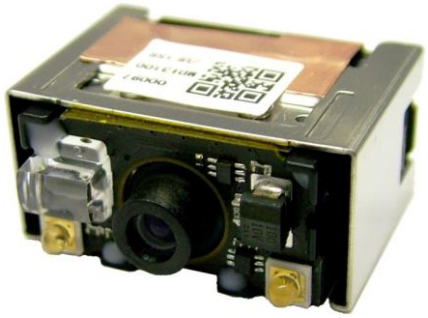
OPTICON

2D Scan Engine

MDI-3100



MDI-3100

This document provides instructions for installing the MDI-3100 imager scan engine.

Integration Guide

All information subject to change without notice.

Document History

Model Number:	**MDI-3100**	**Specification Number:**	**TS12030**
Edition:	**4th**	**Original Spec Number:**	**TS11039**
Date:	**2017-09-28**		

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

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Revision History

Specification No. : TS12030
Product name : MDI-3100

Edition	Date	Page	Section	Description of Changes
First	2012/07/17	-	-	Initial release
2nd	2012.10.23	8	3.1	H_R, H_L → V_T, V_B
		16	6	EMI Test results
3rd	2013.0124	15,16	5	Interface connector Correct :IRISO 9681-12 Wrong :HIROSE FH19C-12S
4th	2017.09.28	11	4.1	5N_cm or less→ 20cN·m or less

Table of contents

1. Abstract

This guide provides instructions for installing the MDI-3100-SR/HD (hereafter called “scan engine”). In order to maximize its performance and prevent troubles from happening, read this integration guide carefully and design your integration devices in accordance with it.

・Exit Window Material and Placement	: Layout design to prevent the LED illumination from reflecting off the exit window
・Exit Window Size	: Ensuring clearance for optical path of imaging and LED illumination
・Installation	: Detailed installation instructions

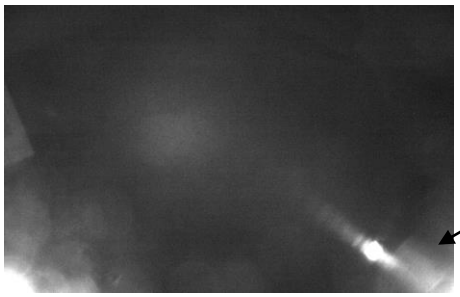
This integration guide is for the following models:

MDI-3100-SR	: Standard range model
MDI-3100-HD	: High density model

* The conditions described herein are ‘recommended’ conditions. Therefore, make sure to check the images with image-capturing tools or the like.

2. Exit Window Material and Placement

Reflection of the LED illumination from the exit window can occur depending on the window material and placement. This chapter describes the material and the distance and inclination limitations for the exit window.



The chapter contains:

2.1. Exit Window Material

The following items are recommended for selecting the exit window to prevent the reflection of the LED illumination from the exit window and the degradation of image contrast by scratches and dirt.

- For the best optical quality, use an acrylic material (cast or extruded) for the exit window.
- Select a high-quality achromatic acrylic material with a smooth, flat surface and no scratches or dents.
- It is recommended that the acrylic material is 1 mm thick and have an anti-reflective (AR) coating applied to both sides of the exit window.
- It is recommended to apply an anti-scratch coating to the surface of the exit window to protect it from scratches during operation.
- Hard coated acrylic sheets are readily available. Such a coating greatly enhances anti-scratch properties without degrading the optical characteristics of the acrylic material.
- To protect the exit window from dust, stains, and scratches during assembly, a protective sheet was attached. This should be removed before operation.
- After removing the protective sheet, use an ion-blower or other method to remove any dust that may have been attracted by static electricity.

Recommended acrylic material:

Nitto Jushi Kogyo Co., Ltd. : “Clarex Precision Thin Sheet”
MITSUBISHI RAYON CO., LTD. : “Shinkolite”

2.2. Exit Window Placement

The exit window must be positioned to accommodate the limitations of distance and inclination in order to prevent the LED illumination from reflecting off the window. Design the layout within the range specified in the following diagram and associated table.

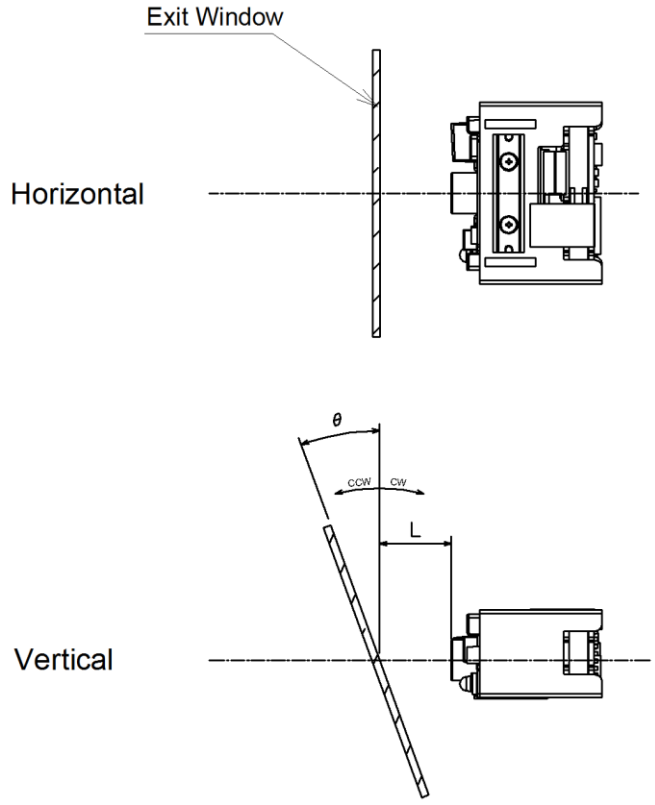


Figure 1: Exit Window Placement

The following shows the recommended mounting position of the window with 'both sides AR coated' and 'non AR coated'.

