

OPI 4002

2D Barcode Scanner

OPTICON

Specifications Manual



All information subject to change without notice.

Document History

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Contents

1. Abstract	6
2. Overview	6
3. Physical Features	7
3.1. Dimensions	7
3.2. Weight	7
3.3. Color	7
4. Environmental Specifications	8
4.1. Operating Temperature and Humidity	8
4.2. Storage Temperature and Humidity	8
4.3. Ambient Light Immunity	8
5. Electrical Specifications	9
5.1. Main Battery	9
5.2. Main Battery	9
5.3. Battery Life and Charging Time	9
5.4. Dedicated AC Adapter	9
5.4.1. Buzzer and LED Display	10
6. Optical Specifications	10
7. Technical Specifications	11
7.1. 1D Symbology Test Samples Used	11
7.2. 1D Symbology Test Samples Used	11
7.3. Print Contrast Signal (PCS)	12
7.4. Scan Area and Resolution	13
7.4.1. Scan Depth	13
7.5. Angles	14
7.5.1. Pitch, Skew, and Tilt	14
7.6. Curvature	15
8. Aiming	16
8.1. Aiming Patterns	16
8.2. Aiming Guidelines	16
9. Interface Specifications	17
9.1. Wireless Specifications	17
9.2. IEEE 802.15.4	17
9.2.1. Radio Equipment	17
9.2.2. Frequency Band	17
10. Default Settings	18
10.1. Default Settings 1: Supported symbologies	18

10.2. Default Settings 2: Read Options, Trigger, Buzzer, and Indicator.....	20
10.3. Default Settings 3: Other Communication Functions	20
10.4. Set Default Interface	21
10.4.1. Default Settings	21
10.5. Configuring Settings by Reading Menu Barcode Labels.....	21
10.5.1. Address Registration to Connect with OPA 1001.....	21
10.5.2. Wireless Communication Channel Settings: CH11–CH26.....	21
10.5.3. Data Memorizing Settings Outside the Communication Range: DTME/DTMD	21
11. Serial Number and Certifications	22
11.1. Serial Number Label	22
11.2. FCC Label	22
12. Packaging Specifications	23
12.1. Individual Packaging Specification	23
12.2. Collective Packaging Specification	24
13. Durability	25
13.1. Electrical Noise	25
13.2. Static Electricity	25
13.3. Shock	25
13.3.1. Drop Test (without packaging).....	25
13.3.2. Drop Test (with individual packaging)	25
13.4. Vibration Strength	25
13.4.1. Vibration Test (without packaging)	25
13.4.2. Vibration Test (with individual packaging)	25
13.5. Dust and Drip Proof.....	25
14. Reliability.....	26
15. Regulatory Compliance	26
15.1. LED Safety Standard	26
15.2. Product Safety.....	26
15.3. EMC	26
15.4. RoHS.....	26
15.5. R&TTE	26
15.6. Radio Law	27
15.7. State of California: Perchlorate Best Management Practices	27
16. Safety.....	27
16.1. Shock	27
16.2. Temperature Conditions.....	27
16.3. Foreign Materials	27

16.4. Other27

Table of Figures

Figure 1:Dimensions7
Figure 2: Depth of field in millimeters..... 13
Figure 3: Pitch, skew, and tilt 14
Figure 4: Curvature 15
Figure 5: Aiming patterns 16
Figure 6: Serial number label.....22
Figure 7: FCC label.....22
Figure 8: Individual packaging23
Figure 9: Collective packaging.....24

1. Abstract

This manual provides master specifications for the OPI 4002 2D barcode scanner (hereafter referred to as “scanner”).

2. Overview

The OPI 4002 includes the following features:

- A 1.3 million-pixel (SXGA) CMOS area image sensor, and a compact camera module with wide-angle lens that enables scanning of wider symbologies at higher resolution
- Wide-angle lens optics that make it possible to scan wider symbologies at closer distances
- A small, high-performance, power-saving decoder that processes data faster and provides smoother scanning of both linear (1D) and 2D symbologies
- Wireless communication compliant with IEEE 802.15.4 (an interface standard for ZigBee physical layer and MAC layer) is the interface between the OPI 4002 and a host system
- Supported symbologies:

Linear (1D)	2D
JAN/UPC/EAN (WPC), incl. add-on	Aztec Code
Codabar/NW-7	Aztec Runes
Code 39	Data Matrix (ECC 0-140, ECC200)
Code 93	Maxi Code (mode 2~5)
Code 128: EAN-128	MicroPDF417
Composite Codes: UCC/EAN-128 (incl. CC-A/B/C)	Micro QR Code
IATA	PDF417
Industrial 2of5	QR Code
Interleaved 2of5	
MSI/Plessey–UK/Plessey	
RSS (all, incl. CC-A/B); RSS-14/RSS-Limited/ RSS-Expanded	

- Scanner settings can be configured by scanning menu labels.
- A lithium-ion secondary battery is used as the power supply for the scanner.
- Connect a dedicated AC adapter or an optional charger directly to the OPI 4002 to charge the battery.

The OPI 4002 complies with the Restriction of Hazardous Substances (RoHS).

3. Physical Features

3.1. Dimensions

W 58.1 mm x D 42.4 mm x H 163.9 mm

3.2. Weight

125 grams, max.

