# 2D Code Reader (Fixed Type)

V530-R2000

OMRON

Integration of
Objects
and Information

CE

Innovate Production by the Integration of Objects and Information

Directly mark objects with 2D codes containing product information. Then read the information to manage each wafer, to trace automotive parts, or to achieve any of a wide range of applications. The integration of objects and information starts with reading stable direct marking codes.

Conforms to SEMI-T7.
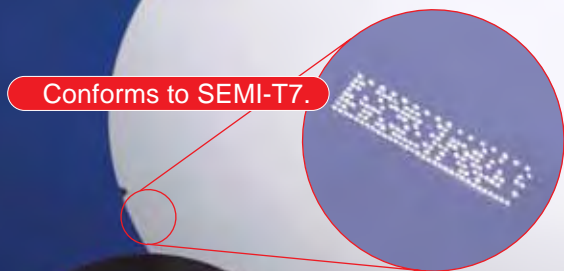
OMRON pursues reading of 2D codes that are directly marked.

Three variations of the new "Reading Head"

- Select any of three models of Reading Head to suit the application.
- The new Reading Head will reduce installation work for lens and lights.
- You can also use the traditional configuration of Camera and external lighting if preferred.

Reading Head with Oblique/Coaxial Lighting
V530-L2001 (See note.)

Reading Head with Ring Lighting
V530-L2002 (See note.)

Reading Head with V-type Coaxial Lighting
V530-L2003 (See note.)

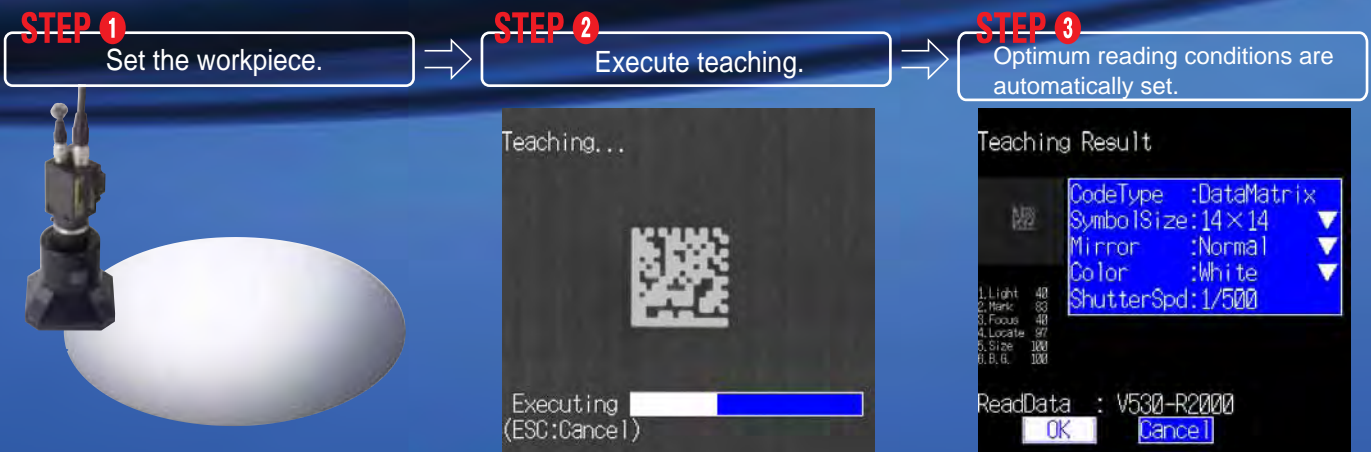Note: The illustrations show the Reading Heads mounted to Cameras.

Exceptional reading performance

Integration of lighting feedback control and image processing algorithm. Even if the condition of the material and the surrounding environment change, the V530-R2000 will be automatically set up in the best state for image capture by actively controlling the original lighting.

One-step teaching for easy setup

A new auto-setting function for the lighting and shutter speed eliminates troublesome setting procedures and greatly reduces setup work.

STEP ❶ Set the workpiece.

STEP ❷ Execute teaching.

STEP ❸ Optimum reading conditions are automatically set.

Teaching...

