

**OPTICON**

Laser Scan Engine

# MDL-4000



This manual provides specifications for the MDL-4000 laser scan engine.

## Specifications Manual

All information subject to change without notice.

## Document History

Model Number:	<b>MDL-4000</b>	Specification Number:	<b>SS11026</b>
Edition:	<b>1st</b>	Original Spec Number:	<b>SS11023</b>
Date:	<b>2011-07-28</b>		

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## Revision History

Specification No. : SS11026  
Product name : MDL-4000

Edition	Date	Page	Section	Description of Changes
First	2011/07/28	-	-	Initial release

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## **1. Abstract**

This manual provides specifications for the MDL-4000 laser scan engine.

## **2. Overview**

The MDL-4000 is a compact and slim laser barcode scan engine which can be installed in various handheld products, such as a handy terminal. It has the ability to scan up to 44 mm wide at an angle of 44° when a target is scanned at the closest point. It also has a high level of scanning line visibility using a short-wavelength red laser beam. The MDL-4000 has a built-in decoder, which decodes a scanned bar code, and the decoded data is transmitted via serial communications. The MDL-4000 is a RoHS compliant product.

## **3. Physical Features**

### **3.1. Dimensions**

20.4 x 14.0 x 5.5 (WDH mm)

### **3.2. Weight**

4.0 g (max.)

## 4. Electrical Specifications

### 4.1. Absolute Maximum Ratings

Item	Symbol	Rated Value	Unit
Power Supply Voltage ( $V_{CC}$ to GND)	$V_{CC}$	3.9	V
Input Voltage	$V_I$	$-0.3 \sim V_{CC}+0.3$	V

### 4.2. Electrical Characteristics

Electrical characteristics  $V_{CC}=3.3$  V,  $T_a=25^\circ$  C

Item	Symbol	Conditions	Min	Typ	Max	Unit
Operating Voltage	$V_{CC}$		3.0	—	3.6	V
Operating Current 1	$I_{OP1}$	READ state	—	85	100	mA
Operating Current 2	$I_{OP2}$	READ state	—	70	85	mA
Idle Current	$I_{IDL}$	IDLE state	—	40	50	mA
Aiming Current	$I_{AIM}$	AIMING state	—	60	75	mA
Low Power Current	$I_{LOW}$	Low Power state	—	—	300	$\mu$ A
Peak Inrush Current	$I_{PEEK}$		—	600	1000	mA
Input Voltage	High	$V_{IH}$	$V_{CC} \times 0.8$	—	—	V
	Low	$V_{IL}$	—	—	$V_{CC} \times 0.2$	V
Output Voltage	High	$V_{OH}$	$I_{OH} = -1$ mA	$V_{CC} - 0.5$	—	V
	Low	$V_{OL}$	$I_{OL} = 1.0$ mA	—	0.5	V
Input Current	$I_{IN}$	$V_{IN} = V_{CC}$ $V_{IN} = 0V$	—	—	1.0	$\mu$ A

