



Guideline of the Camera & Imaging Products Association

*CIPA DCG-001-Translation-2014*

“JCIA GLA03

Guideline for noting digital camera specifications in catalogs”

Revised version

**This translation is based on the original guideline (CIPA DCG-001). In the event of any doubts arising as to the contents, the original guideline in Japanese is to be the final authority.**

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Standardization Committee

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### **A note for the revision**

In recent years, along with the increase in the number of pixels in image sensors and the rapid improvement in image processing technology, new methods have been adopted for camera design, and further methods are expected in the future. For example, accompanying the diversification of lens design, methods such as using only a partial area of the image sensor, compensating variation of the image area by image processing, and compensating geometric distortion by image processing can be noted. In view of such a situation, we have clarified the notation method of the “number of effective pixels” in this guideline again to avoid misunderstanding by general consumers.

### **Revision history**

1998-3-12 Established	JCIA DSGSG001-1998	Renamed to “JCIA GLA01” later
2001-4-10 Revised	JCIA DSGSG001-2001	Renamed to “JCIA GLA02” later
2001-7-17 Revised	JCIA GLA03	Changed notation rules and examples for multi-sensor cameras
2005-10-11 Revised	CIPA guideline DCG-001-2005	Clarified notation rules and added examples, for multi-sensor cameras (summation notation)
2014-2-26 Revised	CIPA guideline DCG-001-2014	In 5., iv) was added to (1); in (1-a), clarified notation rules for the case in which the “number of effective pixels” varies along with variation of lens focal length

**Preface of DCG-001-2005 at the revision (for reference)**

The JCIA GLA03 guideline was established on 1998-3-12, by Japan Camera Industry Association (JCIA) and has been revised twice since then. The JCIA GLA03 guideline was accepted as is even after Camera & Imaging Products Association (CIPA), an LLC (Limited Liability Company), was established, and has been observed not only by the members of the association but also widely in the world. However, due to the subsequent advancement of technologies, some of the descriptions no longer match the current specifications, and the guide is thus revised this time.

The revised edition is issued here as CIPA guideline *DCG-001-2005*.

Note that the revised item of JCIA GLA03 is “Number of effective pixels” in 5. (1) (1-a).

## **Guideline for noting digital camera specifications in catalogs**

### **1. Foreword**

In 1995, a request for unifying the rules for reporting Digital Still Camera (DSC) specifications in catalogs was submitted to the JCIA Digital Camera Study Group, which is now the JCIA Digital Camera Committee. This request was discussed in a Technical Committee in the Study Group, and was approved without objection.

After more than two years of work by the committee, "Guideline for Noting Digital Camera Specifications in Catalogs" was published on 1998-3-12.

Since that time, because of technical innovations and variations in the designs of DSCs, several problems appeared which were not properly addressed in this guideline, and the guideline became inadequate for the original purposes.

The new edition of the guideline addresses these problems.

### **2. Purpose of publication**

The purpose of this guideline is to provide uniform information about DSCs from DSC suppliers. Standardization of the rules for representing specifications noted in catalogs or other printed matter will provide accurate knowledge of the products to customers, and help them when they choose, purchase, or use DSCs.

### **3. Rules for implementation**

To achieve the purpose above each DSC supplier shall observe the following rules with sincere effort.

- a) When an item that is described in this guideline is noted in any matter which can be noticed by customers, such as catalogs, printed matter which provides specifications of the product, or software, the item shall comply with this guideline.
- b) In case of revision, the revised portions of this guideline shall apply to products that are released to the market after the publication date of the revised edition. Even though transitional applications are permitted if there is a reasonable cause, complete adherence to this guideline is required for all new products which are launched 6 months after publication (in case of no same date, 1st of the next month).
- c) Even though all responsibility, relative to the items mentioned here being used in printed matter or on software, is left to the describer's discretion based on the policy of the describer's organization, any description which differs from the actual specification, causes customer misunderstanding concerning the excellence of the product, or impedes fair competition by unfairly enticing customers, shall be prohibited.

#### 4. Scope

This guideline shall apply to digital cameras (official name: digital still camera) as defined below. It shall also apply to products that resemble digital cameras and possess the items described in this guideline, in case they might confuse consumers.

<Definition of digital camera>

A camera which includes a lens and an image sensor, and which records captured still image data into internal or removable digital recording media as its primary function.

