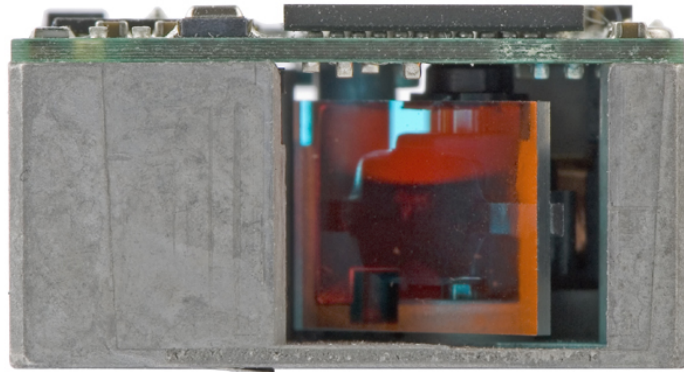


MDL 2000

Laser Scan Engine

OPTICON

Specifications Manual



All information subject to change without notice.

Document History

| | | | |
|----------------------|------------|------------------------------|---------|
| Model Number: | MDL 2000 | Specification Number: | SS06024 |
| Edition: | 2 | Original Spec Number: | SS05046 |
| Date: | 2006-04-20 | | |

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PLEASE READ THIS MANUAL CAREFULLY BEFORE INSTALLING OR USING THE PRODUCT.

Serial Number

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Packaging

The packing materials are recyclable. We recommend that you save all packing material to use should you need to transport your scan engine or send it for service. Damage caused by improper packaging during shipment is not covered by the warranty.

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1. Abstract

This manual provides specifications for the MDL 2000 laser scan engine.

2. Overview

The MDL 2000 laser scan engine is a compact laser barcode scan engine that can be installed in various handheld products, such as a cellular terminal. When scanning a target at the closest point, it has the ability to scan up to 44 mm wide at an angle of 44°. The use of a short-wavelength red laser beam enhances visibility when scanning lines.

A decoder is built into the MDL 2000 that enables this scan engine to decode barcodes after scanning and output the information using serial communication.

The MDL 2000 complies with the Restriction of Hazardous Substances (RoHS).

3. Physical Features

3.1. Dimensions

W 20.4 x D 18.0 x H 11.2 mm

3.2. Weight

4.7 g (max.)

4. Environmental Specifications

4.1. Operating Temperature and Humidity

Temperature: -20° C to 65° C

Humidity: 5% to 90% RH

4.2. Storage Temperature and Humidity

Temperature: -30° C to 70° 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 | 4,000 lx |
| Fluorescent light | 4,000 lx (excluding high-frequency lighting) |
| Sunlight | 80,000 lx |

Conditions

Barcode Sample: OPTOELECTRONICS Test Sample

| | |
|-------------------------|--|
| PCS: | 0.9 |
| Resolution: | 0.25 mm |
| Symbology: | 9-digit Code 39 |
| Quiet zone: | 10 mm |
| N/W ratio: | 1:2.5 |
| Distance: | 150 mm |
| Angle (see note below): | $\alpha = 0^\circ \beta = 15^\circ \gamma = 0^\circ$ |
| Curvature: | $R = \infty$ |
| Power supply voltage: | 3.3 V |

Direct light or specular reflection from a light source should be prevented from entering the acceptance area.

Note: α , β and γ respectively represent pitch, skew and tilt. Please see section 8 for how these values are defined.

