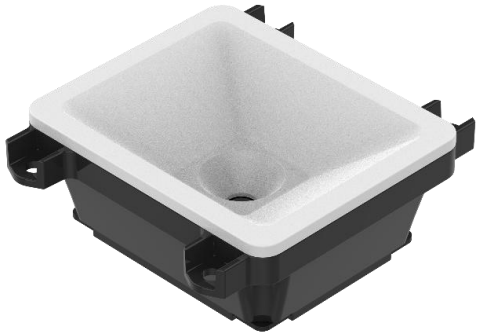
# Q-250

## Wide angle 2D Imager



## Q-250 – Integration Guide – Rev 1.0

The information in this document is subject to change without notice.

## Document History

| | | |
|---|---|---|
| Model Number: | Q-250 | Specification Number: |
| Edition: | Integration Guide | Original Spec Number: |
| Date: | 4-October-2024 | |

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## Limited Warranty and Disclaimers

Please read this manual carefully before installing or using the product.

## Serial Number

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## Revision History

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| Edition | Date | Page | Section | Description of Changes |
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| 1st | 2024/10/05 | - | - | Initial release |
| | | | | |
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| | | | | |

# Contents

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# 1 Introduction

This guide provides instructions for installing the Q-250 (hereafter called “scan engine”) and is intended for engineers who are responsible for integrating the scan engine into their product. In order to maximize the performance and to minimize problems, read this integration guide carefully and integrate the scan engine in accordance with it. The instructions described in this guide are recommendations. Following them will help to ensure that the scan engine can properly capture images, but it is still advised to check some actual images that the scan engine makes with image capturing tools. These tools are available from the Opticon website.

The Opticon Q-250 OEM scan engine (referred to as "Q-250" or "engine") is designed with a CMOS image sensor. It provides fast, accurate barcode scanning for a wide range of surfaces including paper, mobile phone screens, and LCD displays. The Q-250 can be integrated into various devices, such as handheld scanners or kiosks. It also offers a full interface for image acquisition, raw data transfer, and I/O communication, enabling developers to create custom applications using Opticon’s SDK.

**Key Features:**

- **CMOS Image Sensor**
- **Custom wide angle lens**
- **8 Illumination LEDs** for enhanced lighting
- **2 Good Read LEDs** for status indication
- **Buzzer** for feedback signals
- **12-pin multi interface**, this can be used for **RS-232** and **USB communication**

This integration guide is for the following models:
Q-250

# 2 Exit Window Material and Placement

Reflection from the LED light off the exit window can cause large overexposed areas in the images captured by the scan engine, and should be avoided at all times. This chapter gives recommendations for the material of the exit window that helps to prevent this (Section 2.1). It also describes the best position of the exit window (Section 2.2).

## 2.1 Exit Window Material

Below is a list of recommendations for constructing the exit window. These recommendations help to prevent reflection from the LED illumination off the exit window and help to prevent degradation of the image by scratches and dirt.

- For the best optical quality, use an acrylic material (cast or extruded) or glass window with AR coating.
- Select a high-quality achromatic acrylic material or a scratch resistant glass with a smooth, flat surface without scratches and dents.
- Use 1mm thick material that has (AR) coating applied to both sides.
- 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, most manufacturers cover the raw material with a protective sheet that stays attached during the entire production process of the exit window. This protective sheet should be removed in the final stage of the production process, before operation.
- After removing the protective sheet, use an ion blower 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 CHEMICAL CO., LTD. | Shinkolite |

## 2.2 Exit Window Placement

Reflection from the LED light off the exit window can cause large overexposed areas in the images captured by the scan engine. Therefore, it is important to position the exit window in such a way that the reflection is minimal and not directed into the camera. Make sure that the distance of the exit window is within the range specified in the following diagram and associated table. If the window is not inclined we advise to have the window as close as possible to the scan engine.

**Installing exit window**

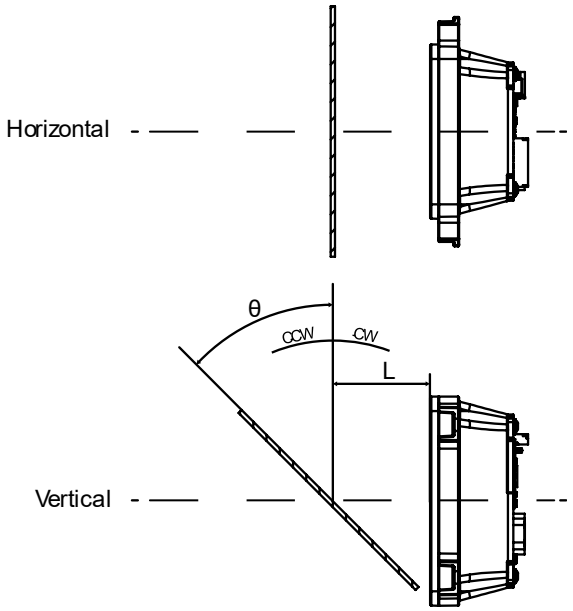



Figure **1**: Exit Window Placement of the Q-250

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

**Conditions**

| | |
|---|---|
| Window | 1 mm acrylic sheet or glass plate |
| Conditions | Visually check reflections by taking images with the scan engine in a darkroom with no light source and no reflecting objects. |

