

NLV 2101

Fixed-position 2D Barcode Imager

OPTICON

Specifications Manual



All information subject to change without notice.

Document History

Model Number:	NLV 2101	Specification Number:	SS07027
Edition:	1	Original Spec Number:	SS07001
Date:	2007-04-11		

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1. Abstract

This manual provides specifications for the NLV 2101 fixed-position 2D barcode imager (hereafter referred to as “scanner”).

2. Overview

The NLV 2101 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
- Three different models of NVL 2101 (Type-L, Type-I and Type-S) are available where the position of the optical window differs for each type. The default model type is the Type-L; the Type-I and Type-S are available for large purchase orders.
- 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

Linear (1D)

JAN/UPC/EAN (WPC), incl. add-on
 Chinese Post
 Codabar/NW-7
 Code11
 Code39
 Code93
 Code128: EAN-128
 Composite Codes: UCC/EAN-128 (incl. CC-A/B/C)
 IATA
 Industrial 2of5
 Interleaved 2of5
 ISBN-ISMN-ISSN
 Korean Postal Authority Code
 Matrix 2of5
 MSI/Plessey – UK/Plessey
 RSS (all, incl. CC-A/B); RSS-14/RSS-Limited/ RSS-Expanded
 S-Code
 Telepen
 Tri-Optic

2D

Aztec Code
 Aztec Runes
 Data Matrix (ECC 0-140, ECC200)
 Maxi Code (mode 2–5)
 MicroPDF417
 Micro QR Code
 PDF417
 QR Code

- The ability to change symbology settings, scanning settings, and communication settings by sending commands

Command transmissions (from the host to the scanner), decoded data transmissions, and captured image transmissions (from the scanner to the host) are done via serial communication (unless you are using the USB-HID model of the NLV 2101).

There are three versions of the NLV 2101. Location of the optical window differs, depending on the version.

The NLV 2101 complies with the Restriction of Hazardous Substances (RoHS).

3. Physical Features

3.1. Dimensions

W 46.0 mm x D 58.0 mm x H 24.5 mm

3.2. Weight

120 grams, max. (excludes the weight of the cable)

4. Environmental Specifications

4.1. Operating Temperature and Humidity

Temperature: 0 to 45° C

Humidity: 20 to 85% RH

4.2. Storage Temperature and Humidity

Temperature: -20 to 60° C

Humidity: 20 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

Conditions

Barcode Sample: PDF417 with 0.254 mm resolution

Distance:	107 mm from the plastic mask of the camera module
Angle:	$\alpha = 0^\circ \beta = 15^\circ \gamma = 0^\circ$
Curvature:	$R = \infty$
Power Supply Voltage:	5.0 V

Scanning performance is guaranteed as long as direct light or a reflection from a light source does not impact the light detection range of the NLV 2101.

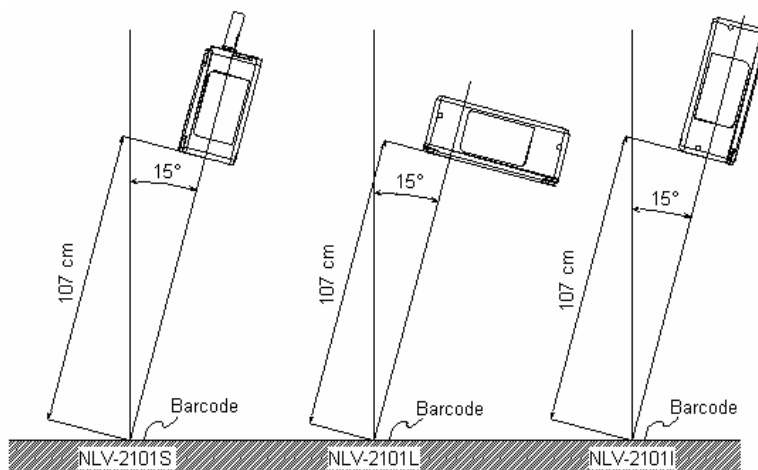


Figure 1: Ambient light and scanning performance

5. Electrical Specifications

5.1. Framework and Structure

This product consists of a camera module, a decoder, communication controls, an interface, and a power supply. The camera module consists of a CMOS area image sensor and lens. The decoder decodes the scanned 1D and 2D codes. The interface transfers data between this product and the host system.

- The NLV 2101 with RS-232C interface requires the supplied AC adaptor.
- The NLV 2101 with USB interface uses bus power. It does not require an AC adaptor.

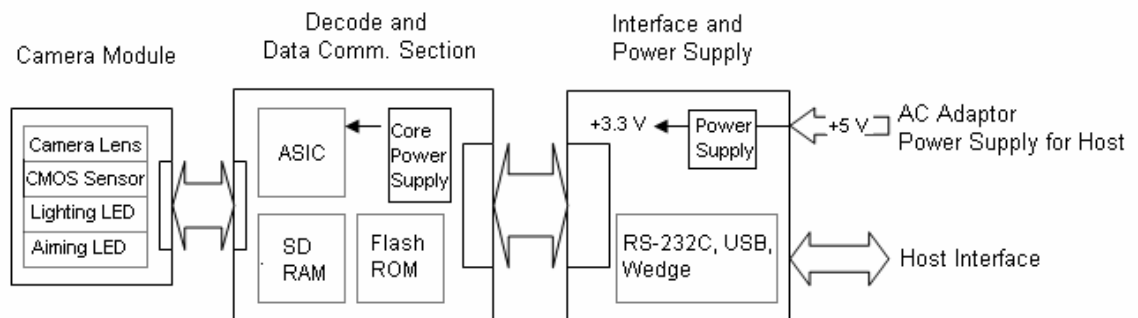


Figure 2: Framework and structure diagram

5.2. Electrical Characteristics

5.2.1. AC Adapter

AC adapter output: DC 5.0 V, 600 mA or less

Parameter	Min	Max	Unit
Power Supply Voltage 5 V \pm 10%	4.5	5.5	V
Ripple: 0.1 Vp-p or less, power supply voltage 5.0 V	10	100	kHz
Operating Current (typical)	230	330	mA
Stand-by Current (typical)	130	165	mA

5.2.2. USB Power Supply

Current consumption: 300 mA

Parameter	Min	Max	Unit
Bus power class: high power (500 mA)	-	-	mA
Ripple: 0.1 Vp-p or less, power supply voltage 5.0 V	10	100	kHz

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	°

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
Power supply voltage	5.0 V
Successful scans	70% and higher

7.1. Symbologies

The size of barcodes does not include quiet zones.

7.1.1. Barcode

Resolution	Symbology	PCS	Size (mm)	Digits
0.508 mm	Code39	0.9	29 x 25	2
0.254 mm	Code39	0.9	14 x 10	2
0.127 mm	Code39	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	$R = \infty$

7.1.2. 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.

7.1.3. QR Code (Model 2)

Resolution	Error Correction	PCS	Size (mm)	Characters
0.339 mm	M	0.9	10 x 10	44
0.212 mm	M	0.9	6 x 6	44
0.169 mm	M	0.9	5 x 5	44

Charts are printed by a regular printer.

7.1.4. Data Matrix

Resolution	Model	PCS	Size (mm)	Characters
0.339 mm	ECC200	0.9	8 x 8	40
0.212 mm	ECC200	0.9	5 x 5	40
0.169 mm	ECC200	0.9	4 x 4	40

Charts are printed by a regular printer.

7.1.5. Maxi Code

Resolution	Model	PCS	Size (mm)	Characters
0.889 mm	Standard	0.9	26 x 26	29

Charts are printed by a regular printer.

7.2. Print Contrast Signal (PCS)

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

7.3. Scan Area and Resolution (L-type model)

The depth of field is measured from the plastic mask of the camera module. (The distance from the camera module to the optical window is the same for all L-type, S-type and I-type models.)

