スタイル定義: 見出し 2: 行間： 1 行

スタイル定義: 見出し 3: インデント : 左： 0 mm, ぶら下げインデント： 7.2 字, 間隔 段落前： 6 pt, 段落後 : 6 pt, 行間： 1 行, 行頭文字または番号を削除

スタイル定義: 見出し 4: フォント : 11 pt, インデント : 左： 0 mm, ぶら下げインデント： 8.64 字, 間隔 段落前： 6 pt, 段落後： 6 pt, 行間： 1 行

スタイル定義: inno-说明: 間隔 段落前： 3 pt, 段落後 : 3 pt, 行間： 1 行

Falcon K2 LiDAR

User Manual

Table of Content

削除: 6
削除: 6
削除: 6
削除: 7
削除: 7
削除: 8
削除: 13
削除: 17
削除: 17
削除: 17
削除: 18
削除: 18
削除: 20
削除: 20
削除: 21
削除: 22
削除: 26
削除: 27
削除: 27
削除: 27
削除: 28
削除: 28
削除: 30
削除: 33
削除: 34
削除: 38
削除: 38
削除: 39
削除: 40
削除: 40

削除: 40
削除: 41
削除: 46
削除: 51
削除: 52
削除: 53
削除: 53
削除: 54
削除: 54
削除: 54
削除: 55
削除: 55
削除: 56
削除: 58
削除: 59
削除: 60
削除: 61
削除: 62
削除: 66
削除: 70
削除: 72
削除: 73
削除: 74
削除: 75
削除: 77

Overview

Product Name

Falcon K2 LiDAR

Manufacturer

SEYOND

Legal Information

Manual Overview

This manual provides detailed instructions for the Falcon K2 LiDAR (hereinafter referred to as “Falcon K2” or “the LiDAR”) regarding its installation, operation, maintenance, and troubleshooting. The contents are organized according to the various stages of the sensor’s lifecycle, including installation, configuration, and maintenance procedures.

This manual is intended for use by development personnel (such as R&D engineers), installation technicians, electrical specialists, safety engineers, and maintenance personnel.

Original Document

This document is an original publication of Seyond.

Manual Description

This document covers general usage instructions and common troubleshooting measures. However, it may not address all possible issues that could arise during product use. If you encounter any problems not described in this manual, please contact Seyond for technical support.

This manual will be updated as product technology evolves. For the latest version of the user manual, please consult the relevant personnel at Seyond Inc.

Contact Phone: (650)963-9573

Email: info@seyond.com

Important Notes

This user manual covers the Falcon K2 LiDAR introduction, installation, handling/transport, operation, maintenance, troubleshooting, end-of-life disposal, and related software instructions.

As this product is a laser device (1550 nm), please read this manual carefully before use and observe all precautions to avoid hazards. During operation, strictly follow the procedures described in this manual.

削除: Preface

書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.32 字

書式変更: 行間： 1 行

書式変更: 行間： 1 行

書式変更: 間隔 段落前： 6 pt, 段落後： 6 pt, 行間： 1 行

削除: The information contained in this document is copyrighted by Seyond, Inc. and is subject to change without notice. Seyond endeavors to ensure the completeness and accuracy of manual publications. When new or revised information becomes available, the entire document will be updated. Copyright 2024 Seyond, Inc. All rights reserved.

書式変更: 間隔 段落前： 6 pt, 段落後： 6 pt, 行間： 1 行

削除: This manual provides instructions for the installation, usage, maintenance, and diagnostic evaluation of Falcon K2 LiDAR (hereinafter referred to as "Falcon K2" or "LiDAR"). The contents of this manual are cover the different phases of the LiDAR life cycle, including the installation, configuration, operation, and maintenance of the LiDAR.↵ The intended users of this manual include project developers (R&D personnel and designers), installers, electrical professionals, safety professionals, and service personnel.↵

書式変更: 間隔 段落前： 6 pt, 段落後： 6 pt, 行間： 1 行

削除: This document is the original document owned by

削除:

書式変更: 間隔 段落前： 6 pt, 段落後： 6 pt, 行間： 1 行

削除: Although this document covers instructions to handle typical problems, it is not guaranteed to resolve all problems. If you encounter issues not covered in the manual, please contact Seyond staff in a timely manner. This manual will be updated when new information becomes available

削除:

書式変更: インデント：最初の行： 4 mm

削除:

変更されたフィールド コード

削除: Precautions

書式変更: 間隔 段落前： 6 pt, 段落後： 6 pt, 行間： 1 行

書式変更: 標準

削除: This user manual covers the product introduction, installation, transferring, usage, maintenance, diagnos ... [1]

Safety Instruction

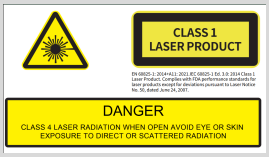
Before using this product, please read this manual carefully and strictly follow all operating guidelines. To reduce the risk of electric shock or laser exposure, and to avoid voiding the warranty, do not disassemble or modify the LiDAR.

This product contains no user-serviceable parts. For maintenance or repair, please contact Seyond staff.

⚠ CAUTION

Use of controls, adjustments, or performance of procedures other than those specified for this product may result in hazardous radiation leakage.

⚠ CAUTION



➢ Class 1 Laser Product.

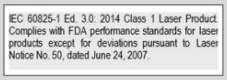
➢ Failure to use, control, adjust or operate LiDAR as specified herein may result in serious radiation hazards.

➢ The product incorporates a Class 4 fiber laser system which, by itself, may be hazardous. This device incorporates a protective housing and a scan failure safeguard in the machine design such that there is no exposure or human access to laser radiation generated by the fiber laser during operation or maintenance.

➢ UNDER NO CIRCUMSTANCE shall attempts be made to operate the laser with protective housing removed or the scan failure safeguards overridden.

□ When the laser is powered up, service procedures are only intended to be operated by Seyond service personnel or persons trained and certified by Seyond.