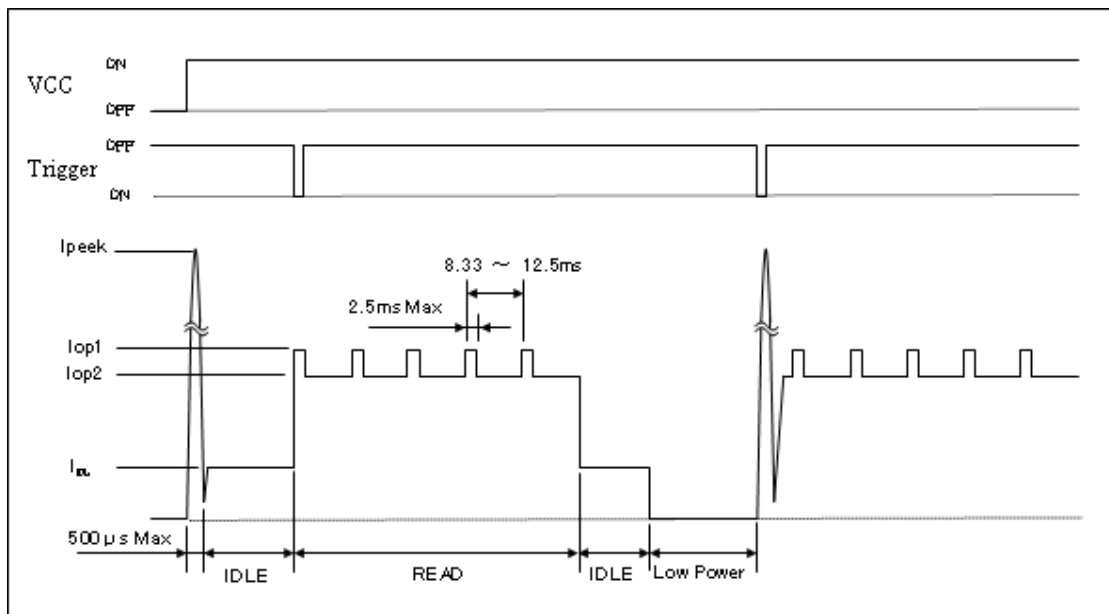


Figure 1: Current Waveform

## 5. Power Mode Transition

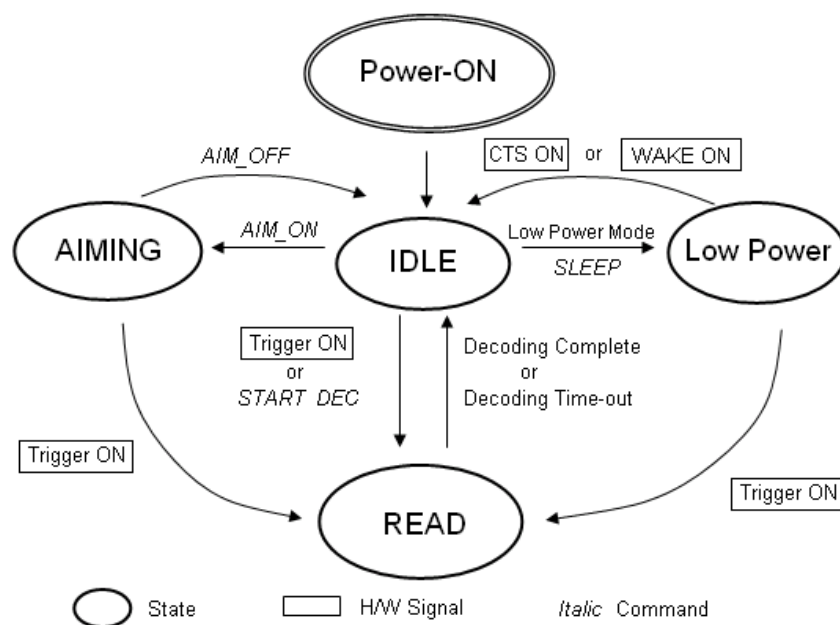


Figure 2: Power Mode Transition

- \*1 When "Low Power" mode is enabled, the MDL-4000 automatically enters "Low Power" state from "Power-ON".
- \*2 When moving to "IDLE" state by "CTS ON" or "WAKE ON" in Low Power mode, the MDL-4000 goes back to "Low Power" state in a second if no event occurs to move to other states.

## 6. Interface Specifications

### 6.1. Interface Connector

Signal	Pin No.	I/O	Functions
TEST	1	I	Input for test: High or Open = normal operation, Low = maintenance mode (*1)
VCC	2	—	Power supply: DC 3.0V ~ 3.6V
GND	3	—	Ground
Rxd	4	I	Serial data input, CMOS logic level
Txd	5	O	Serial data output, CMOS logic level
CTS	6	I	Clear to send, CMOS logic level
RTS	7	O	Request to send, CMOS logic level
Power Down	8	O	Power down output, CMOS logic level: High = Low Power state
Buzzer	9	O	Buzzer control pulse output, CMOS logic level: Low = Buzzer On
Decode LED	10	O	LED output, CMOS logic level: Low = LED On
Aim/Wake	11	O	Aiming / Wakeup input, CMOS logic level: Low = Aim/Wake
Trigger	12	I	Trigger input, CMOS logic level: Low = Trigger

Connector used: IRISO Electronics Co.,LTD."IMSA-9681S-12 "

12-pin, 0.5 mm pitch, FFC connector, bottom contact type (gold-plated)

\*1) If the level is Low when the power turns on, the MDL-4000 enters Maintenance mode.