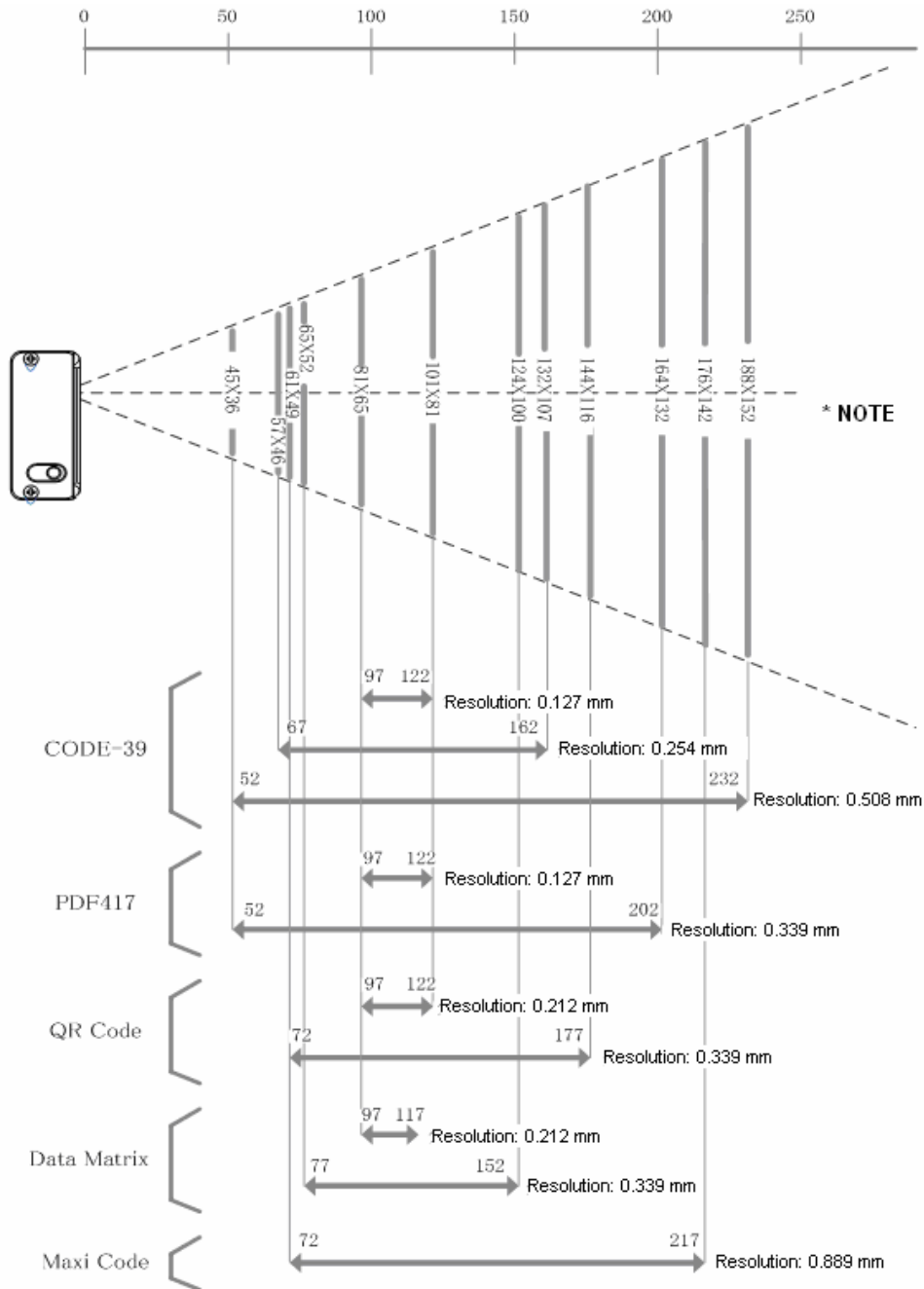


Figure 3: Depth of field in millimeters. Values describe average scannable ranges.

7.4. Resolution

0.127 mm: Code39 and PDF417

0.169 mm: Data Matrix and QR Code

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

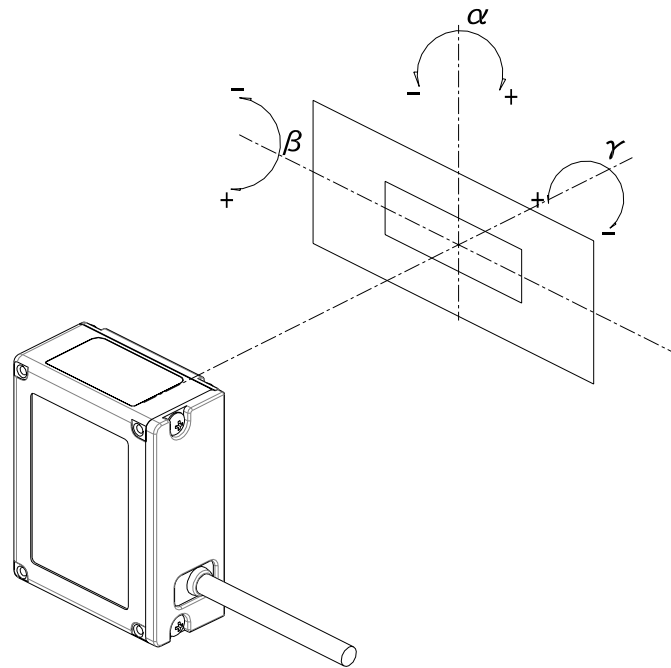


Figure 4: Pitch, skew, and tilt

Conditions

Barcode Sample: Code39 and PDF417 with 0.254 mm resolution

Distance:	107 mm from the plastic mask of the camera module
Angle:	Curvature: $R = \infty$ (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/UPC/EAN barcodes, decoding performance is guaranteed when $R \geq 15$ mm.

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

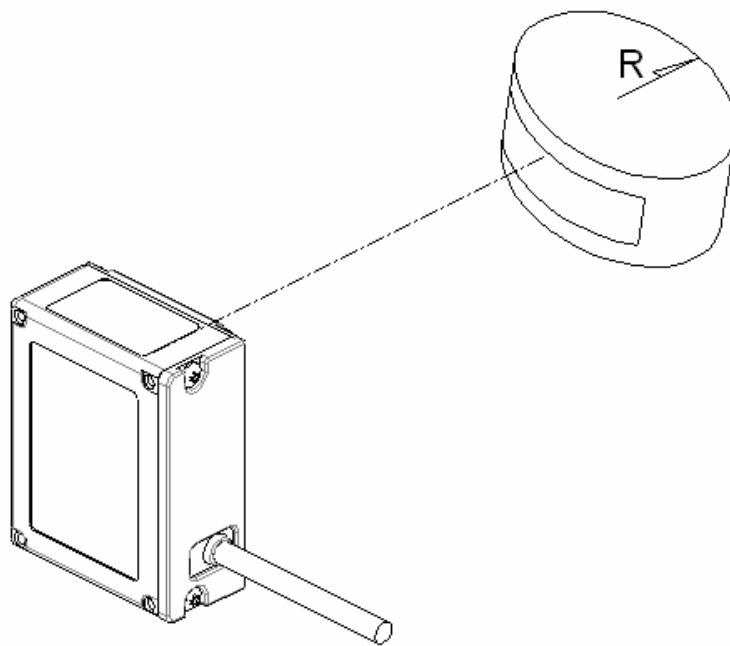


Figure 5: Curvature

Conditions

Barcode Sample: JAN barcode

Distance:	107 mm from the mask of the camera module
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.

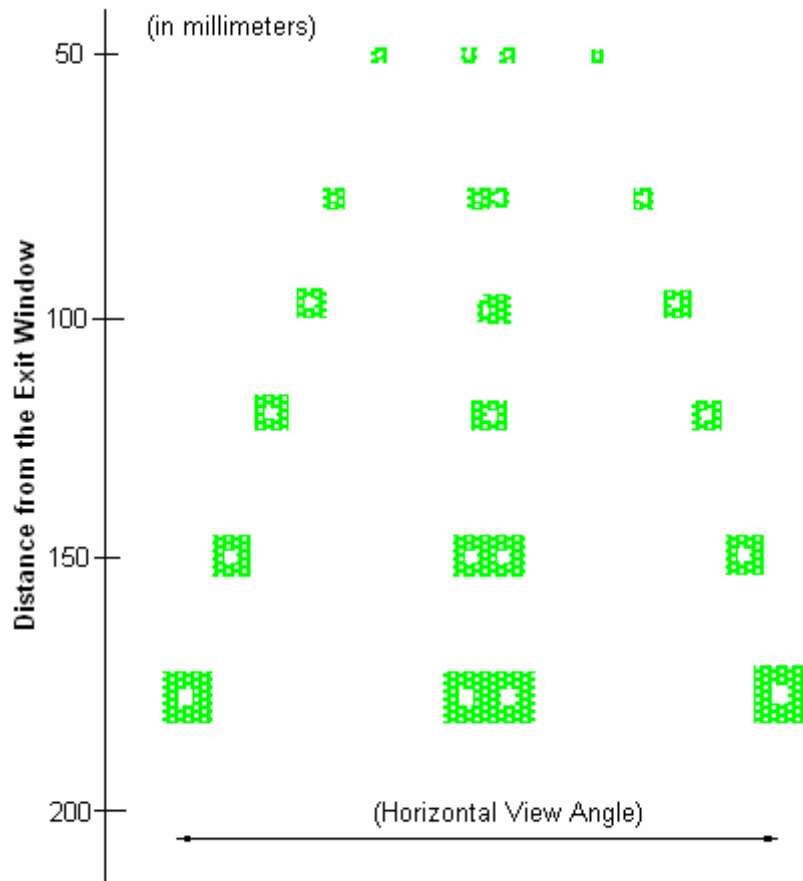


Figure 6: Aiming patterns

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.

9. Interface Specifications

9.1. RS-232C (9-pin) Interface Specifications

D-sub 9-pin output connector.

9.1.1. Settings and Communication

Reading menu barcodes [ZZ] + [U2] + [ZZ] can set the RS-232C interface default.

Item	[U2] setting
Baud rate	9600 BPS
Start/stop bits	1 bit
Data bits	8 bits
Parity bits	No parity
Handshaking	No handshake
Flow Control Time Out	Indefinitely

You can change the communication condition using the menu barcode.