| L | [mm] | 0.0 | 10.0 | 20.0 | 30.0 | 40.0 | 50.0 |
|---|---|---|---|---|---|---|---|
| $\theta_{CW}$ | [deg] | 0° | 0° | 0° | ≧40° | ≧40° | ≧40° |
| $\theta_{CCW}$ | [deg] | 0° | 0° | 0° | ≧40° | ≧40° | ≧40° |

Recommended values: L = mm, $\theta_{CW}$ = 0° and both sides AR coated.

- Use of AR coated material for the exit window is recommended.
- External light is not factored in.
- Confirm that there is no reflection of the LED illumination off the exit window by acquiring images from the scan engine.

# 3 Exit Window Size

Vignetting (radial brightness or saturation fall-off) in the LED illumination and the captured image can occur depending on the size and position of the exit window. Additionally, specular (mirror like) reflection can occur in the target barcode depending on how it is presented to the scanner. This chapter describes the distance and inclination limitations for the exit window to avoid these problems.

## 3.1 Window Size and Optical Path Clearance

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

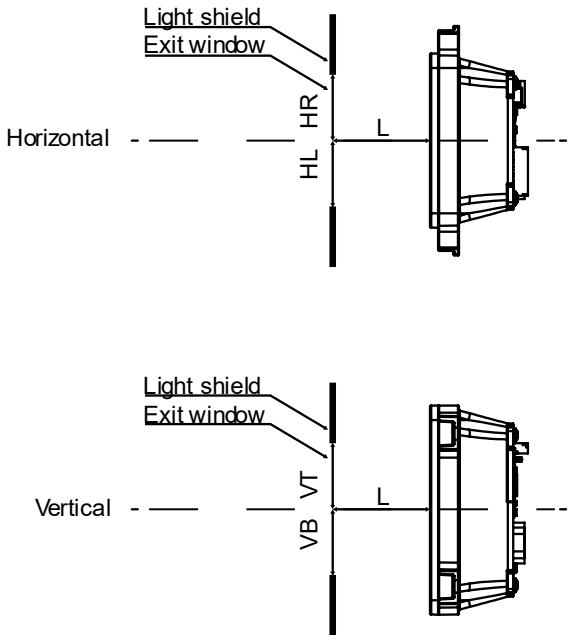



Figure **2**: Window Size and Optical path Clearance

The following tables show the requirements for the horizontal and vertical optical path clearance. The light-shielding part should not reflect light (e.g. coated matte black).

Horizontal

| L | [mm] | 0.0 | 10.0 | 20.0 |
|---|---|---|---|---|
| $H_R$ | [mm] | ≧17.2 | ≧26.2 | ≧35.2 |
| $H_L$ | [mm] | ≧17.2 | ≧26.2 | ≧35.2 |

Vertical

| L | [mm] | 0.0 | 10.0 | 20.0 |
|---|---|---|---|---|
| Vt | [mm] | ≧12.8 | ≧19.6 | ≧26.4 |
| Vb | [mm] | ≧12.8 | ≧19.6 | ≧26.4 |

- Vignetting is caused by insufficient exit window size. It manifests as darker edges in the image. Confirm this visually by acquiring images from the scan engine in the design phase.

## 3.2 Field of View

Install a frame with sufficient clearance for the field of view.

