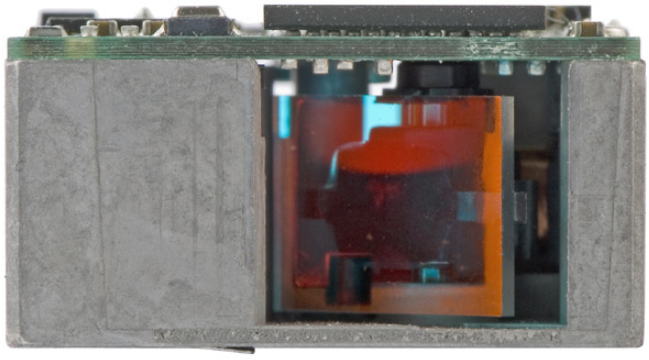
OPTICON

Laser Scan Engine

MDL2001



This manual provides specifications for the MDL2001 laser scan engine.

Specifications Manual

All information subject to change without notice.

Document History

Model Number:	MDL2001	**Specification Number:**	SS09033
Edition:	Initial release	**Original Spec Number:**	SS08040
Date:	2008-08-28		

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Limited Warranty and Disclaimers

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

Serial Number

A serial number appears on all Opticon products. This official registration number is directly related to the device purchased. Do not remove the serial number from your Opticon device. Removing the serial number voids the warranty.

Warranty

Unless otherwise agreed in a written contract, all Opticon products are warranted against defects in materials and workmanship for two years after purchase. Opticon will repair or, at its option, replace products that are defective in materials or workmanship with proper use during the warranty period. Opticon is not liable for damages caused by modifications made by a customer. In such cases, standard repair charges will apply. If a product is returned under warranty and no defect is found, standard repair charges will apply. Opticon assumes no liability for any direct, indirect, consequential or incidental damages arising out of use or inability to use both the hardware and software, even if Opticon has been informed about the possibility of such damages.

Packaging

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

Trademarks

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1. Abstract

This manual provides specifications for the MDL2001 laser scan engine.

2. Overview

The MDL2001 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 of the laser line.

A decoder is built into the MDL2001 that enables this scan engine to decode barcodes after scanning and output the information using serial communication.

The MDL2001 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):	α = 0° β = 15° γ = 0°
Curvature:	R = ∞
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 6.2 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 V, Ta=25° 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	uA
Rush Current Peak		I_{PEEK}		–	500	1000	mA
Input Voltage	High	V_{IH}		V_{CC} x 0.8	–	–	V
	Low	V_{IL}		–	–	V_{CC} x 0.2	V
Output Voltage (Decode LED)	High	V_{OH}	I_{OH} < 8 mA	V_{CC}-0.6	–	–	V
	High (Low Power State)	V_{OH}	I_{OH} < 5 uA	V_{CC}-0.6	–	–	V
	Low	V_{OL}	I_{OL} < 8 mA	–	–	0.4	V
Output Voltage (Txd, RTS)	High	V_{OH}	I_{OH} < 4 mA	V_{CC}-0.6	–	–	V
	High (Low Power State)	V_{OH}	I_{OH} < 5 uA	V_{CC}-0.6	–	–	V
	Low	V_{OL}	Iy < 4 mA	–	–	0.4	V
Output Voltage (Power Down)	High (Low Power State)	V_{OH}	I_{OH} < 5 uA	V_{CC} -0.6	–	–	V
	Low	V_{OL}	I_{OL} < 4 mA	–	–	0.4	V
Input Current		I_{IN}	V_{IN}=3.3 V	–	–	50	μA
			V_{IN}=0 V	–	–	-10	μA