9.1.2. Signal Level

Signal Name	I/O	RS-232C Level (V)	
		Mark/OFF	Space/ON
TxD	OUT	-5 to -15	+5 to +15
RxD	IN	-3 to -15	+3 to +15
RTS	OUT	-5 to -15	+5 to +15
CTS	IN	-3 to -15	+3 to +15

9.1.3. Pin Assignment

Connector for scanner side: D-sub 9-pin female

Pin No.	Signal Name	Remarks
1	NC	Open (not connected)
2	TxD	
3	RxD	
4	NC	Connected to pin #6
5	GND	
6	NC	Connected to pin #4
7	CTS	
8	RTS	
9	NC	Open (not connected)
Case	FG	Shield

Power supply: Power supply jack

9.1.4. Interface Circuit

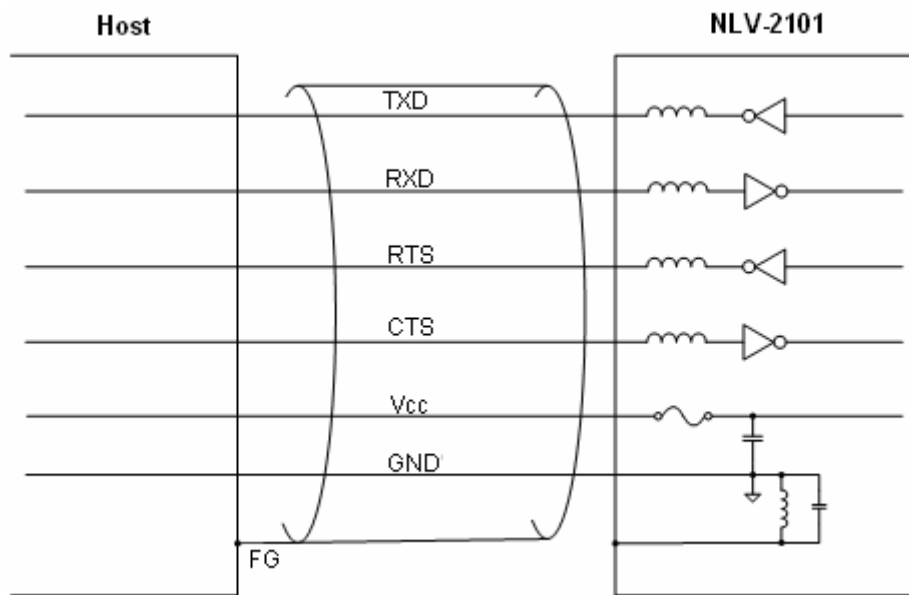


Figure 7: RS-232C interface circuit (9-pin)

9.1.5. Character Format



Figure 8: Character format (same for both sending and receiving)

9.1.6. Communication Format

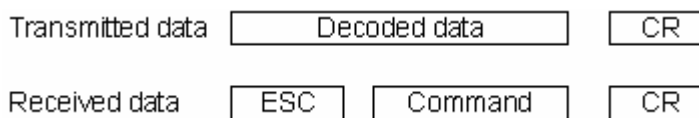


Figure 9: Communication format

9.1.7. Handshaking

Select handshaking options using the menu or command listed below.

Handshaking	Menu/Command
No handshake	P0
BUSY/READY	P1
MODEM	P2
ACK/NAK	P3
ACK/NAK NO RESPONSE	P4

a) No Handshaking

The scanner attempts the communication regardless of the state of the host system.

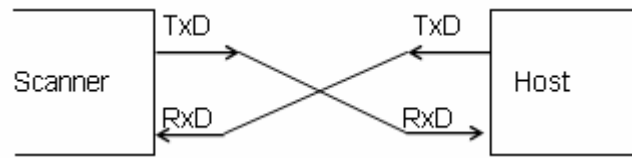


Figure 10: No handshaking

b) BUSY/READY

The scanner and the host computer notify each other of their state and whether they can receive data with BUSY/READY through an RTS line. They can communicate state to each other through a CTS line when connected as in the following figure.

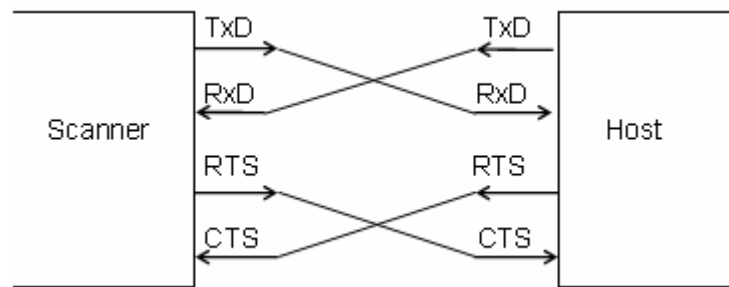


Figure 11: Busy/Ready communication

The scanner stays ON (is able to receive data) except during certain parts of the process, such as receiving data (buzzer command execution), transmitting data, and menu processing. The scanner checks the CTS line before transmitting data. When it is ON, the scanner transmits data. When it is OFF, the scanner waits for it to turn ON within a set time. The scanner will abort transmission with an error indication (buzzer) when the CTS line is not ON within a specified period. The Flow Control time-outs are as follows, and the default setting is "indefinitely" (10).

Flow Control Time Out	Menu/Command
Indefinitely	10
100 ms	11
200 ms	12
400 ms	13

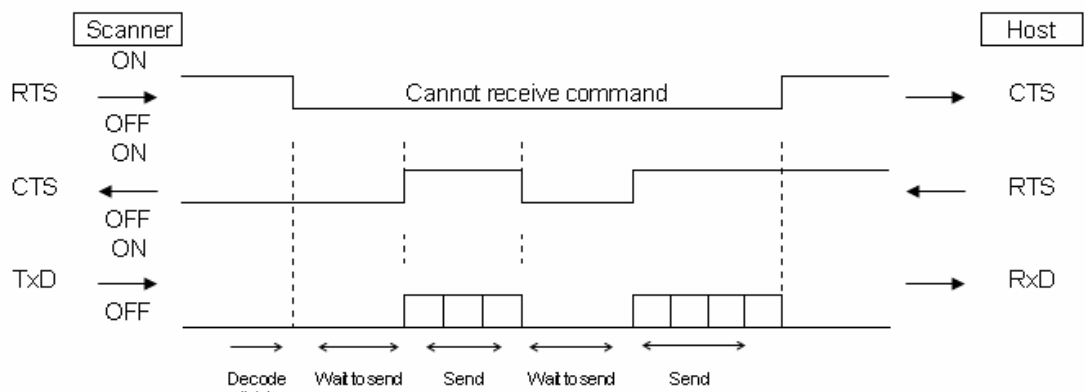


Figure 12: Cannot receive command

CTS, Tx/D signal timing

When the CTS line is turned OFF while sending a Tx/D signal, the scanner transmits one character and waits. When the RTS signal is turned ON while transmitting a character, the character will be transmitted.



Figure 13: Signal timing

Note: When using loopback (wire connection) for CTS, RTS line of the scanner in this setting, *No handshake* is not enabled.

c) MODEM

The scanner turns CS line ON before transmitting data. Other processes are the same as BUSY/READY.

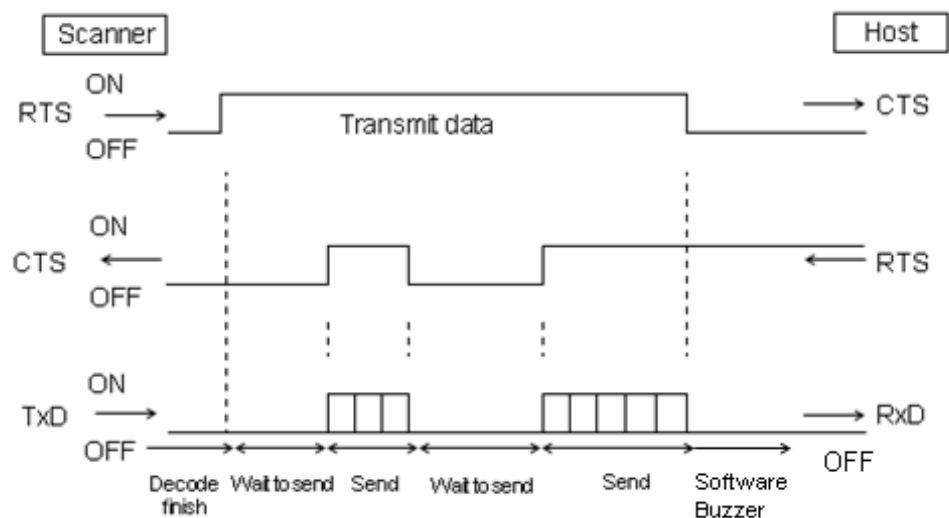


Figure 14: Modem transmit data

d) ACK/NAK

After data has been transmitted, the scanner expects to receive one of the following responses from the host:

- *ACK* response—Action: The scanner completes transmission with the good-read buzzer and returns to the initial state.
- *NAK* response—Action: The scanner sends the data again and waits for the response from the host.
- *DC1* response—Action: The scanner returns to waiting for the trigger, if it has a trigger (the initial state).
- *None* response—Action: The scanner sounds the error buzzer and returns to the initial state.

ACK/NAK timeout can be set as follows using the menu or commands.