<Measurement conditions>
Window : 1 mm acrylic sheet
Conditions : Visually check reflections when taking images with the scan engine in a darkroom with no light source and no reflection object around.

[Both sides AR coated]l

L	[mm]	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	6.0	7.0	8.0	9.0	10.0
θ_{CW}	[deg]	0°	≧0°	≧0°	≧25° ≦5°	≧30°	-	-	-	-	-	-	-	-	-
θ_{CCW}	[deg]	0°	≧0°	≧0°	≧0°	≧5°	≧10°	≧10°	≧20°	≧20°	≧20°	≧20°	≧20°	≧20°	≧20°

[Non AR coated]

L	[mm]	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	6.0	7.0	8.0	9.0	10.0
θ_{CW}	[deg]	0°	0°	-	-	-	-	-	-	-	-	-	-	-	-
θ_{CCW}	[deg]	0°	≧0°	≧10°	≧15°	≧20°	≧20°	-	-	-	-	-	-	-	-

∗ L = 1 mm, θ = 0° (recommended)
∗ 1 mm or more clearance between the scan engine and the exit wind (recommended) due to the dimensional tolerance of mounting holes
∗ Use of AR coating (recommended). Under the above conditions the external light is not factored in.
∗ Confirm that there is no reflection of the LED illumination from the window by acquiring images from the scan engine.

3. Exit Window Size

Vignetting (brightness variations) in the LED illumination and the captured image can occur depending on the size and position of the exit window. Additionally, specular reflection can occur in scanned image depending on how the media is presented to the scanner. This chapter describes the distance and inclination limitations for the exit window to avoid those incidences.

The chapter contains:

3.1. Window Size and Optical Path Clearance

With respect to the optical path depicted below, provide an exit window with sufficient clearance.

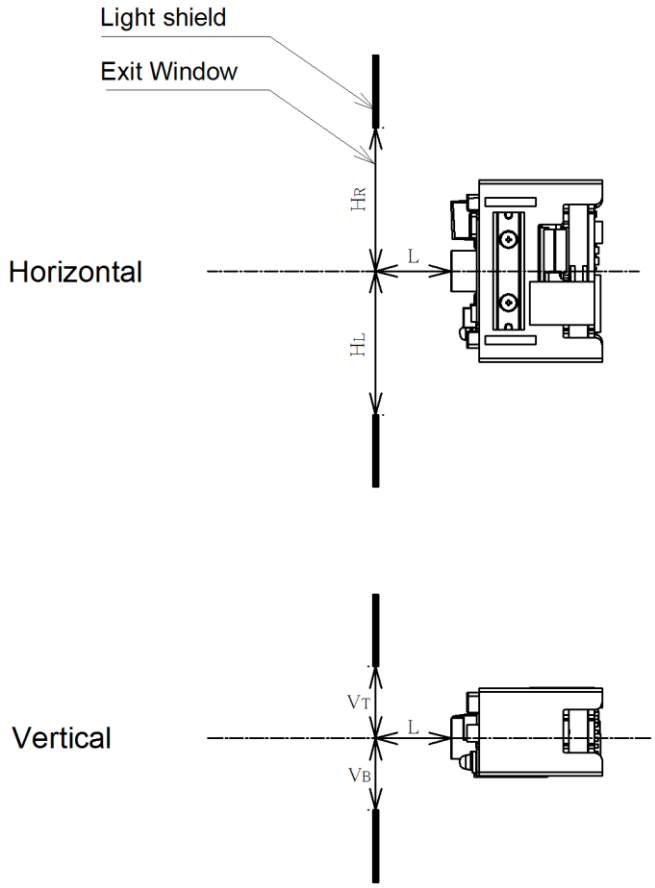


Figure 2: Window Size and Optical Path Clearance

The following tables show the conditions of the horizontal and vertical optical path clearance.

[Horizontal]

L	[mm]	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	6.0	7.0	8.0	9.0	10.0
H_R	[mm]	≧11.0	≧11.5	≧12.0	≧12.5	≧13.0	≧13.5	≧14.0	≧14.5	≧15.0	≧16.0	≧17.0	≧18.0	≧19.0	≧20.0
H_L	[mm]	≧11.0	≧11.5	≧12.0	≧12.5	≧13.0	≧13.5	≧14.0	≧14.5	≧15.0	≧16.0	≧17.0	≧18.0	≧19.0	≧20.0

[Vertical]

L	[mm]	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	6.0	7.0	8.0	9.0	10.0
V_T	[mm]	≧3.5	≧3.5	≧3.5	≧3.5	≧3.5	≧3.5	≧3.5	≧3.5	≧3.5	≧3.5	≧3.5	≧3.5	≧3.8	≧4.1
V_B	[mm]	≧5.4	≧5.4	≧5.4	≧5.4	≧5.4	≧5.4	≧5.4	≧5.4	≧5.5	≧5.8	≧6.1	≧6.4	≧6.7	≧7.0

* The vignetting is caused by insufficient exit window size and an illumination shape is decided depending on the window frame. Confirm them visually and by acquiring images from the scan engine in the design phase.