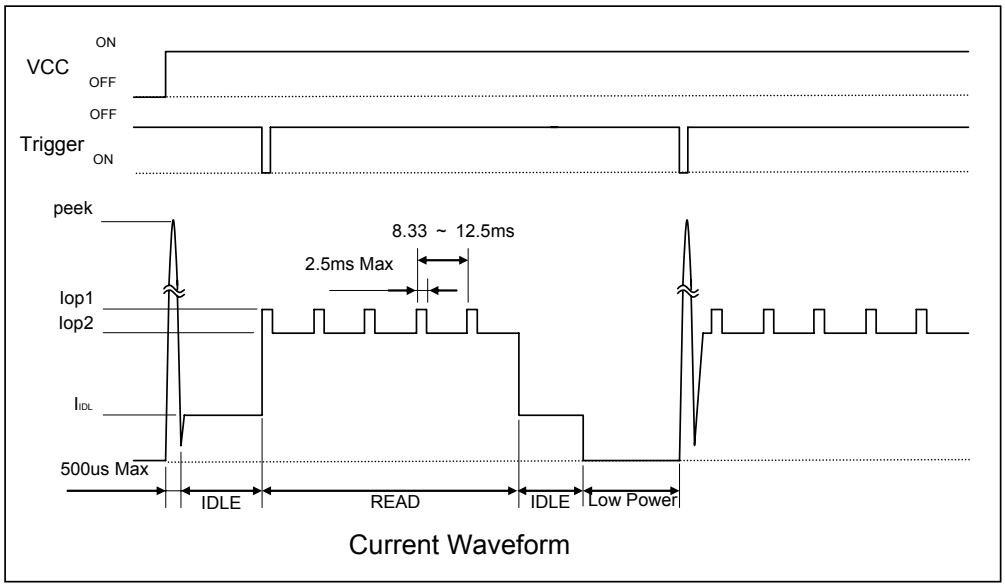


Figure 1: Current waveform

5.3. Power Mode Transition

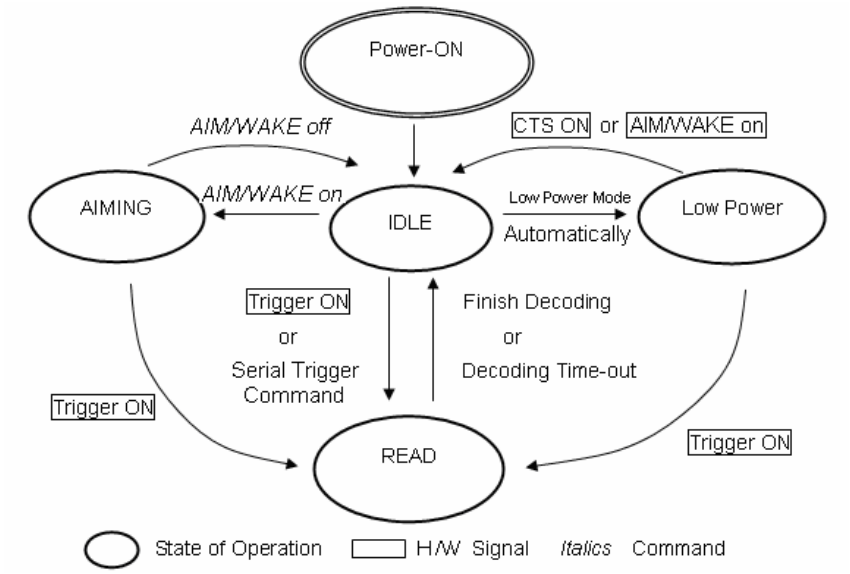


Figure 2: Power mode transition

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.

6. Optical Specifications

6.1. Laser 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)	°

6.2. Laser Scan Standard

6.2.1. Tilt of Laser Scan Line

Maximum tilt between both ends of laser scan line

Less than 0.92° upward tilt from the scan origin.

Maximum of 2.46 mm when measured at the point 150 mm away from the scan origin.

(Measurement was done from the center of the scan line.)

6.2.2. Curvature of Scanning

Maximum gap between the straight line connecting both ends of the laser scan line and the actual laser scan line.

Less than 1.17° curvature from the scan origin (from a mirror motor mirror).