Note: The term "digital camera" as used herein has the same meaning as the term "digital still camera" until the terminology used by customers and industry is unified.

This guideline is primarily intended for the noting of specifications in catalogs, other printed matter that describes product specifications, or on software products. However, obviously, the objectives of this guideline shall also be observed for noting on the product, representations in advertising or on point-of-purchase promotional materials etc., which are directly related

#### 5. Items to be noted in catalogs

The rules of description in catalogs are described below.

##### (1) Description of the number of pixels

In previous guidelines, we had requested that suppliers diligently note the specifications of image sensors in printed matter and software related materials for digital cameras. However, with technological improvements and diversification of digital cameras, we are in the situation that it does not match the current status enough. Therefore, to help the general consumer to quickly and properly understand the products, suppliers shall note heeding the following instructions.

- i) The number of effective pixels shall be written first when describing image capturing performance.
- ii) Therefore, when noting other pixel numbers, such as the number of total pixels or number of recorded pixels, the supplier shall ensure that they are not confused for the number of effective pixels.
- iii) When noting other pixel number along with the number of effective pixels, the number of effective pixels shall be noted as primary notation.
- iv) When both the number of effective pixels of a camera and the size of an image sensor are noted, the number of total pixels of the image sensor shall also be noted near the number of effective pixels.

## (1-a) “Number of effective pixels”

## Definition

The number of pixels on the image sensor which receive input light through the optical lens, and which are effectively reflected in the final output data of the still image. The number of ring pixels may be included. (Specification of the camera.)

Ring pixel: The reasonable and minimum pixels surrounding the image area required for the filtering process.

Image area: The area where the area of a still image that is output from the camera is transposed on the image sensor (focal plane).

## Rules for notation

- a) The number of effective pixels defined in this guideline shall be used whenever the performance of cameras is noted. The number of effective pixels of the image sensor itself thus shall not be used, because the latter has a different definition from the one defined here.
- b) For cameras that use a plurality of image sensors, the number of image sensors and the number of effective pixels corresponding to each image sensor shall be noted. However the summation of the number of effective pixels may also be noted. If the summation of the number of spatially sampled pixels (ring pixels may be included) is also noted, the description shall clearly state that the noted number is the summation of effective pixels of all the image sensors, to avoid consumer misunderstanding.
- c) For cameras that move the position of the image sensor (including linear sensors) spatially or optically for image capture, the number of effective pixels and the number of sampling positions shall be noted. If the summation of the number of sampled pixels (ring pixels may be included) is also noted, the description shall clearly state that the noted number is the summation of the number of pixels with enough explanation, to avoid consumer misunderstanding.
- d) If the number of effective pixels varies along with the variation of the focal length of the taking lens, the minimum number of effective pixels within the variation shall be used as primary notation\*1. However, only for image processing that compensates distortion (excluding electronic zoom\*2), the maximum number of effective pixels within the variation may be noted as primary notation\*3 for the number of effective pixels.

\*1: “Primary notation” means “notation which describes feature name and value solely or most noticeably when noting multiple terms”.

\*2: “Excluding electronic zoom” means that the resulting image includes a pixel or more of which the compensating magnification is 1. Compensating magnification is a ratio of the distance from the image centre (i.e. the centre of the compensation) before and after compensation on the imaging surface. For the centre itself, the asymptotic value of the magnification of the neighbour points is adopted. (See annex 3. Note that compensating magnification in this guideline differs from localized magnification.)

\*3: When explaining in a note that the number of effective pixels varies along with the variation of the focal length, as explained in the underlined sentence beginning with “However” above, the description shall not cause uncertainty among general users.

e) Numerical values may be rounded to two digit significant figures.