⚠ CAUTION



This product complies with the following standards:

- IEC 60825-1:2007
- IEC 60825-1:2014

Maintenance and Care

This product is made of metal and plastic and contains sensitive electronic components inside. To ensure product reliability and user safety, please observe the following precautions:

- Do not drop, burn, puncture, strike, or crush the product.
- If the product has been dropped or subjected to impact, stop using it immediately and contact Seyond technical support for assistance.
- If you suspect that the product is damaged in any way, discontinue use immediately to prevent injury or further damage.

削除: Precautions

書式変更: 間隔 段落前： 6 pt, 段落後： 6 pt, 行間： 1 行

削除: Before using the product, please read the contents of this manual carefully and strictly follow the relevant instructions.
To reduce the risk of electric shock and avoid violating the warranty, please do not disassemble or modify the LiDAR without permission. This product does not contain the user's serviceable parts. Please consult Seyond's certified service personnel for maintenance and repair.

書式付きの表

削除:

削除:
Device m

書式を変更: フォント : 14 pt

書式変更: 行頭文字または番号を削除

書式変更: インデント : 左： 6.3 mm, ぶら下げインデント： 3.57 字, 間隔 段落前： 0.6 行, 段落後： 0.6 行, 行間： 1 行, 箇条書き + レベル : 1 + 整列： 6.3 mm + インデント： 12.7 mm

- Do not touch the LiDAR optical window with your hands, as this may degrade performance.
- If the optical window becomes contaminated, clean it according to the instructions in the Cleaning section of this manual.
- Do not attempt to disassemble or service the product yourself. Unauthorized disassembly may cause damage, compromise waterproofing, or result in personal injury.

Electrical Safety

- Always use the original power cables and adapters provided by Seyond to supply power to the product.
- Using damaged cables or adapters, especially in humid environments, may cause fire, electric shock, personal injury, product damage, or property loss.

Heat dissipation

- Prolonged contact with hot surfaces may cause discomfort or injury.
- To prevent heat buildup, ensure adequate ventilation around the device.
- The device surface may become warm during extended operation; allow it to cool down for several minutes after power-off before touching.

Operating environment

- Do not expose the product to excessive vibration or mechanical shock. For detailed performance specifications, please contact Seyond technical support for assistance.
- Although the product is designed to meet Class 1 eye-safety standards, users should avoid direct visual exposure to the laser during operation to ensure maximum personal safety. Do not view the emitted laser through magnifying or optical instruments (such as microscopes or magnifiers).
- Do not observe the emitted laser through other electronic or optical devices, such as camera, cell phones.
- Do not operate or expose the product in explosive atmospheres, such as areas containing high concentrations of flammable chemicals or vapors
- Do not expose the product to environments with high concentrations of industrial chemicals, including volatile liquefied gases (such as helium), as this may damage or degrade the product's performance.

Radio frequency interference

Before operating the product, please carefully read the certification and safety information. While the product has been designed, tested, and manufactured in compliance with applicable radio-frequency (RF) emission standards, radiation emitted from the device may, in some cases, cause interference with other nearby electronic equipment.

Medical Equipment Interference

This product contains components and radio devices that emit electromagnetic fields, which may interfere with medical equipment such as cochlear implants, pacemakers, or defibrillators. Consult your physician and the manufacturer of your medical device for specific information regarding safe operating distances between your device and this product.

削除: This product is made of metal, glass, plastic, and contains sensitive electronic components.
Do not misuse the product by dropping, burning, piercing, bumping, squeezing, etc.
Shut off the product immediately once it is hit or dropped. Please contact Seyond staff for technical support.
If there is any possibility that the product may have been damaged, please stop using it immediately to prevent personnel injury.
Do not touch the LiDAR window with your hands in case of performance degradation.
If the LiDAR window is stained, please clean the product as described in the Cleaning section of this manual.
It is strictly forbidden for users to disassemble or convert the device without permission. Dismantling this product may result in product damage, loss of waterproof performance, or personal injury.
The upper shield should not be opened during the u... [2]
書式を変更: フォント : (日) Microsoft YaHei, 14 pt
書式変更 ... [3]
書式変更 ... [4]
書式変更 ... [5]
削除: Always use the connecting cable and power adapter provided or specified by Seyond.
削除: <#>Using damaged cables or adapters in a humid environment may lead to fire, electric shock, perso... [6]
書式を変更: フォント : 14 pt
書式変更 ... [7]
削除: <#>Long-time contact with the hot surface of the product may cause personal discomfort or injury. ... [8]
書式を変更: フォント : (日) Microsoft YaHei, 14 pt
書式を変更 ... [9]
削除: <#>Do not subject the product to intense vibration.
削除: Do not look directly at the transmitting laser through a magnifying device (such as a microscope and mag... [10]
書式を変更: フォント : (日) Microsoft YaHei, 14 pt
削除: Before the operation, please read the product label's certification and safety information. Although the pr... [11]
書式を変更: フォント : 14 pt, 太字
書式を変更 ... [13]
書式変更 ... [12]
書式を変更: フォント : 10.5 pt, 太字 (なし)
書式変更 ... [14]
書式を変更: フォント : 10.5 pt, 太字 (なし)
書式を変更: フォント : 10.5 pt, 太字 (なし)

If you suspect that this product is interfering with your medical equipment, stop using it immediately and contact your medical professional for guidance.

書式変更: 1 行の文字数を指定時に右のインデント幅を自動調整する, 間隔 段落前： 0 pt, 段落後： 0 pt

削除: Medical device interference

削除: Some components and radio devices contained in this product will emit electromagnetic fields that may interfere with medical equipment, such as cochlear implants, pacemakers, and defibrillators. Consult your doctor and medical equipment manufacturer for specific information, e.g., whether you need to keep a safe distance from this product. If there's any possibility that this product is interfering with your medical equipment, please stop using it immediately.

1 Product Description

1.1 Product introduction

Product Introduction

Falcon K2 LiDAR (hereinafter referred to as "Falcon K2" or " LiDAR") is an industry-leading ultra-long-range automotive-grade LiDAR developed by Seyond. It can achieve a maximum detection range of up to 500 meters, with a standard detection distance of 250 meters at 10% reflectivity. Falcon featuring a region of interest (ROI) function which allows user to flexible adjust the area of interest to generate and change the high-density point clouds with a specific region. This enables precise object tracking and robust perception performance, effectively meet the safety and reliability requirements of L2+ ADAS applications.