Executing
(ESC:Cancel)

Teaching Result

CodeType   :DataMatrix
SymbolSize:14×14
Mirror   :Normal
Color   :White
ShutterSpd:1/500

1.Light   40
2.Mark   83
3.Focus   40
4.Locate   97
5.Size   100
6.B.G.   100

ReadData : V530-R2000
OK   Cancel

Complete analytical functions

A 2D Code Checker is used to analyze the quality of codes that are read, including the contrast, marking status, size, position, and background.

This function will be a Great Help during initial introduction.

Rather than just knowing if a code has been read or not, you'll know at a glance the leeway in the ability to read the code.
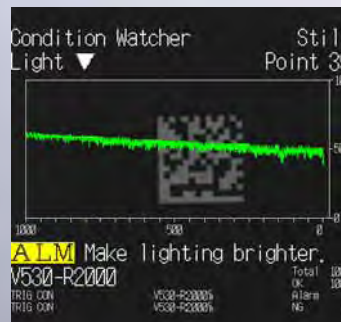
Complete monitoring functions

- A Condition Watcher monitors changes in the stability of codes that have been read.
- A warning will be output as soon as it can be predicted that reading cannot be performed any more.
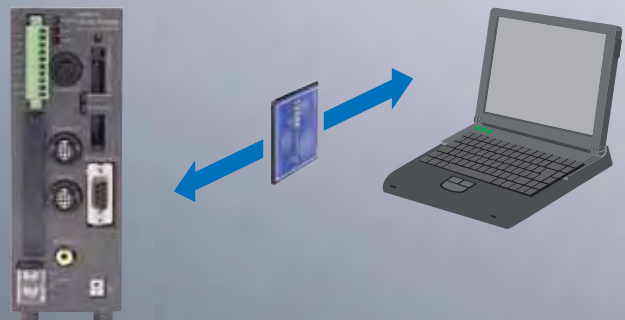
This function can be used to set guidelines for replacing parts in marking devices and other equipment.

Easy Analysis

- The V530-R2000 also provides a Memory Card slot (Compact Flash™). Information from the Condition Watcher, read images, and other information can be saved to easily analyze reading conditions on a personal computer.
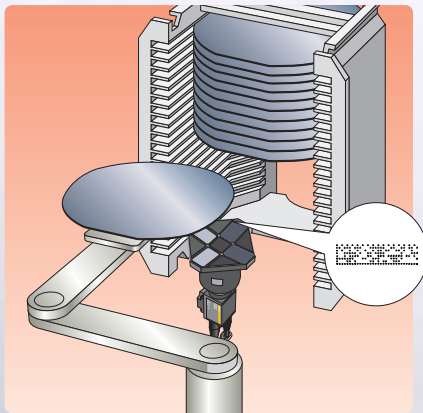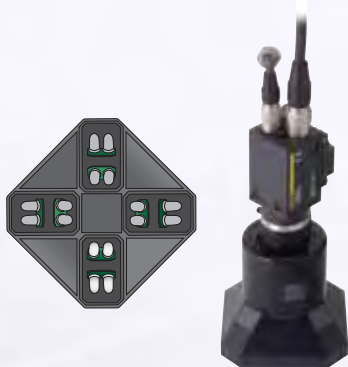
4

Applications and Variations

Select the Reading Head that best suits the application conditions, such as workpiece material, surface conditions, etc.
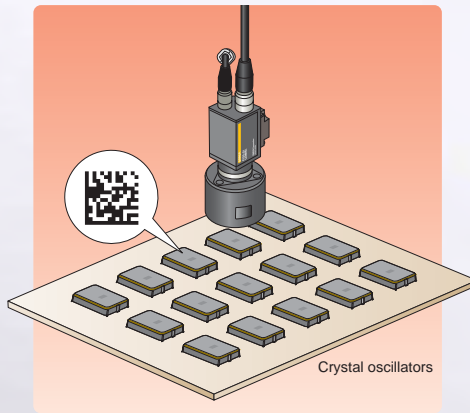
V530-L2001 Reading Head with Oblique/Coaxial Lighting	V530-L2002 Reading Head with Ring Lighting	V530-L2003 Reading Head with V-type Coaxial Lighting

Provides oblique/coaxial lighting arranged at various angles. Suitable for wafers, liquid crystal glass, PDP glass, electronic components, and many other types of workpiece.

A diffuse optical system consisting of white LEDs arranged in a ring to read regular reflections from a code. This system is ideal for reading 2D codes that have been laser-marked on electronic components or codes embossed in engine parts or other metal parts.

