LIVOX HORIZON High Performance/Compatibility LiDAR Sensor User Guide

Contents

Livox Horizon

LIVOX HORIZON High Performance/Compatibility LiDAR Sensor

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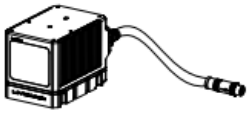
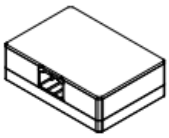
Warnings

1. Be careful when using Livox Horizon in conditions with low visibility such as foggy or stormy weather. In such conditions, the detection range may be reduced.
2. When mounting the Livox Horizon, make sure there is enough space for ventilation for the air inlet and air outlet (at least 10 millimeters from the nearest objects). It is normal for the temperature of the Livox Horizon to increase during use. If the air inlet or air outlet is blocked, however, the temperature increase will be more significant, which may negatively affect the performance and may lead to permanent damage.
3. DO NOT touch the optical window of the Livox Horizon. Dust and stains on the optical window can negatively affect the performance. Use compressed air, isopropyl alcohol, or a lens cloth to clean the optical window correctly. Refer to the Livox Horizon User Manual for more information on how to clean optical windows.
4. When customizing Livox Horizon power cables, make sure the current-carrying capacity of the cable can support the power requirement of the Livox Horizon. Otherwise, the product may become a fire hazard or be damaged permanently.
5. In order to avoid electric shocks or radiation exposure, DO NOT disassemble the Livox Horizon. If an accessory or product part needs to be replaced, contact Livox for support.
6. Located at the bottom of the Livox Horizon is the self-dissipation module. Users are allowed to detach the self-dissipation module. However, make sure to prepare an alternative dissipation system so that the Livox Horizon can work properly without the self-dissipation module. Otherwise, the highest working temperature of Livox Horizon may be decreased when the self-dissipation module is detached. The self-dissipation module is not designed to be mounted and detached several times. Only remove the self-dissipation module if necessary.
7. The Livox Horizon is classified as a Class 1 Laser Product (IEC/EN 60825-1: 2014) and is safe under all normal conditions of use.
8. Liquid damage is not covered under warranty.
9. DO NOT drop the Livox Horizon.
10. The Livox Horizon Quick Start Guide contains important information. Make sure to read before first use and keep for reference.

In the Box

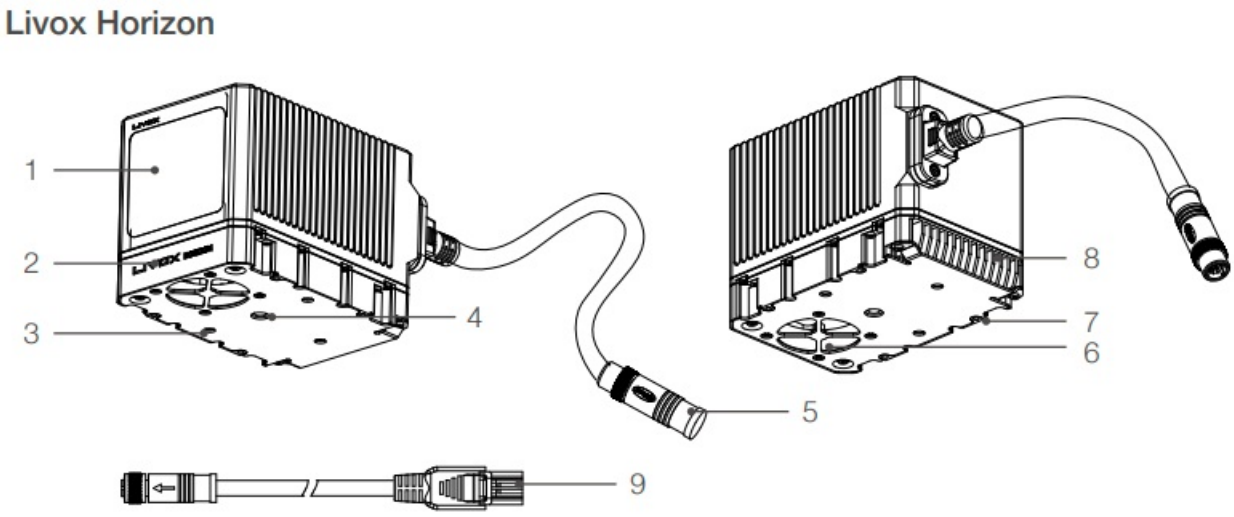
Livox Horizon × 1	Livox Converter 2.0 × 1	Conversion Cable × 1	L-shape Hex Screwdriver × 1	Rubber Seal × 1
				