Product Features

- 500 meters Ultra-long detection range with image-grade ultra-high resolution.
- ROI focusing with flexible, adjustable field of view.
- 1550 nm laser wavelength ensures enhanced eye safety.
- Automotive-grade reliability designed for mass production and long-term stability.

1.2 Product operating principles

The Falcon K2 LiDAR measures distance based on the Time of Flight (TOF) principle. This method calculates the distance by measuring the time it takes for a laser pulse to travel to a target object and back to the receiver.

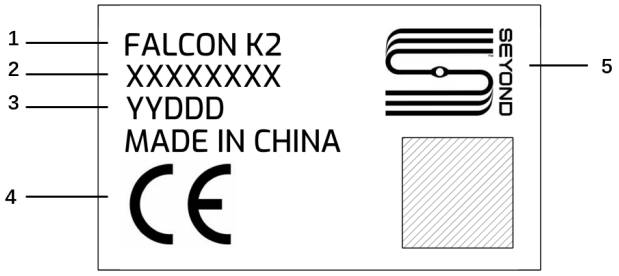
1. The laser emitter transmits an ultra-short laser pulse.
2. The emitted pulse hits an object and is scattered and reflected.
3. The receiver detects the returned laser signal.
4. By measuring the round-trip flight time of the laser pulse in air, the system accurately computes the distance to the target.

The measured distance is expressed as:

$$d = \frac{ct}{2}$$

d:distance c:speed of light t:flight time of the laser beam

1.3 Label description



書式変更: インデント：左： 0 mm, ぶら下げインデント： 5.78 字, 間隔 段落前： 6 pt, 段落後： 6 pt
削除: Overview
書式を変更: フォント：14 pt, 太字
書式を変更: フォント：(日) Microsoft YaHei, 14 pt
書式を変更: フォント：14 pt, 太字
書式変更: 標準, 1 行の文字数を指定時に右のインデント幅を自動調整しない, 間隔 段落前： 6 pt, 段落後： 6 pt, 行頭文字または番号を削除
削除: ↵
削除: through forward engineering
削除: It can detect objects as far as 500 meters, and dark objects with 10% reflectivity up to 250 meters
削除: can maximize point density in
削除: is adjustable to focus where it matters most to better track objects on the road. High performance LiDAR with strong environmental adaptability like Falcon is key to L2+ safe autonomy and smart transportation
削除: ↵
書式を変更: フォント：14 pt, 太字
書式変更: 標準, 1 行の文字数を指定時に右のインデント幅を自動調整しない, 間隔 段落前： 6 pt, 段落後： 6 pt, 行頭文字または番号を削除
書式変更: inno-一级有序步骤, 1 行の文字数を指定時に右のインデント幅を自動調整する, 間隔 段落前： 0 pt, 段落後： 0 pt, 箇条書き + レベル：1 + 整列： 6.3 mm + インデント： 12.7 mm
削除: <#>500m ultra-long detection range, image-grade ultra-high resolution.↵ Flexible and adjustable ROI.↵ 1550nm laser wavelength enables better eye-safe ... [15]
削除: The measurement principle of this product is t ... [16]
削除: :
削除: transmitter
削除: emits a beam of
削除: s
書式変更 ... [17]
削除: The laser projects onto an object, undergoes ... [18]
書式変更 ... [19]
削除: By measuring the flight time of the laser bea ... [20]
削除: Thus, t
削除: represented
削除: ↵

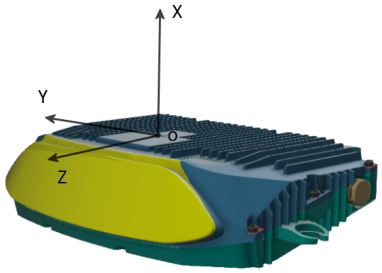
Table 1 Nameplate Explanation

Serial Number	Name	Serial Number	Name
1	Product Model	2	PN Code
3	Production Date	4	CE Logo
5	Company Logo		

1.4 LiDAR coordinate system

The Falcon K2 is a hybrid solid-state LiDAR with a laser wavelength of 1550nm. The three-dimensional coordinate system is defined as follows:

- x is perpendicular to the ground, pointing upwards.
- y is parallel to the ground, pointing to the right.
- z is parallel to the ground, pointing forward.
- The coordinate origin is the calibration reference point of the LiDAR.



1.5 Scanning pattern

The Falcon K2 LiDAR adopts a two-dimensional scanning architecture.

The Field of View (FOV) defines the total scanning area of the LiDAR.

- Horizontal FOV: 120° with an angular resolution of 0.2°
- Vertical FOV: 25° with an angular resolution of 0.24°

Within the FOV, the Region of Interest (ROI) represents a high-density scanning area that can be dynamically adjusted.

- Horizontal ROI: 120° with an angular resolution of 0.1°
- Vertical ROI: 9.6°, with a resolution of 0.15° (lower 4.8°) and 0.1° (upper 4.8°)

The ROI region can be dynamically adjusted in real time within the full FOV by sending control commands from the host computer to the LiDAR, as described in Appendix H.