Maximum of 3.06 mm when measured at the point 150 mm away from scan origin.

(Measurement was done from the center of the scan line.)

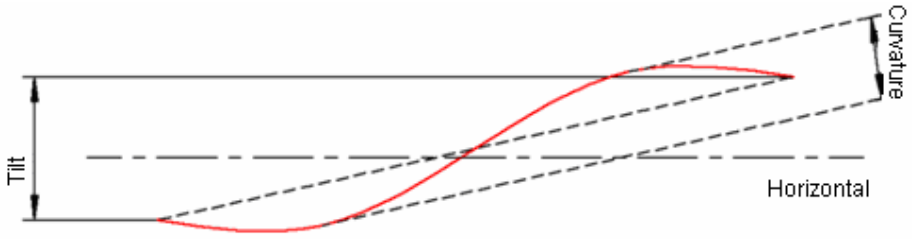


Figure 3: Laser scan standards

7. 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 35º 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.)

7.1. 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.

7.2. Minimum Resolution

0.127 mm

7.3. Scan Area and Resolution

7.3.1. 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.

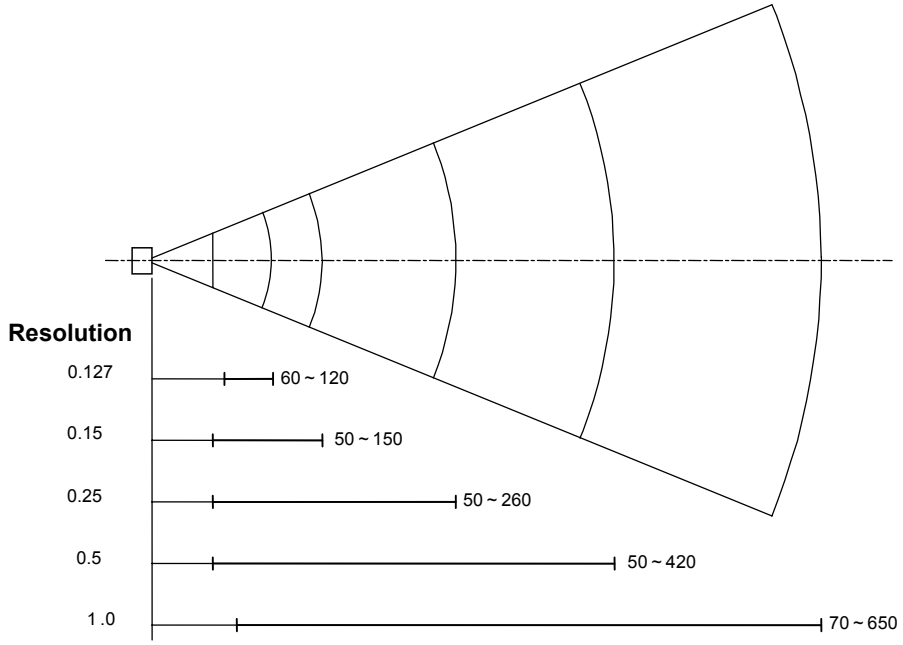


Figure 4: The depth of a decoding field (in millimeters)

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	α = 0°, β = 15°, γ = 0°
Curvature	R = ∞

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

7.4. Pitch, Skew, and Tilt

Pitch angle: α = ±35°

Skew angle: β = ±50° (Excluding dead zone)

Dead zone: β = ±8° (There are some areas in which decoding fails due to specular reflection)