Screws Package* × 2	Power Cable × 2	Sync Cable × 2	Optical Window Cleaning Cloth × 1	

* Includes a bag of M2 screws and a bag of M3 screws.

Introduction

The Livox Horizon is a high-performance, high-compatibility LiDAR sensor that can be used for multiple applications including autonomous driving, robotic navigation, dynamic path planning, and high-precision mapping. The Livox Horizon features a wider field of view (FOV), DL-Pack (multi-laser and multi-APD) technology, and an advanced opto-electronic system design. This ensures the Livox Horizon can not only deliver point cloud coverage approximately three times more dense than the LIVOX MID™-40, but also scans horizontally from nearly top to bottom to capture more data in the FOV. Users can check the real-time point cloud using Livox Viewer, and a software development kit (SDK) is provided to help develop customizable applications using the data acquired from the point cloud.
The Livox Horizon has a detection range of up to 260 meters.*

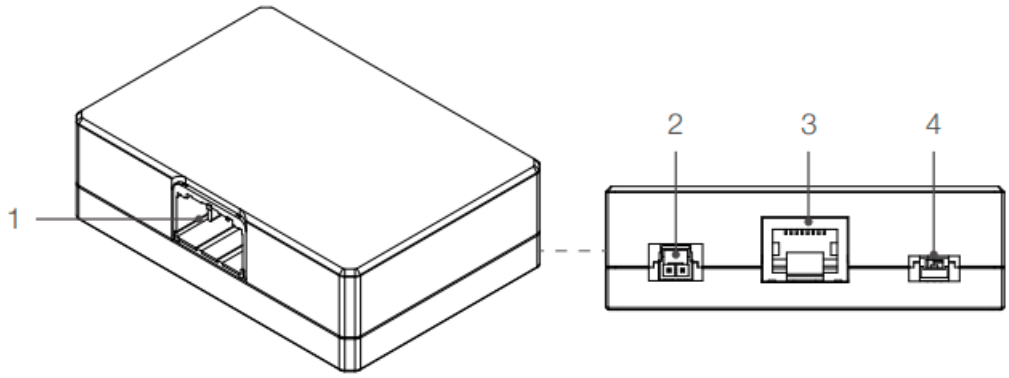
* This distance can be reached when the target object reflects 80% or more of incident light (e.g., grey concrete walls and roads have a reflectivity range from 15% to 30%, while white plaster walls have a reflectivity range from 90% to 99%) in an environment with a temperature of 25° C (77° F).



1. Optical Window
2. Self-Dissipation Module
3. Self-Dissipation Module Screws (M2) × 7
4. ¼ inch Mounting Hole
5. LiDAR Connector
6. Fan (Air Inlet)
7. M3 Mounting Holes × 4