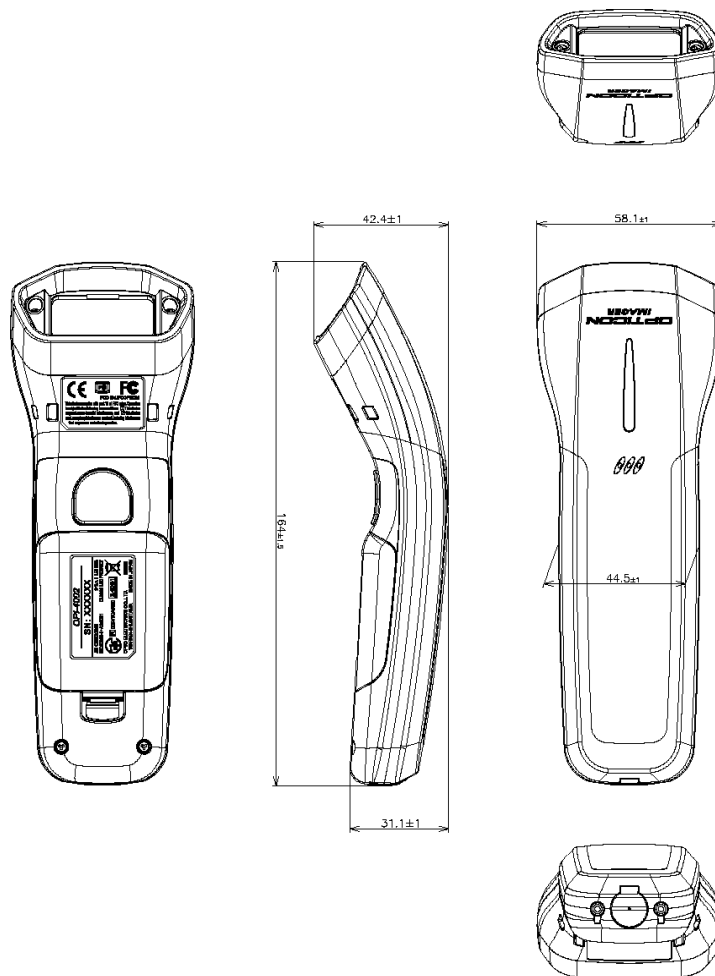


Figure 1:Dimensions

3.3. Color

Light gray

4. Environmental Specifications

4.1. Operating Temperature and Humidity

Temperature: 0 to 40° C

Humidity: 5 to 90% RH

4.2. Storage Temperature and Humidity

Temperature: -20 to 60° C

Humidity: 5 to 90% RH

4.3. Ambient Light Immunity

Decoding performance is guaranteed when the range of illumination on a barcode surface is between zero and the following values:

Incandescent light	to 10,000 lx
Fluorescent light	to 10,000 lx
Sunlight	to 100,000 lx

5. Electrical Specifications

5.1. Main Battery

Item	Specifications	Conditions
Main battery	Lithium-ion secondary battery Rated voltage: 3.6 V Rated capacity: 1,100 mAh	
Battery life	Discharge and charge 300 times	Battery capacity 70% (1C charging)
Consumption current	15 mA (max.)	When idle
	250 mA (max.)	When scanning
	550 mA (typ.)	When charging

5.2. Main Battery

The main battery is a lithium-ion secondary battery.

5.3. Battery Life and Charging Time

Items	Specifications	Conditions
Battery life	30 hours (min.)	1 scan / 5 s
Charging time	3 hours	Time necessary to fully charge an empty battery

Ambient temperature: +25°

Symbology: 1-digit Code 39, PCS = 0.9, Resolution = 1.0 mm

Distance: 85 mm from the front edge of the scanner. (Single read)

Note: The foregoing is not guaranteed when the lithium-ion secondary battery is degraded or OPI 4002 settings do not comply with the recommended settings.

5.4. Dedicated AC Adapter

6.0 V / 750 mA—Used for charging the internal battery

Conditions of Consumption Current Measurement

Add 1 ohm resistance on a power supply line. Measure consumption current at the voltage between both ends of resistance.

*Power supply voltage is measured at the terminal area of a connector.

5.4.1. Buzzer and LED Display

The OPI 4002 displays its operating state via LEDs and a buzzer located in its head.

State	Color	Display	Operating State	Buzzer
Charging	Red	Lighting	Shows that the scanner is being charged.	-
	Green	Lighting	The light changes from red to green when charging is completed.	-
Scanning	Green	Blinking	Shows that the scan or transmission was executed normally.	<i>Trrr</i>
	Red	Blinking	Shows that the data could not be transmitted.	<i>Pip, Pip, Pip</i>
	Orange	Blinking	Shows that the data is being stored in memory.	<i>Trrrrrrrrrr</i>
Wireless Connection	Green	Lighting	Shows that registration was completed.	<i>Peeeeeeeep (Completion of Registration)</i>
	Red	Lighting	Shows that registration failed.	<i>Pip, Pip, Pip</i>

6. Optical Specifications

Parameter	Specification	Unit
Scan method	CMOS area sensor (black and white)	-
Scan rate	30	fps
Pixel count	1280 (H) x 1024 (V)	pixel
Aiming LED wavelength (2 green LEDs)	527	nm
Lighting LED wavelength (4 red LEDs)	630	nm
View angle	Horizontal: 47 Vertical: 37.5	°
Focal length	85	mm

7. Technical Specifications

The conditions for technical specifications are as follows, unless otherwise specified in each section.

Conditions

Ambient temperature and humidity	21 °C / 70 °F, 60% RH
Ambient light	1000 to 1500 lx (on the surface of a barcode)
Light source	3-wavelength inverter fluorescent light
Angle	$\alpha = 0^\circ$, $\beta = +15^\circ$, $\gamma = 0^\circ$
Curvature	$R = \infty$
Power supply voltage	3.6V
Successful scans	70% and higher

7.1. 1D Symbology Test Samples Used

The size of barcodes does not include quiet zones.

1D Barcode

Resolution	Symbology	PCS	Size (mm)	Digits
0.254 mm	Code 39	0.9	14 x 10	2
0.1 mm	Code 39	0.9	11 x 10	4
0.26 mm	13-digit JAN	0.9	25 x 19	13
0.26 mm	8-digit JAN	0.9	17.5 x 15.5	8

Barcode samples with 0.127 mm and 0.26 mm resolution are OPTOELECTRONICS test samples. Other charts are printed by a regular printer.