## 7. Optical Specifications

### 7.1. Laser Scanning Specifications

Item		Characteristics	Unit
Light-Emitting Element		Red laser diode	-
Emission Wavelength		645 ~ 664 (25° C)	nm
Light Output		390 or less	μW
Scanning Method		Bi-directional scanning	-
Scanning Speed		100 ±20	scans/s
Scan Angle	Scan Angle	54 ±5	deg
	Effective Scan Angle	44 (Min)	deg

### 7.2. Laser Scanning Standards

#### (1) Laser Scanning Tilt

Vertical differences between both ends of a laser scanning line:

- Up to 0.92 degrees in a vertical direction from the scan origin (scanning mirror).
- Up to 2.46 mm measured at 150 mm from the scan origin and with zero skew angle.
- Measure it in the middle of the scanning line.

#### (2) Laser Scanning Curvature

The maximum differences between the laser scanning line and a straight line connecting the both ends of the scanning line:

- Up to 1.17 degrees from the scan origin (scanning mirror).
- Up to 3.06 mm measured at 150 mm from the scan origin with zero skew angle.
- Measure it in the middle of the scanning line.

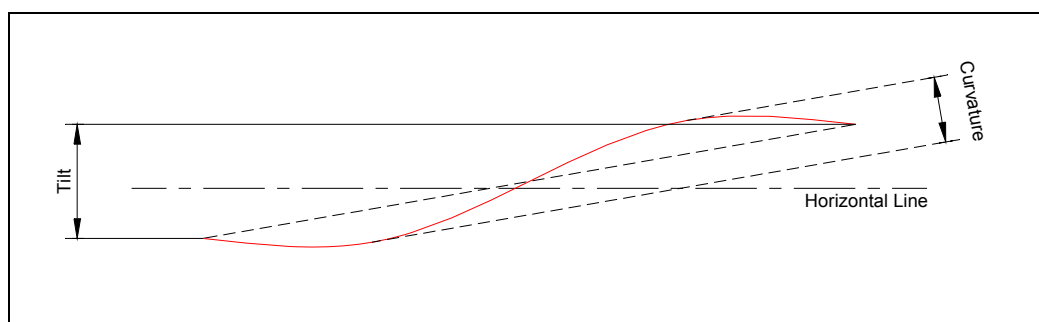


Figure 3: Laser Scanning Tilt and Curvature



## 8. Technical Specifications

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

<Conditions>

Ambient Temperature and Humidity	Room temperature, room humidity
Ambient Light	500 ~ 900 lx (excluding high-frequency lighting)
Background	Black
Power Supply Voltage	3.3 V
Reading Test	Accept the performance with 10 consecutive successes in reading. Each reading should be done in 0.5 seconds or less.

### 8.1. Print Contrast Signal (PCS)

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

$$\text{PCS} = \frac{\text{Reflectance of white bar} - \text{Reflectance of black bar}}{\text{Reflectance of white bar}}$$

