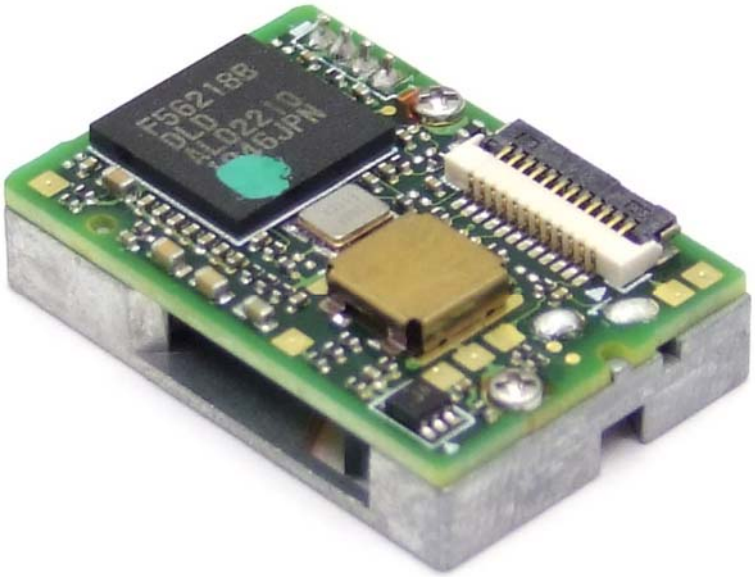
OPTICON

Laser Scan Engine

MDL-4000



This document provides instructions for installing the MDL-4000 laser scan engine.

Integration Guide

All information subject to change without notice.

Document History

Model Number:	**MDL-4000**	Specification Number:	**TS11040**
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Date:	**2011-10-27**		

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Limited Warranty and Disclaimers

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

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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.

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Revision History

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Product name : MDL-4000

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First	2011/10/27	-	-	Initial release

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1. Introduction

The MDL-4000 series laser scan engine consists of precise optical elements and a scanning system. In order to maximize its performance and prevent troubles from happening, read this integration guide carefully and design your integration devices in accordance with this guide.

2. Selecting Exit Window Materials

Use an acrylic material for an exit window of your integrating instrument. Each MDL-4000 series scan engine has a coherent light source. Usage of birefringent material for an exit window may degrade the reading performance of the MDL-4000 series scan engines due to optical interference. Acrylic material is the most suitable for an exit window because it is relatively not birefringent and has greater degree of transparency.

Select a high-quality acrylic material of which surface is flat and smooth and does not have scratches or dents. Its appropriate thickness is from 1 mm to 2 mm. In order to protect an exit window from dust, stain and scratches in its assembling process, leave a protector sheet unpeeled. Static electricity, when peeling protector sheet off, may attract dust. Take an appropriate treatment, such as ion-blow or static removal.

It is recommended to apply anti-scratch coating on the surface of an exit window in order to protect it from scratches during actual operation. Coated acrylic plates are readily available as standard products. Such coating greatly enhances anti-scratch effect without degrading optical properties of the acrylic material.

The use of a colorless transparent acrylic plate is recommended. When using a colored exit window, confirm that its spectral property does not absorb the laser wavelength of the MDL-4000, 645 nm ~ 664 nm. Absorbing materials degrade the reading performance of the MDL-4000 series scan engines. In order to minimize performance degradation due to Fresnel reflection, it is recommended to apply anti-reflective coating on an acrylic plate.

3. Window Size and Optical Path Clearance

With respect to the scanning beam and the detection area depicted below, provide an exit window with sufficient clearance. Design not to have any obstacles within an optical path area.