N/W Ratio:	1:2.5
Angle:	$\alpha = 0^\circ$, $\beta = 15^\circ$, $\gamma = 0^\circ$
Curvature	$R = \infty$

7.2. 1D Symbology Test Samples Used

PDF417

Resolution	Error Correction	PCS	Size (mm)	Characters
0.339 mm	Level-4	0.9	35 x 22	17
0.254 mm	Level-4	0.9	26 x 16	17
0.127 mm	Level-4	0.9	13 x 8	17

Charts are printed by a regular printer.

Horizontal to vertical ratio is 3:1.

QR Code (Model 2)

Resolution	Error Correction	PCS	Size (mm)	Characters
0.339 mm	M	0.9	10 x 10	44
0.169 mm	M	0.9	5 x 5	44

Charts are printed by a regular printer.

Data Matrix

Resolution	Model	PCS	Size (mm)	Characters
0.339 mm	ECC200	0.9	8 x 8	40
0.169 mm	ECC200	0.9	4 x 4	40

Charts are printed by a regular printer.

7.3. Print Contrast Signal (PCS)

0.45 (MRD 32%) or higher (over 70% of reflectivity of space and quiet zone).

7.4. Scan Area and Resolution

The depth of field is measured from the edge of the optical window.

7.4.1. Scan Depth

Symbology	Resolution (mm)	Decode Depth (mm)	PCS
Code 39	0.1	55–75	0.9
	0.254	30–105	
PDF417	0.127	45–80	0.9
	0.339	25–130	
QR Code	0.169	45–75	0.9
	0.339	25–100	
Data Matrix	0.169	45–70	0.9
	0.339	35–95	