ACK/NAK timeout	Menu / Command
Indefinitely (default)	XI4
100 ms	XI5
500 ms	XI6
1000 ms	XI7

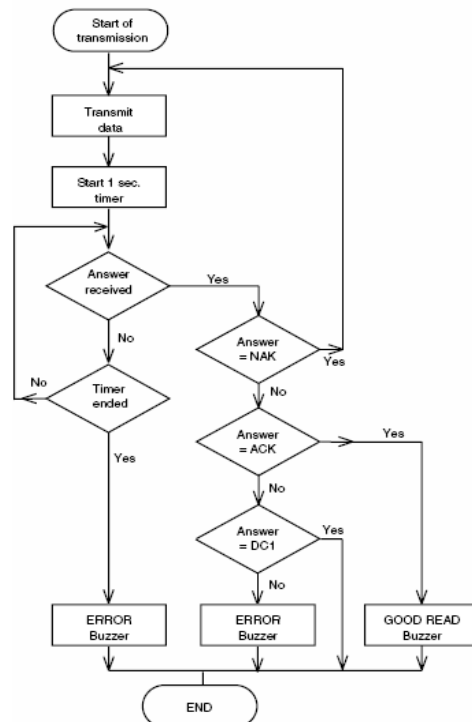


Figure 15: ACK/NAK

e) ACK/NAK NO RESPONSE

When no response from the host is received within the setting time, the scanner assumes an ACK response, and returns to the initial state without the error buzzer. The other actions are the same as ACK/NAK.

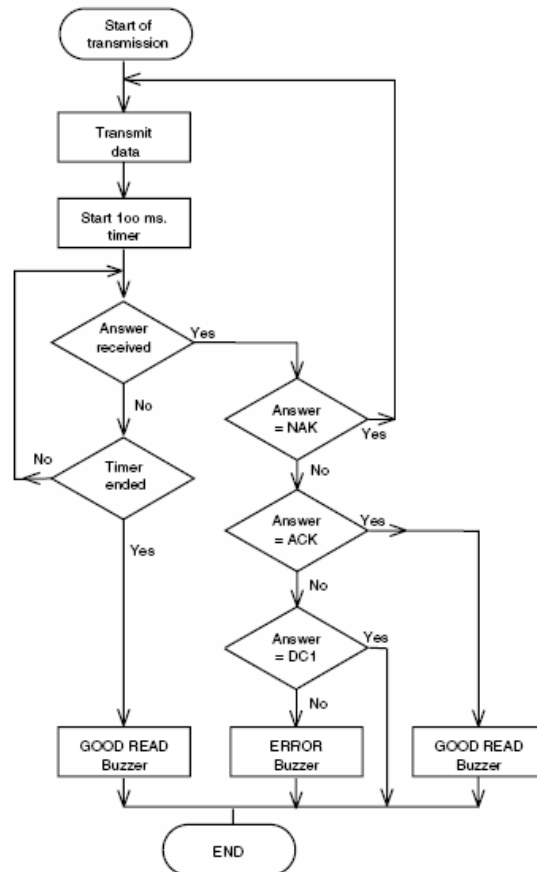


Figure 16: ACK/NAK—No response

9.2. RS-232C (10-pin) Interface Specifications

Cut-off cables for host system.

All RS-232C signals except for sequencer signals should be in accordance with section 9.1.

9.2.1. Signal Level

The following table provides information applicable only to the sequencer signals.

Signal Name	IN/OUT	RS-232C Level (V)	
		L-level	H-level
Trigger	IN	-0.3 V to 0.6 V	3 V to Vcc + 0.3 V
OK	OUT	0.4 V / 10 mA	OC output / max. 6 V
NG	OUT	0.4 V / 10 mA	OC output / max. 6 V

9.2.2. Signal Name and Wire Color

Wire Color	Signal Name	Note
Brown	Trigger	(Enable: Low / Disable: Hi)
Orange	NG	
Yellow	OK	
Green	TxD	
Blue	RTS	
White	RxD	
Gray	CTS	
Red	VCC	+5 V
Black	GND	Signal GND
Black Flexible Tube	FG	Shield

9.2.3. Interface Circuit

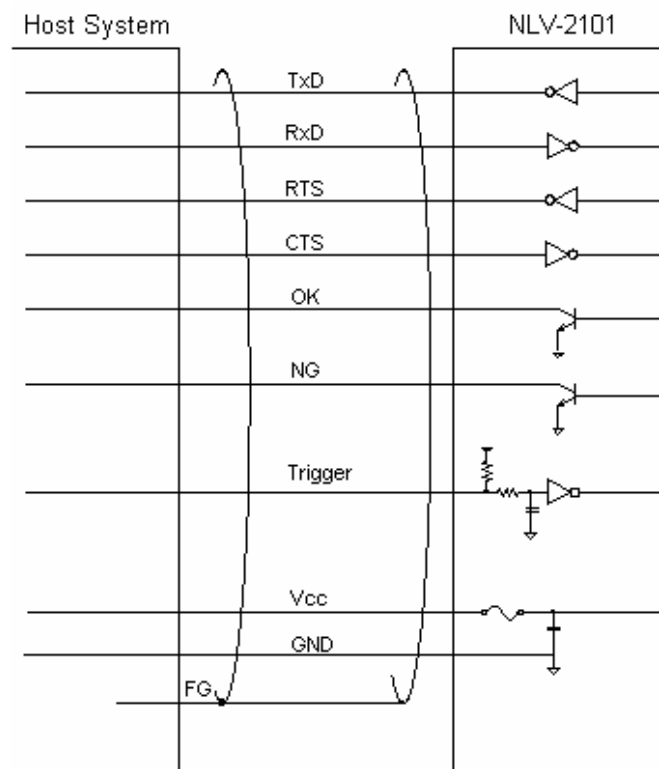


Figure 17: RS-232C interface circuit (10-pin)

9.2.4. Sequencer Signals

The following describes the output timing of OK/NG signals. The signals are output through the open connector of an NPN transistor.