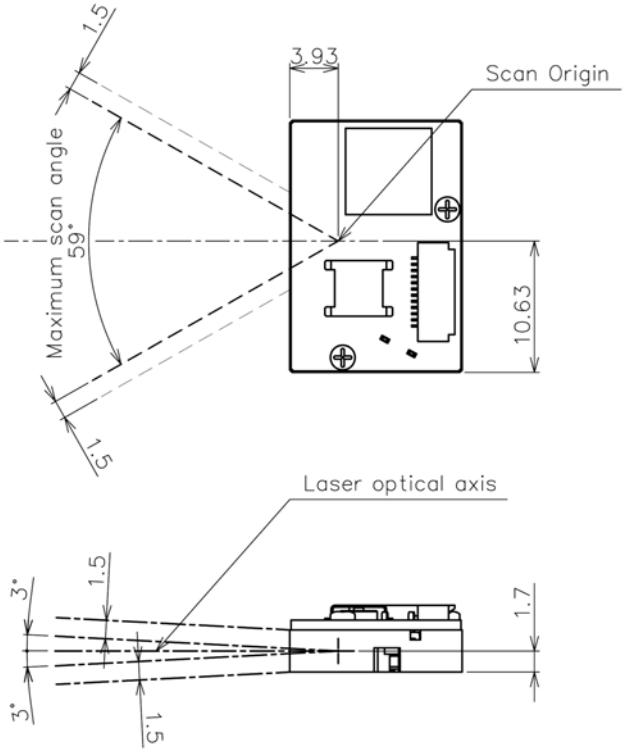

Fig. 1: Optical Path for Scanning and Necessary Clearance

For a scanning plane, provide clearance at least 1.5 mm wider than the lines emanating from the scan origin at the scan angle 59 degrees as shown above.
For the optical axis, provide clearance at least 1.5 mm wider than the lines emanating at the maximum margin of error, 2.0 degrees.

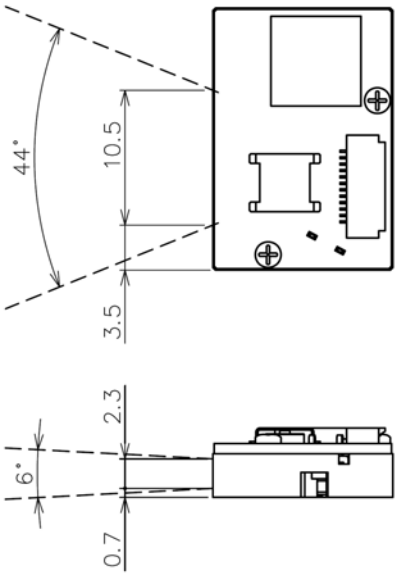

Fig. 2: Optical Path for Detection and Necessary Clearance

Provide clearance for the detecting range between the dotted lines above at least.

4. Window's Position and Inclination

In order to prevent Fresnel reflection of a scanning beam from directly reflecting back into the engine, incline an exit window at the angle described as follows.

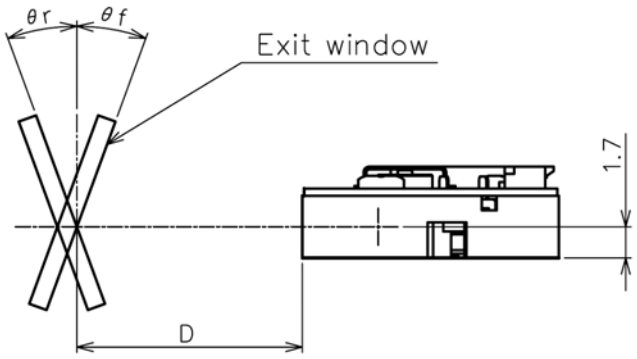

Fig. 3: Window's Position and Inclination

Distance to an Exit Window and Minimum Inclination（θf direction）

D (mm)	3	3.5	4	4.5	5	6	7	8	9	10 ~
θf (deg)	>27°	>24°	>21°	>19°	>18°	>15°	>14°	>12°	>11°	>11°

Distance to an Exit Window and Minimum Inclination（θr direction）

D (mm)	3	3.5	4	4.5	5	6	7	8	9	10 ~
θr (deg)	>31°	>28°	>25°	>23°	>21°	>18°	>16°	>15°	>14°	>13°

* The Maximum exit window inclination is 45 degrees in both directions, θf and θr.
Values of inclinations shown on the table above are the minimum values that satisfy immunity from Fresnal reflected beam reentering. Keep enough margin and design not to make it below the minimum angles in the table above, taking the error margin of your host instrument into account.