## 8.2. Scan Area and Depth of Field

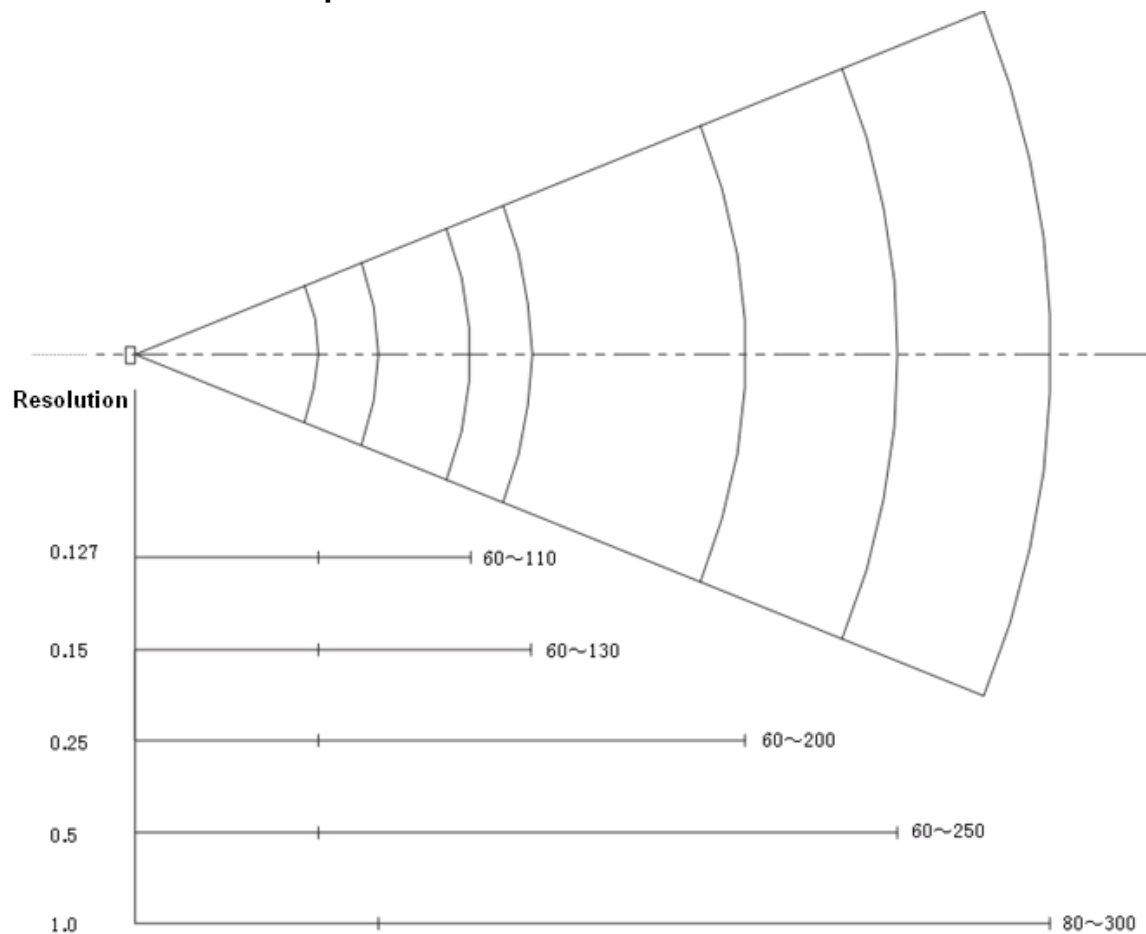


Figure 4: Scan Area and Depth of Field

### Details

The depth of field is measured from the front edge of the scan engine.

The scan area is within the arc centered on the scan origin as shown in each resolution.

### Conditions

Resolution	Symbology	PCS	Quiet Zone	No. of Digits
1.0 mm	Code 39	0.9	25 mm	1
0.5 mm	Code 39	0.9	18 mm	3
0.25 mm	Code 39	0.9	10 mm	8
0.15 mm	Code 39	0.9	7 mm	10
0.127 mm	Code 39	0.9	5 mm	4

Bar Code Sample : Optoelectronics Test Chart, N/W ratio = 1 : 2.5

Angle :  $\alpha = 0^\circ$   $\beta = 15^\circ$   $\gamma = 0^\circ$

Curvature :  $R = \infty$

### 8.3. Pitch, Skew, and Tilt

Pitch :  $\alpha \leq \pm 25^\circ$   
 Skew :  $\beta \leq \pm 40^\circ$  (Excluding dead zone)  
 Dead Zone :  $\beta \leq \pm 8^\circ$  (Decoding may fail in some areas as a result of specular reflection)  
 Tilt :  $\gamma \leq \pm 20^\circ$

#### <Conditions>

Bar Code Sample Optoelectronics Test Sample  
 Distance 110 mm from the edge of the scan engine  
 <Pitch, Skew and Dead Zone>  
 PCS 0.9, Resolution 0.25 mm, 9-digit Code 39,  
 Quiet Zone 10 mm, N/W Ratio = 1 : 2.5  
 <Tilt>  
 PCS 0.9, Resolution 0.5 mm, 3-digit Code 39, Quiet Zone 15 mm  
 Angle Pitch and Tilt angles calculated with Skew angle  $\beta = +15^\circ$   
 Curvature  $R = \infty$

