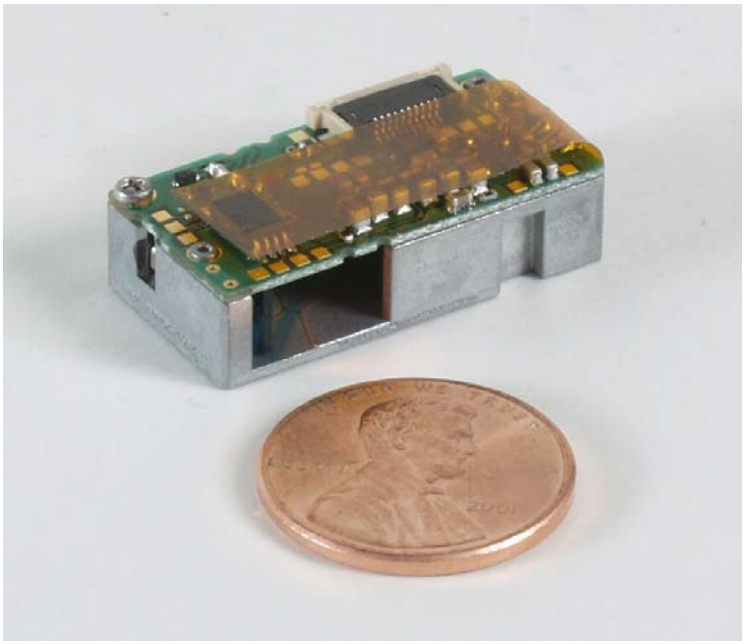
Preliminary



MDL1000
Windows Integration Guide
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TABLE OF CONTENTS

1

Introduction

The MDL 1000 1D Laser Module is a miniature,100 scan per second, single line scanning engine designed for direct integration into customer's OEM decode equipment. The small physical size makes the scanner easy to integrate into any hardware design. Advanced decoding technology results in high speed operation with superior accuracy.

The engine is encased in a compact rugged yet light weight enclosure. The compact size permits installation in the tightest areas allowing great flexibility in mounting and positioning the module for optimum performance.

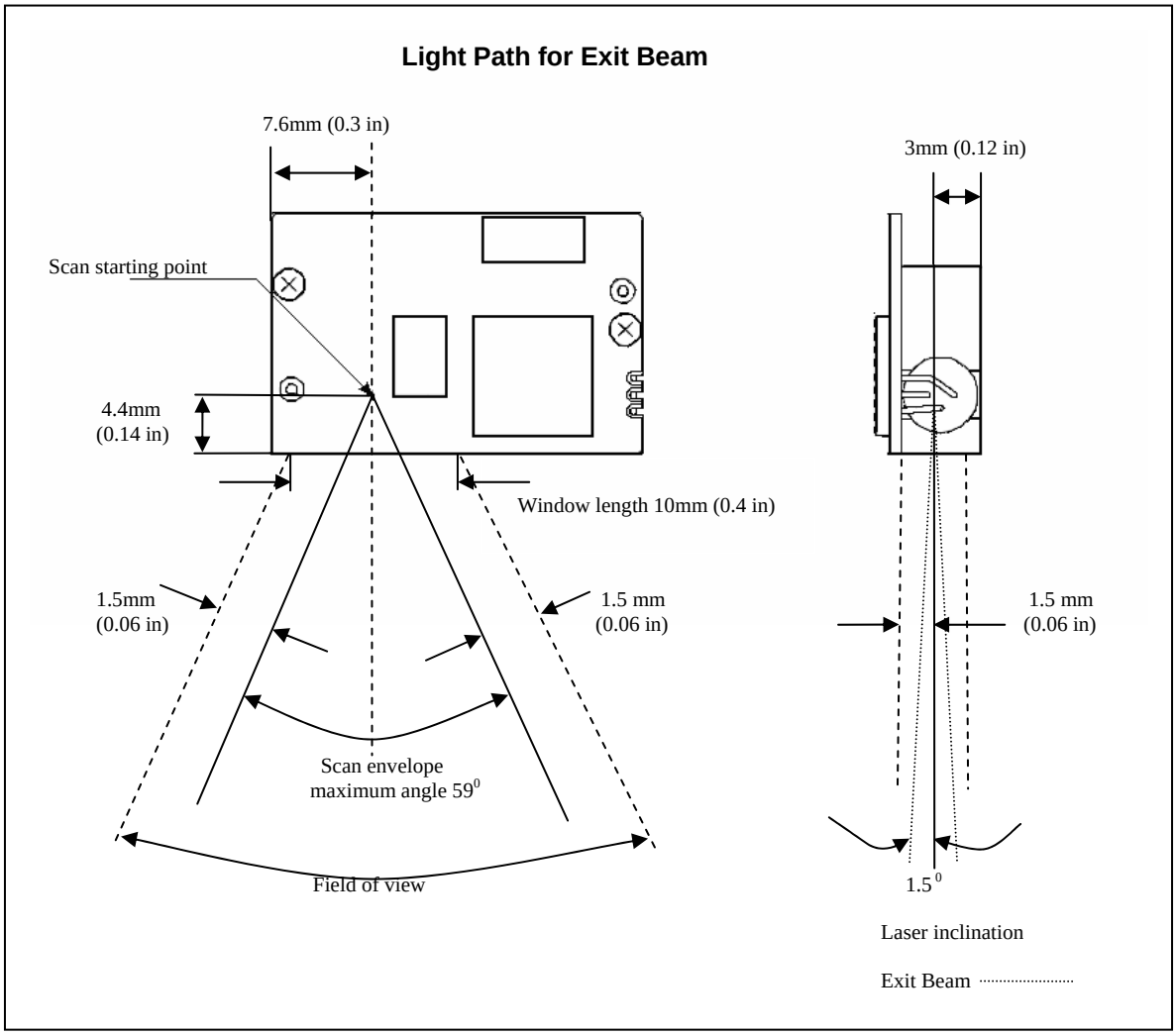
The MDL 1000 is equipped with a multiple of features including:

- 100 scans per second
- Support 3.3 input voltage
- 650 nm laser diode
- A narrow exit angle to provide precision beam positioning
- A rugged die cast chassis with threaded mounting holes.
- A 12 pin ZIF connector for easy integration into portable devices
- Low mass 10 grams

2

Exit Beam Specification

When mounting the engine, it is important to maintain a degree of clearance for the exiting beam. When designing an application, the dimension of the exiting window must keep the engine beam sweep free of obstructions and must not interfere with the engine field of view. The MDL1000 scanning angle is 54 degrees with a maximum scanning view of 59 degrees. The dimension of the engine exiting aperture window is 10 mm x 5mm.



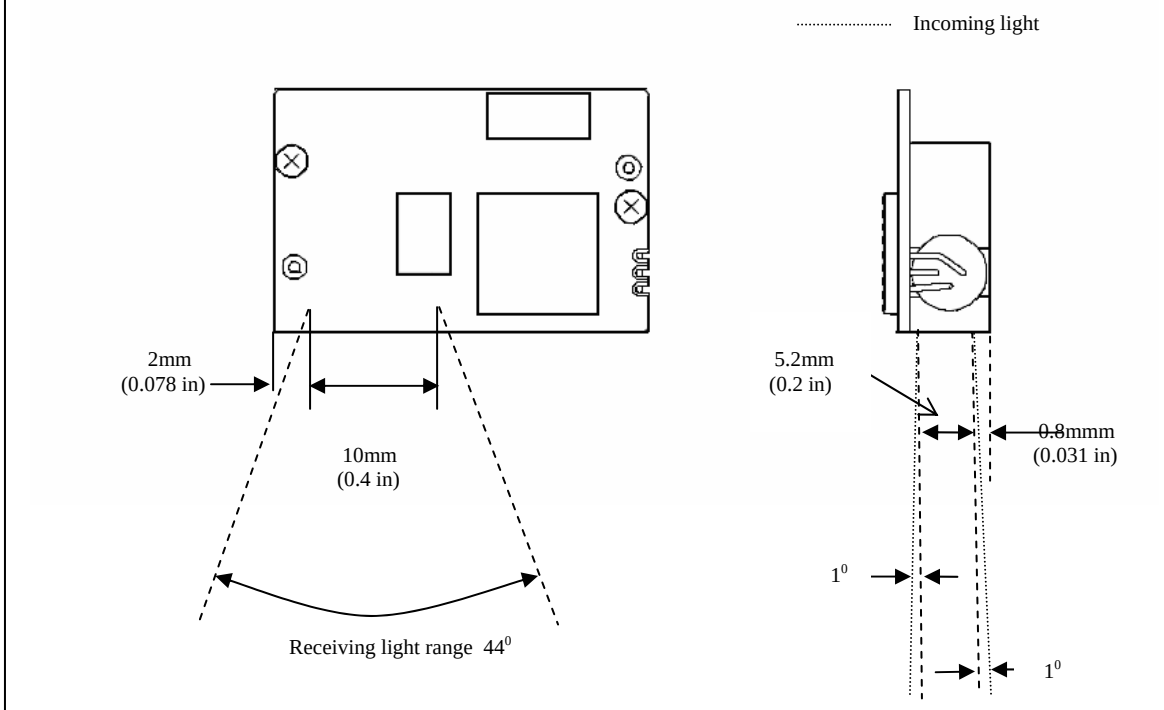
It is recommended the clear aperture of the transparent window extend beyond the 54 degrees. To avoid side obstruction, maintain a minimum offset distance of 1.5 mm (0.6 in) from the line that connect the scanning maximum angle of 59 degrees (see figure). The exiting beam has an inclination angle of $\pm$1.5 degrees with an axis height of 3 mm (0.12 in). To keep exit beam clearance, maintain a minimum offset distance of 1.5 mm (0.6 in) from the exit axis height.