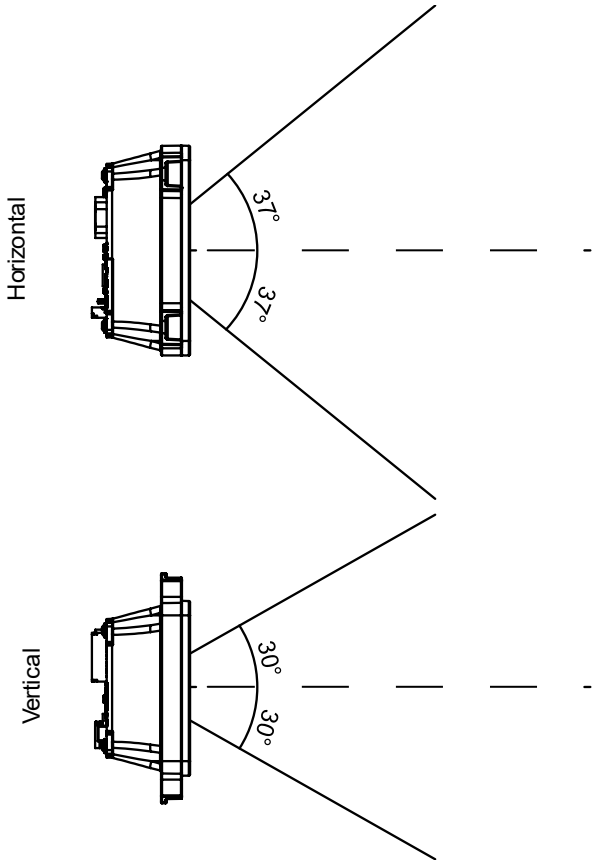



Figure **3**: Q-250 Field of View

L Distance from front edge of the scan engine
H Horizontal FOV
V Vertical FOV

Field of View

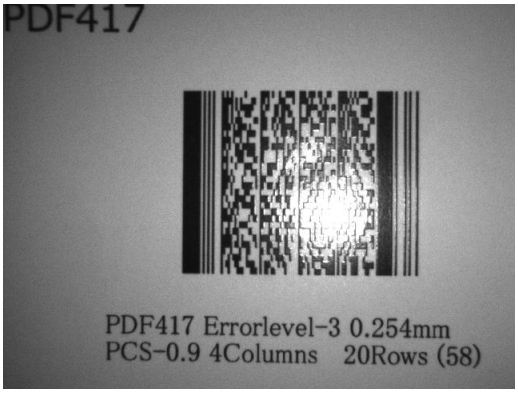
| L | [mm] | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| H | [mm] | 43.8 | 58.8 | 73.9 | 89.0 | 104.1 | 119.1 | 134.2 | 149.3 | 164.3 |
| V | [mm] | 33.5 | 45.1 | 56.6 | 68.2 | 79.7 | 91.3 | 102.8 | 114.4 | 125.9 |

- The table above shows the field of view which should not be obstructed by any parts of a housing.

## 3.3 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.

**Problem: Glossy label**
Specular reflection of the LED illumination from the scan engine can occur when the target label is on a highly reflective surface.




**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 as the angle becomes bigger, it becomes more difficult to read the target label.

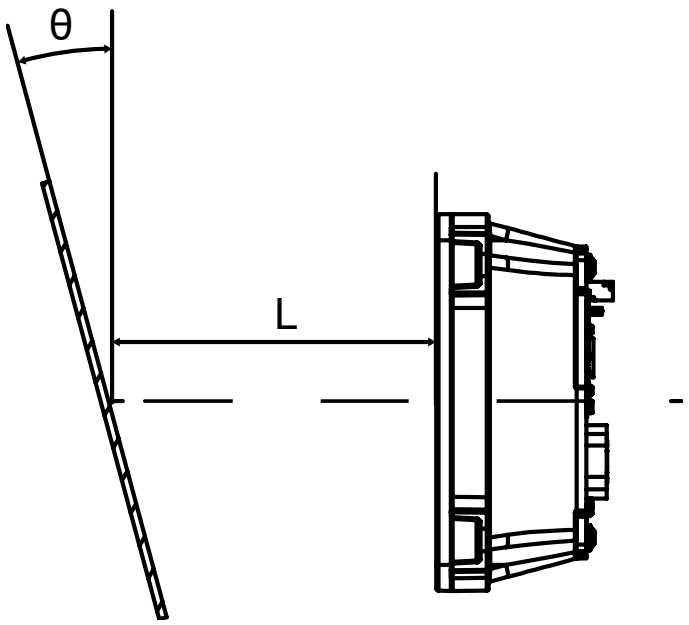



Figure **4**: Inclination of Scanned Target

# 4 Installation

This chapter describes practical guidelines for the mechanical installation.

## 4.1 Installation recommendations for the Q-250

- ESD Protection: The Q-250 includes basic ESD protection. For environments with high ESD risk, additional protective measures (such as TVS diodes) are recommended during integration. Always handle the engine with proper ESD precautions.
- Dust and Dirt: Ensure that the engine is properly enclosed to prevent dust accumulation on the lens or circuit board, which can degrade performance over time.
- Ambient Environment:
  - Operating Temperature: -20°C to 70°C
  - Storage Temperature: -40°C to 75°C
  - Humidity: 5% - 95% (non-condensing)

**Thermal Considerations**

Continuous operation of the Q-250 can cause components such as the CPU and LEDs to generate heat. Ensure there is proper airflow around the engine to prevent overheating. Prolonged LED usage should also be minimized to reduce heat buildup.

