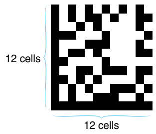
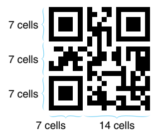
2D Code Characteristics

DataMatrix



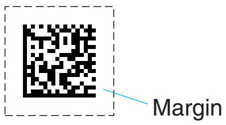
The DataMatrix system was developed by I.D. Matrix and is used extensively in the semiconductor and electronics industries. A DataMatrix has a relatively large data capacity for its size. There are several different types of DataMatrix, differentiated by their error correction method. The ECC200 is the most commonly used type.

QR Code



The "Quick Response Code" is a 2-dimensional code that was developed by the Denso Company in Japan. High-speed reading is possible with QR Code, but the code size is quite large compared to other 2-dimensional codes.

Margin (Quiet Zone)



This is the empty space around 2-dimensional codes. Usually it is necessary to ensure that there is a margin around 2-dimensional codes. The size of the required margins varies with the type of code.

Cells

These squares are the units that make up matrix-type 2-dimensional codes. Whether these cells are black or white determines the information carried by the code.

Symbol Size

The symbol size is expressed in the number of cells of which a 2-dimensional code matrix consists. (Examples: 10 x 10 and 12 x 12).
The symbol size is sometimes called the matrix size or simply, the number of cells.

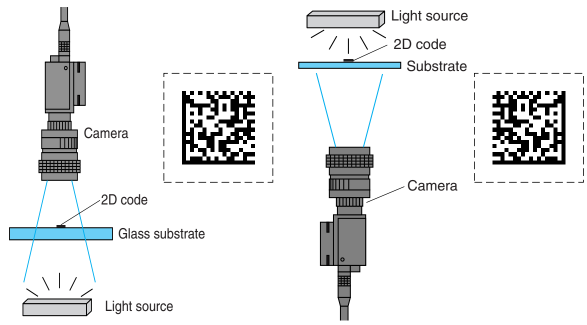
Error Correction

This term is used to describe the function which detects and corrects errors using a special mathematical technique (commonly known as the "Reed-Solomon" method). Using this function, reading is possible, to a certain extent, for codes with poor printing quality or that are damaged. There are, however, limits on the extent to which correction is possible, and reading may not be possible for codes if the damage is extensive.
There are 2-dimensional codes for which the error correction level can be selected.
For example, the error correction level for DataMatrix ECC200 is approximately 30% (varies with the symbol size). With QR Code, error correction levels of 7%, 15%, 25%, and 30% are available.

Left and Right Reversal (Mirror Status)

This is the term used to describe reading 2-dimensional codes marked on a transparent material from the reverse side or reading 2-dimensional codes reflected in a mirror.
For example, when a 2-dimensional code marked on glass is read from the back, left and right reversal appears.

Reading the Normal Image Reading a Left and Right Reversal



Symbol Color

Usually, in images of 2-dimensional codes, the code itself is black and the background is white. Sometimes, however, due to the material of the reading object and the kind of lighting used, the code will appear white in the image obtained. This state is called "black and white reversal."

Quick-reference Tables of Data Capacities for 2-Dimensional Codes

DataMatrix ECC200

The relation between symbol size (number of cells) and data capacity is shown in this table. The symbol size in the following example code is 12 x 12.

12 cells

12 cells

Symbol size	Maximum data capacity (See note 1.)				
	Numerals	Alphanumeric characters	Alphanumerics and symbols	JIS8	Japanese Kanji (Shift JIS)
10 × 10	6	3	3	1	–––
12 × 12	10	6	5	3	1
14 × 14	16	10	9	6	3
16 × 16	24	16	14	10	5
18 × 18	36	25	22	16	8
20 × 20	44	31	28	20	10
22 × 22	60	43	38	28	14
24 × 24	72	52	46	34	17
26 × 26	88	64	57	42	21
32 × 32	124	91	81	60	30
36 × 36	172	127	113	84	42
40 × 40	228	169	150	112	56
44 × 44	288	214	190	142	71
48 × 48	348	259	230	172	86
52 × 52	408	304	270	202	101
64 × 64	560	418	372	278	139
8 × 18	10	6	5	3	1
8 × 32	20	13	12	8	4
12 × 26	32	22	20	14	7
12 × 36	44	31	28	20	10
16 × 36	64	46	41	30	15
16 × 48	98	72	64	47	23

QR Code, Model 2

The relation between symbol size (number of cells) and data capacity is shown in this table. The symbol size in the following example code is 21 x 21.

7 cells

7 cells

7 cells

7 cells 14 cells

Symbol size (version) (See note 2.)	Error correction	Maximum data capacity (See note 1.)			
		Numerals	Alphanumeric characters (upper case)	JIS8	Japanese Kanji (Shift JIS)
21 × 21 (version 1)	L (7%)	41	25	17	10
	M (15%)	34	20	14	8
	Q (25%)	27	16	11	7
	H (30%)	17	10	7	4
25 × 25 (version 2)	L (7%)	77	47	32	20
	M (15%)	63	38	26	16
	Q (25%)	48	29	20	12
	H (30%)	34	20	14	8
29 × 29 (version 3)	L (7%)	127	77	53	32
	M (15%)	101	61	42	26
	Q (25%)	77	47	32	20
	H (30%)	58	35	24	15
33 × 33 (version 4)	L (7%)	187	114	78	48
	M (15%)	149	90	62	38
	Q (25%)	111	67	46	28
	H (30%)	82	50	34	21
37 × 37 (version 5)	L (7%)	255	154	106	65
	M (15%)	202	122	84	52
	Q (25%)	144	87	60	37
	H (30%)	106	64	44	27
41 × 41 (version 6)	L (7%)	322	195	134	82
	M (15%)	255	154	106	65
	Q (25%)	178	108	74	45
	H (30%)	139	84	58	36
45 × 45 (version 7)	L (7%)	370	224	154	95
	M (15%)	293	178	122	75
	Q (25%)	207	125	86	53
	H (30%)	154	93	64	39
49 × 49 (version 8)	L (7%)	461	279	192	118
	M (15%)	365	221	152	93
	Q (25%)	259	157	108	66
	H (30%)	202	122	84	52
53 × 53 (version 9)	L (7%)	552	335	230	141
	M (15%)	432	262	180	111
	Q (25%)	312	189	130	80
	H (30%)	235	143	98	60
57 × 57 (version 10)	L (7%)	652	395	271	167
	M (15%)	513	311	213	131
	Q (25%)	364	221	151	93
	H (30%)	288	174	119	74

Source: 2D Codes, Basic Specifications for QR Code (JISX0510)

Note 1: The maximum amount of data that can be stored in a code varies with the code size. In other words, if there is a large amount of data to be stored, then the code size must also be large. The maximum data capacity will also vary with the type of characters used. With a QR Code or DataMatrix, the numeric capacity (numbers only) is larger than the alphanumeric capacity (numbers and letters), which is in turn larger than the Japanese Kanji (Shift JIS) capacity. The order and combinations of different characters also affects the data capacity.

Note 2: The symbol size of a QR Code is indicated by the version. "Version 1" indicates that a QR Code contains (the minimum) 21 cells both horizontally and vertically. The larger the version number, the larger the number of cells per side.