Tilt Angle: γ = ±20°

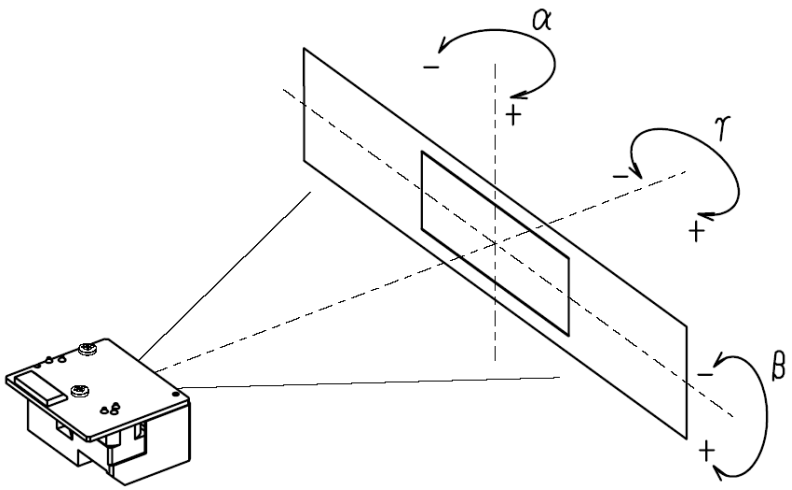


Figure 5: Pitch, skew, and tilt

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 = ∞, Skew Angle = β +15° (for measuring Pitch Angle and Tilt Angle)

7.5. Curvature

With 8-digit JAN/UPC/EAN barcodes, decoding performance is guaranteed when R≥15 mm.

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

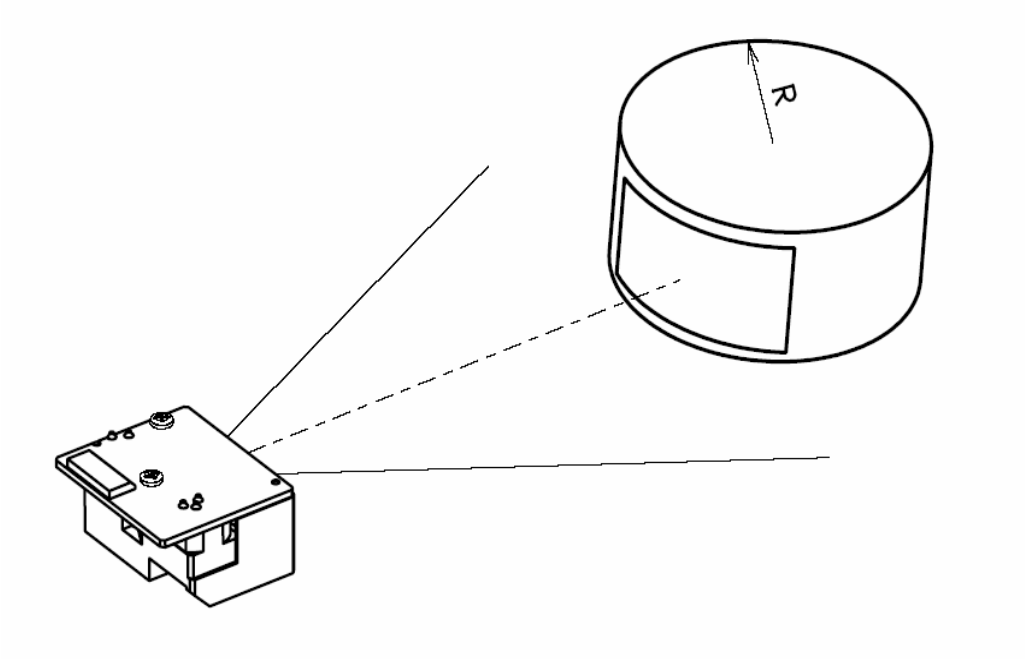


Figure 6: Curvature

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 β = +15°

8. Interface Specifications

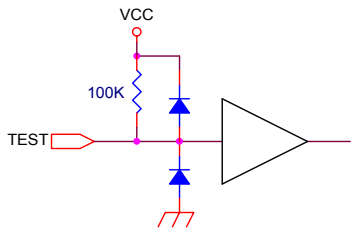
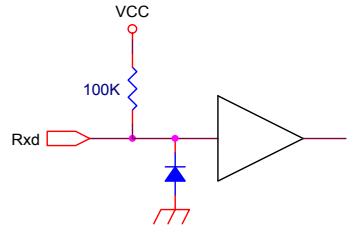
8.1. Interface Connector