削除: <#>

削除: semi-

削除:

書式変更: inno-一级有序步骤, 箇条書き + レベル : 1 + 整列 : 6.3 mm + インデント : 12.7 mm

削除:

書式変更: inno-图片

書式変更: インデント : 左 : 0 mm, ぶら下げインデント : 5.78 字, 間隔 段落前 : 6 pt, 段落後 : 6 pt

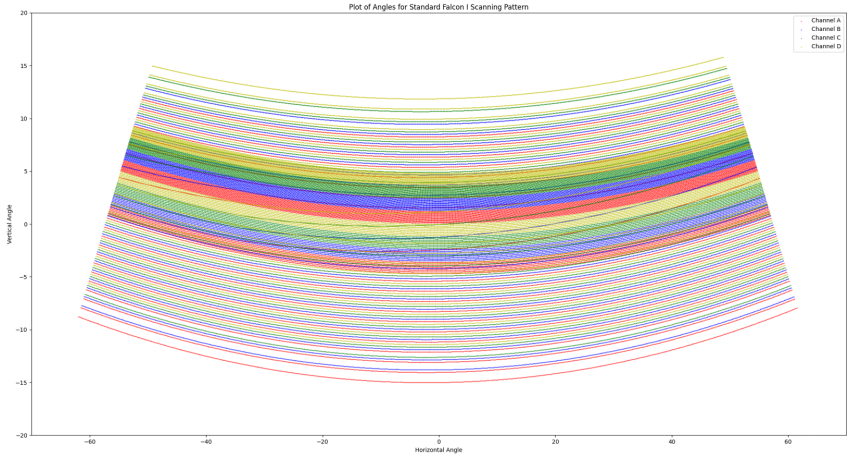
削除: The Falcon K2 utilizes a two-dimensional scanning mode. The Field of View (FOV) is the area that the LiDAR can scan. The horizontal FOV is set to 120° with a resolution of 0.2°; the vertical FOV is set to 25° with a resolution of 0.24°. The Region of Interest (ROI) is a high-density area within the LiDAR's scannable region. The horizontal ROI is set at 120° with a resolution of 0.1°; the vertical ROI is set at 9.6° with a resolution of 0.15° (lower 4.8°)/0.1° (upper 4.8°). Commands from the host computer to the LiDAR can dynamically adjust the ROI in real time within the entire FOV

書式変更: 間隔 段落前 : 3 pt, 段落後 : 3 pt, 行間 : 1 行

書式変更: 間隔 段落前 : 3 pt, 段落後 : 3 pt, 行間 : 1 行

書式変更: 標準, 間隔 段落前 : 3 pt, 段落後 : 3 pt

削除: .



1.6 Product Technical Specifications

Table 2 Specification Table

OPTICAL PERFORMANCE	
Range (Maximum)	500 m
Range (Minimum)	1.5 m
Detection Range (10% Lambertian reflectivity @ 10 Hz)	250 m@100 klx sunlight, POD>90%
Detection Range Accuracy	± 2 cm ***Note:*** *Accuracy is calculated based on the discrepancy between the average of 50 measurements on static target at a specific distance and the true distance*
Detection Range Precision *	Up to 2 cm (1 standard deviation)
Detection Range Resolution	0.5 cm
Vertical Scanning Lines *	1500 lines/sec
FOV in non-ROI (H×V)	120°×25°
FOV in ROI (H×V)	120°×9.6°
Angular Resolution in sparse (H×V)*	0.2°×0.24°
Angular Resolution in ROI (H×V)*	0.1°×0.15° (1st 4.8°), 0.1°×0.1°(2nd 4.8°)
Angular Accuracy	± 0.1°
Frame Rate *	10 FPS
# of Returns	Up to 2 returns
LASER	
Laser Safety Class	Class 1 (IEC 60825-1: 2014)
Laser Wavelength	1550 nm
Beam Divergence (Full Angle)	0.1°

書式付きの表

書式変更: 左揃え

削除: non-ROI

削除:

書式付きの表

LIDAR OUTPUT	
Data transmission	1000Base-T1 Ethernet (UDP, TCP/IP)
Points Per Second	1370,000 Points/sec @1 return 2740,00 Points/sec @2 return
Data Rate (Megabits Per Second)	11.69MB/S@1 return 17.45MB/S@2 return
Data Output	radius, azimuth, reflectivity, timestamp, frame ID, return mode, working mode, fault state, CRC verification, etc.
CONTROL INTERFACE	
Interface	TCP and HTTP APIs
Time Synchronization	IEEE1588 (PTP), IEEE 802.1as(gPTP), NTP
MECHANICAL/ELECTRICAL	
Power Consumption	20 W
Operating Voltage	9 to 32V DC
Standard Voltage	12V DC
Connector	Proprietary pluggable connector (Power + Automotive Ethernet + CAN)
Dimensions (H×W×D)	58.9 mm × 228 mm × 149.6 mm
Weight	1.7 kg
Mounting	4×M4×18 screws, locating in bushings
OPERATIONAL	
Operating Temperature	-40 °C to +85 °C
Storage Temperature	-40 °C to +105 °C
Ingress Protection	IP67(body), IP69K(window)
Shock	IEC 60068-2-27
Vibration	IEC 60068-2-64
ACCESSORIES	
Optional Wire Harness	5m cable (power & Ethernet)
Optional Converter	MetAdaptor
Optional Mount	Metal bracket
SOFTWARE	
Available Drivers	ROS/ROS2

書式付きの表
書式付きの表
書式付きの表
削除:
削除:
削除:
削除:
書式付きの表
書式付きの表
書式付きの表

Note

削除:

- If there are any changes to the specification table, please refer to the latest product manual. No separate notification will be provided.
- Parameters marked with an "*" indicate that customization is available. If you have customization needs, please contact Seyond staff.

2 Installation

2.1 Installation Precautions

The Falcon K2 is generally installed on vehicles. Please observe the following precautions during installation.

Personnel Requirements

Installation must be performed only by qualified and trained professionals.

Installation

- If any component is damaged or missing, contact Seyond technical support for assistance.
- Ensure the mounting surface is flat and stable.
- Ensure that the LiDAR cables maintain an appropriate amount of slack to prevent tension or stress on the connector.
- Reserve at least 8 cm of clearance at the connector for wiring.
- Before installation, ensure the LiDAR's Field of View (FOV) is not obstructed.
  - Default vertical FOV: –13° to +12°
  - Default horizontal FOV: –60° to +60°

Storage

- Store the product in a well-ventilated, dry environment.
  Recommended storage temperature: -40°C to +105°C, with humidity below 85%.
- Do not immerse the product in water or operate it under harsh environmental conditions beyond its ingress protection rating.
  Avoid exposure to environments exceeding the specified IP rating.

Transportation

- Use the original shipping box with protective cushioning materials to prevent damage during transportation.
- Handle the product carefully; do not drop or impact the device to avoid misalignment or optical damage.
- Consider using lifting tools or assistance to minimize handling distance and avoid strain or impact.
- Do not place the unit on unstable surfaces or carry it in an unsafe posture to prevent personal injury or equipment damage.