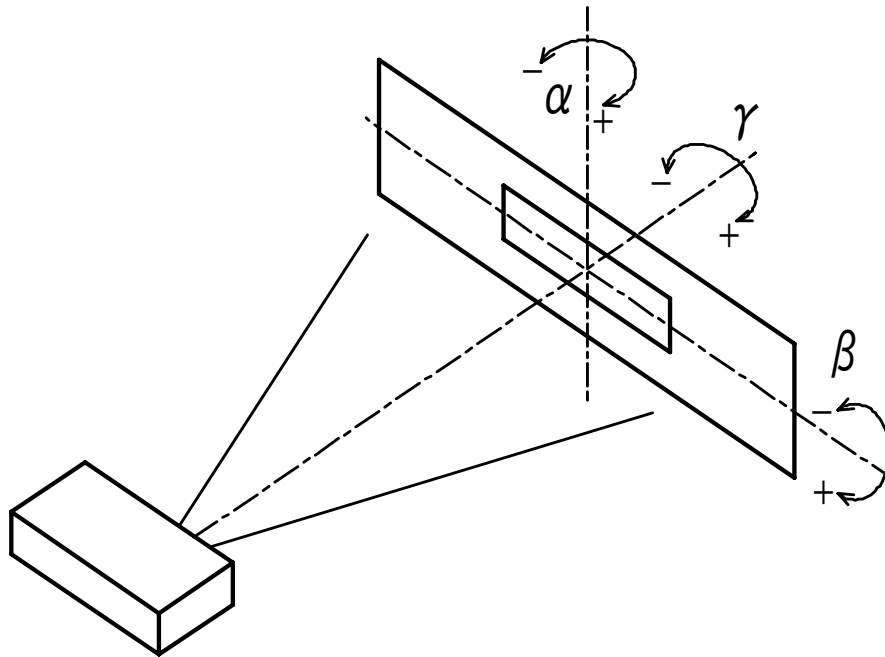


Figure 5: Pitch, Skew, and Tilt

## 8.4. Curvature

8-digit JAN :  $r \geq 15 \text{ mm}$   
13-digit JAN :  $r \geq 20 \text{ mm}$

### <Conditions>

Bar Code Sample Optoelectronics Test Sample  
PCS 0.9, Resolution 0.26 mm, JAN-13, Quiet Zone 10 mm  
Distance 110 mm from the edge of the scan engine  
Angle Skew angle  $\beta = +15^\circ$

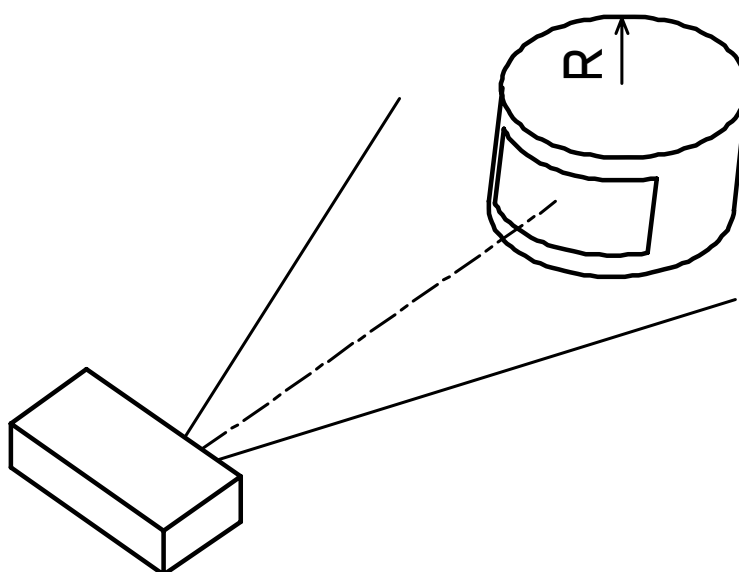


Figure 6: Curvature

## 9. Environmental Specifications

### 9.1. Temperature

Operating Temperature : -20 ~ 65 °C  
Storage Temperature : -30 ~ 70 °C

### 9.2. Humidity

Operating Humidity : 5 ~ 80% RH (no condensation, no frost)  
Storage Humidity : 5 ~ 80% RH (no condensation, no frost)