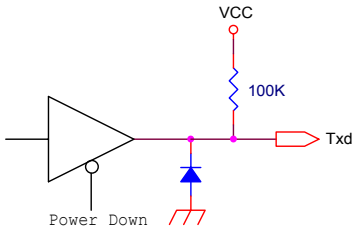
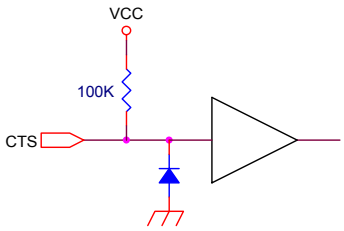
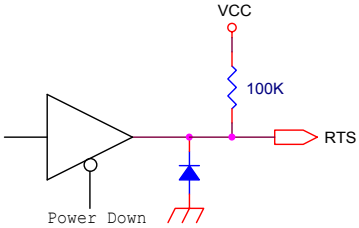
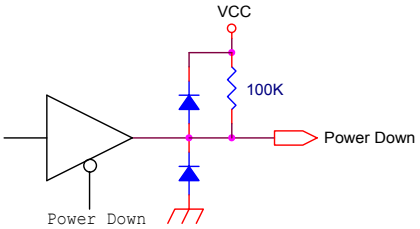
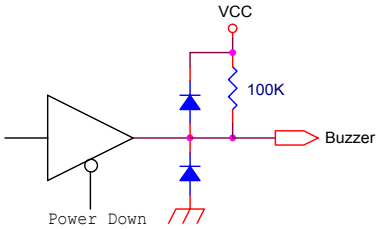
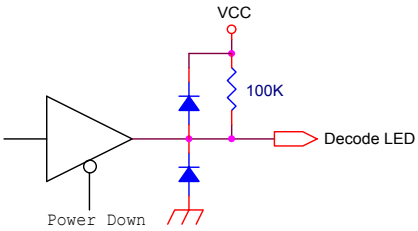
Signal	Pin No.	I/O	Features
TEST	1	I	Input for the Test: High or Open = Normal Operation, Low = Maintenance Mode *
VCC	2	—	Power Supply: DC 3.0 V to 3.6 V
GND	3	—	Ground
Rxd	4	I	Input Serial Data, CMOS Logic Level
Txd	5	O	Output Serial Data, CMOS Logic Level
CTS	6	I	Clear to Send, CMOS Logic Level
RTS	7	O	Request to Send, CMOS Logic Level
Power Down	8	O	Power Down Output, CMOS Logic Leve 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

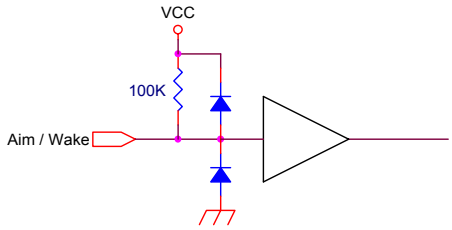
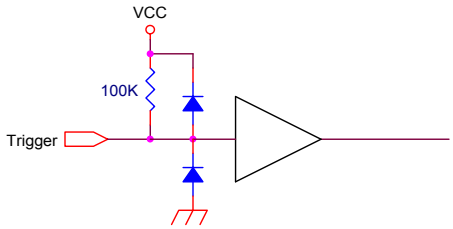
Connector used was produced by KYOCERA ELCO Corporation.
Product No. 04 6238 012 010 800+

12 pin 0.5 mm pitch FFC Connector Bottom contact (Tinned terminal)

8.2. Interface Circuit

Pin No.	Signal	Circuitry
1	Test Terminal High = Normal Operation Mode Low = Maintenance Mode	
2	VCC	—
3	GND	—
4	Rxd Input	