3.2. Optical Path

Install the window with sufficient clearance for the field of view, LED illumination and LED aiming. With respect to the optical path depicted below, provide an exit window with sufficient clearance.

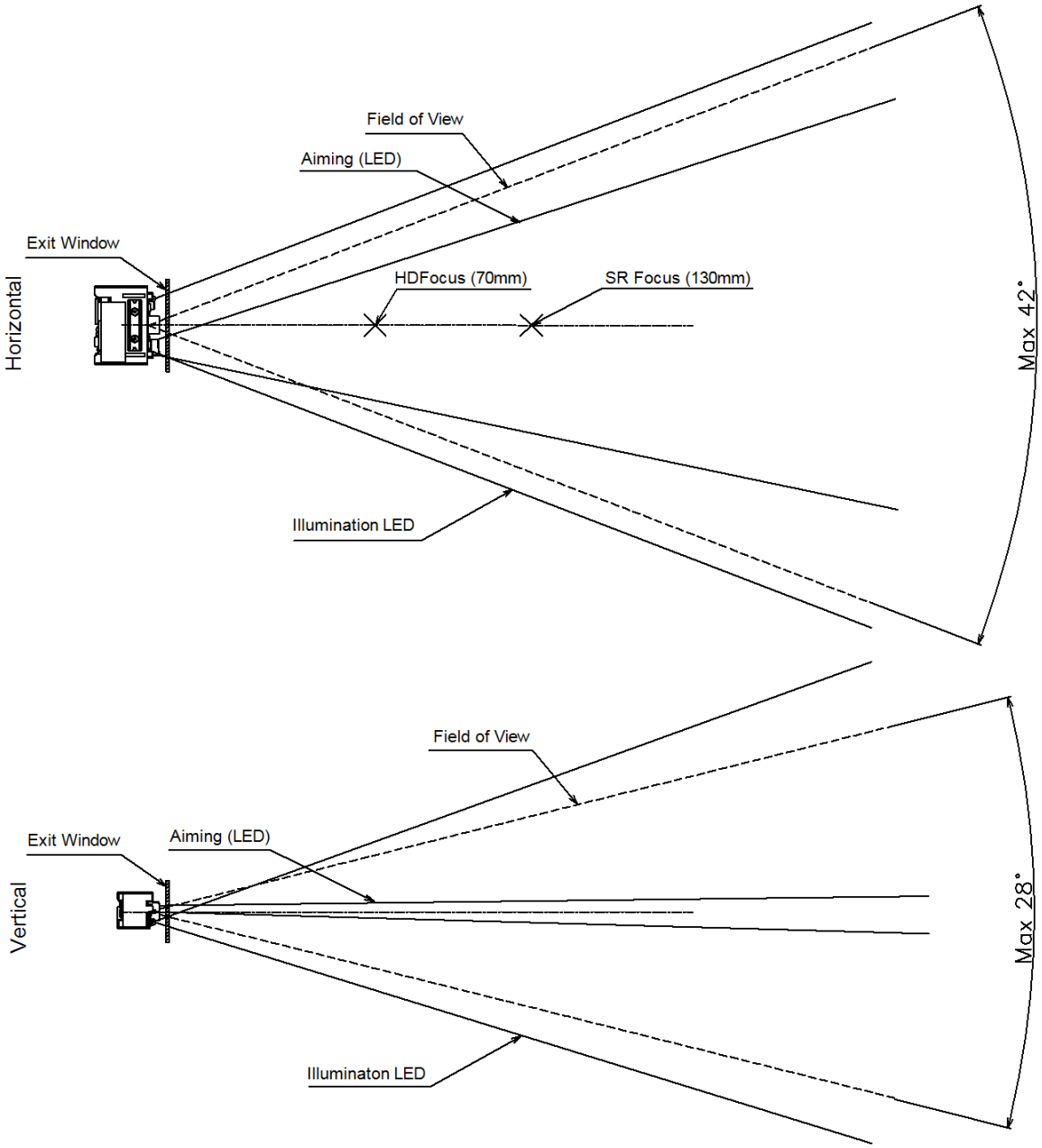


Figure 3: MDI-3100 Optical Path

* Refer to 3D drawings for details of the configuration of scan engine and the optical path.
* It is recommended to verify the details of optical path with an actual device.