Receiving Beam Specification

The engine relies on the reflection of light from a symbol and it must receive back a reasonable amount of reflected light from the outgoing beam. Keep the receiving light range area free of obstructions. The maximum light receiving angle is 44 degrees indicated by the dotted line area. To efficiently use the true ability of the reading range, the optical path range of 44 degrees should be maintained.

To receive the maximum amount of reflected light, the receiving aperture must have a clearance of 5.2 mm (0.2 in) as illustrated in the figure below, allowing incoming light up to 1 degree of inclination.

Light Path for Receiving Beam



Selection of Material for the Transparent Window

The exit window material should have a spectra transmission of least 95 % of the laser light from 640 nm to 690 nm. It is recommended to use acrylic plastic for the transparent window of the device on which the laser module will be mounted. The reading performance might decline through optical inference when transmitting from a window made of a material that has multiple refractions like polycarbonate.

Acrylic is a perfect material for the transparent window because of its low multiple refraction and also its excellent optical performance such as the degree of transparency. Select a high quality acrylic with flat surface and free of imperfections such as scars and dents. A thickness of 1mm (0.04 in) to 2mm (0.08 in) will be suitable. During assembly, handle the window with a protection sheet affixed and avoid adhesion of dirt, flaws and dust. When removing the protection sheet, take appropriate measures like the use of electrostatic eliminators or an ion blow because static electricity that occurs when tearing off the protection sheet can gather dust.

In principle, use colorless transparent acrylic board. When using a red colored window, check that it has a spectroscopic property with minimul adsorption on the laser wavelength, 650 nm ±10 nm.

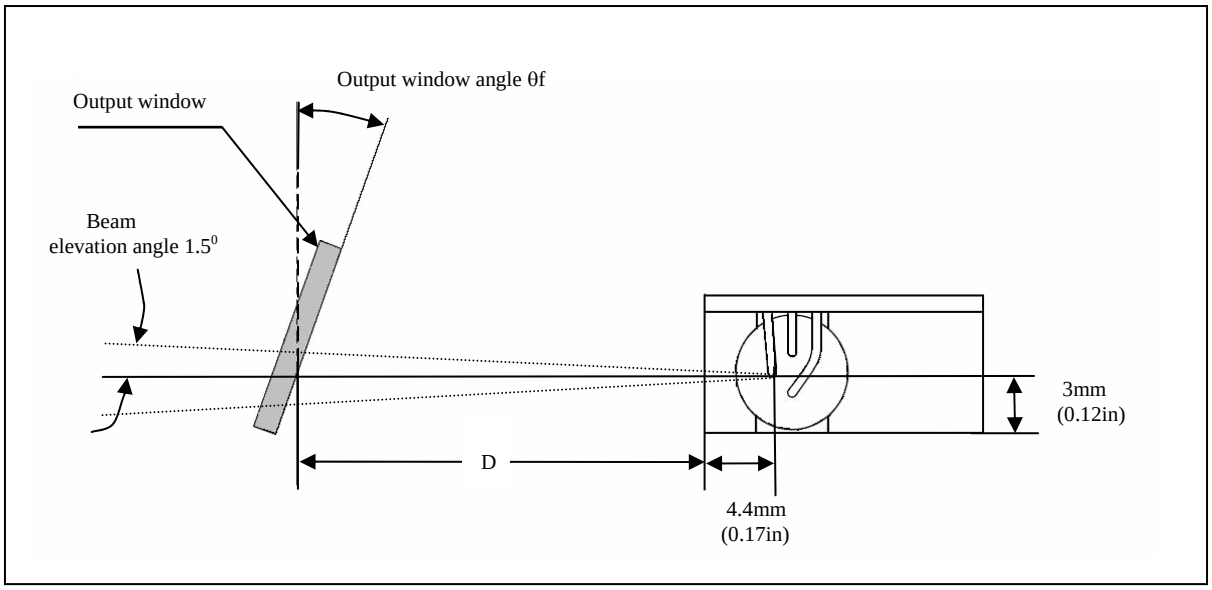
The use of an acrylic window in which the surface has been treated with a hard coating can help to protect the window from surface scratches and abrasions that may interfere with the scan performance of the engine. The hard coating improves the resistance to scratches significantly without having any harmful effect on the optical performance of the acrylic. Acrylic boards with hard coating are supplied by manufactures as standard goods. Recessing the window into the housing can also provide extra protection against surface damage.