8. Air Outlet
9. Conversion Cable

Livox Converter 2.0

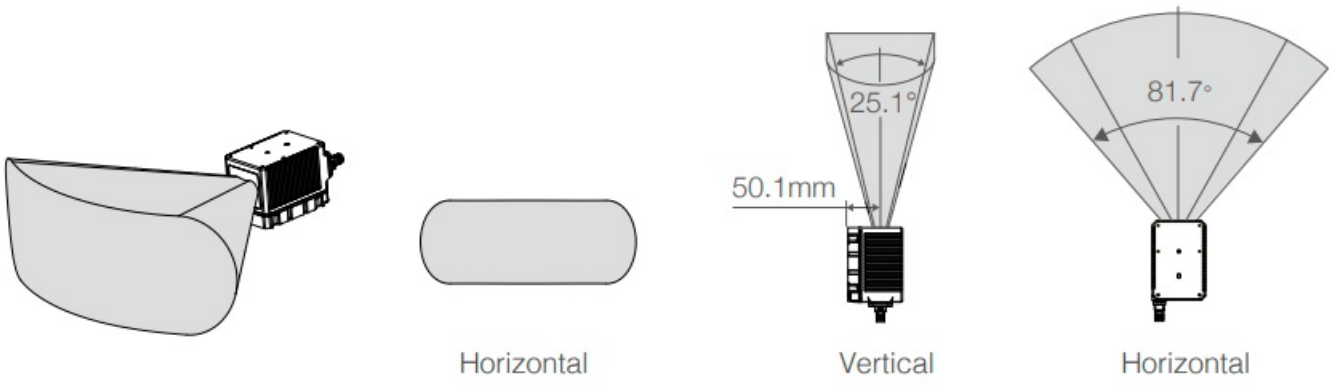


1. LiDAR Connector Port
2. Power Port
3. Ethernet Port
4. Sync Port

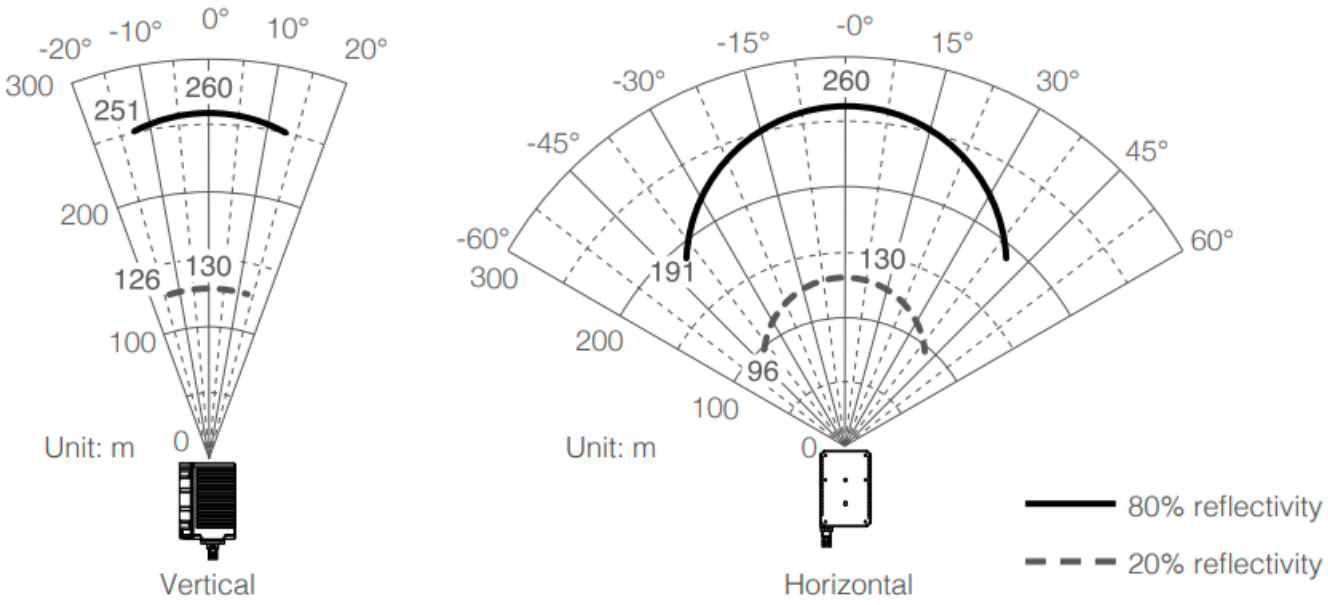
Installation and Connection

FOV Range

Livox Horizon has a FOV of 81.7° (horizontal) × 25.1° (vertical) as shown below. When mounting the sensor, make sure that the FOV is not blocked by any objects.