5. Electrical Specifications

5.1. Absolute Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|----------|------------------------|------|
| Power supply voltage (V_{CC} to GND) | V_{CC} | 3.9 | V |
| Input voltage | V_{IN} | -0.3 to $V_{CC} + 0.3$ | V |

5.2. Electrical Characteristics

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

| Item | Symbol | Conditions | Min | Typ | Max | Unit | |
|--------------------------------|---------------------------|-----------------|---------------------------------|---------------|---------------------|---------------|---------------|
| Operating Voltage | V_{CC} | | 3.0 | — | 3.6 | V | |
| Operating Current 1 | I_{OP1} | READ State | — | 110 | 125 | mA | |
| Operating Current 2 | I_{OP2} | READ State | | 95 | 110 | mA | |
| Idle Current | I_{IDL} | IDLE State | — | 30 | 40 | mA | |
| Aiming Current | I_{AIM} | AIMING State | — | 50 | 65 | mA | |
| Low Power Current | I_{LOW} | Low Power State | — | — | 1400 | μA | |
| Rush Current Peak | I_{PEEK} | | — | 500 | 1000 | mA | |
| Input Voltage | High | V_{IH} | $V_{CC} \times 0.8$ | — | — | V | |
| | Low | V_{IL} | — | — | $V_{CC} \times 0.2$ | V | |
| Output Voltage (Decode LED) | High | V_{OH} | $I_{OH} < 8\text{ mA}$ | $V_{CC}-0.6$ | — | V | |
| | High (Low Power State) | V_{OH} | $I_{OH} < 5\text{ }\mu\text{A}$ | $V_{CC}-0.6$ | — | V | |
| | Low | V_{OL} | $I_{OL} < 8\text{ mA}$ | — | — | 0.4 | V |
| Output Voltage (Txd, RTS) | High | V_{OH} | $I_{OH} < 4\text{ mA}$ | $V_{CC}-0.6$ | — | V | |
| | High (Low Power State) | V_{OH} | $I_{OH} < 5\text{ }\mu\text{A}$ | $V_{CC}-0.6$ | — | V | |
| | Low | V_{OL} | $I_{y} < 4\text{ mA}$ | — | — | 0.4 | V |
| Output Voltage (Power Down) | High (Low Power State) | V_{OH} | $I_{OH} < 5\text{ }\mu\text{A}$ | $V_{CC} -0.6$ | — | V | |
| | Low | V_{OL} | $I_{OL} < 4\text{ mA}$ | — | — | 0.4 | V |
| Input Current | | I_{IN} | $V_{IN} = 3.3\text{ V}$ | — | — | -10 | μA |
| | | | $V_{IN} = 0\text{ V}$ | — | — | 50 | μA |