#### Examples of notation

a) “2.0M Effective Pixels,” “Number of Effective Pixels 3,150k (or 3.2M)”

b) “Number of Effective Pixels 340k x 3”

“3 x Number of Effective Pixels 340k CCDs”

“Number of Effective Pixels 1,020k (340k x 3)”

“Number of Effective Pixels 1.0M (340k x 3)”

c) In the case of linear sensors:

“Number of Effective Pixels 1,000 pixels x 1,500”

“Number of Effective Pixels 1,000 pixels x 1,500 steps”

In the case of area sensors:

“Number of Effective Pixels 340k x 4”

“Number of Effective Pixels 340k x 4 steps”

d) When the number of effective pixels varies along with the variation of the focal length:

“Number of Effective Pixels 13M”

“Number of Effective Pixels 13M (Maximum 15M)”

And also when distortion is compensated (excluding electronic zoom)

“Number of Effective Pixels 15M”

“Number of Effective Pixels 15M

Note; The number of pixels may decrease due to image processing that corrects image distortion”

“Number of Effective Pixels (Maximum) 15M”

e) When a partial number of pixels are used:

“Number of Effective Pixels 10M,

Number of Total Pixels 15M,

Size of image sensor 1/2.3 type”

f) When a partial number of pixels are used and also the number of effective pixels varies along with the variation of the focal length:

“Number of Effective Pixels 10M (Maximum 12M),

Number of Total Pixels 15M,

Size of image sensor 1/2.3 type”

And also when distortion is compensated (excluding electronic zoom)

“Number of Effective Pixels 12M,

Number of Total Pixels 15M,

Size of image sensor 1/2.3 type”

“Number of Effective Pixels 12M,

Note: The number of pixels may decrease due to image processing that corrects image distortion

Number of Total Pixels 15M,

Size of image sensor 1/2.3 type”

“Number of Effective Pixels (Maximum) 12M,

Number of Total Pixels 15M,

Size of image sensor 1/2.3 type”

Note:

- a) Number of effective pixels that includes ring pixels provides a somewhat larger value than the maximum number of recorded pixels, even for a camera having no pixel interpolation.
- b) The area used for image stabilization when shooting movies shall not be included.
- c) The optical black area shall not be included.

(1-b) “Number of total pixels”

Definition

The total number of pixels possessed by the image sensor (specification of the image sensor).

Rules for notation

- a) “Number of total pixels” shall be used only for explanations of the image sensor. The “number of effective pixels” defined in this guideline shall be used when specifications of the camera are noted.
- b) Terms indicating image sensors, such as “image sensor”, “solid-state image sensor” or “CCD”, shall be used.
- c) For cameras that use multiple image sensors, the number of image sensors shall be noted. Reporting only the total number of pixels shall not be allowed.
- d) Numerical values may be rounded to two digit significant figures.

Examples of notation

- a) “2 M Effective Pixels (using CCD with 2.1 M Number of Total Pixels)”
- b) “Number of Effective Pixels 340k × 3 ( using 3 CCDs with 380k Number of Total Pixels each)”

(1-c) “Number of recorded pixels”

Definition

The number of pixels comprising one picture frame which is recorded to digital recording media.

Rules for notation

- a) The “number of recorded pixels” or other wording which has the same meaning shall be used. The term “resolution” shall not be used for the number of recorded pixels.
- b) The number of horizontal and vertical pixels of the luminance signal that are recorded to digital recording media shall be reported. The horizontal dimension should be written before the vertical dimension, unless there is no distinction between them.
- c) The components of the image signal should also be noted. To describe the components of the image signal, the chrominance signal may be noted with symbols “RGB”, “YCbCr”, etc., or terms such “Y/C”, “line sequential system”, or “color difference system” may be used. When there is no chrominance signal, a description without color signals such as “monochrome signal” is to be used.
- d) Further description of the composition ratio of the chrominance signal, such as “4:4:4” or “4:2:2”, is recommended.
- e) When the number of pixels is increased by means of image processing, such as interpolation, the pixels are considered recorded pixels if the pixels are recorded.
- f) Numerical values may be rounded to two digit significant figures.

Examples of description

- a) “Number of Recorded Pixels  $640 \times 480$  (RGB 4:4:4)”
- b) “Number of Recorded Pixels  $1,280 \times 960$  (1.2M)”
- c) “Image Signal Components: YCbCr 4:2:2”

(1-d) “Number of output pixels”

Definition

The number of pixels comprising one picture frame which is output from the camera by transmission means.