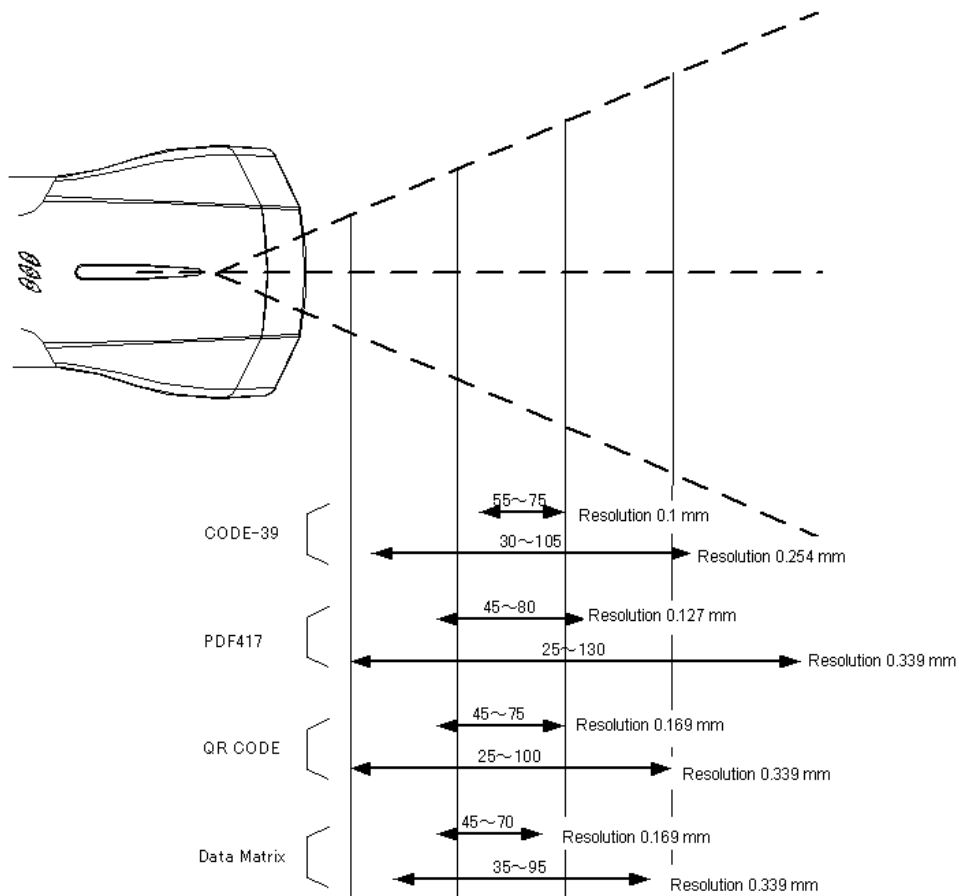


Figure 2: Depth of field in millimeters

7.5. Angles

7.5.1. Pitch, Skew, and Tilt

Pitch: $\alpha = \pm 50^\circ$

Skew: $\beta = \pm 60^\circ$ or less

Tilt: $\gamma = 360^\circ$ or less

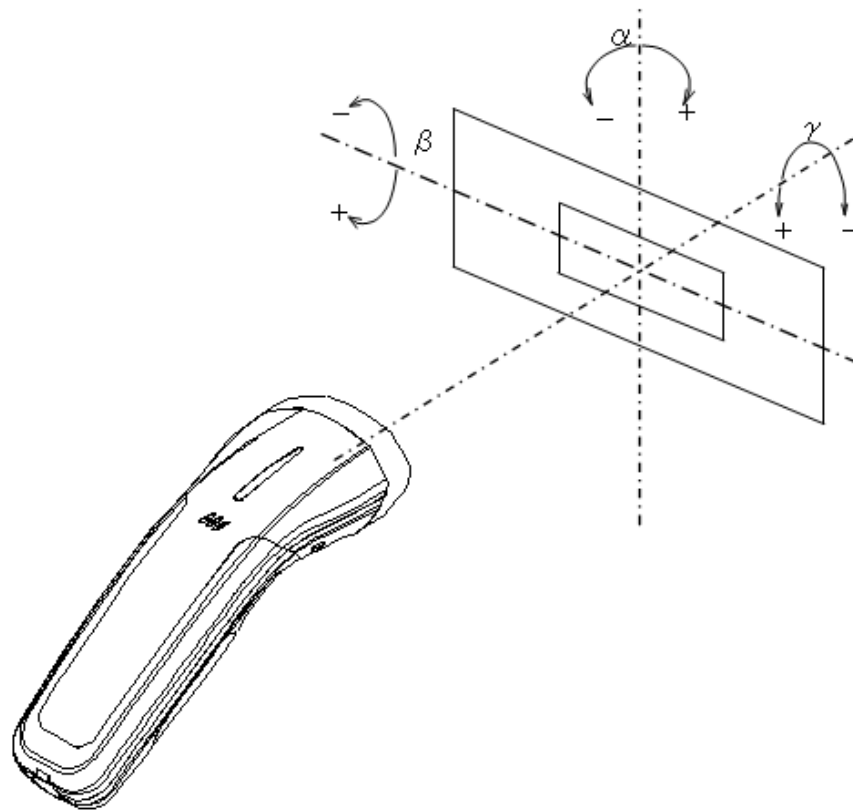


Figure 3: Pitch, skew, and tilt

Conditions

Barcode Sample: CODE39 and PDF417 with 0.254 mm resolution, PCS: 0.9

Distance:	56 mm from the front edge of the scanner
Curvature:	R = ∞ (The calculation of pitch and tilt angles is based on the skew angle formula being $\beta = +15^\circ$)

Notes

When a barcode is printed on glossy paper or a card case, it may cause difficulties in scanning due to the reflection of lighting LEDs. To improve scanning performance under these circumstances, scan the barcode with a scan angle of 15 degrees or with lighting LEDs turned off. When scanning a barcode with lighting LEDs turned off, confirm that there is enough ambient lighting in the room (1000 lx or higher), or scanning performance may decline. Scanning performance may also decline if room light reflects on the barcode surface.

7.6. Curvature

With 8-digit JAN barcodes, decoding performance is guaranteed when $R \geq 15$ mm.

With 13-digit JAN barcodes, decoding performance is guaranteed when $R \geq 20$ mm.

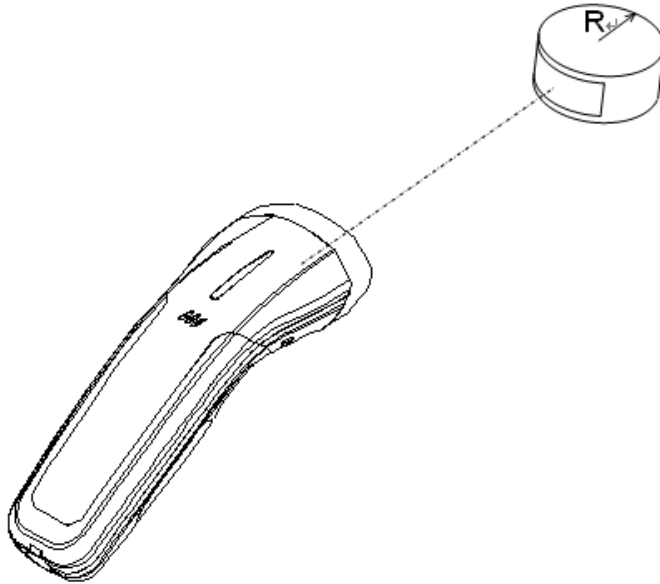


Figure 4: Curvature

Conditions

Barcode Sample: Symbology: 13-digit JAN, resolution: 0.26 mm, PCS: 0.9 mm

Distance:	56 mm from the front edge of the scanner
Angle:	$\alpha = 0^\circ$, $\beta = +15^\circ$, $\gamma = 0^\circ$

8. Aiming

8.1. Aiming Patterns

During a scan, the green LED patterns shown below will be visible. These patterns assist you in aiming the scanner; they are superimposed on the illuminated scan field. The aiming patterns are only a guide. They do not indicate exact scannable width or distance between a scanner and a barcode.

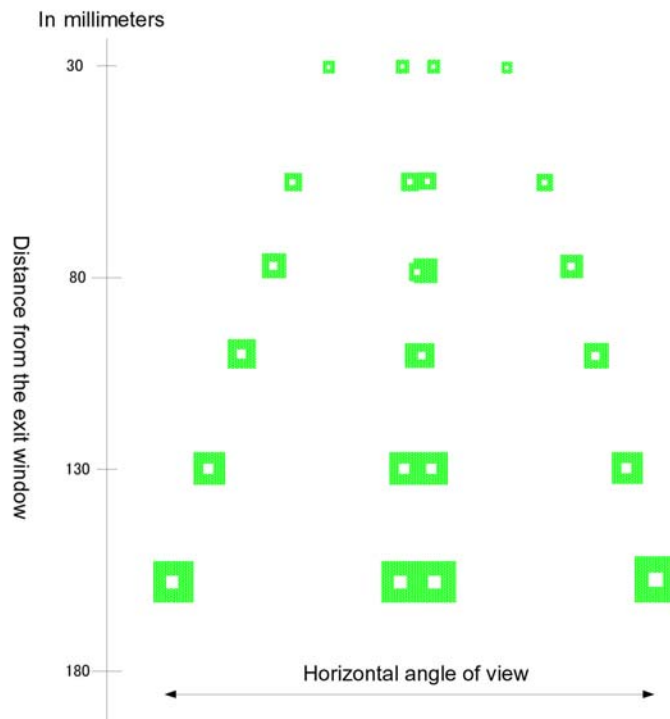


Figure 5: Aiming patterns

8.2. Aiming Guidelines

- The focal point is where two central LED light patterns (green and square-shaped) overlap—where two dots meet.
- To scan a barcode within the aiming range, make sure that two central LED light patterns overlap, then place the center of the overlapping LED light patterns on the center of the barcode.
- To scan a barcode wider than a width of the aiming range, aim at the barcode from further away. Make sure that the barcode is between two LED light patterns on both the right and left.
- Scanning performance may decline due to the specular reflection when the symbology is printed on certain types of materials. In such cases, incline the scanner at 15 degrees to adjust the scanning angle.