Output Window Angle

Careful consideration must be made when designing the output window distance and angle placement relative to the scan's engine exit beam. An incorrect angle for the window can cause the laser light to reflect off the inside of the window and back into the scan engine optics. This will degrade the engine performance. When placing the output window, it is important that the angle of the window not to be perpendicular to the exit beam of the engine. The window angle depends on the distance between the window and the scanning engine.

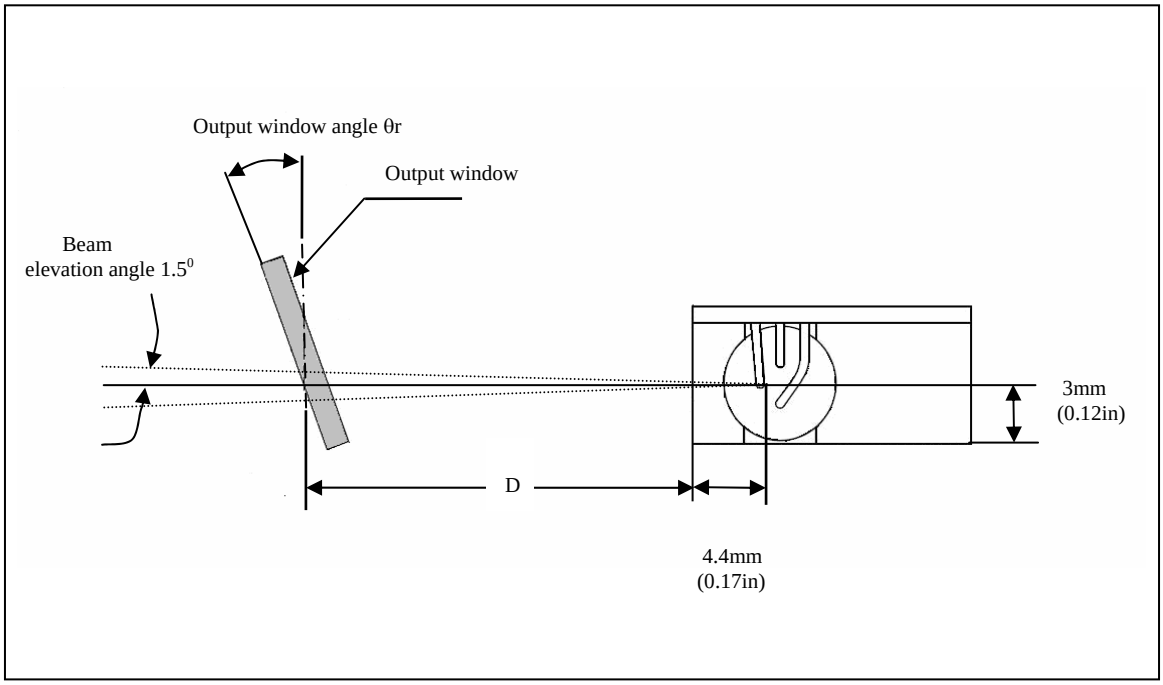
Refer to the figure and table below on the minimum window angle needed to avoid reflective beam interference.

Distance of transparent window and minimum pitch angle θf.



Distance mm(in)	3 (0.12)	3.5 (0.14)	4 (0.16)	4.5 (0.18)	5 (0.2)	5.5 (0.21)	6 (0.24)	7 (0.28)	8 (0.31)	9 (0.35)	10 (0.4)	11 (0.43)	12 (0.47)	13 (0.5)
θf (degree)	>30	>28	>26	>24	>23	>22	>20	>18	>16	>15	>14	>13	>12	>11

Distance of transparent window and minimum pitch angle θr .