Disposal of Packaging Materials

➢ Packaging materials are recyclable. Please dispose of them correctly when discarding.

□ Packaging bags, cartons, or plastic films should be kept out of reach of infants and children to avoid injury or suffocation.

削除: Falcon is generally intended to be mounted on vehicles. Please follow the instructions during the installation process.

書式変更: 見出し 2

削除: The device is only intended to be installed by Seyond service personnel or persons trained by Seyond

削除:

書式を変更: フォント : (日) Microsoft YaHei, 10.5 pt, 太字 (なし)

書式を変更: フォント : (日) Microsoft YaHei, 10.5 pt, 太字 (なし)

書式を変更: フォント : (日) Microsoft YaHei, 10.5 pt, 太字 (なし)

書式を変更: フォント : (日) Microsoft YaHei, 10.5 pt, 太字 (なし)

書式を変更: フォント : (日) Microsoft YaHei, 10.5 pt, 太字 (なし)

書式を変更: フォント : (日) Microsoft YaHei, 10.5 pt, 太字 (なし)

書式を変更: フォント : (日) Microsoft YaHei, 10.5 pt, 太字 (なし)

書式変更: リスト段落, 1 行の文字数を指定時に右のインデント幅を自動調整する, 間隔 段落前： 0 pt, 段落後： 0 pt, 箇条書き + レベル : 2 + 整列： 19 mm + インデント： 25.4 mm

削除: If components are damaged or lost before installation, please contact Seyond staff for support. Make sure the LiDAR installation is flat and the tilt angle should be less than 3.5°. If there are specific tilt angle requirements, please contact Seyond staff for support. It is recommended that the mounting surface should be made of aluminum alloy to facilitate the heat dissip ... [21]

書式変更 ... [22]

書式変更 ... [23]

書式変更 ... [24]

削除: The storage environment should be dry and ... [25]

書式変更: リスト段落, インデント : 左 0 字

書式を変更: フォントの色 : 自動

書式変更 ... [26]

書式を変更: フォントの色 : 自動

書式変更 ... [27]

書式変更 ... [28]

削除: The equipment should be packed in a packi ... [29]

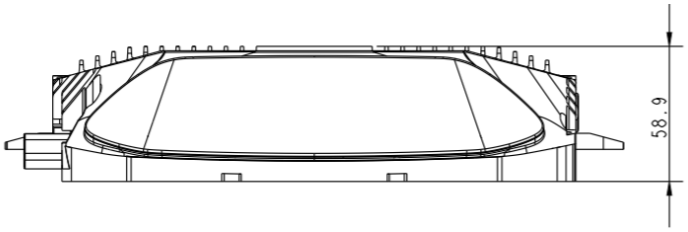
削除: <#>Please handle the device with care. Imp ... [30]

2.2 Installation Instructions

Power Supply Description

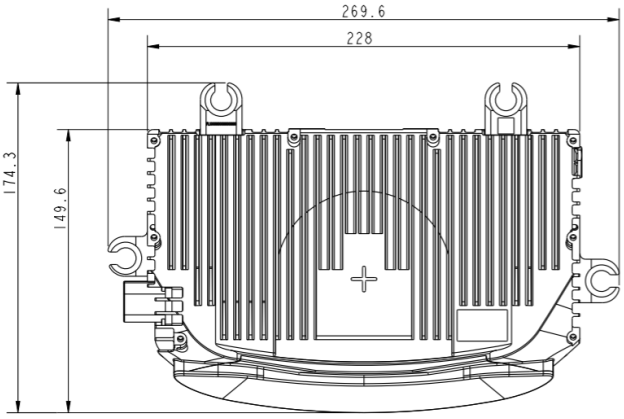
The Falcon K2 LiDAR operates within a voltage range of 9–32 VDC, with a recommended supply voltage of 12 V. Under normal operating conditions, the LiDAR's typical power consumption is approximately 20 W.

Installation Dimensions



（Unit：mm）

Front View



（Unit：mm）

Top View

2.3 Installation Method

The LiDAR is mounted to the vehicle using four mounting ears, each equipped with a secondary vibration-damping ring. The LiDAR is secured to the vehicle body with bolts and further isolated using soft rubber damping rings to minimize vibration and mechanical shock.

During installation, users should reserve adequate operating space according to the vehicle layout and assembly

削除: The operating voltage range of Falcon is 9 to 32 VDC. It is recommended to use standard 12 VDC for the power supply. The power consumption of LiDAR is about 20W during regular operating.

削除: ↵

書式変更: 見出し 3

削除: ↵

書式変更: 両端揃え

書式変更: 標準

process.

削除: The LiDAR is installed on the vehicle through 4 lugs, each equipped with a secondary bushing for damping. The LiDAR is fixed to the vehicle through the screws and damped by the bushings.

Cable Description

削除: During installation, users need to reserve reasonable operating space based on the vehicle's layout scheme and installation process. Refer to the dimensions of the brackets and their relative positions to the LiDAR in section 2.2.2 Installation Dimensions. Before installation, it is essential to reserve sufficient space according to the vehicle condition and installation craft. Refer to the lugs' size and relative positions to the LiDAR in 2.2.2 Installation Dimensions. The installation method is shown below.