Pin No.	Signal	Circuitry
5	Txd Output	
6	CTS Input	
7	RTS Output	
8	Power Down Output High = Low Power State	
9	Buzzer Output High = OFF Low = ON	
10	Decode LED Output High = OFF Low = ON	

Pin No.	Signal	Circuitry
11	Aim/Wake Input Low = Aim / Wake	
12	Trigger Input Low = Trigger	

8.3. Laser Light Specifications

Items	Conditions	Min	Typ	Max	Unit
Time delay	LASER EN = ON	—	100	200	µsec
Start-up time	LASER EN = ON	—	10	50	µsec
Falling time	LASER EN = OFF	—	-	1	µsec

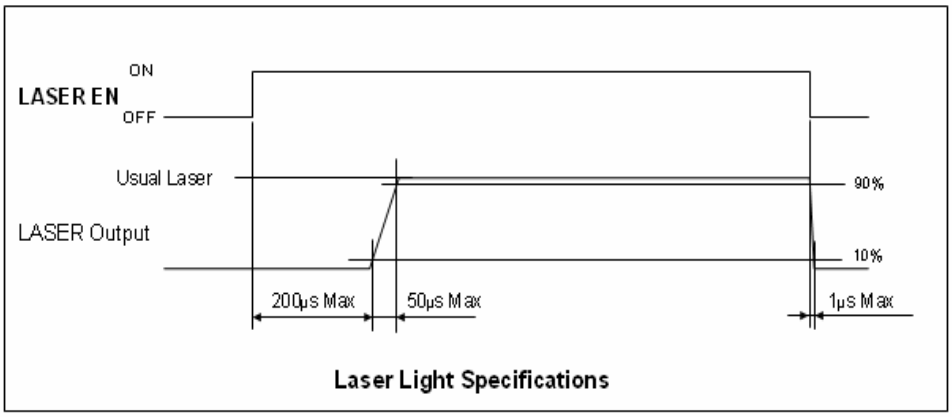


Figure 7: Laser specifications

9. Serial Number

The serial number shown below is affixed to the MDL2001.

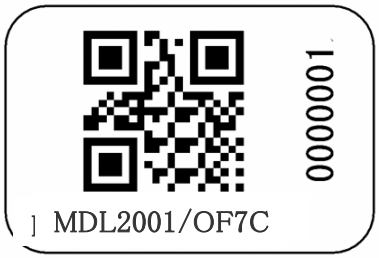


Figure 8: Serial number diagram

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.