3.3. Field of View

Install a frame with sufficient clearance for the field of view

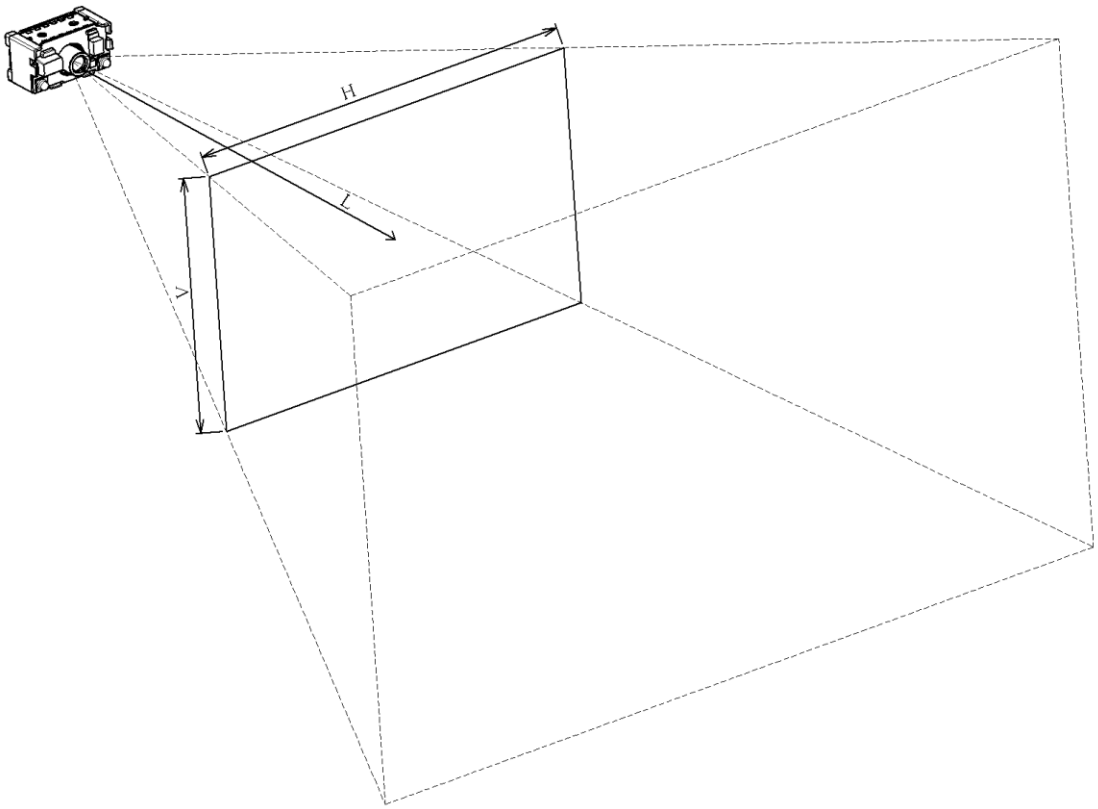


Figure 4: MDI-3100 Field of View

[Field of View]

L	[mm]	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	6.0	7.0	8.0	9.0	10.0
H_R	[mm]	10.5	18.5	25.5	34	41	48	55	63	70	78	86	93	101	108
H_L	[mm]	7.5	12	16	21	26	31	35.5	40	45.5	50	55	59.5	65	69.5

* L :Distance from front edge of the scan engine , H :Horizontal FOV , V :Vertical FOV
* The table above shows the field of depth. Therefore, install the frame and place the scanned object with sufficient clearances.

3.4. Scanned Media and Placement

When an object is being scanned, there are conditions where specular reflection of the LED illumination and intense ambient light can occur easily.

Glossy label:
Specular reflection of the LED illumination from the scan engine can occur under certain conditions.

Solution:
Specular reflection does not occur when an angle is created between the scan engine and the target label as shown in the figure below. The conditions for the occurrence of specular reflection depend on the distance L and the inclination angle θ. The recommended inclination angle is about 15 degrees. Note that when the angle becomes bigger, it will be difficult to read the target label.

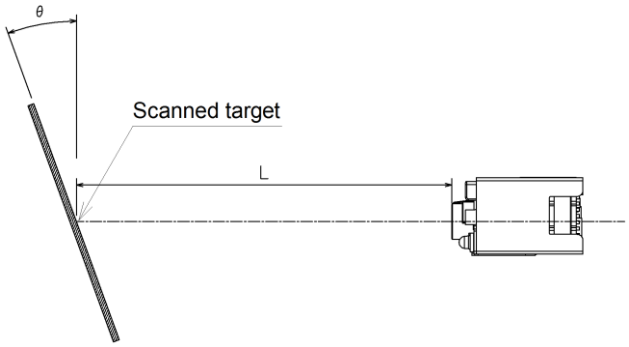


Figure 5: Inclination of Scanned Target

Code displayed on LCD:
Specular reflection of intense ambient light (fluorescent light, window light etc.) occurs on the LCD glass surface.

Solution:
It is recommended to have a structure for blocking the intense ambient light around the scanning position.

4. Installation

This chapter describes the major focus points to consider when incorporating the scan engine into your device.

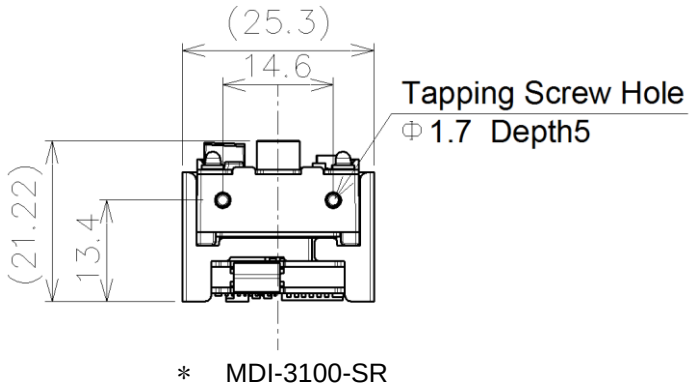
The chapter contains:

4.1. Installation Conditions

The installation conditions of the scan engine are as shown below.