a) Reading Registered Barcodes with “YB” or “X*C” Settings

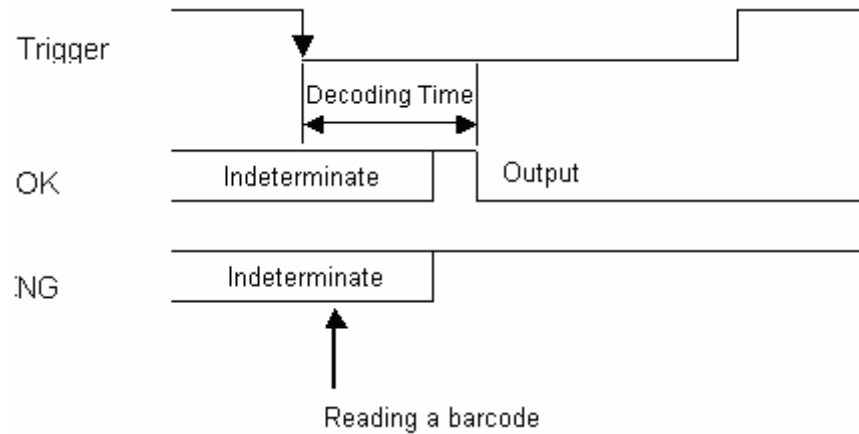


Figure 18: Sequencer signal 1

b) Reading Unregistered Barcodes with “YB” or “X*C” Settings

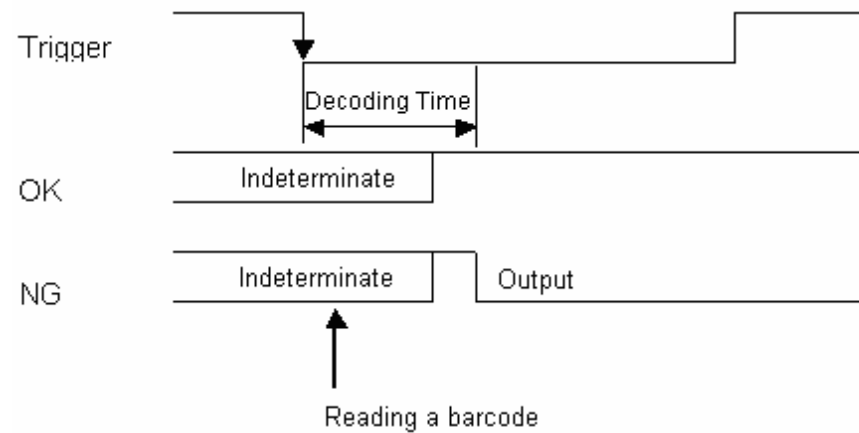


Figure 19: Sequencer signal 2

c) Reading Registered Barcodes with “YB” or “X*E” Settings

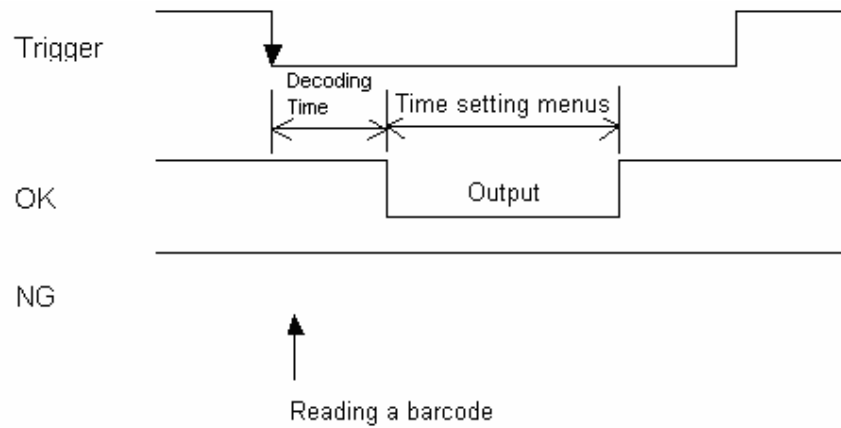


Figure 20: Sequencer signal 3

d) Reading Unregistered Barcodes with “YB” or “X*E” Settings

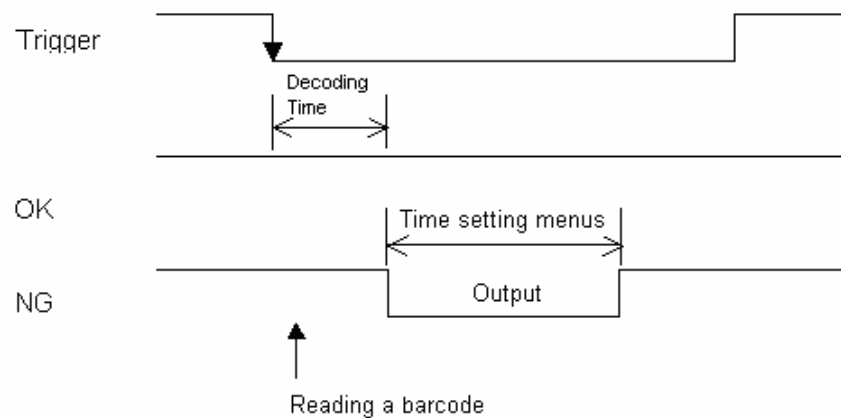


Figure 21: Sequencer signal 4

e) Sequencer Output Commands and Menus

UM	OPTO Menu	Function / Feature	Menu	Command
X8A	8A	External trigger input signal (active H)	○	○
X8B	8B	External trigger input signal (active L)	○	○
X*C	8C	SYNC synchronous H active	○	△
X*D	8D	SYNC synchronous L active	○	△
X*E	8E	One Shot H active	○	△
X*F	8F	One Shot L active	○	△
X*G	8G	One Shot time 10 ms	○	○
X*H	8H	One Shot time 20 ms	○	○
X*I	8I	One Shot time 30 ms	○	○
X*J	8J	One Shot time 40 ms	○	○
X*K	8K	One Shot time 50 ms	○	○
X*L	8L	One Shot time 60 ms	○	○
X*M	8M	One Shot time 70 ms	○	○
X*N	8N	One Shot time 80 ms	○	○
X*O	8O	One Shot time 90 ms	○	○
X*P	8P	One Shot time 100 ms	○	○
X*Q	8Q	Enable Sequence output	○	△
X*R	8R	Disable Sequence output	○	△

To set menus with "△", send following "Z2" after a command.

9.3. USB Interface Specifications

Use full-speed USB interface for both USB-HID and USB-VCP.

For the USB-VCP interface, a driver needs to be installed on the host.

9.3.1. Settings

USB-HID: Scan menu barcodes “ZZ” + “SU” + “ZZ”.

USB-VCP: Scan menu barcodes “ZZ” + “C01” + “ZZ”.

9.3.2. Connector Specifications

USB A Connector

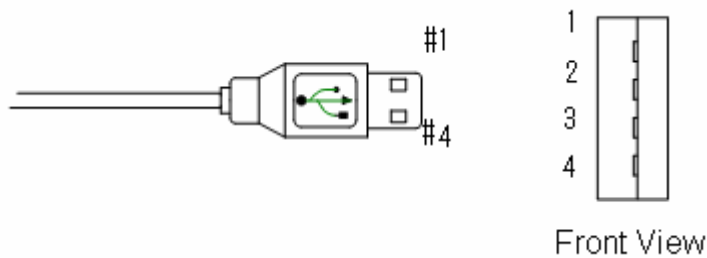


Figure 22: USB A interface connector

Contact Number	Signal Name
1	VCC
2	-Data
3	+Data
4	GND

9.3.3. USB Interface Circuit

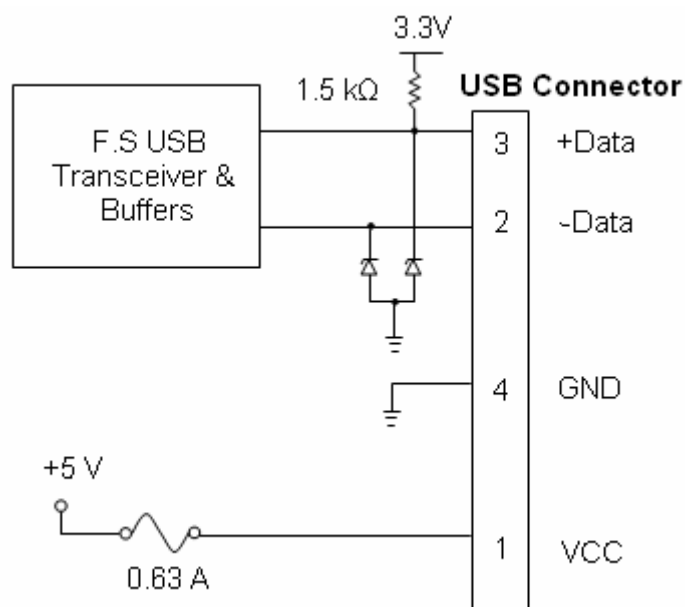


Figure 23: USB interface circuit

Note: Do not use the host keyboard during data transmission when the scanner is connected as USB-HID or if the capture application cannot distinguish between the scanner and a standard keyboard.

10. Cable and Connector

10.1. RS-232C (9-pin) Cable (standard specification)

Type:	Straight
Diameter:	$\Phi 3.8 \pm 0.5$ mm
Length:	1500 (+100, -0) mm
Cores:	9 insulated wires, 1 conductive wire
Weight:	Approximately 65 g

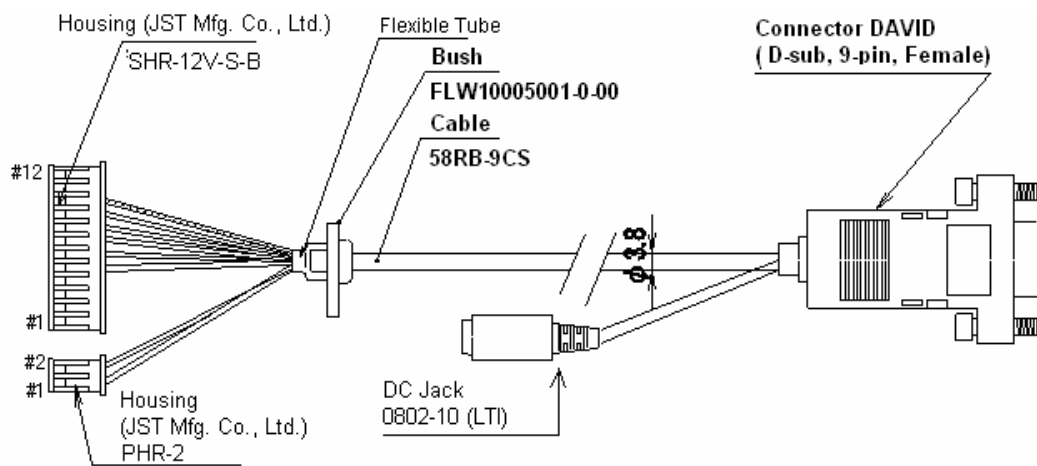


Figure 24: RS-232C (9-pin) cable

10.2. RS-232C (10-pin) Cable (standard specification)

Type:	Straight
Diameter:	$\Phi 3.8 \pm 0.5$ mm
Length:	1500 (+100, -0) mm
Cores:	9 insulated wires, 1 conductive wire (excluding USB interface cable)
Weight:	Approximately 65 g

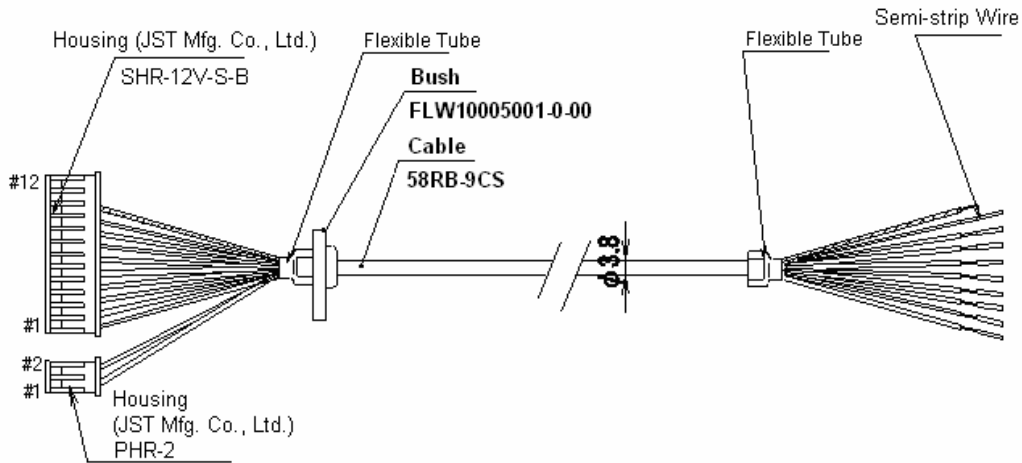


Figure 25: RS-232C (10-pin) cable

10.3. USB Cable (standard specification)

Type:	Straight
Diameter:	$\Phi 3.8 \pm 0.5$ mm
Length:	1500 +100, -0 mm
Cores:	4 insulated wires, 1 conductive wire (excluding USB interface cable)
Weight:	Approximately 50 g