5. Treatment of Scanning Beam Reflection at Exit Window

The reflection of laser beam generated at an exit window may directly reflect back into the scan engine and degrade the reading performance of the MDL-4000 series scan engines if it also reflects at a chassis surface as shown on Fig. 4. In order to avoid such a trouble, prevent reflection of laser beam. For instance, provide a chassis with a certain inclination so that a reflected beam can be deflected as shown on Fig. 5. Furthermore, black or dark navy blue chassis is recommended because those chassis absorb reflected laser beam.

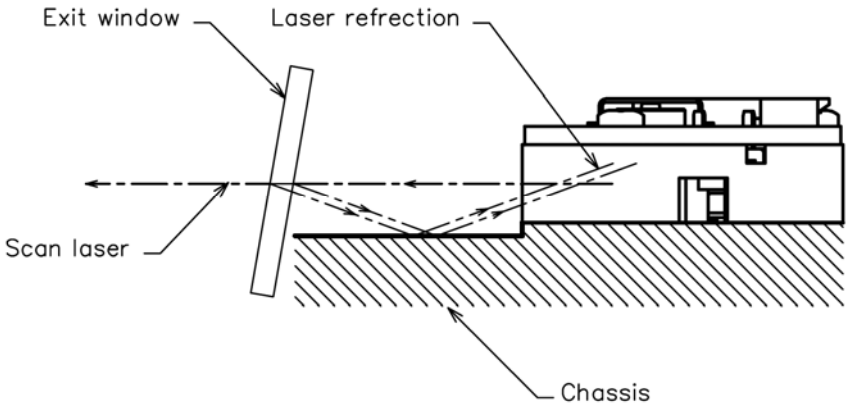

Fig. 4: Scanning Beam Reflection_bad example

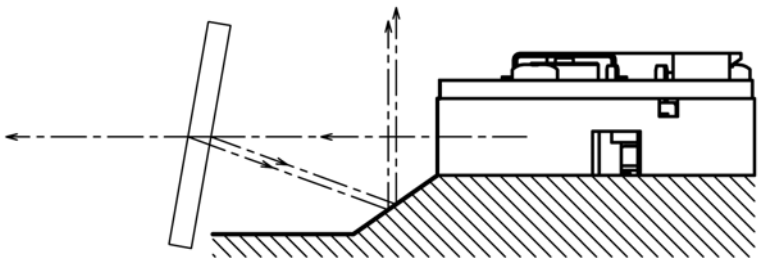

Fig. 5: Scanning Beam Reflection _good example

6. Installation

When installing the MDL-4000 series scan engine, use the assigned screw holes on the bottom surface. Do not screw down further than the limitation of its depth. Use non-magnetic or brass screws since the MDL-4000's scan mirror is driven by electromagnetic force. Do not apply torque greater than 1.6kgf/cm^2 onto a screw when fixing.

There are also guide holes on the bottom surface. Providing a chassis surface with corresponding projections, alignment precision can be improved.

Only the bottom surface of the MDL-4000 series scan engine can be attached to a chassis for installation. Keep enough clearance so that your host instrument does not apply direct force onto the MDL-4000 in case it is dropped or deformed. The MDL-4000's anti-shock reliability is confirmed only in case impulse (acceleration) is applied via the contact (bottom) surface. However, the MDL-4000 cannot withstand direct shock since it consists of precise optical elements.

The MDL-4000's metal case is connected to its circuit ground (including interface). The metal case has to be grounded or insulate from your host instrument's circuit.