- When installing a camera module, use the crew holes on the bottom surface.
- Do not screw down further than the specified depth.
- When installing a camera module, only the bottom surface of the camera module should be attached to a chassis for installation.
- Keep enough clearance to avoid damage to the camera module in case the host device is dropped and damaged.
- Shock / impact resistance of the camera module to the acceleration applied via the bottom surface is guaranteed. In case of direct shock, the camera module will almost certainly be damaged since it consists of precise optical elements.

<MDI-3100 Installation Conditions>
Recommended screw : D2 B tight
Tightening torque : 20cN·m or less
Valid screw depth : Within 4.5 mm from the mounting surface of the scan engine



＊ MDI-3100-SR

Figure 6: Mounting Holes

4.2. Cable and Connector

The following shows the cable and the connector to connect the scan engine and the host.

Recommended connector : IRISO 9681-12 (12pin)
Recommended cable length : 50 mm (max)

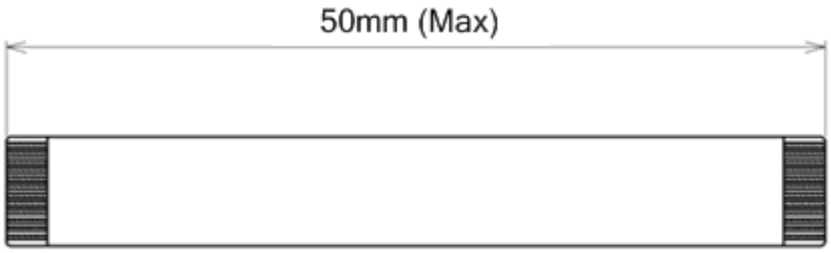
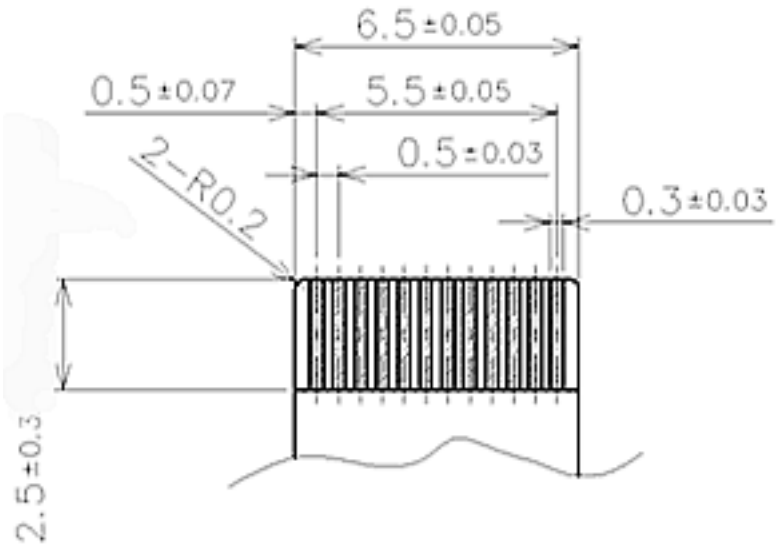


Figure 7: FFC



FFC specified thickness: 0.3±0.03

Figure 8: FFC Terminal

* When using the FPC, it is recommended to use “polyimide and thermoset adhesive” as material for the reinforcing film.
* When using the FPC, make sure the thickness and the dimensional tolerance of the FPC.

4.3. Handling Requirements

The recommended handling conditions for incorporating the scan engine into your device are as shown below.

- Use anti-static measures such as a grounding strap before handling the scan engine in order to avoid damage to the electronic components from electrostatic discharge.
- Hold the scan engine only by the case. Do not touch the circuit board or the front side of the scan engine when handling it.
- Do not touch the electronic components or the terminals on the circuit board.
- Installation in a clean environment is recommended in order to protect the imaging lens from dust.
- Operators should wear gloves to avoid contaminating the optical elements.
- Do not drop the MDI-3100.