### 9.3. Ambient Light Immunity

Decoding performance is guaranteed when the illuminance on the bar code surface is between zero and the following values:

Incandescent light: 4000 lux  
Fluorescent light: 4000 lux (excluding high-frequency lighting)  
Sunlight: 80000 lux

<Conditions>

Bar Code Sample : Optoelectronics Test Sample  
PCS 0.9, Resolution 0.25 mm, 9-digit Code 39, Quiet Zone 10 mm, N/W Ratio = 1 : 2.5

Distance : 150 mm from the edge of the scan engine  
Angle :  $\alpha = 0^\circ$ ,  $\beta = 15^\circ$ ,  $\gamma = 0^\circ$   
Curvature :  $R = \infty$   
Voltage : 3.3 V

\* Be sure that the direct light or specular reflection from the light source does not enter the light receiving area of the MDL-4000.

### 9.4. Electrical Noise

There shall be no abnormalities in the output signals when sinusoidal electrical noise (50 Hz to 100 kHz, smaller than 0.1 Vp-p) is added to the power supply line.

<Conditions>

Bar Code Sample : Optoelectronics Test Sample  
PCS 0.9, Resolution 0.25 mm, 9-digit Code 39, Quiet Zone 10 mm, N/W Ratio = 1 : 2.5

Distance : 150 mm from the edge of the scan engine  
Angle :  $\alpha = 0^\circ$ ,  $\beta = 15^\circ$ ,  $\gamma = 0^\circ$   
Curvature :  $R = \infty$   
Voltage : 3.3 V

## 9.5. Vibration Strength

There shall be no sign of malfunction after the following vibration test.

**Vibration Test:** Increase the frequency of the vibration from 12 Hz to 100 Hz at an accelerated velocity of 32.3 m/S<sup>2</sup> (3.3G) for 10 minutes per cycle. Repeat this for 2 hours in X-direction, 2 hours in Y-direction and for 4 hours in Z direction.

## 9.6. Drop Impact Strength

There shall be no sign of malfunction after the following drop test:

**Drop Test:** Fix the scan engine in a specific dummy case and drop it 10 times in total, at top, bottom, front, back, left, right, top-left, top-right, bottom-left and bottom-right faces, from a height of 180 cm onto a concrete floor.

<Conditions>

Bar Code Sample : Optoelectronics Test Sample

PCS 0.9, Resolution 0.25 mm, 9-digit Code 39, Quiet Zone 10 mm, N/W Ratio = 1 : 2.5

Distance : Between 50 ~ 150 mm from the edge of the scan engine

Pitch :  $\alpha = 0^\circ$

Skew :  $\beta = 15^\circ$

Tilt :  $\gamma = 0^\circ$

Curvature :  $R = \infty$

Voltage : 3.3 V

## 10. Regulatory Compliance

Laser Safety : IEC 60825-1:2007 Class 1

## 11. RoHS

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

## 12. Reliability

MTBF (Mean Time Between Failures)	30,000 hours (excluding the following parts)
Laser diode	: 10,000 hours
Mirror scan unit	: 10,000 hours

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

## 13. Precautions

### 13.1. Precaution against Laser Light

\*Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Caution - Do not stare into the laser light from a scanning window. It may harm your eyes.  
Do not point the laser directly at others' eyes. It may harm your eyes.  
Do not stare into the beam with optical instruments. It may harm your eyes.

### 13.2. Handling

- All work-benches, tools, measuring instruments and any part of the human body which have come into contact with MDL-4000 must undergo preliminary antistatic treatment.
- Do not touch the optical and electrical components. Hold it on the metal chassis when you carry the device.
- Avoid handling MDL-4000 in a dusty area. In case the dust gets on this product, gently blow off the dust with dry air. Direct contact of swabs and such on its optical part may cause deterioration of its performance.
- Do not drop the MDL-4000.