7. Magnetic Element Placement

The MDL-4000's scan mirror is driven by electromagnetic force. Placing magnetic materials, such as iron, and magnetic-field inducing materials around the MDL-4000 may affect the scan mirror's normal operation. More precisely, it may cause scan angle inconsistency, scan angle decrease and irregular scan mode. In order to avoid such anomaly, design your host instrument carefully based on the following points.

1. Do not place magnetic materials within the area of 10 mm from the edge of the MDL-4000.
2. In case there is no way but placing magnetic materials within the surrounding area of the MDL-4000, confirm in advance that the magnetic materials do not affect the scanning property.
3. Do not apply any strong magnetic field to the MDL-4000 even for the short period of time.

8. Handling

Engineering personnel has to undergo anti-static process before handling the MDL-4000 in order to avoid electrostatic discharge damage. The MDL-4000 contains electro-statically sensitive devices such as laser diode and LSIs.

Hold on the metal case of the scan engine when handling. Do not hold on its circuit board or the opening of scanning beam. Do not touch the electronic elements and the terminals of the circuit board.

Installation under clean environment is recommended in order to protect optical elements from dust. Wearing a mask is desirable so that the optical elements will not have any stain. In case dust is clung to the scan mirror, gently blow it off with dry air. High volume air blow may cause damage to the scan mirror. Removing stains from the scan mirror needs some skills. Manage not to leave stains on the scan mirror when handling.

