displayed in such a way that they are easy to understand on either a PC monitor, a waveform monitor and/or a vector scope monitor.

5.4 Measuring methods

5.4.1 General

The measurement methods for video surveillance camera specification items are described.

5.4.2 Resolution

5.4.2.1 General

This item applies to “Resolution”, “Maximum Resolution” and “Output Image Resolution”.

5.4.2.2 Camera setting conditions

The camera settings shall be as expressed in Table 3, except for the settings expressed in Table 5. When the settings in Table 5 or similar settings are available, set them according to Table 5.