## 14. Packaging Specifications

### 14.1. Packaging

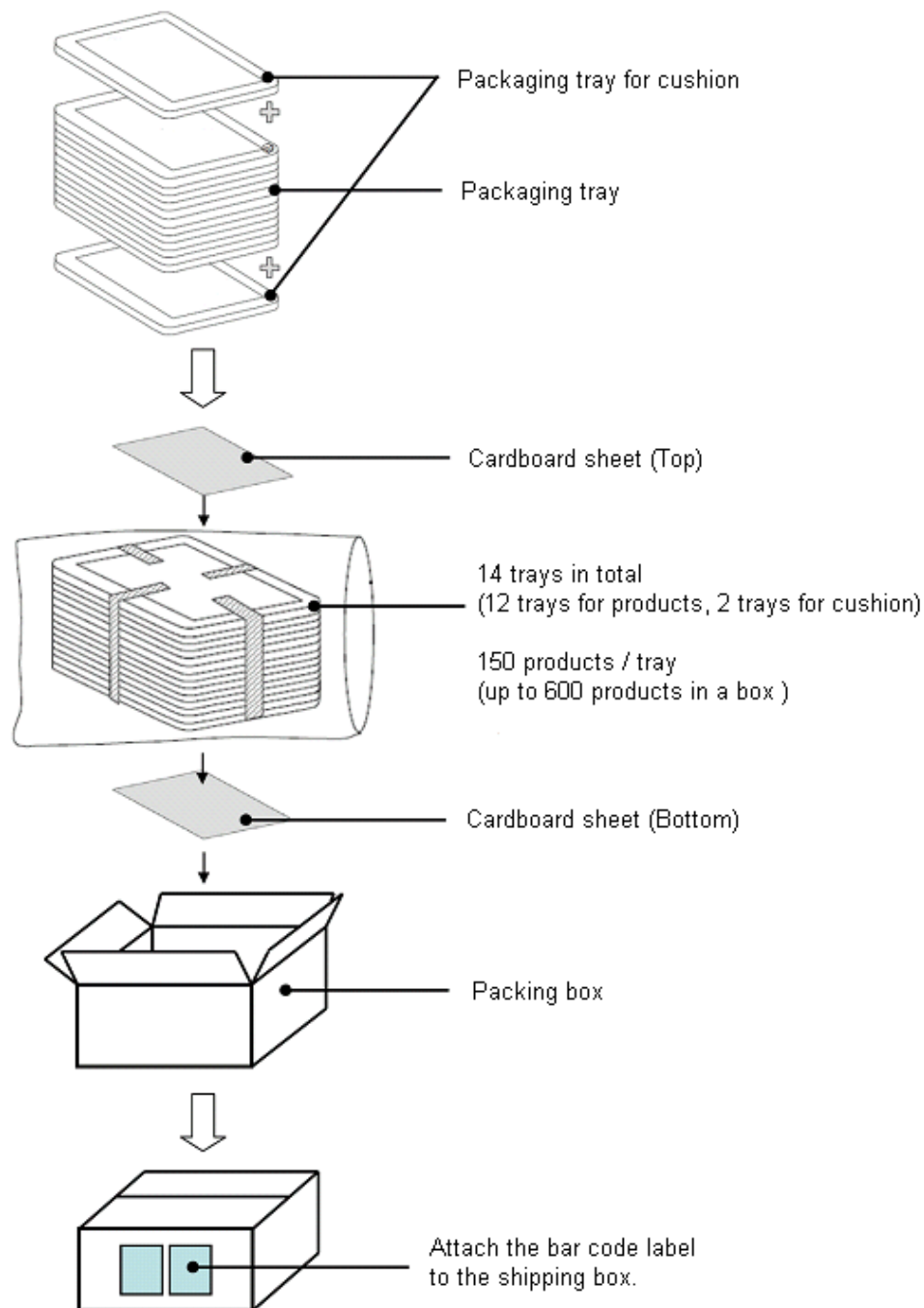


Figure 7: Packaging

### 14.2. Package Size

355 x 290 x 185 (WDH mm)

Note: 'Ro mark' on the trays and the boxes for the product indicates that the product is RoHS compliant, which is declared by Optoelectronics Co., Ltd.



## 15. Serial Label

The following label with serial number is attached to the product.



Top Administrative bar code (Code 39, Resolution 0.06 ~ 0.12, N/W 2.5 ~ 3)  
Bottom Product name, serial number (font size 1.2 ±0.3)

Serial number (seven-digit) starts from 0000001 and is sequentially numbered regardless of the lot number.