Note that the effective detecting distance of the Livox Horizon varies based on where the object is within the FOV. The closer to the edge of the FOV, the shorter the effective detecting distance is. The closer to the center of the FOV, the further the effective detecting distance. Refer to the diagrams below:

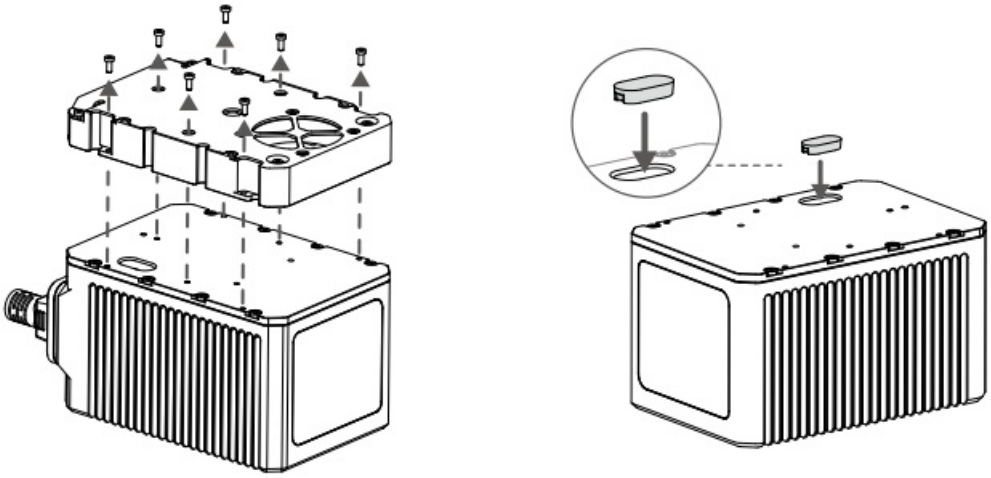


Always pay attention to the effective detecting range when in use.

Mounting the Livox Horizon

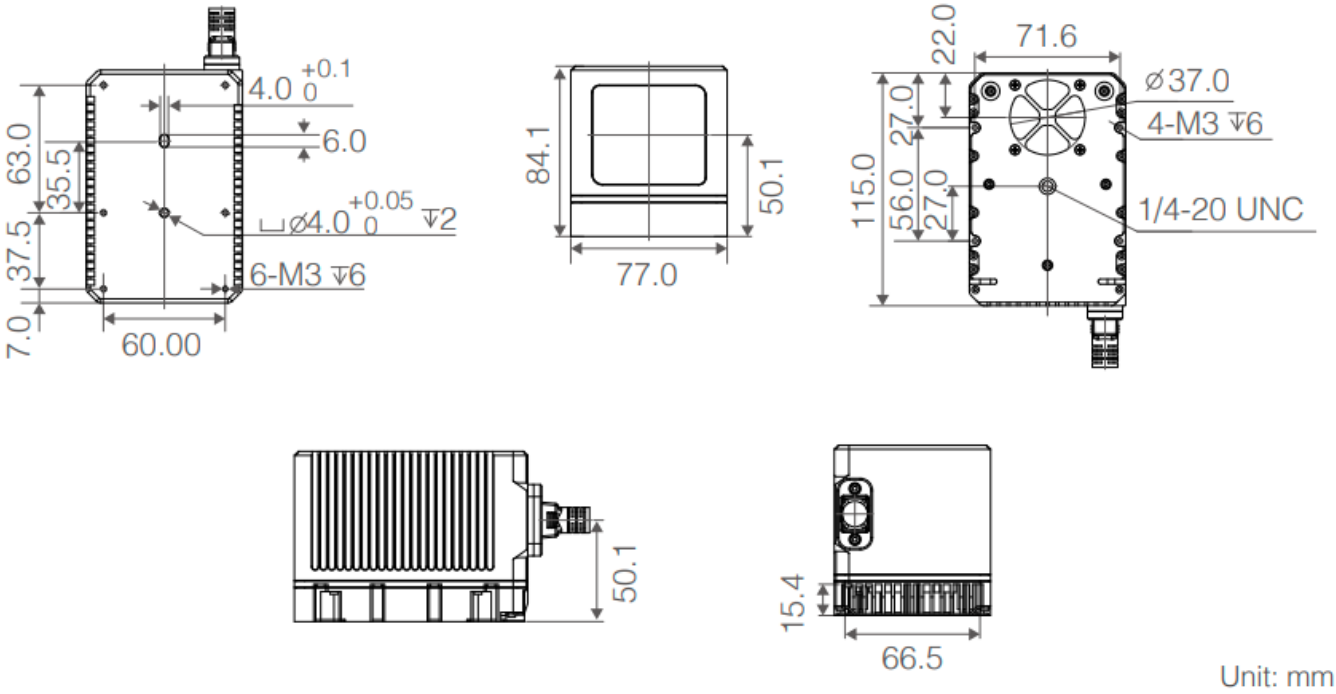
Located at the bottom of the Livox Horizon is the self-dissipation module. Users are allowed to detach the self-dissipation module. However, make sure to prepare an alternative dissipation system so that the Livox Horizon can work properly without the self-dissipation module. Otherwise, the highest working temperature of Livox Horizon may be decreased when the self-dissipation module is detached. The self-dissipation module is not designed to be mounted and detached several times. Only remove the self-dissipation module if necessary.