Rules for notation

- a) Wording which indicates the number of pixels output from the camera by the transmission means, such as the “number of output pixels”, the “number of pixels communicated”, or the “number of transmitted pixels” shall be used.
- b) The number of horizontal and vertical pixels of the luminance signal output from the camera shall be reported. The horizontal dimension should be written before the vertical dimension, unless there is no distinction between them.
- c) Description of the components of the image signal is recommended, but when the components are described as part of the previously mentioned “number of recorded pixels”, this additional reference may be omitted.
- d) Further description of the composition ratio of the chrominance signal, such as “4:4:4” or “4:2:2”, is recommended, but when the composition ratio of the chrominance signal is described as part of the previously mentioned “number of recorded pixels”, this reference may be omitted.
- e) An increase in the number of pixels by means of image processing, such as interpolation, is considered output if the pixels are output. When the number of pixels has been decreased such as by data compression, the act of compression shall be indicated.
- f) Numerical values may be rounded to two digit significant figures.

Examples of notation

- a) “Number of Output Pixels  $640 \times 480$  (RGB 4:4:4)”
- b) “Number of Transmitted Pixels  $1,280 \times 960$  (1.2M)”

Note: “Number of output pixels” shall be distinguished from “number of recorded pixels”.

(2) Other notations

(2-a) “Image file size”

Definition

The amount of information comprising one image frame which is recorded to the digital storage media.

Rules for notation

- a) “Image file size” or similar wording which has the same meaning shall be used.
- b) Total data amount of one image frame, including image data and appended data, such as a file header, shall be noted in bytes (symbol: B).
- c) Terms such as “file” or “frame”, which indicate “per image frame”, shall be used.
- d) When the file size varies by image, an explanation shall be provided. In this case, it is still recommended to indicate the approximate file size.
- e) Numerical values may be rounded to two digit significant figures.

Examples of notation

- a) “Image File Size: 40 kB/frame”
- b) “Image File Size Approx. 30-60 kB (variable file sizes)”

(2-b) “Recorded image file format”

Definition

The image file format and directory structure that are recorded to digital storage media.

Rules for Notation

- a) “Recorded image file format” or similar wording which has the same meaning shall be used.
- b) When a standard format such as DCF is used, it is recommended that the name of the format along with its version number be provided. An original file format shall be described as being “original”.
- c) When a type of file format is used to output from the camera, a term such as “output image file format” shall be used to distinguish from the recorded image format.

Examples of notation

- a) “Recorded Image File Format: Conforms to DCF (Design rule for Camera File System) 1.0”
- b) “Recorded Image File Format (Non-compressed): TIFF”
- c) “Recorded Image Format: Conforms to JPEG (Exif Ver. 2.1)”

## (2-c) “35mm film equivalent lens focal length”

## Definition

The value obtained when the lens focal length is converted into the focal length of a 35mm film camera that has the same angle of view.

## Rules for notation

- a) “35mm film equivalent” or similar wording shall be used.
- b) The value shall be calculated using the following equation:

35mm film equivalent lens focal length =

$$\text{Lens focal length} \times \frac{\text{Diagonal length of 35mm film image area (43.27 mm)}}{\text{Diagonal length of image area of image sensor}}$$

- c) Numerical values in millimetres may be rounded to the nearest whole number.

## Example of notation

- a) “Lens Focal Length: 7 mm (Corresponds to 50 mm in 35mm film camera)”
- Etc.

(2-d) “Image data compression ratio”

Definition

The compression ratio when image data is compressed with image processing circuitry.

Rules for notation

- a) “Image data compression ratio” or similar wording shall be used.
- b) The value shall indicate the ratio of the size of the compressed image data compared to the size of the image data that was input to the compression processing circuitry.
- c) It is recommended that the components of the input image signal, such as RGB or YC, be noted.
- d) It is recommended to express the value as a fraction with a numerator of 1. In this case, all numeric values may be rounded off to the nearest whole number.
- e) In cases where a variable image compression method is used, and the compression ratio varies due to the subject in the scene, an explanation shall be added indicating that the camera uses a variable compression ratio.