5. Mechanical Drawings

5.1. MDI-3100-SR (Standard Range Focus)

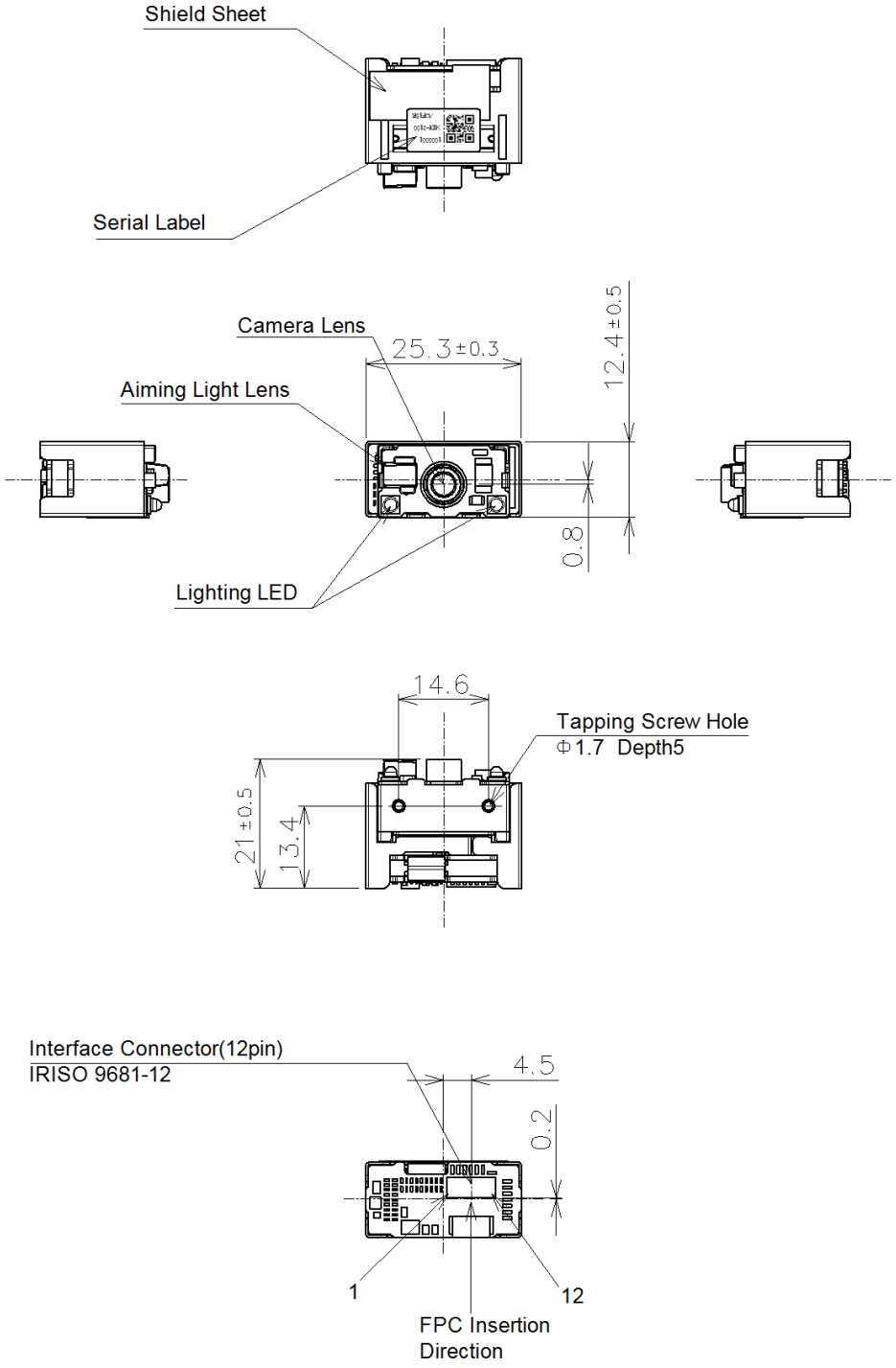


Figure 9: MDI-3100-SR

∗ The depth of the HD model is 0.2 mm deeper in size than that of the SR model.