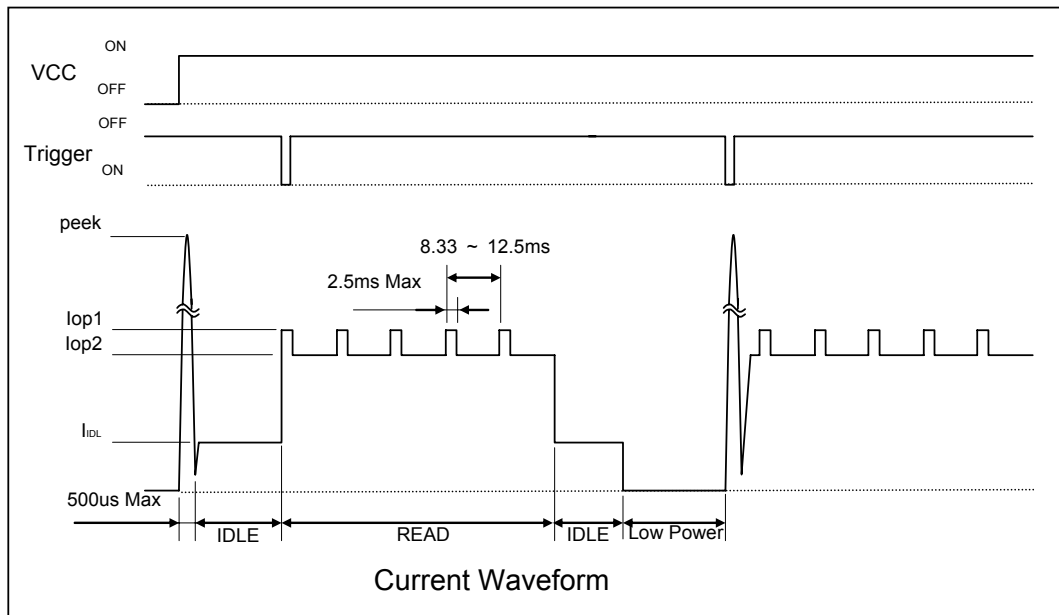


Figure 1: Current waveform

6. Transition Diagram in Power Mode

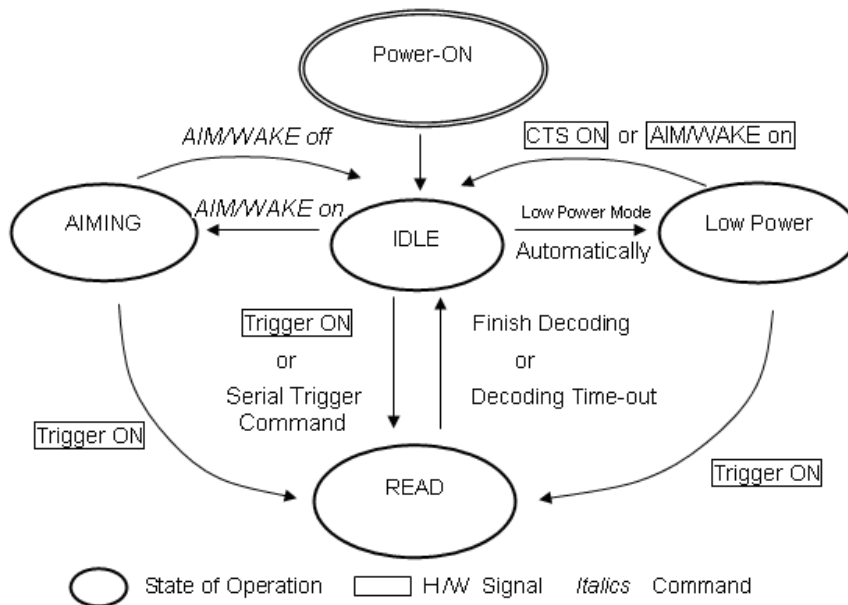


Figure 2: Transition diagram in power mode

When in low power mode, the state of operation changes automatically from “Power On” to “Low Power”.

If there is a transition to the “IDLE” state by enabling “CTS ON” or “WAKE ON” in “Low Power Mode,” it will automatically go back to the “Low Power” state in a second unless transitioning to another mode.

7. Optical Specifications

7.1. Imager Scanning

| Parameter | Specification | Unit |
|------------------------|-------------------------|---------|
| Light-emitting element | Red laser diode | - |
| Emission wavelength | 650 ±10 (25° C) | nm |
| Light output | 1.0 or less | mW |
| Scanning method | Bi-directional scanning | - |
| Scanning speed | 100 ±20 | scans/s |
| Scan angle | Scan angle: 54 ±5 | ° |
| | Read angle: 44 (Min) | ° |

8. Technical Specifications

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

Conditions

| | |
|----------------------------------|---|
| Ambient temperature and humidity | Room temperature and room humidity (5 to 35° C / 45% to 85% RH) |
| Ambient light | 500 to 900 lx (excluding high-frequency lighting) |
| Background | Barcode = black Space = white Margin = white Background of label = black |
| Power supply voltage | 3.3 V |
| Decoding test | Approve the performance when decoding is successful in all ten tests. (Decoding is deemed successful when completed in 0.5 seconds or less.) |

8.1. Print Contrast Signal (PCS)

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

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

Scanning performance may decline if dirt or scratches mar the optical window. Keep the optical window clean.

8.2. Scan Area and Resolution

8.2.1. Depth of Field

The depth of the decoding field is measured from the edge of the exit window. The decoding area is rectilinear near the exit window and expands in an arc centered on a virtual reference point in the distance.