To remove the self-dissipation module, make sure the bottom of the Livox Horizon is facing upward, and then remove the seven M2 screws using the hex screwdriver included. Detach the self-dissipation module. Make sure the connectors on the bottom of the Livox Horizon and the self-dissipation module are aligned, and secure the self-dissipation module using seven black M2 screws. When the self-dissipation module is detached, make sure to attach the provided rubber seal to the fan connector on the bottom of the Livox Horizon to prevent liquids or dust from coming into contact with the Livox Horizon.



Mounting the Livox Horizon with Self-Dissipation Module

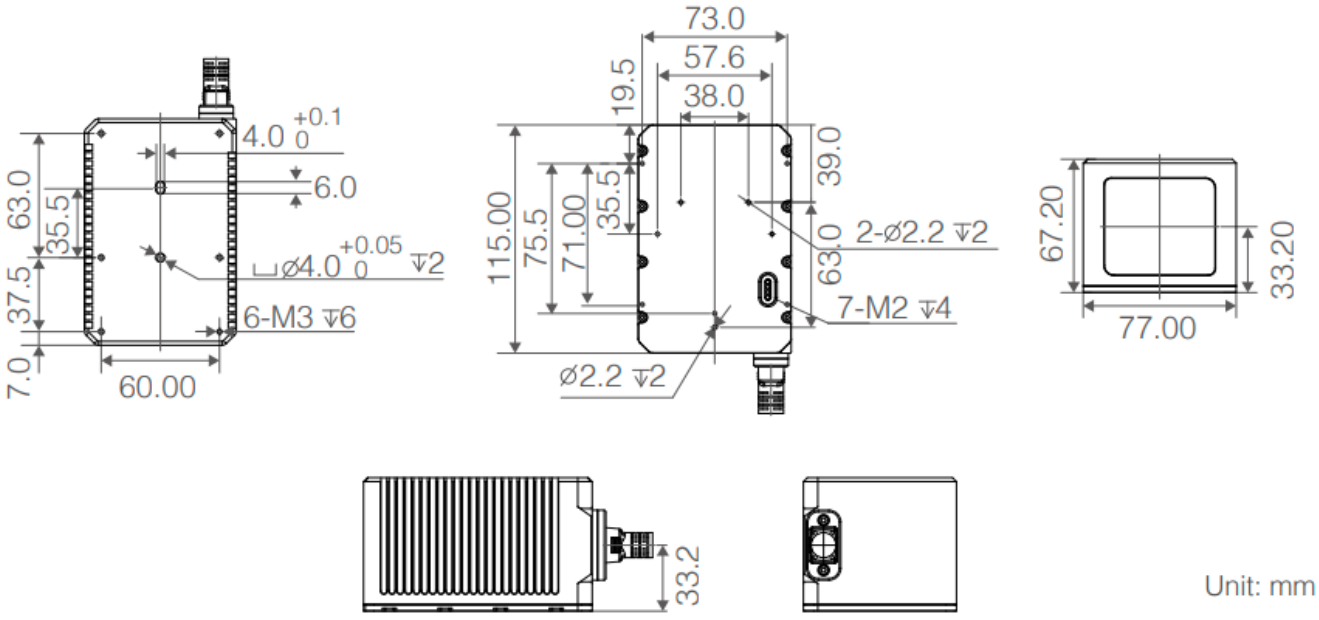
Refer to the dimensions and the mounting holes in the diagram below to mount or embed the Livox Horizon to or in an appropriate place on the target base. When the self-dissipation module is attached to the Livox Horizon, the Livox Horizon can be mounted on the target
base using M3 screws or outfitted with ¼ inch mounting holes.