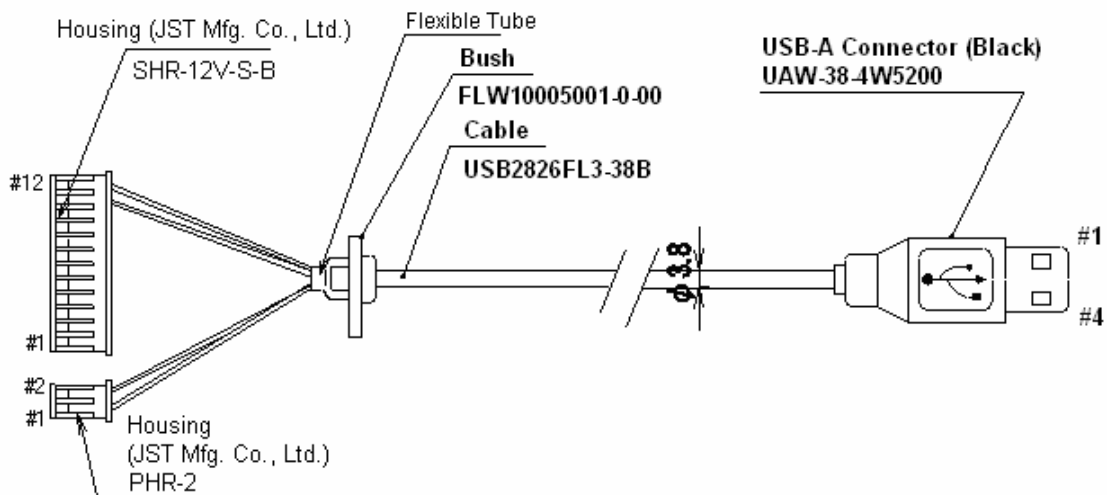


Figure 26: USB cable

10.4. Scanner Connector Specifications

Pin Number	Signal Name		
	RS-232C (9P)	RS-232C (10P)	USB
1	N.C	N.C	N.C
2	N.C	N.C	N.C
3	N.C	Trigger	N.C
4	N.C	OK	N.C
5	N.C	NG	N.C
6	GND	GND	N.C
7	RTS	RTS	N.C
8	CTS	CTS	N.C
9	TxD	TxD	N.C
10	RxD	RxD	N.C
11	N.C	N.C	USB-
12	N.C	N.C	USB+

Connector used: SHR-12V-S manufactured by JST Mfg. Co., Ltd.

CN3 (2-pin) for power input

Pin Number	Specifications		
	RS-232C (9P)	RS-232C (10P)	USB
1	+5V	+5V	+5V
2	GND	GND	GND




Connector used: PHR-2 manufactured by JST Mfg. Co., Ltd.

11. Readable Barcodes

11.1. Menu Barcodes: Default Settings

Default menu barcodes set the scanner to factory defaults.




RS-232C Default

Functions	Menu labels	Menu codes
SET		ZZ
RS-232C		U2
END		ZZ

USB-HID Default

Functions	Menu labels	Menu codes
SET	 z z	ZZ
USB default	 s u	SU
END	 z z	ZZ

USB-VCP Default

Functions	Menu labels	Menu codes
SET	 z z	ZZ
USB default	 c 0 1	C01
END	 z z	ZZ

11.2. Default Settings 1: Readable Codes

Code type	Reading	Transmit Code Length	Transmit CD	Calculate CD	Transmit Other
UPC-A	■	X	■	■	
UPC-A Add-on	X	X	■	■	
UPC-E	■	X	■	■	
UPC-E1	X	X	■	■	
EAN-13	■	X	■	■	
EAN-13 Add-on	X	X	■	■	
EAN-8	■	X	■	■	
EAN-8 Add-on	X	X	■	■	
Aztec Code	■	X	—	■	
Aztec Runes	X	X	—	■	
Chinese Post	X	X	■	X	
Code39	■	X	■	X	Not transmit ST/SP
Code93	■	X	—	■	
Code128	■	X	—	■	
Composite EAN EAN-13 CCA EAN-13 CCB EAN-8 CCA EAN-8 CCB	X	X	■ (Linear 1D)	■	
Composite UPC UPC-A CCA UPC-A CCB	X	X	■ (Linear 1D)	■	

Code type	Reading	Transmit Code Length	Transmit CD	Calculate CD	Transmit Other
UPC-E CCA UPC-E CCB					
Composite RSS RSS-14 CCA / RSS-14 CCB / RSS Limited CCA / RSS Limited CCB / RSS Expanded CCA / RSS Expanded CCB	X	X	■ (Linear 1D)	■	
Composite UCC EAN-128 UCC EAN-128 CCA UCC/EAN-128 CCB UCC/EAN-128 CCC	X	X	—	■	
Data Matrix (ECC200)	■	X	—	■	
Data Matrix (ECC0-140)	X	X	—	■	
IATA	■	X	■	X	
Industrial 2of5	■	X	■	X	
Interleaved 2of5	■	X	■	X	
Korean Post Authority Code	X	X	X	■	
Matrix 2of5	X	X	■	X	
Maxi Code (Mode 2–5)	■	X	—	■	
MicroPDF417	■	X	—	■	
Micro QR Code	■	X	—	■	
NW-7 Codabar	■	X	■	X	Not transmit ST/SP
PDF417	■	X	—	■	
MSI/Plessey	■	X	■	■	
UK/Plessey	■	X	■	■	
QR Code	■	X	—	■	
RSS-14 Standard Truncated Stacked Stacked Omni-directional	■	X	■	■	
RSS Expanded Standard Stacked	■	X	X	■	
RSS Limited	■	X	■	■	
S-Code	■	X	■	X	
Telepen	■	X	X	■	
Tri-Optic	■	X	—	—	Not transmit ST/SP

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.”
- In the “Calculate CD” column, “■” means “Calculate check digit” and “X” means “Do not calculate check digit”.

11.3. Default Settings 2: Read Options

Item	Default Setting
Prefix Settings	No setting
Suffix Settings	CR

11.4. Default Settings 4: Read Options, Trigger, Buzzer

Item	Default Setting
Setting the number of characters	Fixed length OFF all codes
Read mode	Multiple read
Multiple read reset time	500 ms
Add-on wait mode	500 ms
Redundancy	Read 4 times, redundancy = 3
NW-7 inter-character gap check	Within 1 character
Multiple columns read	Disable multiple columns read
Trigger switch	Enable trigger
Read time	2 seconds
Buzzer duration	50 ms
Buzzer tone	3 kHz (high-low)
Buzzer loudness	Loud (maximum)
Indicator duration	200 ms

12. Serial Number

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

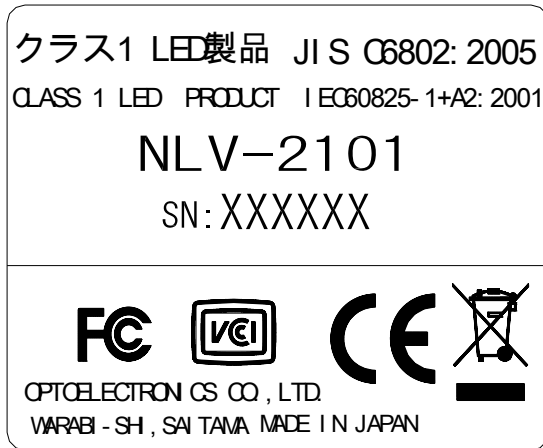


Figure 27: Serial number

13. Packaging Specifications

13.1. Individual Packaging Specification

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

Package dimensions (assembled): 245 mm (W) x 110 mm (D) x 38 mm (H)