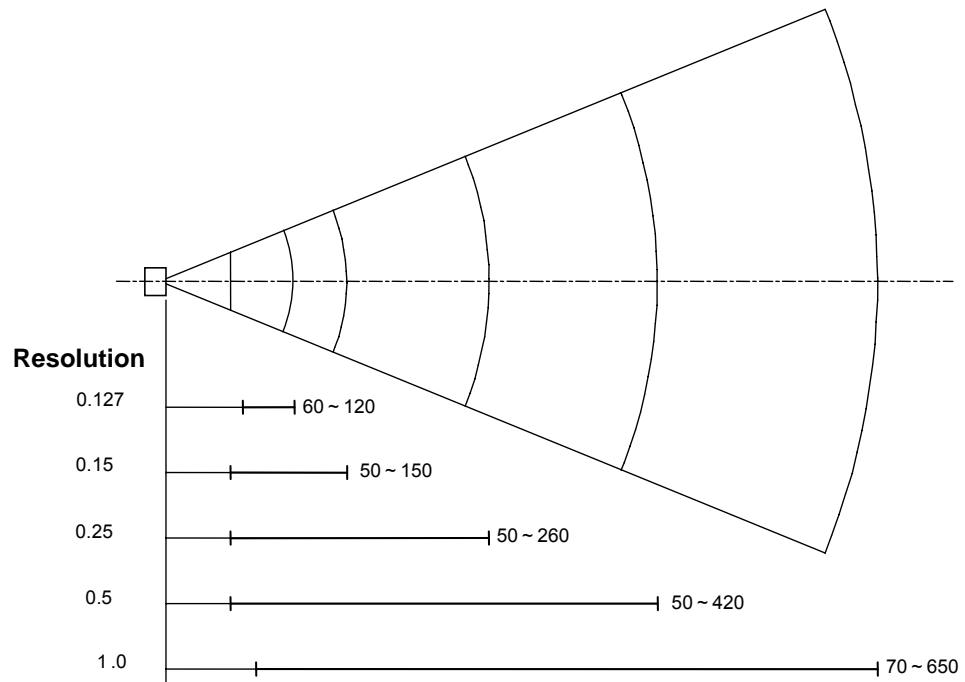


Figure 3: The depth of a decoding field (in millimeters)

| PCS | Resolution (mm) | Decode Depth (mm) |
|-----|-----------------|-------------------|
| 0.9 | 1.0 | 70–650 |
| | 0.5 | 50–420 |
| | 0.25 | 50–260 |
| | 0.15 | 50–150 |
| | 0.127 | 60–120 |

Conditions

Barcode Sample: OPTOELECTRONICS Test Sample

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

| Resolution | Symbology | PCS | Quiet Zone | 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 |

8.3. Pitch, Skew, and Tilt

Pitch angle: $\alpha = \pm 35^\circ$

Skew angle: $\beta = \pm 50^\circ$ (Excluding dead zone)

Dead zone: $\beta = \pm 8^\circ$ (There are some areas in which decoding fails due to specular reflection)

Tilt Angle: $\gamma = \pm 20^\circ$

Conditions

Barcode Sample: OPTOELECTRONICS Test Sample

Distance 110 mm from the exit window

Label **Pitch, Skew Angle, Dead Zone**

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

Tilt Angle

PCS = 0.9, Resolution = 0.26 mm, Symbology = 13-digit JAN, Quiet Zone = 10 mm

Angle Curvature: $R = \infty$, Skew Angle = $\beta + 15^\circ$ (for measuring Pitch Angle and Tilt Angle)