Unit: mm

Mounting the Livox Horizon without Self-Dissipation Module

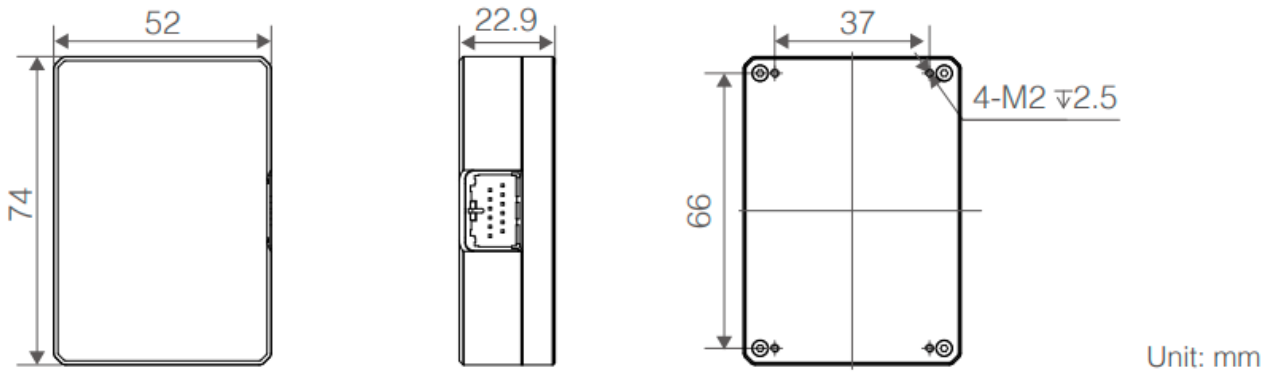
Refer to the dimensions and the mounting holes in the diagram below to mount or embed the Livox Horizon to or in an appropriate place on the target base.



Unit: mm

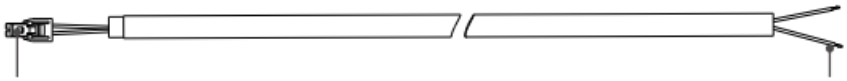
Mounting the Livox Converter 2.0

Refer to the dimensions below to mount the Livox Converter 2.0.