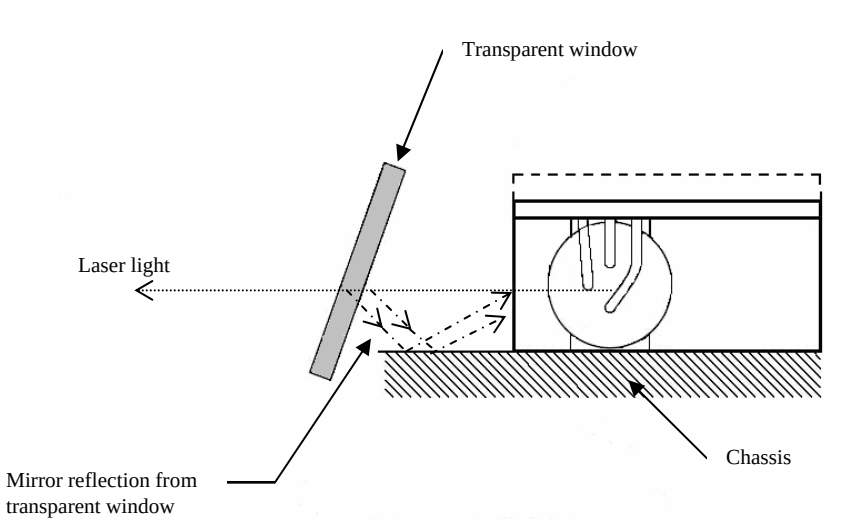


Distance mm(in)	3 (0.12)	3.5 (0.14)	4 (0.16)	4.5 (0.18)	5 (0.2)	5.5 (0.21)	6 (0.24)	7 (0.28)	8 (0.31)	9 (0.35)	10 (0.4)	11 (0.43)	12 (0.47)	13 (0.5)
θf (degree)	>32	>30	>28	>26	>25	>23	>22	>20	>18	>16	>15	>14	>13	>12

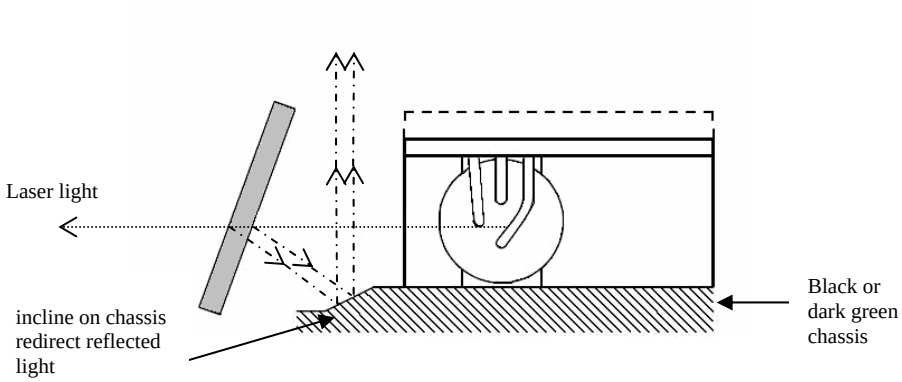
These pitch angles are the minimum angles to avoid interfacial reflections into the module. Make the design so that the margins will not be lower than the angles in the tables. The maximum inclination angle for θf as well as θr is 45 degrees. An improperly placed window has the potential to seriously reduce the scan engine's performance.

Handling Reflection of Light from the Transparent Window

Reflection of laser light can occur from the transparent window. This reflected light can come directly into the visual field of the light receiving module as shown in the diagram below. The reflected light can interfere with the signal light and badly degrade the reading performance.



To eliminate the reflection of light back to the scanning engine, shape the mounting chassis between the transparent window and the engine with a small incline to redirect the reflected light away from the engine. It is recommended that the incline angle be 45 degrees. Use black or dark green as the color for the chassis so the reflected light is easily adsorbed.



Dust and Contaminants

The MDL1000 has very sensitive miniature optical components that need to be protected from any foreign contaminants. The engine optical properties can be affected with the adhesion of dust and other particles.

When handling the engine:

- Work in an environment in which the disposals of waste procedures are implemented as much as possible to avoid adhesion of dust to the optical system.
- Wear masks to avoid dirt.
- If there is dust on the mirror, blow it off with light air. Strong air can damage the scan mirror.
- The scan engine enclosure must be sealed to prevent infiltration of airborne contaminants and foreign materials such as dirt, dust, and smoke. It also must be sealed to protect the engine against humidity and condensation.

In general, dust and contaminants settle in the direction of gravitational pull. Mounting the engine and it's associated window in a vertical position will reduce the settling of dust. If units must be placed on the horizontal, then a covering above the unit and window will also reduce the settling of dust onto the unit.