10. Packaging Specifications

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

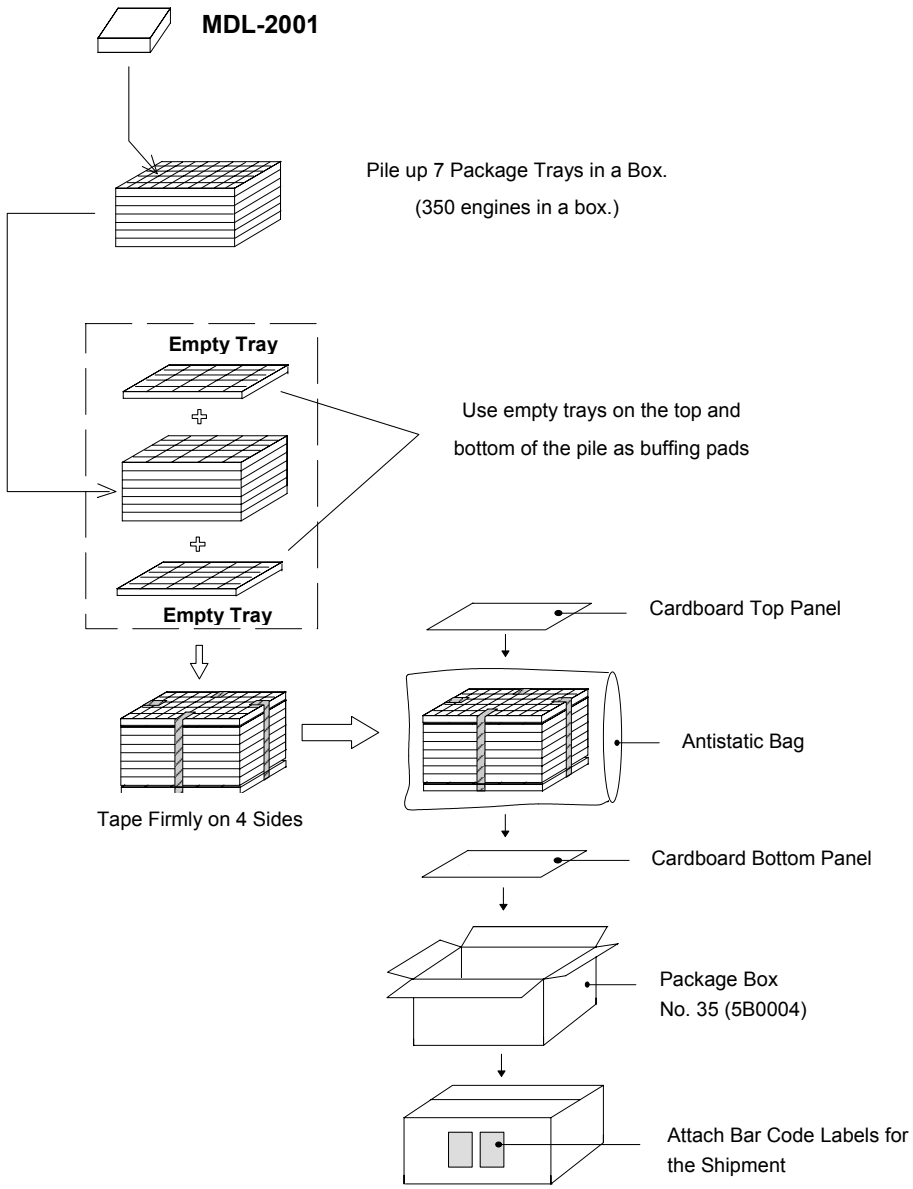


Figure 9: Packaging

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.

11. Durability

11.1. 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	50 to 150 mm
Angle	α = 0° β = 15° γ = 0°
Curvature	R = ∞
Power Supply Voltage	3.3 V

11.2. Shock

No malfunction occurred after the following drop test.

Drop Test: Fixed an MDL2001 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

11.3. 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.

12. 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.

13. Regulatory Compliance

13.1. 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.

13.2. RoHS

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

14. Safety

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

14.1. General use

Do not attempt to disassemble, modify or update this device. In case of serious malfunction, consult your local dealer or Opticon.

Do not use the scanner while operating machinery.

14.2. Shock

Do not drop or put heavy items on this product or its cable

14.3. Temperature & Environment

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

Do not pinch or forcibly bend the cable, especially at very low temperature (if applicable)

Do not use or leave this device

In areas exposed to direct sunlight for long periods of time

Near heat sources such as radiators, heat registers, stoves, or other types of devices that produce heat.

Near microwaves, medical devices, or RF-emitting devices

In the reach of blinking lights such as CRT

Do not use this product during a lightning storm

In any other area where serious damage may occur!

14.4. Anti-static Treatments

All work-benches, tools, measuring instruments and human body parts that might contact the product must undergo preliminary anti-static measurements.

Do not touch optical or electrical components. Hold the product on its metal case when necessary.

14.5. Foreign materials & Cleaning

Do not use the product in dusty environments. In case dust gets into the product gently blow the dust off with dry air. High pressure is not allowed. Also direct contact of swabs is not allowed as it can cause deterioration of the performance.

Avoid risk for an exposure to chemicals.

Prevent the product from contact with water or other liquids, as well as from extremely high humidity.