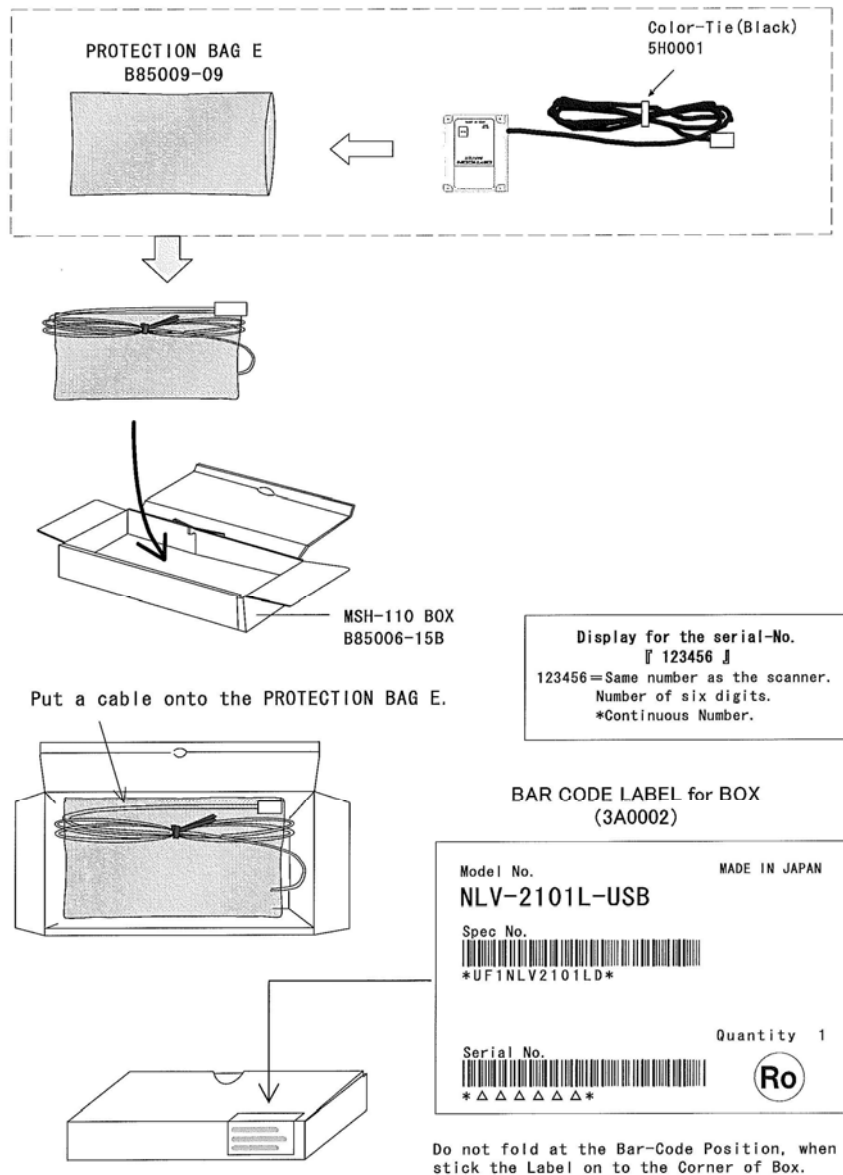


Figure 28: Individual packaging

13.2. Collective Packaging Specification

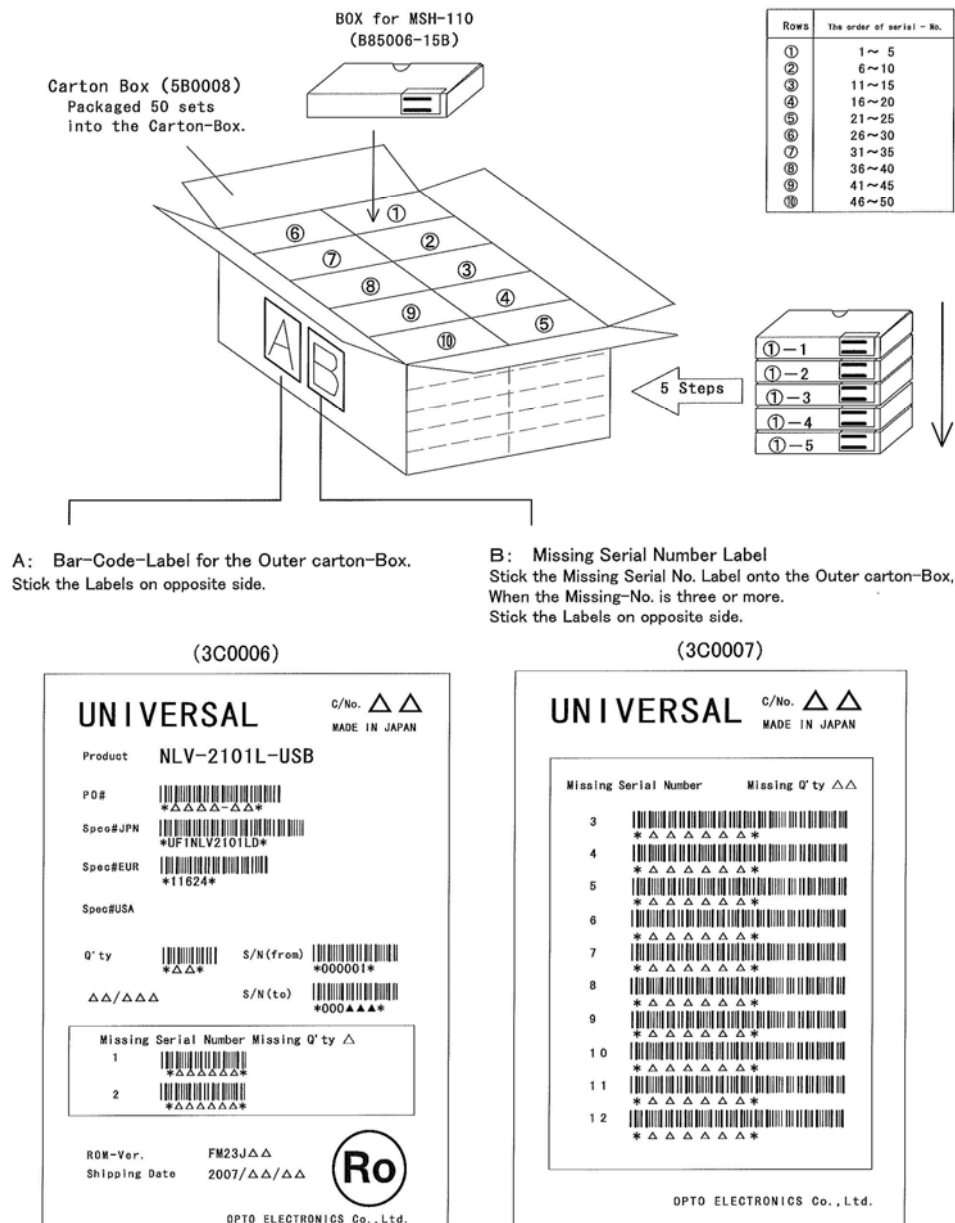


Figure 29: Collective packaging

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.

14. Durability

14.1. Electrical Noise

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

14.2. Drop Test (without packaging)

No malfunction occurred after the following drop test.

Shock Test: Drop the scanner from 75 cm onto a concrete floor once on each of its six sides.

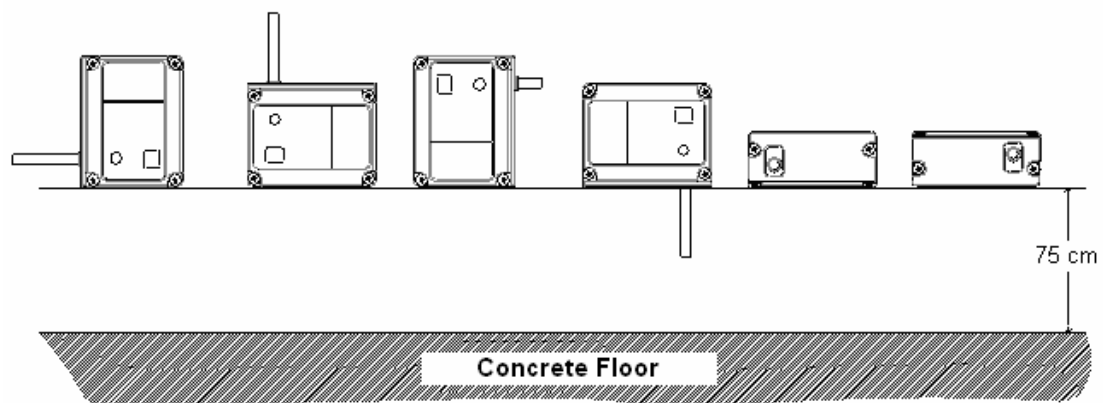


Figure 30: Detailed view of drop test

14.3. Drop Test (with individual packaging)

No malfunction occurred after the following drop test.

Shock Test: Drop the individually packaged scanner from 100 cm onto a concrete floor once on its one corner, three edges, and six sides (ten drop tests, total).

14.4. Vibration Test (without packaging)

No malfunction occurred after the following vibration test.

Vibration Test: Increase the frequency of the vibration from 12Hz to 100Hz with accelerated velocity 9.6m/S^2 (2G) for six minutes in an operating state. Repeat this routine in X, Y, and Z directions ten times.

14.5. Cable Pulling Test

No malfunction to the cable's performance occurred after the following pulling test.

Pulling test: Secure the scanner and pull the cable with the force of 2.5 kg for 1 second. Repeat 20 times.

14.6. Cable Tail Bending Test

No malfunction to the cable's performance occurred after the following bending test.

Bending test: Fix the scanner and attach a weight of 500 grams and swing the cable back and forth at an angle of 60 degrees. Repeat 1,000 times.

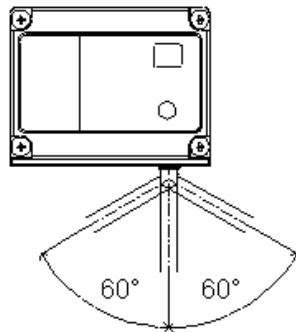


Figure 31: Cable tail bending test

14.7. Static Electricity

Air discharge	± 8 kV
Contact discharge	± 4 kV max. (No malfunction) ± 15 kV max. (No destruction)
Measurement environment	Used electrostatic testing device compliant with IEC 61000-4-2
Discharge resistance:	330 Ω
Capacitor charging:	150pF

14.8. Dust and Splash Proof

IP-67 compliant

15. 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.

16. Regulatory Compliance

16.1. LED Safety

All LED-based products are LED class 1 and are safe under reasonably foreseeable operating conditions. Do not stare into the beam.

- IEC60825-1+A2: 2001 Class 1
- JIS-C-6802: 2005 Class 1

16.2. EMC

CE

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.

16.3. Compliance to RoHS

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

17. Safety

Handle this product carefully. All workbenches, tools, measuring instruments, and any part of human body that contact the NLV 2101 must undergo preliminary antistatic treatments.