削除:

書式変更: inno-図片, インデント：左： 0 mm

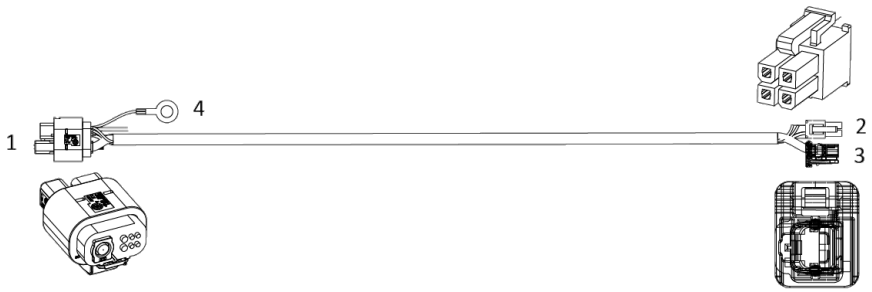
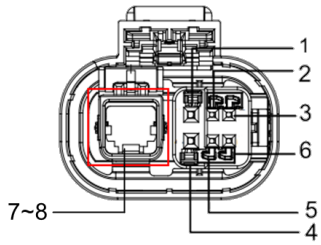


Table 3 Cable Interface Description

書式付きの表

Serial Number	Name	Description
1	LiDAR interface	8-pin interface, pin definitions are as follows:  [1]: Power- [2]: Empty pin [3]: Shield grounding [4]: Power + [5]: CAN high [6]: CAN low [7] and [8]: Gigabit Ethernet
2	Power supply	4-pin interface, pin definitions are as follows:

削除:

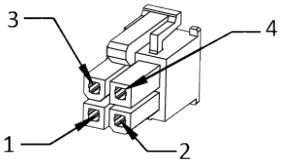
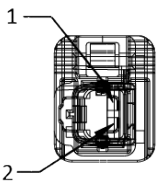
削除:

削除:

削除:

削除:

削除:

Serial Number	Name	Description
		 [1]; Power- [2]; Empty pin [3]; Power+ [4]; Empty pin
3	1000Base-T1 automotive Ethernet	1000Base-T1 Automotive Ethernet, pin definitions are as follows:  [1] :Ethernet signal transmit [2] :Ethernet signal receive
4	Grounding	Shield grounding

書式付きの表

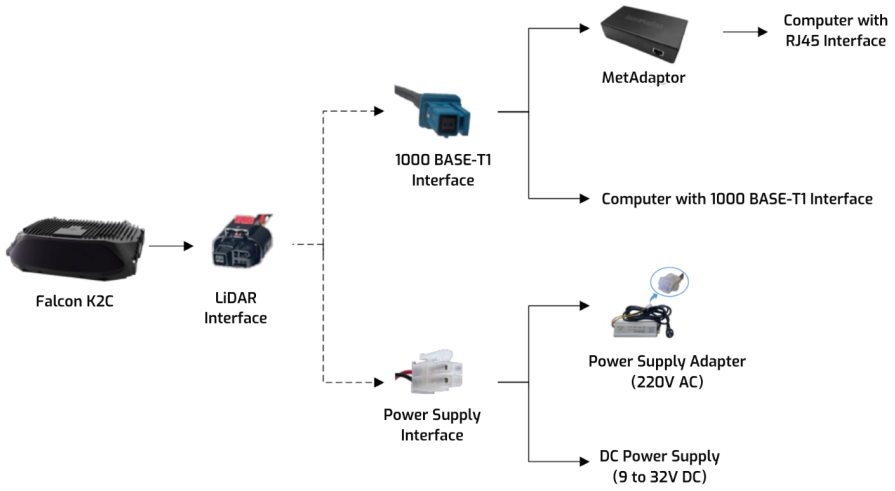
削除:

削除:

削除:

削除:

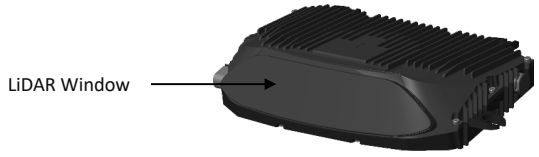
Cable Connection



2.4 Cleaning

To ensure optimal performance, regularly check the LiDAR optical window and keep it clean. Follow the steps below to properly clean the optical surface:

1. Prepare a clean, lint-free cloth, moisten it with alcohol, and wring it dry.
2. Gently apply the damp cloth to the LiDAR window for about one minute to soften any contamination.



3. After one minute, use a clean lint-free cloth to gently remove any dirt or stains, then dry the surface.
4. Wipe the window clean with high-quality tissue or lens paper. Do not apply excessive pressure, as this may damage the optical coating.

Note

Please wash your hands or wear PVC powder-free clean gloves before touching the product.

Do not use solvents since they may damage the window coating.

Please use a new dust-free wiper to wipe the LiDAR window.

The LiDAR window is made of special plastic material. Please pay attention to the following items when cleaning:

- Avoid direct skin contact with the optical window.
- Do not use corrosive cleaners and solvents.
- Do not use paper towels to clean the window to avoid scratches.

削除:

書式変更: 中央揃え

書式変更: 両端揃え

削除: For optimal performance of LiDAR, please keep the front window of the sensor clean and free of dirt, bugs, and other debris. The steps to clean the optical window are as follows.

削除: Prepare a clean microfiber cloth, soak it in the methyl alcohol, and wring it out

書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.42 字, 行間： 1 行

削除: Loosen the debris from the LiDAR window with the clean, dust-free wiper for 1 minute. Do not wipe dirt directly off the LiDAR window glass without loosening it sufficiently…

削除: Please wait 1 minute, gently wipe the window with the clean microfiber cloth and dry it

書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.42 字, 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行

削除: Wipe the window with a high-quality paper towel or mirror paper. Do not apply excessive force to avoid damaging the optical coating…

3 Software Operation

LiDAR operation is supported on the following platforms. For how to operate LiDAR using SDK-related tools, please contact Seyond staff to obtain related manuals.

Table 1 platform instructions

NO.	Software Interface	Description
1	ILA	ILA is the quickest way to view live point clouds and record data. The ILA GUI can be accessed through a web browser (preferably Chrome) and does not require any SW installation. Running on Linux, Windows, or Mac OS, and does not require any SW installation. ILA does not support the replaying of recorded data.
2	ROS	ROS (ROS1) drivers are available for Kinetic, Melodic and Noetic. Please notice that drivers for ROS Kinetic will be discontinued soon. ROS2 drivers are also available for Foxy Fitzroy, Galactic Geochelone, and Humble Hawksbill.
3	MetaView	The MetaView can be run from any Linux or Windows OS computer. It allows viewing of the live point cloud, data recording, and replaying recorded data. It is recommended to use MetaView as the application for evaluation of the Falcon point cloud.