Connection Connecting the Cables

Power Cable



Connects to the Livox Converter 2.0 power port Red (Positive); Black (Negative)

Sync Cable

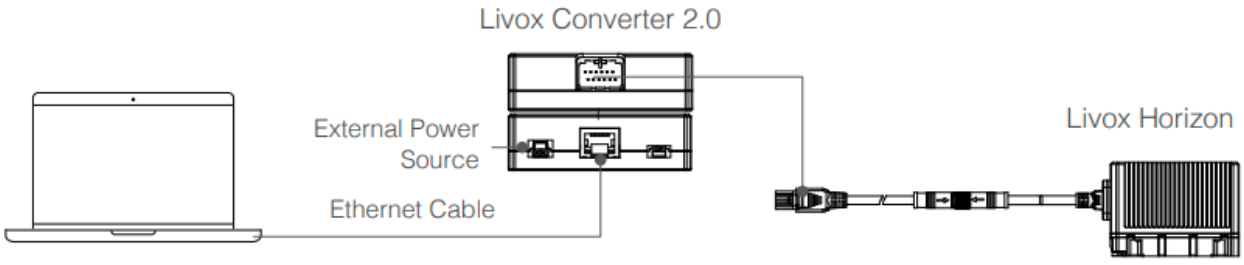
Connects to the Livox Converter 2.0 sync port Black (GND); Blue (PPS); White (NC), null signal

Livox Converter 2.0 supports PPS (TTL level) synchronization. Refer to the Livox Horizon User Manual for more information.

Connecting the Livox Horizon

The Livox Horizon supports two IP modes: dynamic IP address mode and static IP address mode. All Livox Horizon LiDAR sensors are set to static IP address mode by default with an IP address of 192.168.1.1XX (XX stands for the last two digits of the Livox Horizon LiDAR sensor's serial number). The default subnet masks of the Livox Horizon LiDAR sensors are all 255.255.255.0, and their default gateways are 192.168.1.1. Directly connect the Livox Horizon to the computer for the first time.

1. **Before connecting**, set the IP address of the computer to static IP address mode. Set the computer's IP address to 192.168.1.50, and the subnet mask of the computer to 255.255.255.0.
2. **Connect the Livox Horizon as shown below.**



a. Connect the Livox Horizon to the Livox Converter 2.0.

b. Connect the computer and the Livox Converter 2.0 using an Ethernet cable.

c. Connect the Livox Converter 2.0 to an external power source.

WARNING:

• Refer to the Livox Horizon User Manual on how to connect the Livox Horizon to a router supporting the Dynamic Host Configuration Protocol (DHCP).

• Refer to the Livox Horizon User Manual on how to set the IP address of the computer.

• When multiple Livox Horizon LiDAR sensors are connected to one computer in static IP address mode, make sure all sensors connected have different static IP addresses. Refer to Livox Horizon User Manual for more information on how to set the IP address for each LiDAR sensor.

• The working voltage of the Livox Converter 2.0 is 9 to 30 V. Therefore, when connecting the Livox Horizon to an external power source using a Livox Converter 2.0, the supported voltage range of the external power source is from 9 to 30 V. However, if a Livox Horizon is directly connected to an external power source, as the working voltage of the Livox Horizon is from 10 to 15 V, make sure the voltage range of the power source is within the allowable range. Make sure the positive and negative ends of the power cable are connected correctly.

Downloading and Using Livox Viewer

Visit **http://www.livoxtech.com** and download the latest Livox Viewer to check the point cloud data. Livox Viewer supports WINDOWS® 7/8/10 (64 bit) and UBUNTU®16.04 (64 bit).

- Download the file named “Livox Viewer.”
- Unzip the Livox Viewer file and click to open the .exe file named “Livox Viewer.” For Ubuntu users, unzip the Livox Viewer file and click to open the “./livox_viewer.sh” file under the root directory.
- The device manager window is on the left of Livox Viewer. Alternatively, click  to display or hide the device manager window. In this device manager window, users can check all Livox LiDAR sensors in the Local Area Network (LAN).
- Click “LiDAR” on the top of the device manager window.
- Select the Livox Horizon you want to check, and click  to connect. Alternatively, select the Livox Horizon you want to check, right click, and click “Connect.”
- After connecting, click or press the space key on the keyboard to view the point cloud data.

WARNING

- For Windows users, Livox Viewer may fail to detect LiDAR sensors if Windows Firewall is turned on. In this situation, go to the Control Panel to turn off Windows Firewall and restart Livox Viewer.
- Download and read the Livox Viewer User Manual for more information on how to use Livox Viewer.