9. Interface Specifications

9.1. Wireless Specifications

The wireless interface of the OPI 4002 complies with IEEE 802.15.4 standards.

Item	Specification	Notes
Specifications	IEEE 802.15.4 (ZigBee's physical layer and MAC layer)	
Frequency	2400–2483.5 mHz	
Transmission power	0 dBm or less	
Communication distance	30 m or longer (perspective)	Depends on the operating environment
Baud rate	250 kbps	
Antenna	1/4λ (surface mount)	
Communication configuration	One OPI 4002 to one OPA 1001	
Encryption	128-bit encryption	

9.2. IEEE 802.15.4

9.2.1. Radio Equipment

The electromagnetic wave absorption (2.4 GHz) used by this product is also shared by various other devices. Therefore, baud rate and communication distance may be negatively impacted, or their communications may be disconnected, by other devices using the same absorption rate.

Baud rate and communication distance are affected by obstacles, wave conditions, or a device at the other end.

This product is equipped with an antenna. Bringing this product too close to a metallic object may affect communication. Anticipated interference distance is 10 m or less.

9.2.2. Frequency Band

This product uses the 2.4 GHz frequency band. Scientific, medical, and industrial devices, including microwaves, wireless security (camera) systems and W-LAN use the same frequency band as this scanner. Other radio stations also use this frequency for mobile object identification, including local private radio stations that require a license (for example, manufacturing lines at factories), specific power-saving radio stations requiring no license, and amateur radio stations.

Interference from other devices may affect the communication speed or communication range of this scanner or vice versa.

10. Default Settings

10.1. Default Settings 1: Supported symbologies

Code type	Reading	Transmit Code Length	Transmit CD	Calculate CD	Transmit Other	Set prefix	Set suffix
UPC-A	■	X	■	■		-	CR
UPC-A Add-on	X	X	■	■		-	CR
UPC-E	■	X	■	■		-	CR
UPC-E1	X	X	■	■		-	CR
UPC-E Add-on	X	X	■	■		-	CR
EAN-13	■	X	■	■		-	CR
EAN-13 Add-on	X	X	■	■		-	CR
EAN-8	■	X	■	■		-	CR
EAN-8 Add-on	X	X	■	■		-	CR
Aztec Code	■	X	X	■		-	CR
Aztec Runes	X	X	X	■		-	CR
Chinese Post	X	X	■	X		-	CR
Codabar / NW-7	■	X	■	X	Not transmit ST/SP	-	CR
Code 39	■	X	■	X	Not transmit ST/SP	-	CR
Code 93	■	X	■	■		-	CR
Code 128	■	X	■	■		-	CR
Composite EAN EAN-13 CCA EAN-13 CCB EAN-8 CCA EAN-8 CCB	X	X	X	■		-	CR
Composite UPC UPC-A CCA UPC-A CCB UPC-E CCA UPC-E CCB	X	X	X	■		-	CR
Composite RSS RSS-14 CCA RSS-14 CCB RSS Limited CCA RSS Limited CCB RSS Expanded CCA RSS Expanded CCB	X	X	X	■		-	CR

Code type	Reading	Transmit Code Length	Transmit CD	Calculate CD	Transmit Other	Set prefix	Set suffix
Composite UCC/EAN-128 UCC/EAN-128 CCA UCC/EAN-128 CCB UCC/EAN-128 CCC	X	X	X	■		-	CR
Data Matrix IECC200)	■	X	X	■		-	CR
Data Matrix (ECC0-140)	X	X	X	■		-	CR
IATA	■	X	■	X		-	CR
Industrial2of5	■	X	■	X		-	CR
Interleaved2of5	■	X	■	X		-	CR
Korean Post	X	X	X	■		-	CR
Matrix2of5	X	X	■	X		-	CR
Maxi CODE	■	X	X	■		-	CR
MicroPDF417	■	X	X	■		-	CR
Micro QR	X	X	X	■		-	CR
MSI/Plessey	■	X	■	■		-	CR
UK/Plessey	■	X	■	■			
PDF417	■	X	X	■		-	CR
QR CODE	■	X	X	■		-	CR
RSS-14 Standard Truncated Stacked Stacked Omni-directional	■	X	■	■		-	CR
RSS Limited	■	X	■	■		-	CR
RSS Expanded Standard Stacked	■	X	X	■		-	CR
S-CODE	■	X	■	X		-	CR
Telepen	■	X	■	■		-	CR
Tri-Optic	■	X	■	X	Not transmit ST/SP	-	CR

Notes:

- In the “Reading” column, “■” means “Enable reading” and “X” means “Disable reading.”
- In the “Transmit code length” column, “■” means “Transmit code length” and “X” means “Do not transmit code length.”
- In the “Transmit CD” column, “■” means “Transmit check digit” and “X” means “Do not transmit check digit.” Also, “-” means “there is no setting for check digit transmission.”
- In the “Calculate CD” column, “■” means “Calculate check digit” and “X” means “Do not calculate check digit”.
- In the “Setting prefix” column, “-” means “there is no setting for prefix.”