A regular reflection optical system that lights codes along a V-shape axis eliminates optical interference, making this Reading Head ideal for 2D codes on PDP glass or wafers covered with thin films.

Crystal oscillators
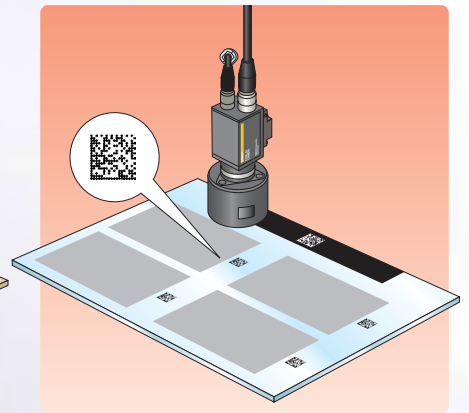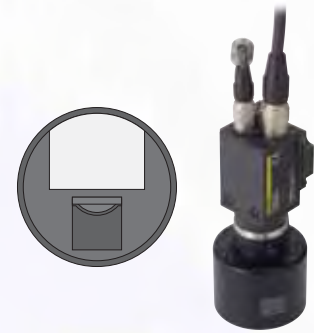
Ordering Information

Name	Model	Remarks
Controllers	V530-R2000/R2000P	NPN output/PNP output
Camera	F160-S2-2D	–––
Reading Heads	V530-L2001	Oblique/coaxial lighting
	V530-L2002	Ring lighting
	V530-L2003	V-type coaxial lighting
Console	F150-KP-2D	Cable length: 2 m
Camera Cable	F150-VS-2D	Cable length: 3 m
Monitor Cable	F150-VM-2D	Cable length: 2 m
Liquid Crystal Monitor	F150-M05L-2D	–––
Video Monitor	F150-M09-2D	–––
Memory Cards	F160-N64S	Memory capacity: 64 MB
	QM300-N128S	Memory capacity: 128 MB

Rating and Performance

Controllers

Model	V530-R2000	V530-R2000P
I/O type	NPN	PNP
Power supply voltage	20.4 to 26.4 VDC	
Current consumption	1.6 A max.	
Camera	F160-S2-2D, 2 max.	
Inputs	TRIG, RESET	
Input specifications	12 to 24 VDC ±10%, ON current: 5 to 15 mA, ON voltage: 8.8 V max., OFF current: 0.1 mA max., OFF voltage: 4.5 V min.	
Monitor output	NTSC composite video output	
Outputs	RUN, ERROR, BUSY, NG, ALARM	
Output specifications	12 to 24 VDC ±10%, Load current: 45 mA max., ON residual voltage: 2 V max., OFF leakage current: 0.1 mA max.	
Functions	Teaching, analytical function, monitoring function, Memory Card backup function	
Applicable codes	DataMatrix ECC200 10 x 10 to 64 x 64 and 8 x 18 to 16 x 48, QR Code (models 1 and 2) versions 1 to 10	
Operating method	Console or communications commands	
Settings	Teaching or selecting conditions	
Memory Card (backup media)	1 slot (Compact Flash™)	
Serial interface	RS-232C/422	
Ambient temperature	Operating: 0 to 50 °C, Storage: –25 to 60 °C (with no icing or condensation)	
Ambient humidity	Operating/storage: 35% to 85% (with no condensation)	
Weight (Controller only)	Approx. 570 g (Controller only)	
Degree of protection	IEC60529 IP20	
Materials	ABS/PC	