Do not touch the optical and electrical components. Hold the NLV 2101 by the metal chassis.

Avoid handling the NLV 2101 in a dusty area. If dust gets on the NLV 2101, gently blow off the dust with dry air. The performance of the NLV 2101 may deteriorate if optical components are wiped with materials such as cotton cleaning sticks or cotton cloth.

Do not deliberately subject it to any of the following.

17.1. Shock

- Do not throw or drop the scanner.

17.2. Environmental 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.

17.3. Foreign Materials

- Do not put the scanner into water.
- Do not put the scanner into chemicals.

17.4. Other

- Do not disassemble this product.

The information in this specification is subject to change without notice.

18. Mechanical Drawing

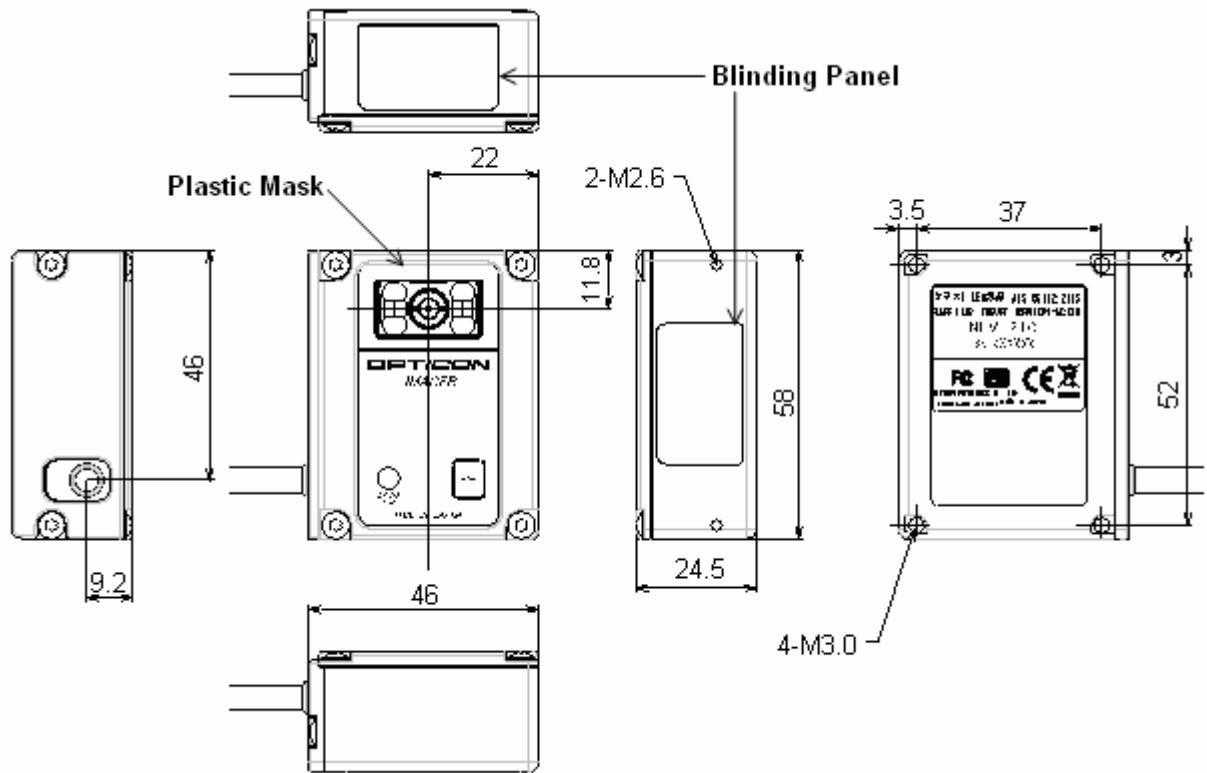


Figure 32: Mechanical drawing (Type-L)

Note: Figure 32 shows the NLV 2101 Type-L. There are two other available types, Type-I (shown in Figure 33) and Type-S (shown in Figure 34), each with different positioning of the optical window. The default model type is the Type-L; the Type-I and Type-S are available for large purchase orders.

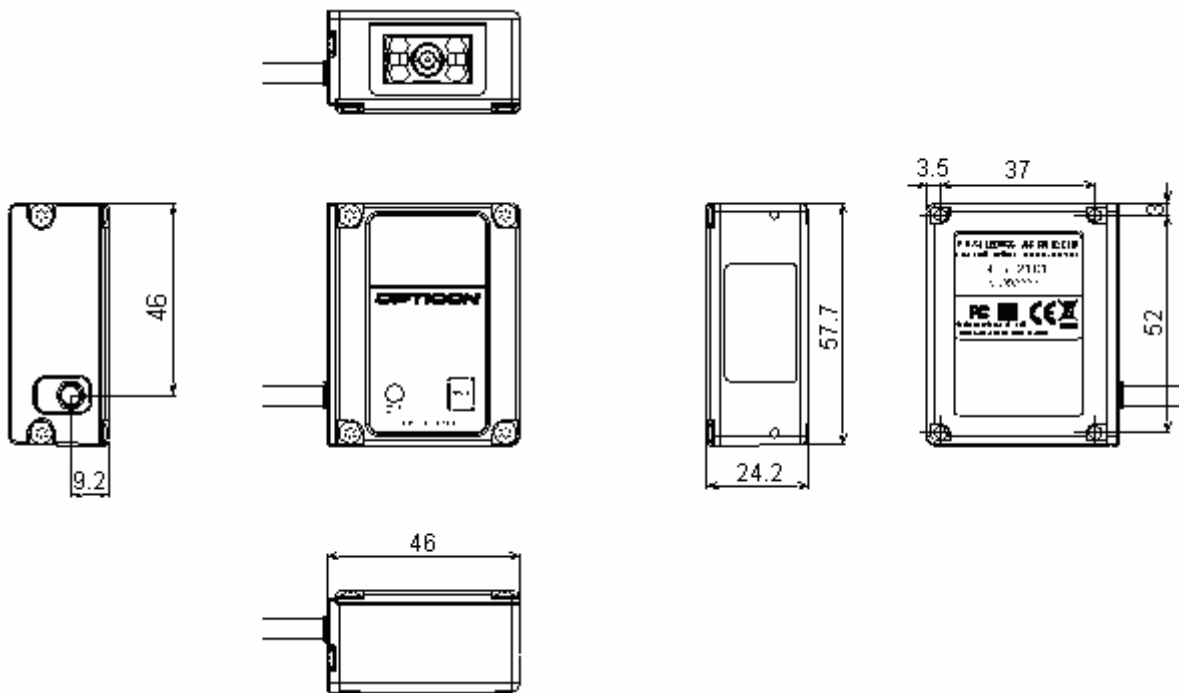


Figure 33: Mechanical drawing (Type-I)

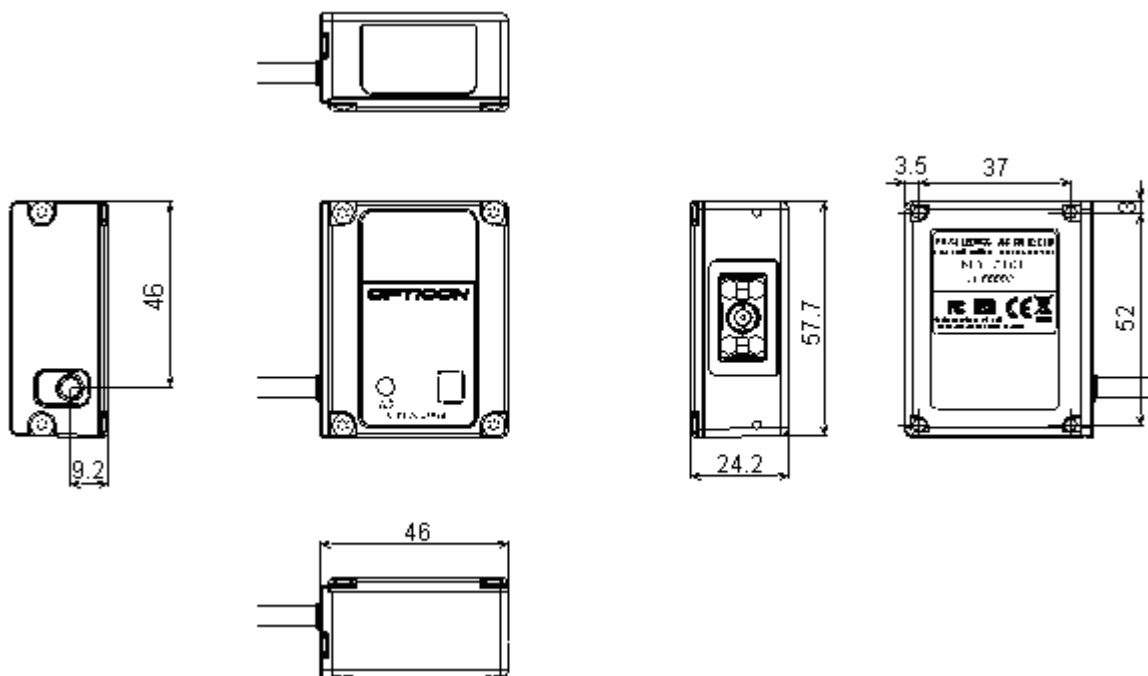


Figure 34: Mechanical drawing (Type-S)