10.2. Default Settings 2: Read Options, Trigger, Buzzer, and Indicator

Item	Default Setting
Setting the number of characters	Fixed length OFF all codes
Scan method	Multiple read
NW-7 inter-character gap check	Character * 1
Multiple columns read	Disable multiple columns read
Trigger switch	Enable trigger
Read time	2 s
Buzzer duration	200 ms
Buzzer frequency	3kHz + 2.5 kHz
Buzzer loudness	Loud
Indicator duration	200 ms

10.3. Default Settings 3: Other Communication Functions

Items	Settings
Set IEEE address	None
Wireless channel	CH15
Encryption	Enabled
Data memorizing	Disabled

10.4. Set Default Interface





There are two ways to configure factory default settings:

- One-by-one configuration by scanning the Code 39 menu labels below.

Note: When duplicated scanning of a menu label occurs, the last label scanned will take effect.

- Multi-configuration by scanning the QR code menu label below.

10.4.1. Default Settings

Code 39 Menu Labels for One-by-One Configuration			QR Code Label for Multi-Configuration
ZZ	Set		
C02	Interface Settings IEEE802.15.4 HID Data Transmission		
ZZ	End		

10.5. Configuring Settings by Reading Menu Barcode Labels

Communication parameter settings for the OPI 4002 can be configured by scanning menu labels.

Refer to the instruction manual for further information about menu labels.

10.5.1. Address Registration to Connect with OPA 1001

Read an address barcode printed on the label attached to the OPA 1001 cradle.
 Confirm that the OPA 1001 is connected to the OPI 4002

Note: Scanned data cannot be transmitted unless the address registration is completed.

10.5.2. Wireless Communication Channel Settings: CH11–CH26

The wireless communication channel settings can be adjusted.

10.5.3. Data Memorizing Settings Outside the Communication Range: DTME/DTMD

Selecting “Data Memorizing Enabled” allows the scanner to read data outside the communication range and store the data in OPI 4002 memory. When the scanner returns to the communication range, it will be re-connected and the temporarily stored data will automatically be transmitted to the host.

Note: When “Data Memorizing Disabled” is selected, the scanner will not read data outside the range.

11. Serial Number and Certifications

The serial number is written on the following label attached to the scanner.

11.1. Serial Number Label

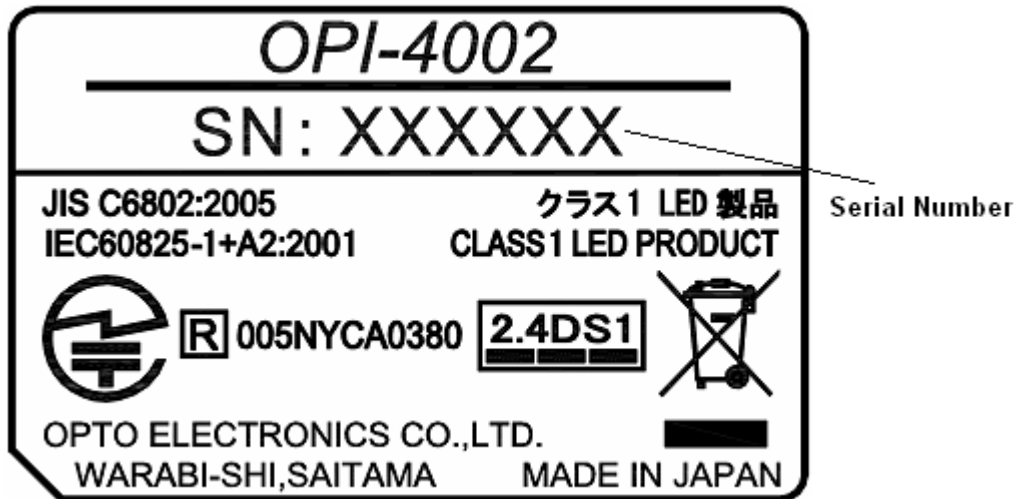


Figure 6: Serial number label

11.2. FCC Label

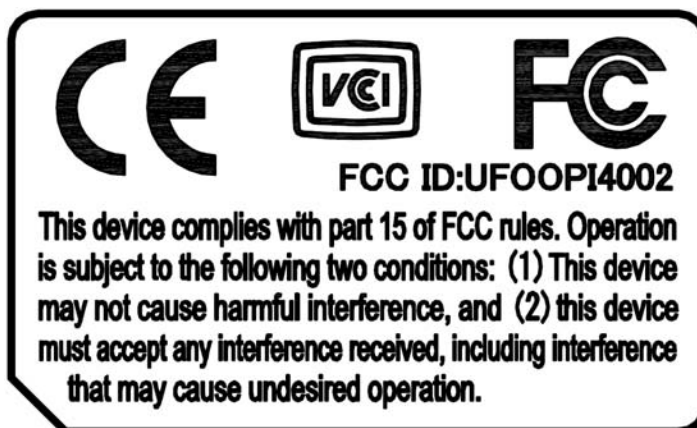


Figure 7: FCC label

12. Packaging Specifications

12.1. Individual Packaging Specification

Put the scanner in a protective foam bag and place it in an individual packing box.