15. Mechanical Drawing

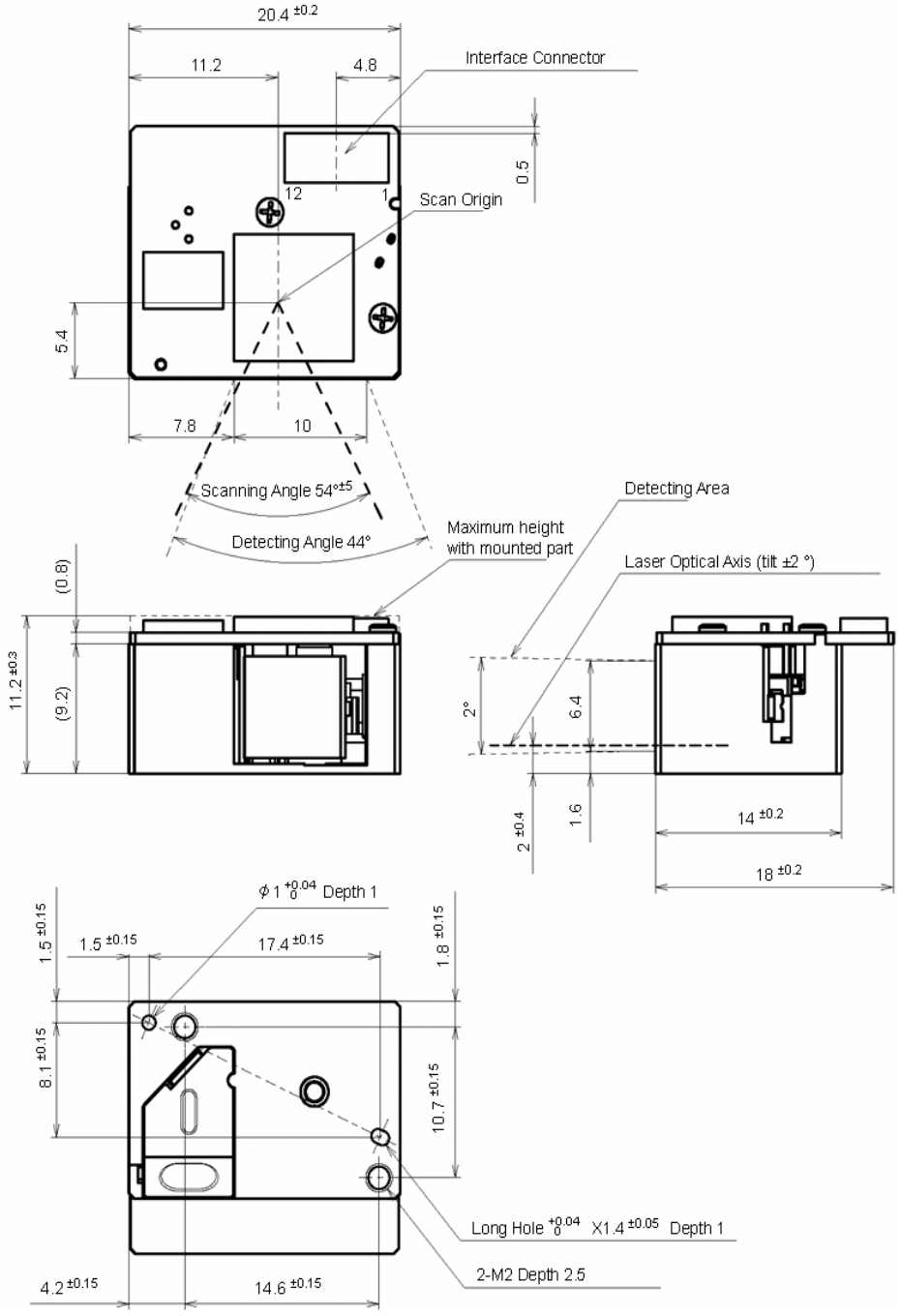


Figure 10: Mechanical drawing