5.2. MDI-3100-HD (High Density Focus)

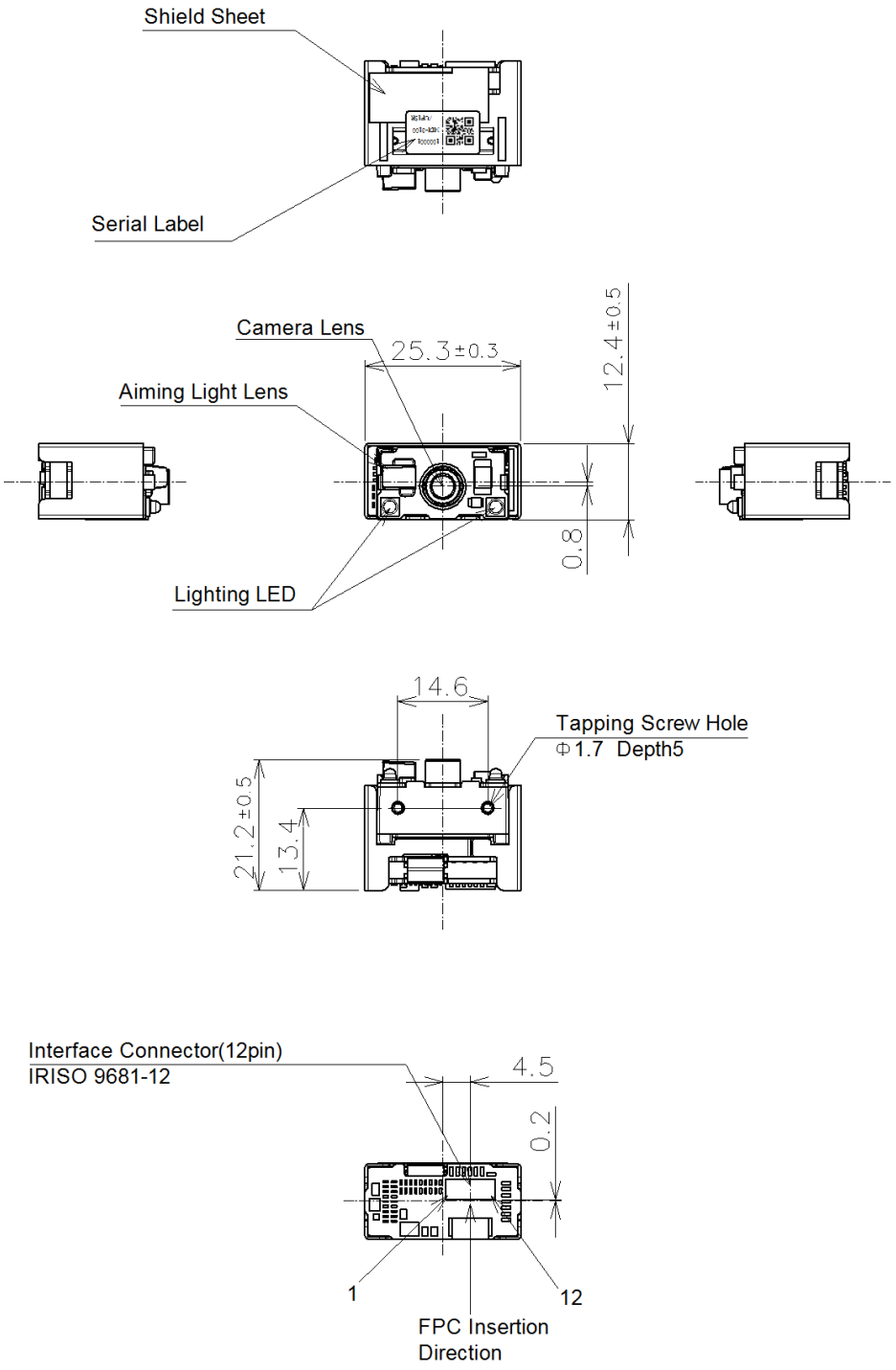


Figure 10: MDI-3100-HD

∗ The depth of the HD model is 0.2 mm deeper in size than that of the SR model.

6. EMI Test

The EMI test results of the MDI-3100 operating on our evaluation kit (MEK-3000) are below.

6.1. Operating Frequencies

The MDI-3000 operates at the following frequencies.

Item	Frequency
Image sensor clock	24.768 MHZ
CPU main clock	396 MHz
Crystal clock	18.432 MHz
Memory clock	132 MHz
Switching power supplies clock	1.3 MHz, 2.4 MHz, 3 MHz

6.2. Test Conditions

The conditions of the EMI test are below.

<MDI-3100 EMI test Conditions>
Module : MDI-3100
Operating board : MEK-3000
FFC length : 53mm
Interface : RS-232C
Cable : D-Sub 9pin
Cable length : 2.1m
Clamp filter : TKK P/N SFT-36SN
Power supply : DC6V, 2A (AC-Adapter)
Host : Notebook
Operating : Continuous reading

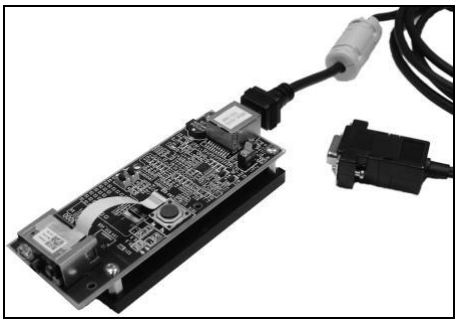
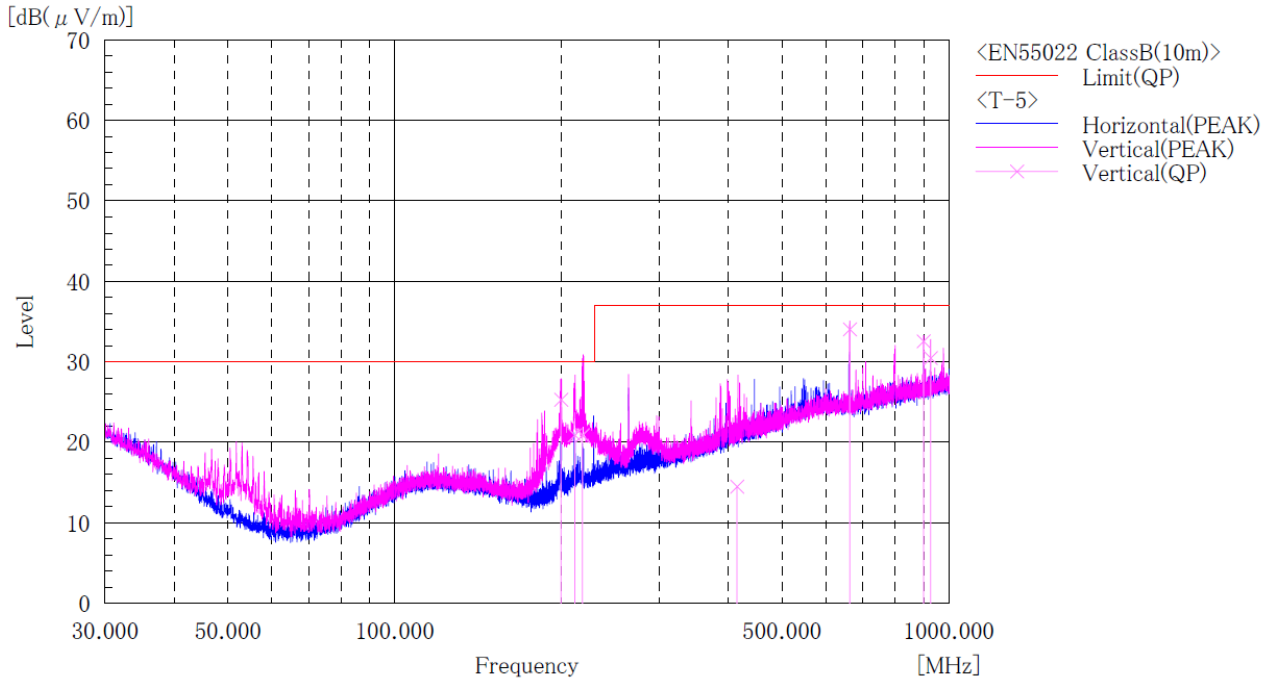