Package dimensions (assembled): 255 mm (W) x 120 mm (D) x 105 mm (H)

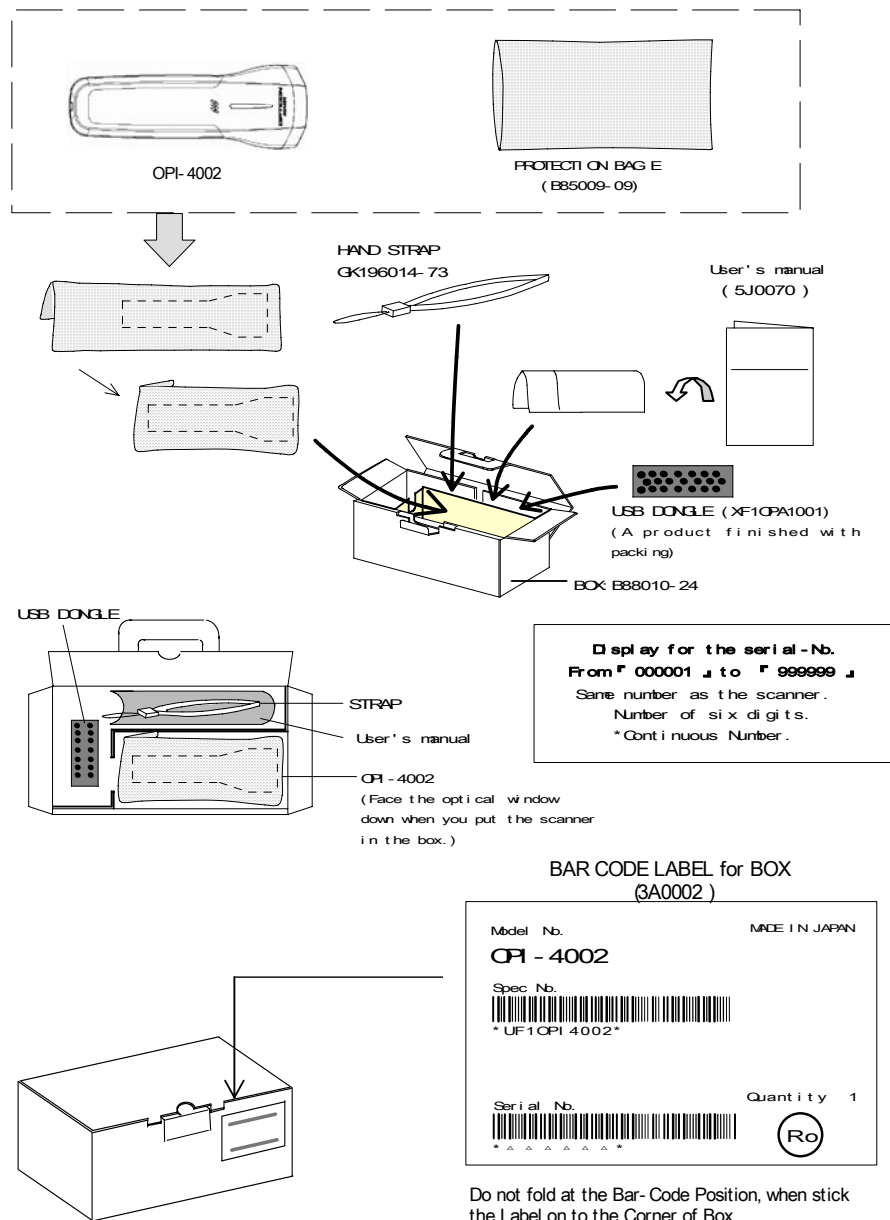


Figure 8: Individual packaging

12.2. Collective Packaging Specification

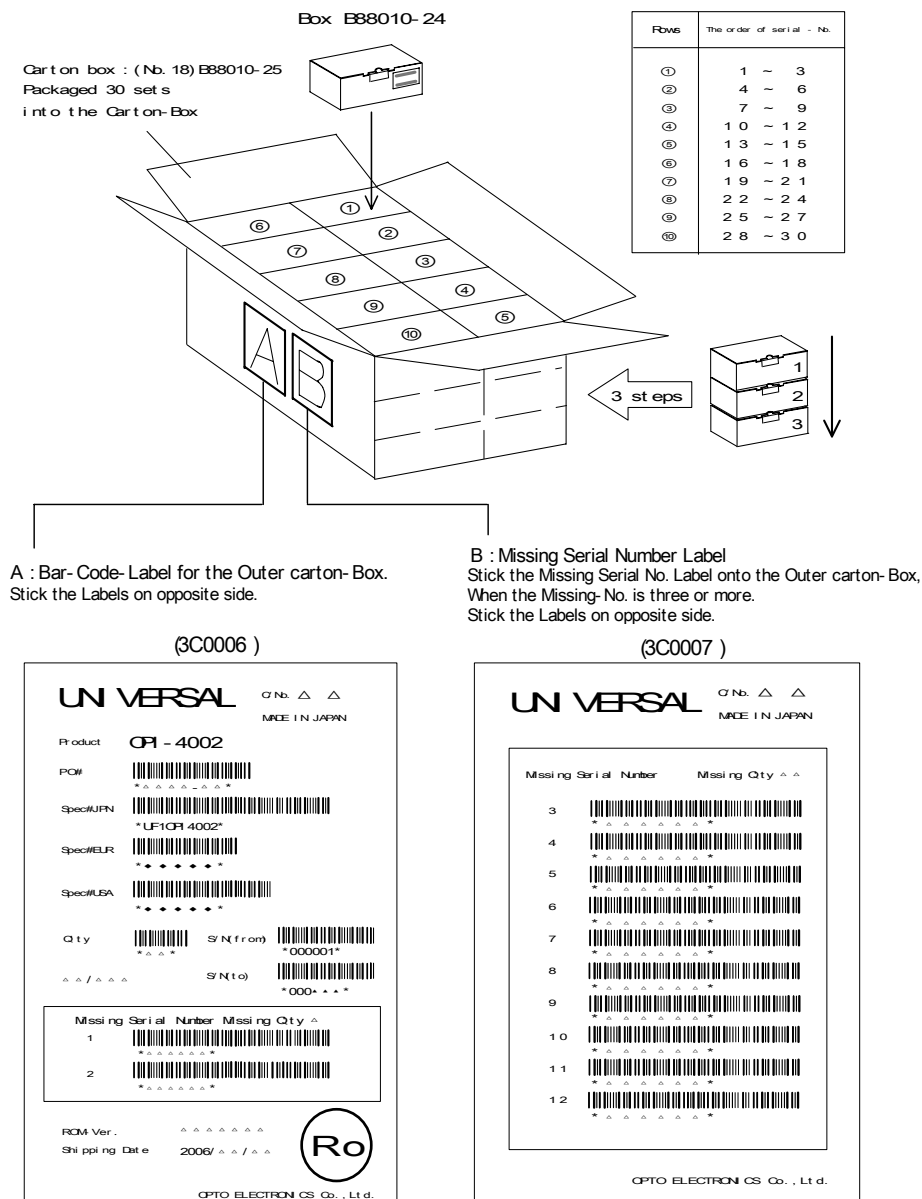


Figure 9: Collective packaging

Note: The “RO” mark labeled on the package tray or package box guarantees that the applicable product has passed our test of RoHS restrictions compliance (the restriction of the use of certain hazardous substances in electrical and electronic equipment, 2002/95 EC). However, this document does **not** have any legal weight in the European Union.

13. Durability

13.1. Electrical Noise

No malfunction occurred when sinusoidal electrical noise (50Hz -100kHz, <0.1Vpp) was added to the power supply line.

13.2. Static Electricity

Air discharge	± 10 kV (No malfunction) ±15 kV max. (No destruction)
Measurement environment	Used electrostatic testing device compliant with IEC 61000-4-2
Discharge resistance:	330Ω
Capacitor charging:	150pF

13.3. Shock

13.3.1. Drop Test (without packaging)

No malfunction with the structural performance of this scanner occurred after the following drop test.

Shock Test: Drop the scanner from 1.5 meters onto a concrete floor three times on each of its six sides. Scratches on the chassis are not counted as a defect.

13.3.2. Drop Test (with individual packaging)

No malfunction with the structural performance of this scanner occurred after the following drop test.

Shock Test: Dropped the individually packaged scanner from 1.5 meters onto a concrete floor once on its one corner, three edges, and six sides. Repeated for ten drop tests, total.

13.4. Vibration Strength

13.4.1. Vibration Test (without packaging)

No malfunction occurred with the exterior appearance or the performance of this scanner after the following vibration test.

Put the OPI 4002 into a non-operating state and carried out sweeping for 30 minutes, increasing the frequency of the vibration from 10 Hz to 100 Hz with accelerated velocity of 2.0 G (19.6m/s²). (60 minutes for one cycle). Repeated this cycle to X, Y and Z directions.

13.4.2. Vibration Test (with individual packaging)

No malfunction occurred with the exterior appearance or the performance of this scanner after the following vibration test.

Put the OPI 4002 into a non-operating state and carried out sweeping for 30 minutes, increasing the frequency of the vibration from 10 Hz to 100 Hz with accelerated velocity of 2.0 G (19.6m/s²). (60 minutes for one cycle). Repeated this cycle to X, Y and Z directions.

13.5. Dust and Drip Proof

IP-42 compliant

14. Reliability

MTBF (Mean Time Between Failures) of this product is 50,000 hours.

The estimate of MTBF is based on standard operation of the product within the recommended temperature range and without extreme electronic or mechanical shock.

15. Regulatory Compliance

15.1. LED Safety Standard