Low-Temperature Start-Up

The working temperature of the Livox Horizon is from -40° to 85° C (-40° to 185° F) with the self-dissipation module attached. When the environment temperature is below -20° C (-4° F), the Livox Horizon may enter self-heating mode when connecting to a power supply. The self-heating mode may last at least 3 min with a maximum power of 42 W. Therefore, make sure the external power source is appropriate, especially in a low-temperature environment.

Specifications

Model HORIZON

- Laser Wavelength 905 nm
- Laser Safety ① Class 1 (IEC60825-1:2014) (safe for eyes)
- Detection Range (@100 klx) ②
  90 m @ 10% reflectivity
  130 m @ 20% reflectivity
  260 m @ 80% reflectivity
- FOV 81.7°(horizontal) × 25.1° (vertical)
- Distance Random Error 1σ (@ 20 m) < 2 cm ③
- Angular Random Error 1σ < 0.05 °
- Beam Divergence 0.03° (horizontal) × 0.28° (vertical)
- Point Rate 240,000 points/s (first or strongest return)
  480,000 points/s (dual return)
- Data Latency ≤ 2 ms
- Data Port 100 Mbps Ethernet
- Data Synchronization IEEE 1588-2008 (PTP v2), PPS (Pulse Per Second)
- False Alarm Ratio (@100 klx) ④ < 0.01%
- IMU Built-in IMU model: BMI088
- Operation Temperate Range -40° to 85° C (-40° to 185° F) (with self-dissipation module)
- Storage Temperature Range -40° to 85° C (-40° to 185° F)
- IP Rating IP67 ⑤
- Power ⑥ 12 W (Startup: 30 W)
- Power Supply Voltage Range ⑦ Livox Horizon: 10 ~ 15 V DC (recommended 12 V DC and 30 W or higher)
- Livox Converter 2.0: 9 ~ 30 V DC
- Noise 40 cm omnidirectional<50 dB (without fan)
- Dimensions
  77×115×84 mm (with self-dissipation module)
  77×115×67 mm (without self-dissipation module)
- Weight Approx. 1180 g (with self-dissipation module)
- Approx. 1010 g (without self-dissipation module)

1. The beam divergence of the Livox Horizon is 0.28° (vertical) × 0.03° (horizontal). The divergence of the embedded laser, however, is approximately 25.2° (horizontal) × 8° (vertical), which was measured at full width at half maximum. The maximum power of the embedded laser may exceed 70 W. In order to avoid being injured by the laser, DO NOT disassemble the Livox Horizon.
2. Livox Horizon cannot precisely detect objects which are less than 0.5 m away. In this situation, the serial number of the Livox Horizon displayed on Livox Viewer will change color to warn users. If in use at the time, the SDK can be checked for more information about the warning.
3. Tested in an environment at a temperature of 25° C (77° F) with a target object that has a reflectivity of 80% and is 20 meters away from the Livox Horizon. The actual environment may differ from the testing environment. The figure listed is for reference only. The point cloud may distort to a varying extent when the target object is within the range of 0.5 to 3 m. Contact Livox for support if you require to detect objects within this range.

4. The false alarm ratio of the noise created by the stray light in a test environment of 100 klx at a temperature of 25° C (77° F).
5. The Livox Horizon has an overall IP rating of IP67 (not including Livox Converter 2.0 and cables).
6. In low-temperature environments, the Livox Horizon will first enter self-heating mode, and its power may reach a maximum amount of 42 W. Make sure the power supply is suitable based on the peak power value of the Livox Horizon. Refer to the Livox Horizon User Manual for more information.
7. Make sure the output voltage of the power supply is within this range at all times.

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Documents / Resources

	LIVOX HORIZON High Performance/Compatibility LiDAR Sensor [pdf] User Guide HORIZON, High Performance Compatibility LiDAR Sensor, HORIZON High Performance Compatibility LiDAR Sensor

Manuals+,