**External Optical Elements**

Avoid applying pressure to external optical components, such as the lens. Mount the engine securely without forcing or over-stressing these components.

### 4.1.1 Q-250 dimensions for mounting

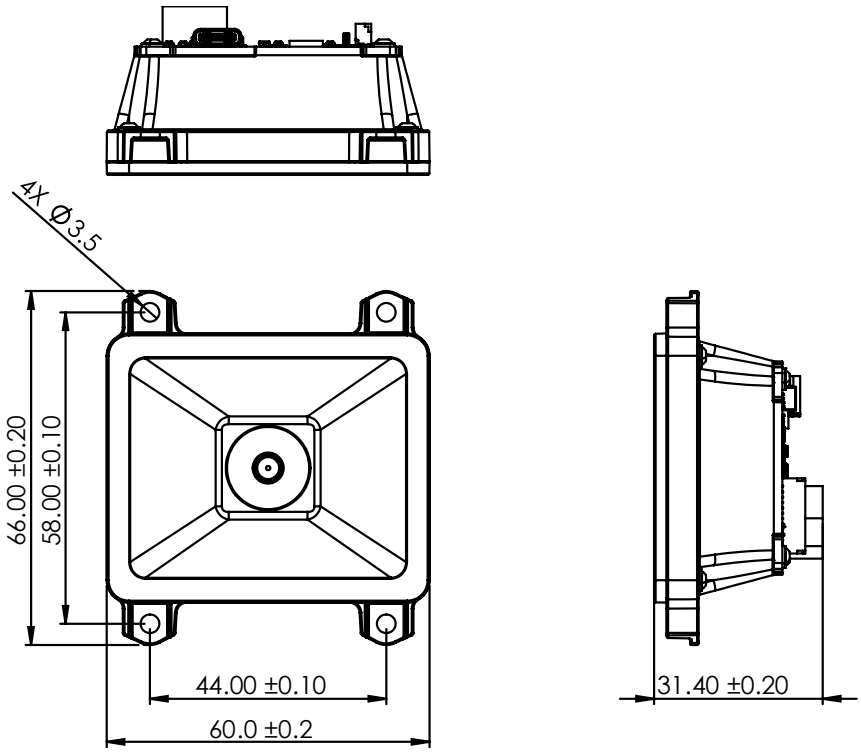



Figure **5**: Q-250 Mounting Holes

## 4.2 Interfaces

The Q-250 provides a 12-pin multi interface connecter and a USB-C connector. The Q-250 recognizes automatically which port is being used.

### 4.2.1 Interface Pinout Multi-interface

The Q-250 has a 12-pin multi interface, this can be used for RS-232 and USB communication.
The connector is a wire-to-board header of the type BM12B-SRSS-TBT made by JST. Compatible cables may be manufactured using receptacles such as JST SHR-12V-S-B or 12SR-3S.

12-pin JST BM12B-SRSS-TBT connector

| Pin No. P1 | Signal name | Signal description |
|---|---|---|
| 1 | Aim/Wake | Pull this pin to ground to enable the aiming function or to wake the scanner from sleep. The pin has an internal pull-up resistor. |
| 2 | VCC | Positive power, 5V External trigger, active on high to low edge. Idle high or high Z |
| 3 | GND | Ground |
| 4 | USB- | USB data |
| 5 | TXD | RS232 level TxD output |
| 6 | USB+ | USB data |
| 7 | RXD | RS232 level RxD input |
| 8 | RTS/PWDN | RS232 level RTS output (Signals deep sleep mode with a logic low) |
| 9 | BUZZER | Buzzer signal output (3.3V logic level, idle = 0) |
| 10 | GR_LED | Good Read LED output (3.3V logic level, idle=0) |
| 11 | CTS/Wake | RS232 level CTS input (Will wake the scanner from deep sleep mode with a logic low) |
| 12 | TRIGn | Trigger input. Pull this pin to ground to activate the scanner. The pin has an internal pull-up resistor. |

Table **6**: Q-250 Pinout multi interface

### 4.2.2 Interface Pinout USB

The USB-C socket supports USB 2.0 connections. Its pinout is as defined by the USB standard.

USB-C connector

| Pin No. | | Pin No. USB-A | Signal name |
|---|---|---|---|
| A4, A9, B4, B9 | | 1 | VCC |
| A7, B7 | | 2 | - Data |
| A6, B6 | | 3 | + Data |
| A1, A12, B1, B12 | | 4 | GND |
| A5 | | | 5.1kΩ pull down resistor |
| B5 | | | 5.1kΩ pull down resistor |
| A8,B8 | | | Not connected |

Table **7**: Q-250 Pinout USB

## 4.3 Handling Requirements

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

- Use anti-static measures such as wearing a grounded hand 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.
- 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 Q-250.