JIS C 6802:2005 Class 1

IEC60825-1+A2:2001 Class1

15.2. Product Safety

IEC60950-1

EN60950-1

15.3. EMC

EN55022

EN55024

VCCI Class B: This is a Class B product, to be used in a domestic environment based on the Technical Requirement of the Voluntary Control Council for Interference from Information Technology Equipment (VCCI). If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Please install and use the equipment according to the instruction manual.

FCC Part 15 Subpart B Class B: This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Certification for Construction Design of Specified Radio Equipment

15.4. RoHS

RoHS: The restriction of the use of certain hazardous substances in electrical and electronic equipment, 2002/95 EC.

15.5. R&TTE

This scanner conforms to the following standards of the Radio and Telecommunications Terminal Equipment (R&TTE) directive from the EU.

EN300 328

IEC60950-1

15.6. Radio Law

The scanner qualifies as radio equipment for low-power radio stations (2.4 GHz band advanced data communication systems) as specified in the Radio Law 38-24-1.

The scanner has obtained the Certification for Construction Design of Specified Radio Equipment. It does not have a radio station license in Japan.

The following activities are prohibited under the Radio Law:

- Remodeling and disassembly
- Peeling off the certificate label

15.7. State of California: Perchlorate Best Management Practices

The batteries on some Opticon products may contain Perchlorate. To comply with California Perchlorate Best Practice Regulations and the Law for the Promotion of Utilization of Recyclable Resources (Japan), products that may contain Perchlorate materials should be properly labeled on the exterior of all outer shipping packages and/or in locations that otherwise satisfy the California Perchlorate Best Management Practices.

16. Safety

Handle this product carefully. Do not deliberately subject it to any of the following.

16.1. Shock

Do not throw or drop the scanner.

Do not place heavy objects on the cables.

16.2. Temperature Conditions

Do not use the scanner at temperatures outside the specified range.

Do not pour boiling water on the scanner.

Do not throw the scanner into the fire.

Do not forcibly bend the cables at low temperatures.

16.3. Foreign Materials

Do not immerse the scanner in liquids.

Do not subject the scanner to chemicals.

16.4. Other

Do not plug/unplug the connectors before disconnecting the power.

Do not disassemble this product.

Do not place the product near a radio or a TV receiver, as the scanner may cause reception problems.

The scanner may be damaged by voltage drops.

The scanner may not perform properly in environments when placed near a flickering light, such as a computer monitor, television, etc.

Opticon shall not be held responsible for any damages caused by using an AC adapter not provided by Opticon.