Camera

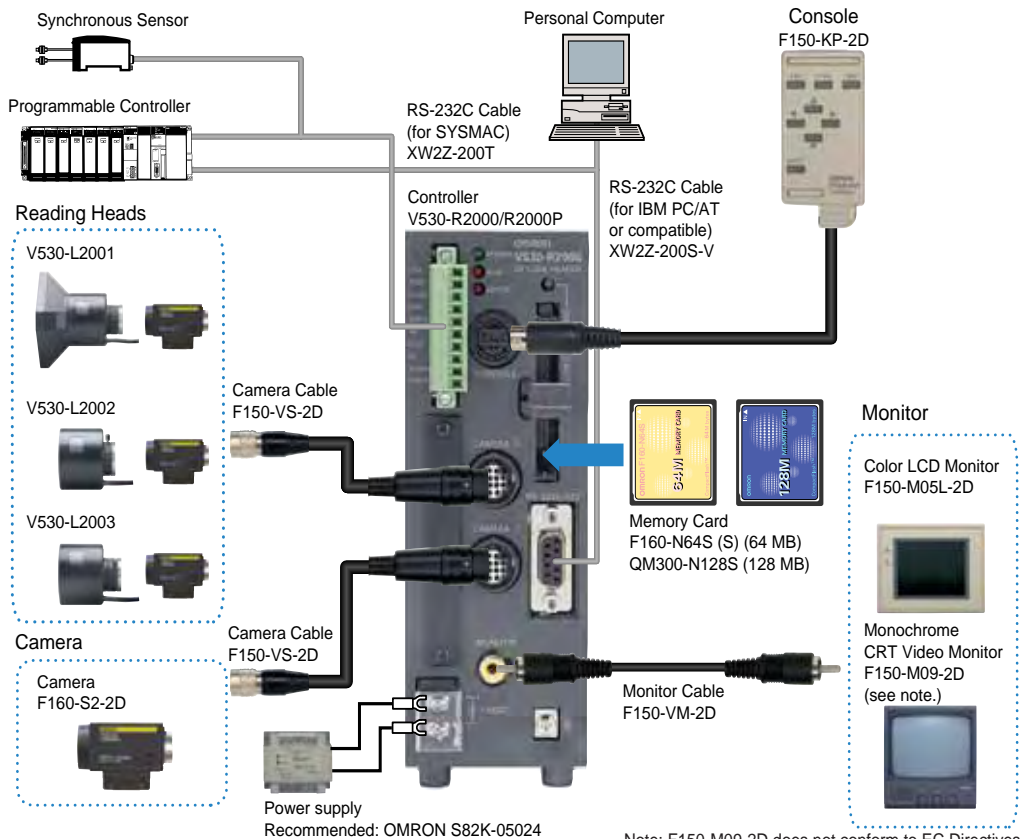| Model	F160-S2-2D
Picture elements	1/3" interline CCD (reading all pixels)
Effective pixels	512 x 484 pixels
Synchronization	External sync via horizontal sync signal
Shutter speed (s)	1/120, 1/200, 1/500, 1/1000, 1/2000, 1/4000, 1/8000, 1/16000, 1/30000, or 1/60,000; Automatically selected.
Lens mount	C mount
Ambient temperature	Operating: 0 to 50 °C, Storage: –25 to 60 °C (with no icing or condensation)
Ambient humidity	Operating/storage: 35% to 85% (with no condensation)
Materials	Cover: Zinc-plated steel sheet Case: Die-cast aluminum alloy Mounting base: Bakelite containing cloth (black)
Weight	Approx. 85 g

Reading Heads

Model	V530-L2001	V530-L2002	V530-L2003
Light source	White LEDs	White LEDs	White, red, green, and blue LEDs
Working distance (installation distance)	20 mm	105 mm	35 mm
Field of view	5 x 5 mm to 12 x 12 mm	20 x 20 mm to 40 x 40 mm	5 x 5 mm to 12 x 12 mm
Functions	Automatic lighting direction selection	–––	Automatic lighting color selection
	Zoom		
	Rotation (using enclosed Allen wrench)		
Ambient temperature	Operating: 0 to 50 °C, Storage: −25 to 60 °C (with no icing or condensation)		
Ambient humidity	Operating/storage: 35% to 85% (with no condensation)		
Materials	Case: ABS, Front filter: PMMA (acrylic), Lens body: Aluminum		
Weight (including cable)	Approx. 160 g	Approx. 100 g	Approx. 110 g
Mount	C mount		
System	Fixed aperture, variable focus		
Light emission method	Pulse (Light emission synced with Camera shutter.)		