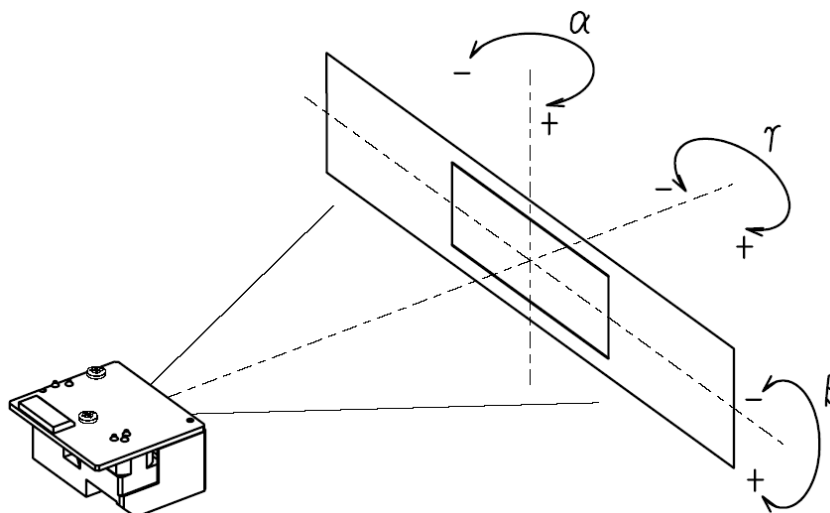


Figure 4: Pitch, skew, and tilt

8.4. 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.

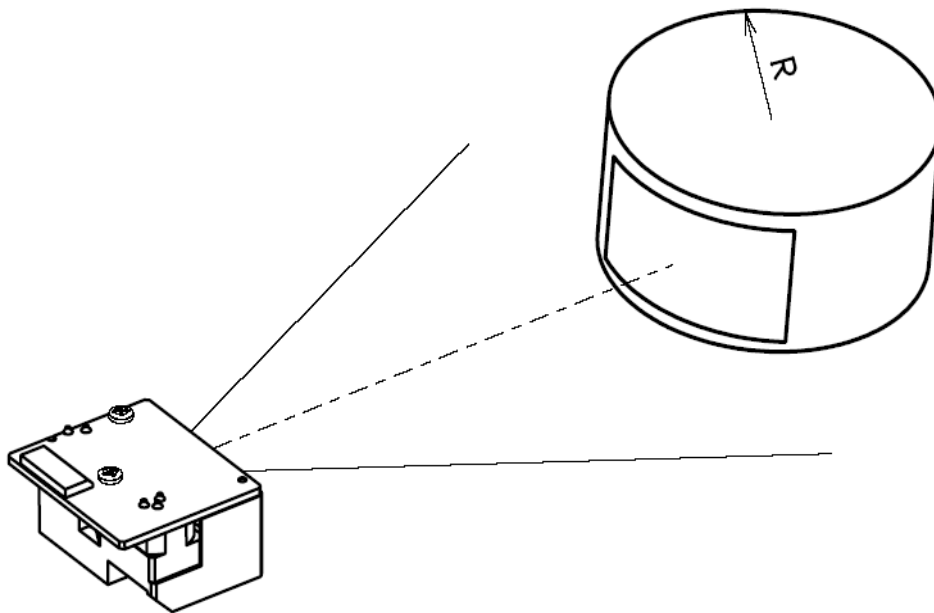


Figure 5: Curvature

Conditions

Barcode Sample: OPTOELECTRONICS Test Sample

PCS = 0.9, Resolution = 0.26 mm, Quiet Zone = 10 mm

Distance 110 mm from the edge of the exit window

Angle Skew Angle $\beta = +15^\circ$

9. Interface Specifications

9.1. Interface Connector

| Signal | Pin No. | I/O | Features |
|------------|---------|-----|---|
| TEST | 1 | I | Input for the Test: High or Open = Normal Operation, Low = Maintenance Mode * |
| VCC | 2 | — | Power Supply: DC 3.0 V to 3.6 V |
| GND | 3 | — | Ground |
| Rxd | 4 | I | Input Serial Data, CMOS Logic Level |
| Txd | 5 | O | Output Serial Data, 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 | I | Aiming / Wakeup Input, CMOS Logic Level Low = Aim/Wake |
| Trigger | 12 | I | Trigger Input, CMOS Logic Level Low = Trigger |

Connector used was produced by KYOCERA ELCO Corporation.