Figure 11: MEK-3000 Evaluation Kit

[Consideration]

- When designing the circuitry of the actual machine, carry out EMI measures of each signal line.
- The length of the FFC cable to connect the scan engine and the host should be short.

6.3. Test Result [30MHz to 1GHz]

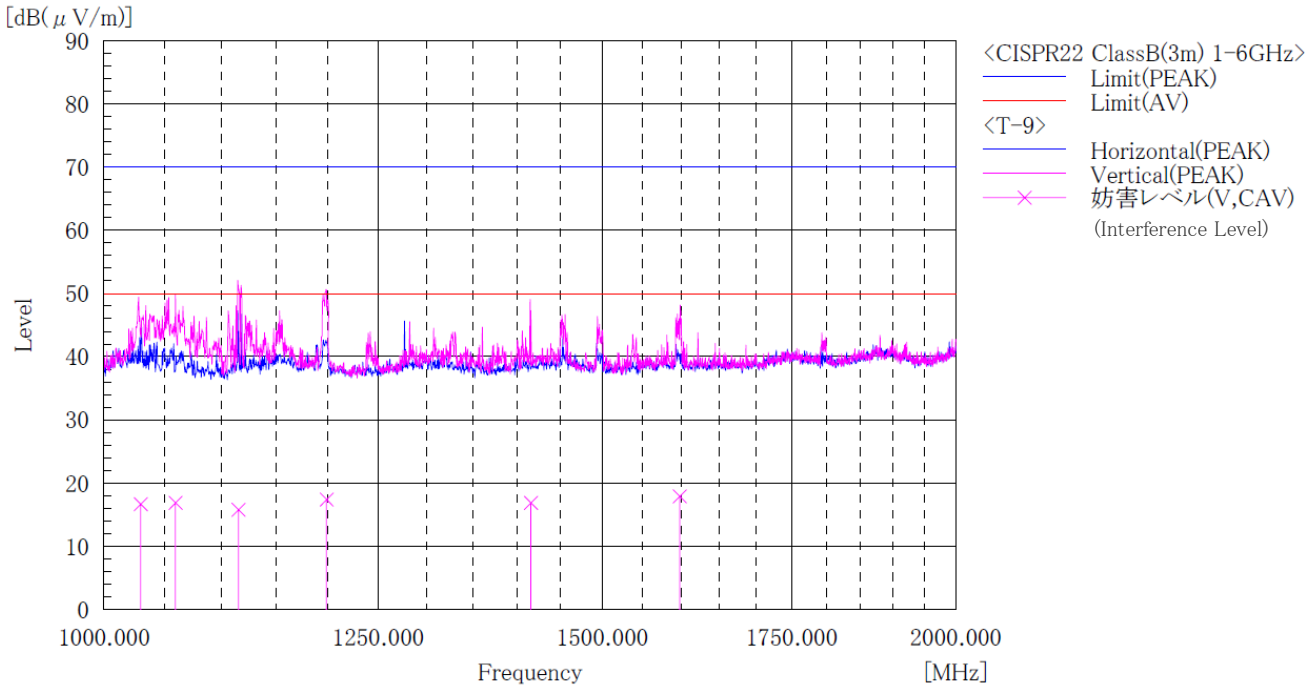


Final Result

--- Vertical Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μV)]	c.f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	199.827	38.6	-13.3	25.3	30.0	4.7	100.0	334.0
2	211.291	33.6	-12.7	20.9	30.0	9.1	128.0	334.0
3	218.346	33.0	-12.1	20.9	30.0	9.1	127.0	309.0
4	414.552	19.6	-5.1	14.5	37.0	22.5	244.0	245.0
5	662.490	36.0	-1.9	34.1	37.0	2.9	164.0	26.0
6	900.000	33.1	-0.5	32.6	37.0	4.4	185.0	246.0
7	927.735	30.8	-0.3	30.5	37.0	6.5	100.0	175.0

6.4. Test Result [1GHz to 2GHz]



Final Result

--- Vertical Polarization (CAV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c.f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	1030.246	24.5	-7.8	16.7	50.0	33.3	100.0	25.0
2	1059.806	24.4	-7.5	16.9	50.0	33.1	100.0	345.0
3	1115.730	22.7	-6.9	15.8	50.0	34.2	100.0	300.0
4	1198.710	23.9	-6.5	17.4	50.0	32.6	100.0	181.0
5	1415.230	22.7	-5.8	16.9	50.0	33.1	100.0	12.0
6	1597.670	23.2	-5.3	17.9	50.0	32.1	100.0	333.0