Monitor

Item Name/Model	F150-M05L-2D LCD Color Monitor	F150-M09-2D Video Monitor
Size	5.5 inches	9 inches
Display method	TFT color liquid crystal	Video Monitor (Monochrome)
Resolution	320 x 240 dots	800 TV lines min. (at center)
Input signal	NTSC composite video (1.0 V/75 Ω termination)	
Power supply voltage	20.4 to 26.4 VDC	85 to 264 VAC
Current consumption	Approx. 700 mA	Approx. 200 mA
Ambient temperature	Operating: 0 to 50 °C, Storage: −25 to 65 °C (with no icing or condensation)	Operating: 0 to 50 °C, Storage: −20 to 65 °C (with no icing or condensation)
Ambient humidity	Operating/storage: 35% to 85% (with no condensation)	Operating/storage: 10% to 90% (with no condensation)
Weight (Monitor only)	Approx. 1 kg	Approx. 4.5 kg

System Configuration

Synchronous Sensor

Programmable Controller

Reading Heads

V530-L2001

V530-L2002

V530-L2003

Camera

Camera F160-S2-2D

Camera Cable F150-VS-2D

Camera Cable F150-VS-2D

Power supply Recommended: OMRON S82K-05024

RS-232C Cable (for SYSMAC) XW2Z-200T

Controller V530-R2000/R2000P

Personal Computer

RS-232C Cable (for IBM PC/AT or compatible) XW2Z-200S-V

Console F150-KP-2D

Memory Card F160-N64S (S) (64 MB) QM300-N128S (128 MB)

Monitor Cable F150-VM-2D

Monitor

Color LCD Monitor F150-M05L-2D

Monochrome CRT Video Monitor F150-M09-2D (see note.)

Note: F150-M09-2D does not conform to EC Directives.
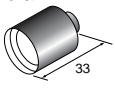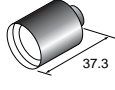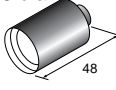
Using CCTV Lenses and External Lighting (without a Reading Head)

Select the Lens and external lighting according to the application whenever a Reading Head is not used. Ask your OMRON representative for details.

CCTV Lenses

	CCTV Lenses			
Model	3Z4S-LEB1214D-2	3Z4S-LEC1614A	3Z4S-LEB2514D	3Z4S-LEB5014A
Dimensions	42 dia. / 50	30 dia. / 33	30 dia. / 37.3	48 dia. / 48
Locking mechanism	Focus/iris locking mechanism			

Note: Refer to the following optical graph to select the Lens and Extension Tube according to the field of vision and working distance being used.

Extension Tubes

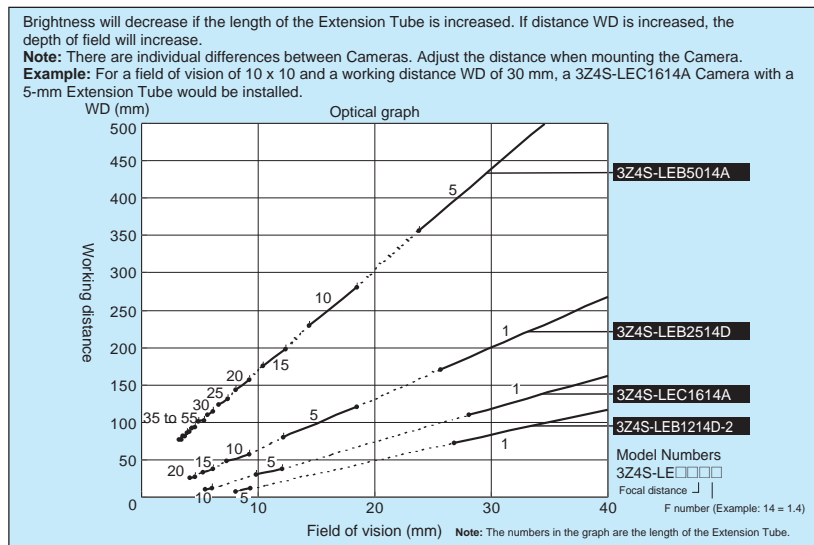| Model	Length
3Z4S-LE EX-C6	A set of six Extension Tubes that are 40, 20, 10, 5, 1, and 0.5 mm in length.

Reading the Optical Graph

The X axis of the graph shows field of vision L in millimeters, and the Y axis shows the working distance WD in millimeters.

The working distance WD indicates the distance from the end of the lens to the surface of the 2-dimensional code, each lens is indicated by a line in the graph, and the numbers indicate the length of the Extension Tube.