Product No. 04 6238 012 0 1 0 883+

12 pin 0.5 mm pitch FFC Connector Bottom contact (Gold-plated terminal)

9.2. Interface Circuit

| Pin No. | Signal | Circuitry |
|---------|---|-----------|
| 1 | Test Terminal High = Normal Operation Mode Low = Maintenance Mode | |
| 2 | VCC | — |
| 3 | GND | — |
| 4 | Rxd Input | |
| 5 | Txd Output | |
| 6 | CTS Input | |
| 7 | RTS Output | |

| Pin No. | Signal | Circuitry |
|---------|---|-----------|
| 8 | Power Down Output High = Low Power State | |
| 9 | Buzzer Output High = OFF Low = ON | |
| 10 | Decode LED Output High = OFF Low = ON | |
| 11 | Aim/Wake Input Low = Aim / Wake | |
| 12 | Trigger Input Low = Trigger | |

10. Serial Number

The serial number shown below is affixed to the MDL 2000.

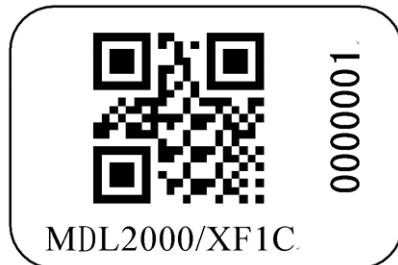


Figure 6: Serial number diagram

Management Quick Response Code (QR Code), model name, and serial number are displayed.

The serial numbers start from 0000001 and are in order regardless of the lot number.