## 16. Software Revision History

No.	Software Ver.	Description
1	TM05J01	Initial release

## Appendix: Mechanical Drawing

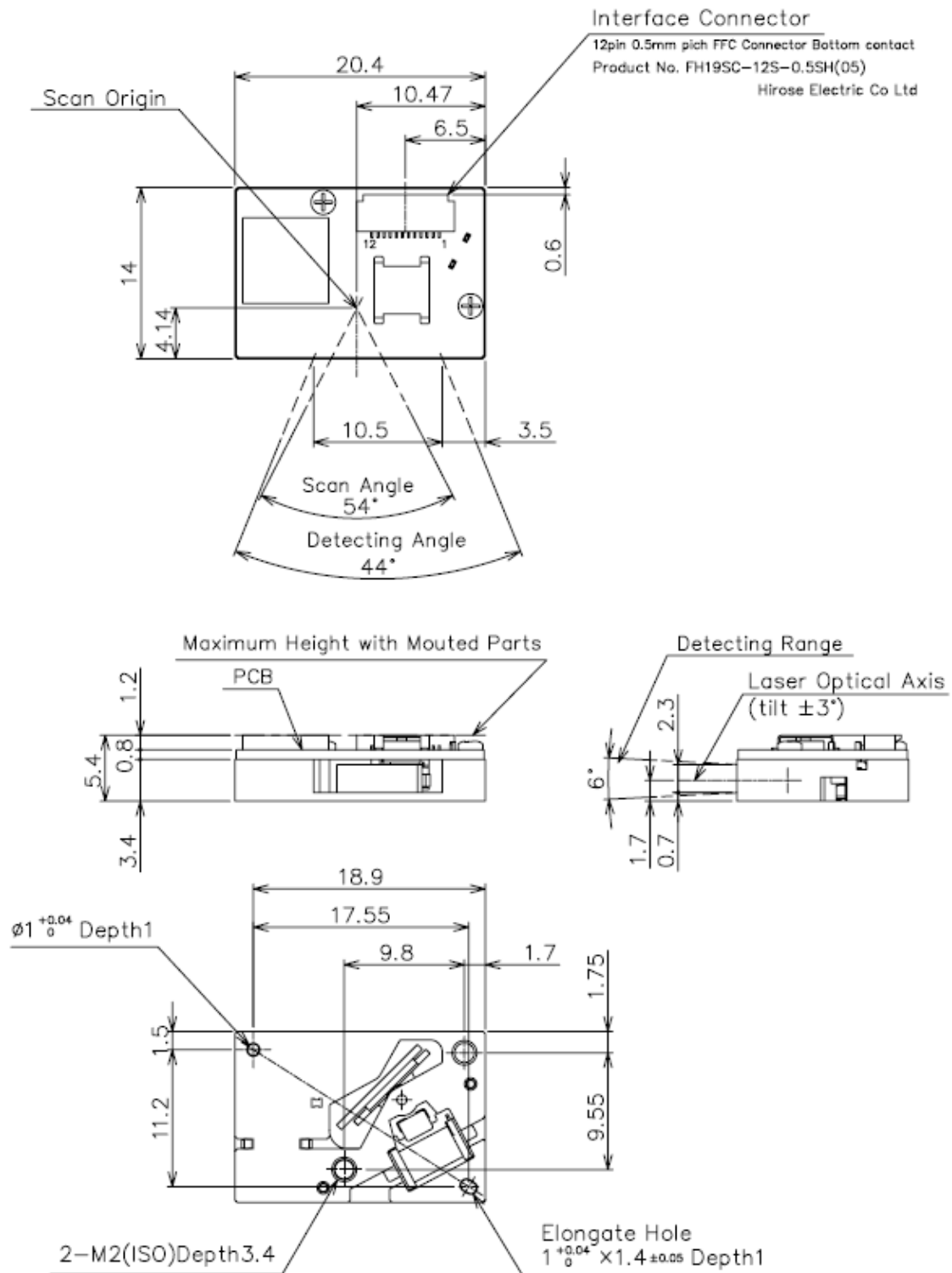


Figure 8: Mechanical Drawing