Camera
Extension Tube
Lens
Working Distance WD (mm)
Field of vision (mm)
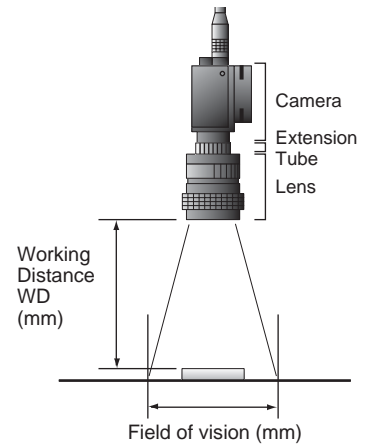
Optical Graph

Select the lens based on the field of vision and the working distance (WD) required between the workpieces and lens.

Brightness will decrease if the length of the Extension Tube is increased. If distance WD is increased, the depth of field will increase.
Note: There are individual differences between Cameras. Adjust the distance when mounting the Camera.
Example: For a field of vision of 10 x 10 and a working distance WD of 30 mm, a 3Z4S-LEC1614A Camera with a 5-mm Extension Tube would be installed.

WD (mm) — Optical graph

Working distance

3Z4S-LEB5014A
3Z4S-LEB2514D
3Z4S-LEC1614A
3Z4S-LEB1214D-2

Model Numbers
3Z4S-LE☐☐☐☐
Focal distance
F number (Example: 14 = 1.4)

Field of vision (mm)   **Note:** The numbers in the graph are the length of the Extension Tube.

2D Code Characteristics

DataMatrix

12 cells

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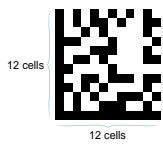
The DataMatrix system was developed by I.D. Matrix and is used extensively in the semiconductor and electronics industries. A DataMatrix has a relatively large data capacity for its size. There are several different types of DataMatrix, differentiated by their error correction method. The ECC200 is the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

QR Code

7 cells

7 cells

7 cells

7 cells   14 cells

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)

Margin

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.
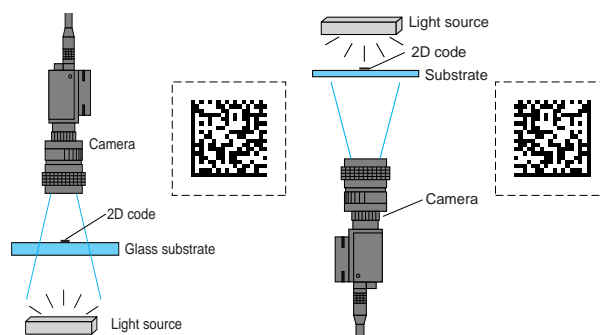
For example, the error correction level for DataMatrix ECC200 is approximately 30% (varies with the symbol size). With QR Code, error correction levels of 7%, 15%, 25%, and 30% are available.

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

Camera

2D code

Glass substrate

Light source

Reading a Left and Right Reversal

Light source

2D code

Substrate

Camera

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

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

DataMatrix ECC200
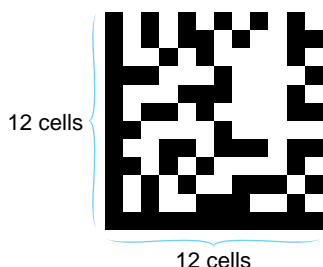
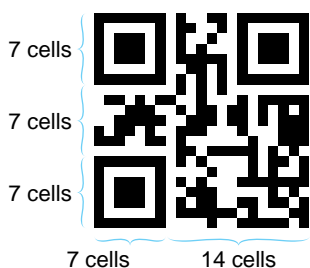| Symbol size	Maximum data capacity (See note 1.)				
	Numerals	Alphanumeric characters	Alphanumerics and symbols	JIS8	Japanese Kanji (Shift JIS)
10 × 10	6	3	3	1	——
12 × 12	10	6	5	3	1
14 × 14	16	10	9	6	3
16 × 16	24	16	14	10	5
18 × 18	36	25	22	16	8
20 × 20	44	31	28	20	10
22 × 22	60	43	38	28	14
24 × 24	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

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

QR Code, Model 2

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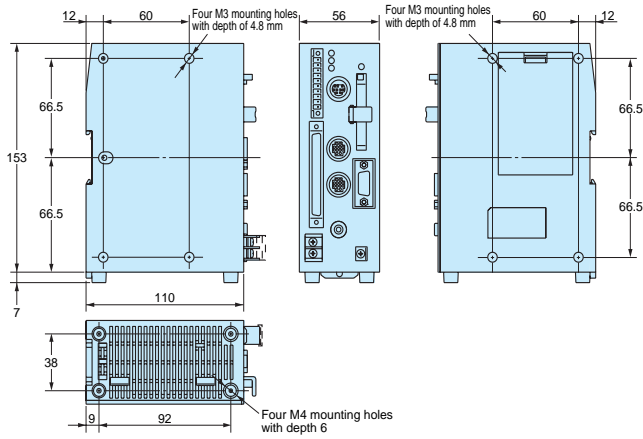
Note 2: The symbol size of a QR Code is indicated by the version. "Version 1" indicates that a QR Code contains (the minimum) 21 cells both horizontally and vertically. The larger the version number, the larger the number of cells per side.