11. Packaging Specifications

Size of the package after assembly: W 355 x D 290 x H 185 mm

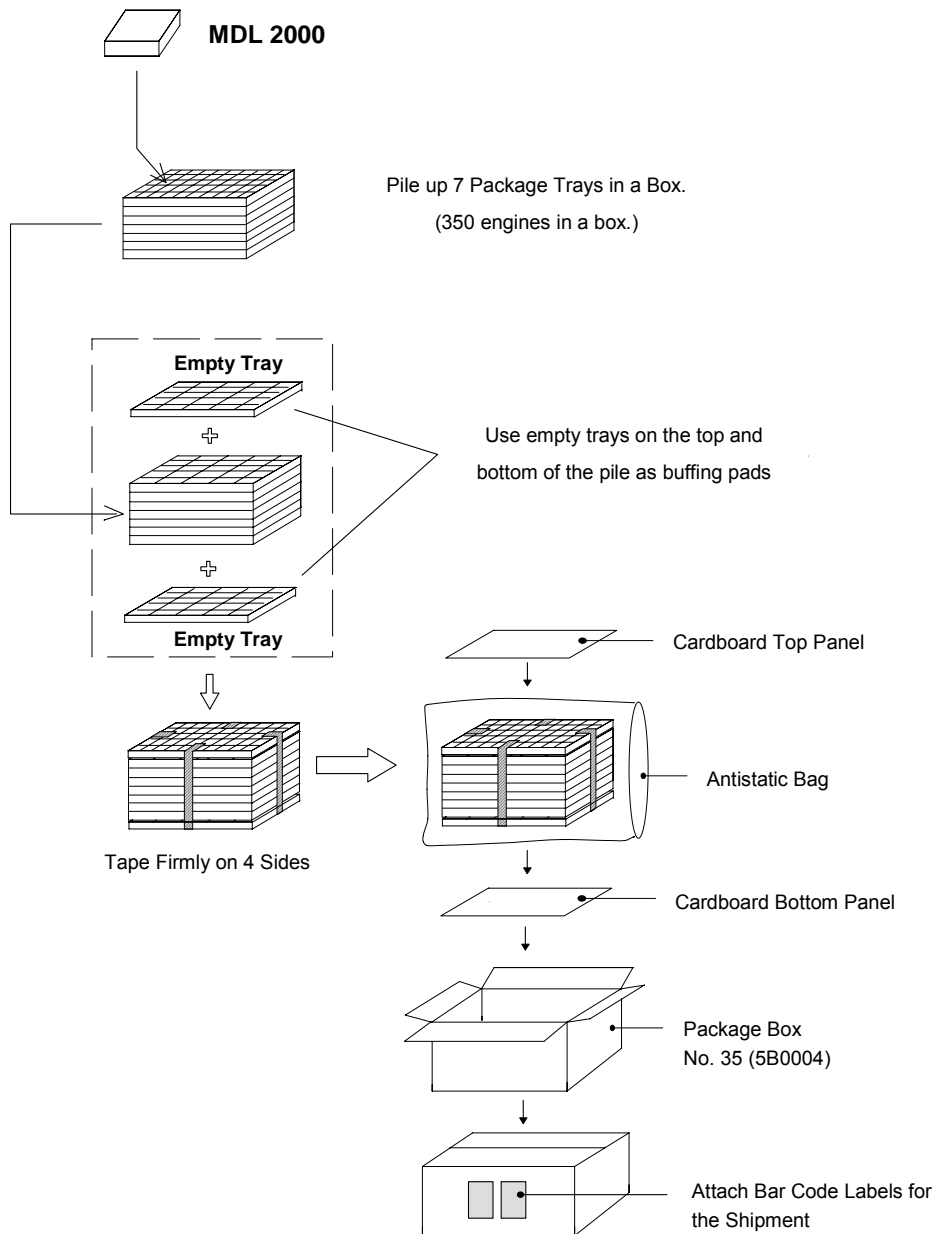


Figure 7: Packaging

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.

12. Durability

12.1. Electrical Noise

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

Conditions

Barcode Sample: OPTOELECTRONICS Test Sample

| | |
|----------------------|--|
| PCS | 0.9 |
| Resolution | 0.25 mm |
| Symbology | 9-digit Code 39 |
| Quiet Zone | 10 mm |
| N/W Ratio | 1:2.5 |
| Distance | 150 mm |
| Angle | $\alpha = 0^\circ \beta = 15^\circ \gamma = 0^\circ$ |
| Curvature | $R = \infty$ |
| Power Supply Voltage | 3.3 V |

12.2. Shock

No malfunction occurred after the following drop test.

Drop Test: Fixed an MDL 2000 inside a dummy case and dropped it on its top, bottom, front, back, left, right, top-left, top-right, bottom-left and bottom-right sides from 1.8 meters above a concrete floor. Repeated this routine ten times

12.3. Vibration Strength

No malfunction occurred after the following vibration test.

Vibration test: Increase the frequency of the vibration from 12 Hz to 200 Hz with accelerated velocity 32.3 m/s^2 (3.3 G) for over 10 minutes. Repeated this routine for 2 hours to X direction, 2 hours to Y direction, and 4 hours to Z direction.

13. Reliability

MTBF (Mean Time Between Failures) of this product except for the laser diode and the mirror scan unit is 30,000 hours.

Life cycle of the laser diode is 10,000 hours and that of the mirror scan unit is also 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.

14. Regulatory Compliance

14.1. Laser Safety

The scan engine emits laser beams.

JIS C6802: 2005: Laser class 2

FDA CDRH Laser class II. Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to laser notice No. 50 dated June 24, 2007.

Class II laser devices are not considered to be hazardous when used for their intended purpose. Avoid staring into the laser beam.

14.2. RoHS

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

15. Safety

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

15.1. Shock

Do not throw or drop the scanner.

Do not place heavy objects on the cables.

15.2. Temperature Conditions

Do not use the scan engine at temperatures outside the specified range.

Do not pour boiling water on the scanner.

Do not throw the scan engine into the fire.

Do not forcibly bend the cables at low temperatures.

15.3. Foreign Materials

Do not immerse the scan engine in liquids.

Do not subject the scan engine to chemicals.

15.4. 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 scan engine may cause reception problems.

The scan engine may be damaged by voltage drops.