書式変更: インデント : 左 0 字
書式変更: 中央揃え, インデント : 左 0 字
書式付きの表
書式変更: 中央揃え
書式変更: 中央揃え
書式変更: 中央揃え

3.1 Operate on ILA

The ILA operations in this chapter are based on the firmware version FW0182 (S30).

削除: 5209
削除: version of the firmware

Access

削除: Login

Note

It is recommended to use the Google Chrome browser to access the ILA webpage.

Please ensure that the system is powered on: the system has no physical power switch and becomes operational automatically upon power connection.

削除: It is recommended to use Google Chrome browser to log into the ILA.
The LiDAR does not have a power switch. It will become operational when power is applied

1. Confirm that the computer IP address is within the same subnet as the LiDAR IP address.
2. Connect the computer to LiDAR and ensure the Ethernet connection. For the detailed connection, see *cable connection*.
3. Open Chrome browser. Enter the LiDAR IP and port number <IP Address>: <PORT> in the address bar to access the ILA.

削除: Change the computer IP address to the same subnet with the LiDAR

Note

The default LiDAR IP address is 172.168.1.10. The default ILA port is 8675. The default ILA login address is 172.168.1.10:8675.

It is recommended to check the access to the LiDAR IP address by using the ping command. The return value is shown in the figure below.

```
demo@demo-OMEN-by-HP-Laptop-16-b0xxx:~$ ping 172.168.1.10
PING 172.168.1.10 (172.168.1.10) 56(84) bytes of data.
64 bytes from 172.168.1.10: icmp_seq=1 ttl=64 time=0.100 ms
64 bytes from 172.168.1.10: icmp_seq=2 ttl=64 time=0.155 ms
64 bytes from 172.168.1.10: icmp_seq=3 ttl=64 time=0.159 ms
^C
--- 172.168.1.10 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2052ms
rtt min/avg/max/mdev = 0.100/0.138/0.159/0.026 ms
demo@demo-OMEN-by-HP-Laptop-16-b0xxx:~$
```

削除:

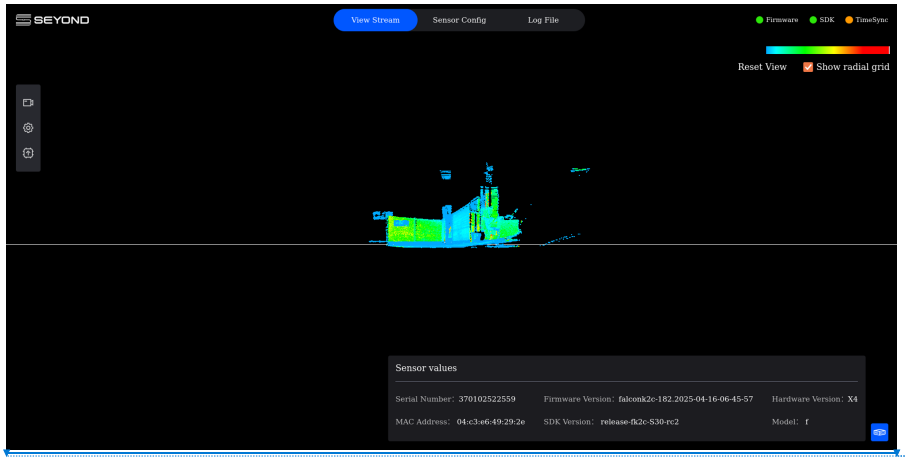
書式変更: inno-图片

View the point cloud status of the LiDAR

1. Directly view the status of the LiDAR point cloud in real-time on the **View Stream**.
2. (Optional) Change the point of view and distance in which the point cloud data is displayed using the keyboard shortcuts and mouse.

書式変更: インデント : 左 : 0 mm, ぶら下げインデント : 4.42 字, 間隔 段落前 : 3 pt, 段落後 : 3 pt, 行間 : 1 行

Click  to check the available keyboard shortcuts.



削除:

削除:

Record LiDAR point cloud data

It is possible to record LiDAR point cloud data in different formats.

1. Go to **View stream** > **Record data stream**.
2. Select the way to record the point cloud file.

   If Auto is selected, specify the size of file before recording. If Manual is selected, the recording will continue until Stop is clicked.

移動 (挿入) [1]

書式変更: インデント : 左 : 0 mm, ぶら下げインデント : 4.42 字

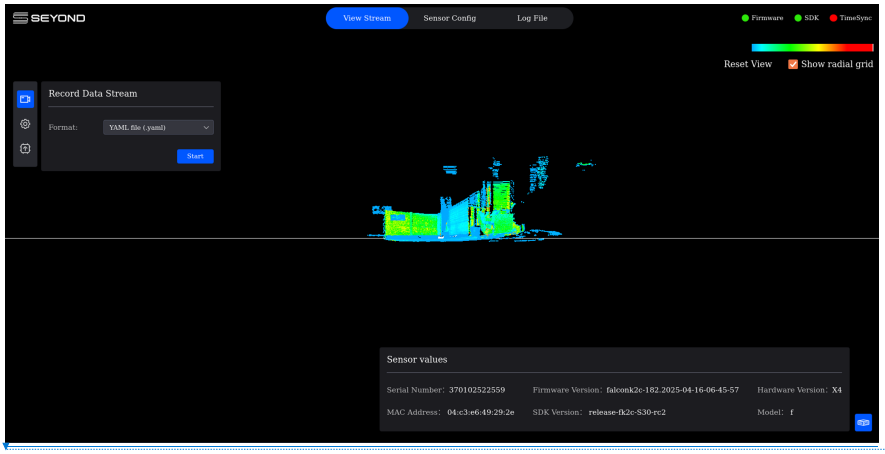
書式を変更: フォント : 太字 (なし)

書式を変更: フォント : 太字 (なし)

書式変更: インデント : 左 0 字

書式を変更: フォント : 太字 (なし) , フォントの色 : テキスト 1

書式変更: 行間 : 1 行, 行頭文字または番号を削除



1. Select the file format and size of the data to be recorded.
   - Record a file in .pcd format.

     Select Pointcloud snapshot (.pcd) in Format. Enter the number of frames to be recorded in frame(s). The range is from 0 to 20.
   - Record a file in inno_pc format.