Examples of notation

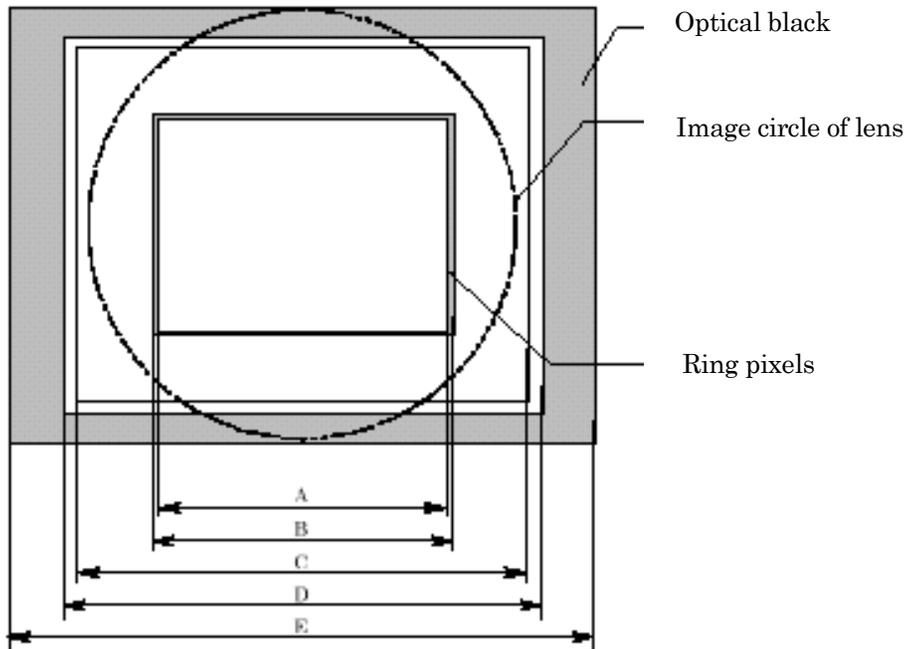
- a) “Image Data Compression Ratio: 1/10”
- b) “Image Data Compression Ratio: Standard 1/15 (varies according to the object)”

Notes

- a) A proposal to use RGB 4:4:4 (three units of data for each pixel) as the denominator for the compression ratio was discussed. However, to avoid the difficulties associated with the compression ratio not being 1 even though compression was not conducted, it was decided to adopt the data to be actually compressed as reference.
- b) To avoid confusing consumers with the problem of the denominator mentioned in note a), it was decided that either the components of the compressed input image or the “image file size” shall be reported.
- c) Since the term “bit/pel” is not easily understood by consumers, it was decided not to adopt it in this guideline.

## (Annex 1) Relationship between each pixel-related definition

The following figure shows the relationship between each pixel-related definition.



- A: Effective pixels (image area without ring pixels)
- B: Effective pixels (with ring pixels)
- C: Maximum available pixels (pixels guaranteed by the vendor of image sensor)
- D: Effective pixels of image sensor
- E: Total pixels

Figure 1. Schematic diagram of image sensor

The relationship between Number of Effective Pixels A (without ring pixels) and the Number of Recorded Pixels and the Number of Output Pixels is as follows.

$A =$  Number of Recorded Pixels or Number of Output Pixels (without interpolation or sub-sampling)

$A <$  Number of Recorded Pixels or Number of Output Pixels (with interpolation)

$A >$  Number of Recorded Pixels or Number of Output Pixels (with sub-sampling)

## (Annex 2) Examples of descriptions in catalogs

The following tables show examples of a specifications column.

Table 1. Example one of specifications column in catalog

Camera Part	Number of Effective Pixels	1.97M
	Focal Length of Lens	7 mm (corresponds to 34 mm in 35mm film)
Image sensor	System	Interlaced CCD
	Size	1/1.8 type
	Number of Total Pixels	2.11M
Recording Part	Number of Recorded Pixels	1,600 × 1,200 (1.9M) 1,280 × 960 (1.2M)
	Recorded Image File Format	Conforms to DCF (Design rule for Camera File system) 1.0
	Image File Size	700 kB/Frame (fine mode)
	Image Data Compression Ratio	Approx. 1/10