9. Mechanical Drawing

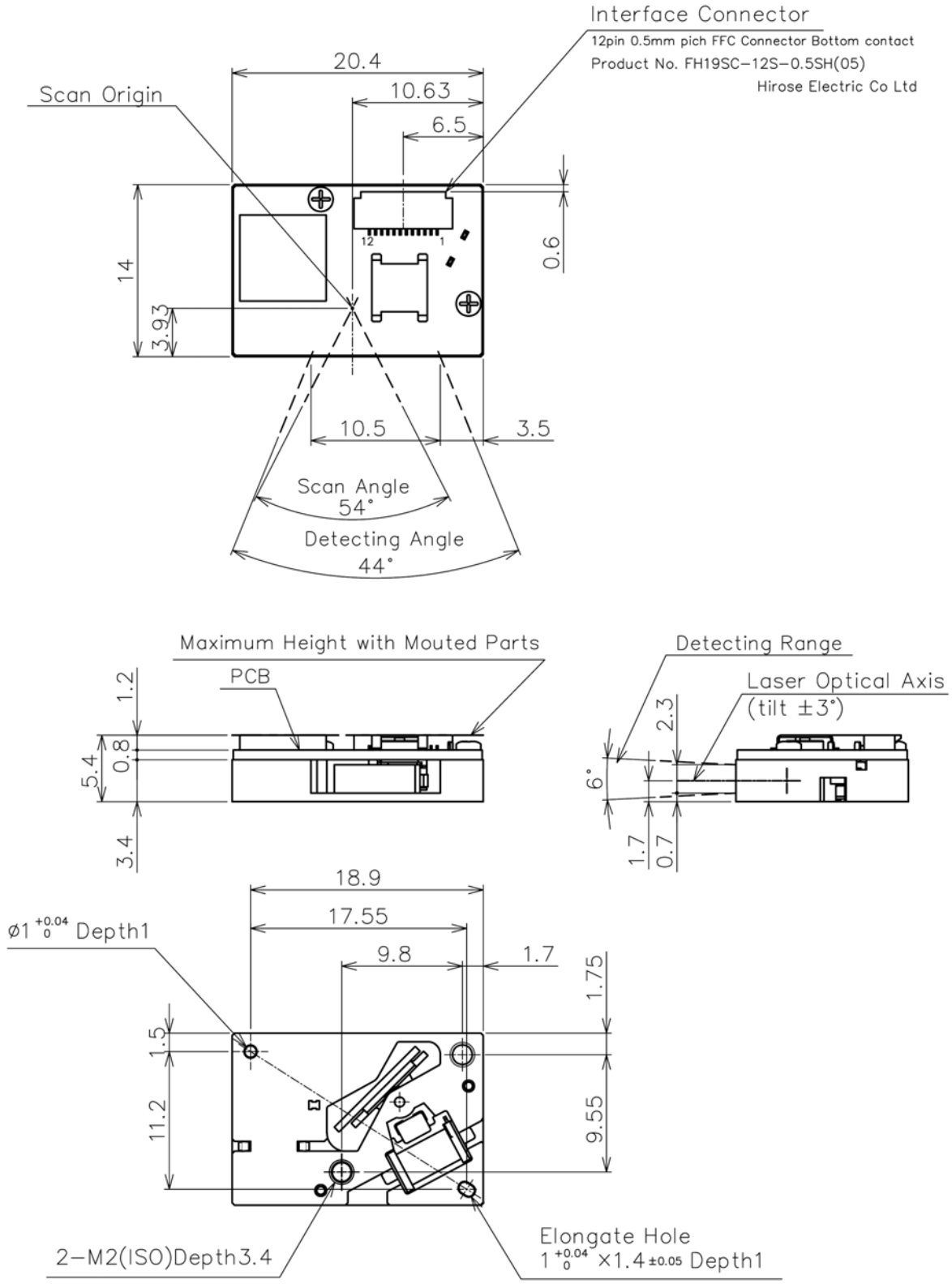

Fig. 6: MDL-4000 Outline Drawing

10. Recommended FPC / FFC Dimensions

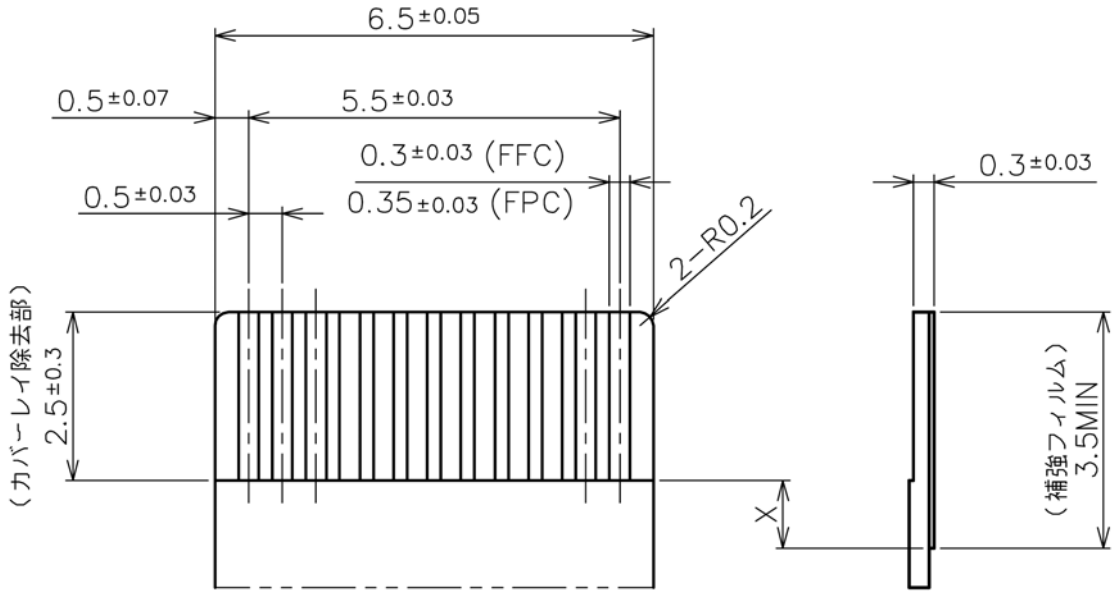

Fig. 7: Recommended FPC / FFC Dimensions

Note:
1. Use polyimide and thermoset adhesive for reinforcement film material.
2. Stiffener dimension should be 3.5 mm min., and X dimension should be 0.5 mm for improved flexibility of FPC.