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

16. Mechanical Drawing

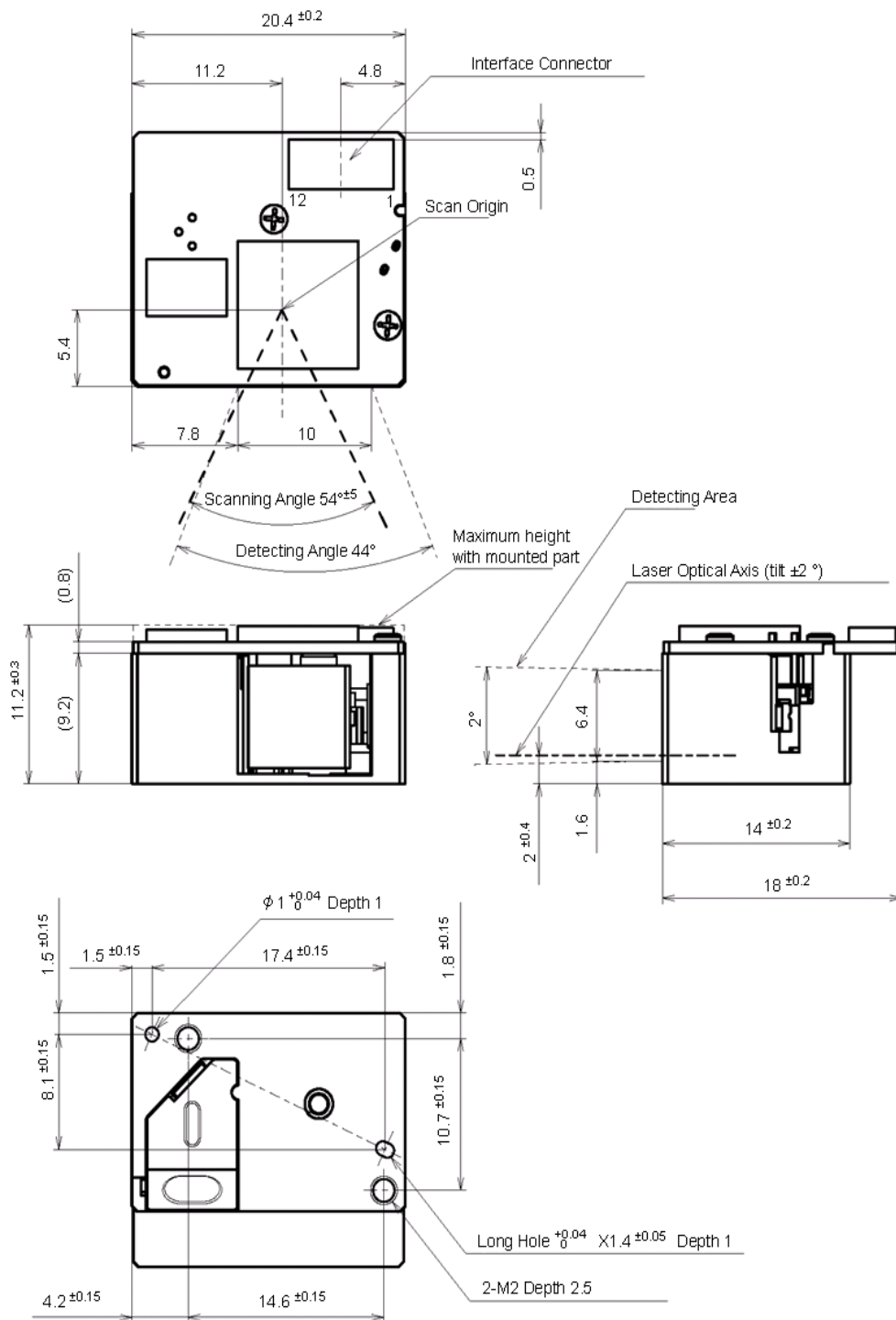


Figure 8: Mechanical drawing