Table 2. Example two of specifications column in catalog

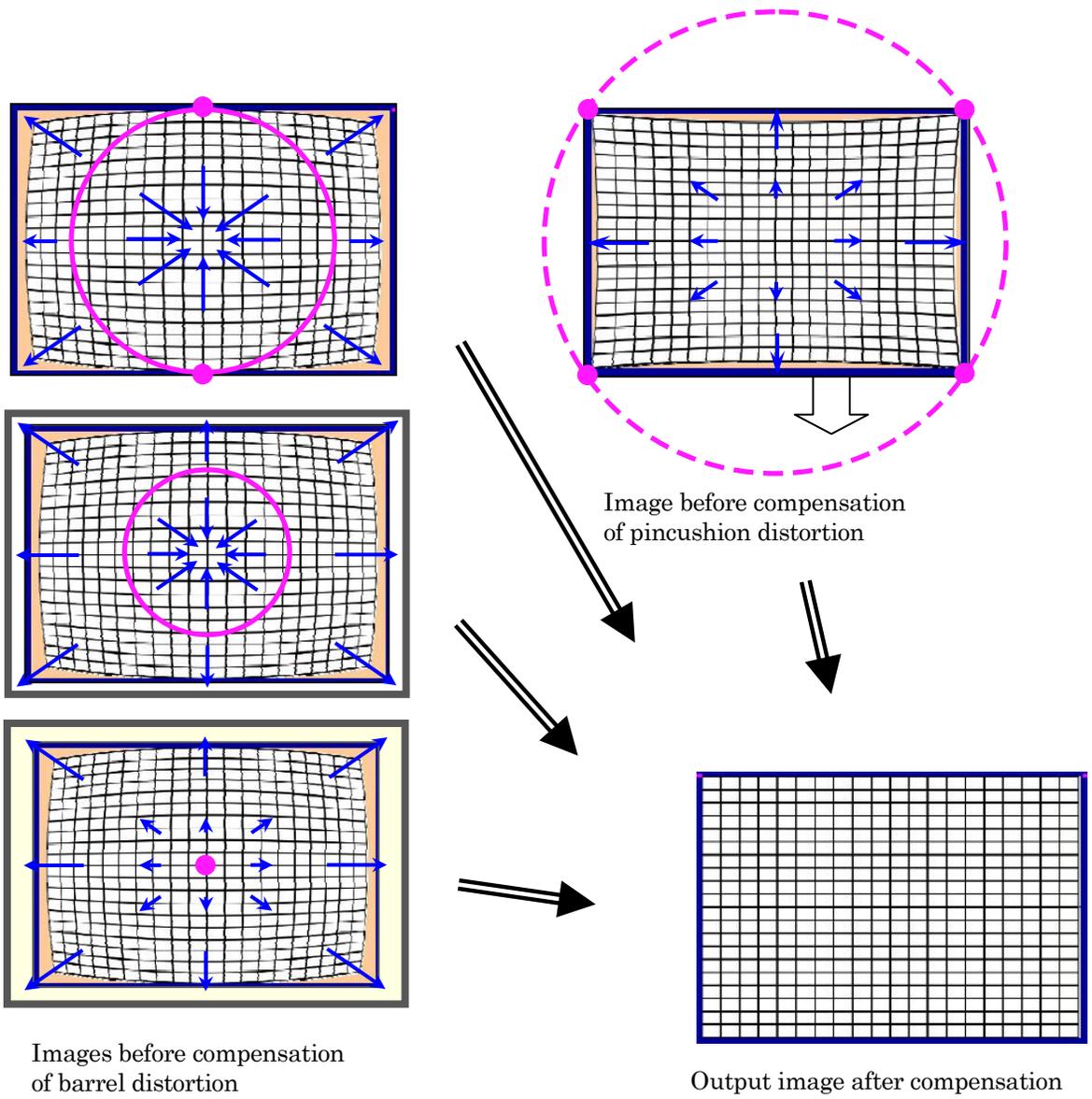
Number of Effective Pixels	2.0M
Image Sensor	1/1.8-type CCD (total number of pixels: 2,1M)
Focal Length of Lens	7 mm (corresponds to 34 mm in 35mm film)
Number of Recorded Pixels	1,600 × 1,200 (1.9M pixels) 1,280 × 960 (1.2M pixels)
Recorded Image File Format	Conforms to DCF (Design rule for Camera File System) 1.0
Image File Size	700 kB/Frame (fine mode)
Image Data Compression Ratio	Approx. 1/10

(Annex 3) Example images with pixels that have a compensating magnification of 1

In the figure below;

- indicates the location of pixels of that have a compensating magnification of 1.
- indicates that they are located at the contact point or the centre of the picture frame

\* For the images before compensation in the figure, the area that is included in the final output image (the part corresponding to the image area) is indicated with grid lines. Arrows schematically indicate rough shifting directions of the pixels when distortion compensation is performed; they do not express a specific positional relationship of movement or amount of movement.



## 6. Deliberation committee members (Revised version 2014)

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