Dimensions

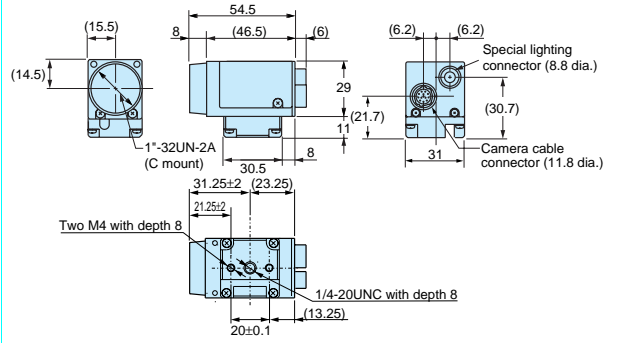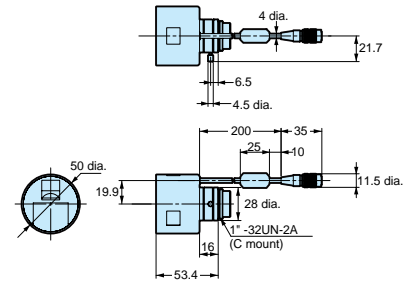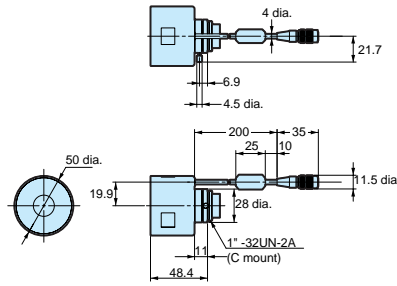## Controllers
V530-R2000/R2000P

Four M3 mounting holes with depth of 4.8 mm

Four M3 mounting holes with depth of 4.8 mm

12 60 56 60 12

66.5

153

66.5

66.5

66.5

110

7

38

9 92

Four M4 mounting holes with depth 6

Camera
F160-S2-2D

(15.5)

(14.5)

54.5

8 (46.5) (6)

(6.2) (6.2)

29

(21.7)

11

30.5

8

1"-32UN-2A (C mount)

Special lighting connector (8.8 dia.)

(30.7)

31

Camera cable connector (11.8 dia.)

31.25±2 (23.25)

21.25±2

Two M4 with depth 8

1/4-20UNC with depth 8

(13.25)

20±0.1

Reading Heads
V530-L2001

4 dia.

21.7

6.5

4.5 dia.

90

90°

90

75.1 75.1

19.9

200 35

25 10

11.5 dia.

28 dia.

1"-32UN-2A (C mount)

16

8.2 52.9

82.5

V530-L2002

4 dia.

21.7

6.9

4.5 dia.

50 dia.

19.9

200 35

25 10

11.5 dia.

28 dia.

1"-32UN-2A (C mount)

11

48.4

V530-L2003

4 dia.

21.7

6.5

4.5 dia.

50 dia.

19.9

200 35

25 10

11.5 dia.

28 dia.

1"-32UN-2A (C mount)

16

53.4

Console
F150-KP-2D

50

1.5 13

87

SHIFT

12 dia.

2000 23 5

10

12.5

Liquid Crystal Monitor
F150-M05L-2D

Mounting bracket

Mounting plate thickness: 1.6 to 4.8

(46 max.)

143 132

(145) (155)

50 min.

(100)

(5.5)

185

Monitor Cable F150-VM-2D

42.2

174

Tolerance: ±1 mm
Dimensions in parentheses are reference values.

Panel Cutout Diagram

133.5 +0.5mm /0

175.5 +0.5mm /0

Video Monitor
F150-M09-2D

222

250

233

143

5

190

50

22

160

11