     Select Inno-pointcloud (.inno_pc) in Format. Enter the number of frames to be recorded in frame(s).

     inno_pc is a proprietary format of Seyond point cloud files and cannot be read by 3rd party software. The points in inno_pc files are in spherical coordinates. inno_pc is in the optimum compression.
   - Record a file in inno_pc_xyz format.

     Select Cartesian coordinates Pointcloud (.inno_pc_xyz) in Format. Enter the number of frames to be recorded in frame(s). The range is from 0 to 10.

     inno_pc_xyz is a proprietary format of Seyond point cloud files and cannot be read by 3rd party software. The points in inno_pc_xyz files are in Cartesian coordinates. inno_pc_xyz is in the less optimum compression compared to inno_pc.
   - Record a file in inno_raw format.

     In the [Format] dropdown menu, select Innovusion raw data (.inno_raw). In the [MiB] input box, specify the file size (range: 10–200 MiB).

     The .inno_raw format is a proprietary raw point cloud file format developed by Seyond.
   - To record a YAML format file.

     In the [Format] dropdown menu, select YAML file (.yaml).
2. Click Start to record the file. If Manual is selected, click Stop to stop recording the file.

Note

Point cloud data recording starts immediately by default.

削除:

上へ移動 [1]: <#>Select the way to record the point cloud file.
If Auto is selected, specify the size of file before recording. If Manual is selected, the recording will continue until Stop is clicked.

書式を変更 ... [31]

削除:

書式を変更 ... [32]

書式変更: インデント：左 0 字, 行間： 1 行

書式変更: インデント：ぶら下げインデント： 4.42 字, 左 0 字, 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行

削除:

書式を変更 ... [33]

書式変更: インデント：左 0 字, 行間： 1 行

書式変更: インデント：ぶら下げインデント： 4.42 字, 左 0 字, 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行

書式を変更 ... [34]

書式変更: インデント：左 0 字, 行間： 1 行

書式変更: インデント：左： 13.8 mm, 行間： 1 行

書式変更 ... [35]

書式変更: インデント：左： 13.8 mm, 行間： 1 行

書式変更 ... [36]

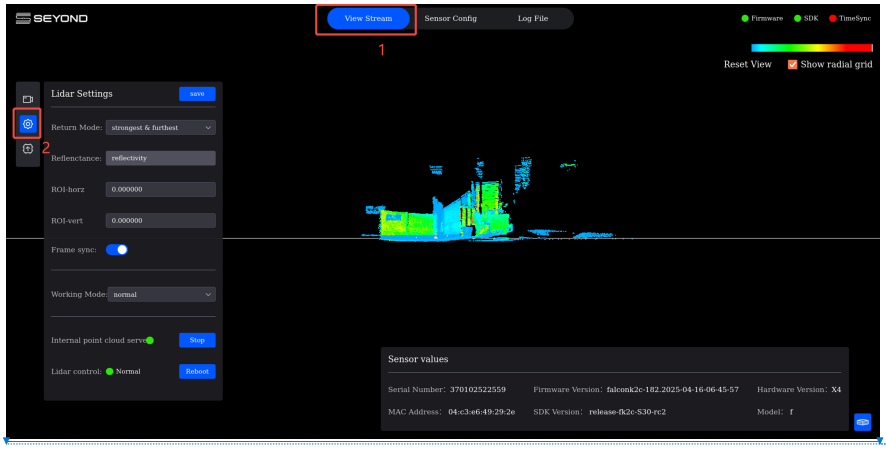
書式変更: インデント：左： 13.8 mm, 行間： 1 行

書式を変更 ... [37]

書式変更: 行間： 1 行

LiDAR configuration

Go to **View Stream** > **LiDAR Settings** to check and configure LiDAR settings.



3.1.1.1 Select return mode

Configure the number and method of echo receptions for each laser emission. The Return Mode can be set to either Single Return or Dual Return.

In Dual Return mode, two options are available:

- 2 Strongest: The system outputs the strongest and second strongest echoes.
- Strongest & Furthest: The system outputs the strongest and furthest echoes.

By default, the system operates in Single Return mode.

3.1.1.2 Select working Mode

In the [Working Mode] section, select the desired operating mode of the LiDAR. The following four modes are available:

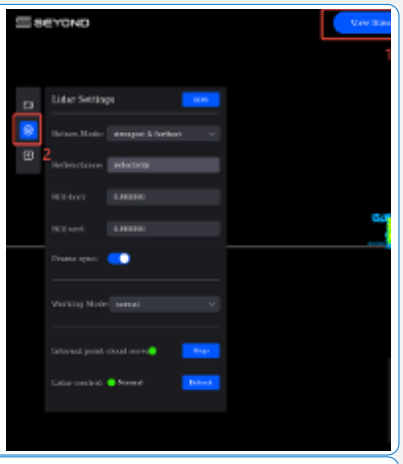
- Standby: The laser, polygon, and galvo are inactive, while electronic components remain powered to allow quick switching to working mode.
- Normal: Normal operating mode.
- Calibration: Calibration mode.
- Quiet: Quiet mode. In this mode, the operational noise level is reduced.

Note

Before changing the working modes, please contact Seyond technical staff for confirmation.

Configure ROI

1. Go to **View Stream** > **LiDAR settings**.



削除:

削除: ↵

書式変更: inno-图片

書式変更: 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行

書式変更: リスト段落, インデント：左： 6.3 mm, ぶら下げインデント： 3.57 字, 間隔 段落前： 3 pt, 段落後： 3 pt, 箇条書き + レベル：1 + 整列： 6.3 mm + インデント： 12.7 mm

削除: Configure the return mode received when a laser is emitted once. ↵
Either single return mode or dual return mode can be selected, and the dual return mode has two options: **strongest + 2 strongest** and **strongest & furthest**. The single return mode is chosen by default.

書式変更: 標準

削除: Select the working mode of the LiDAR in Setting Mode.

書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.42 字, 行間： 1 行

削除: Standby： The standby mode. In this mode, components such as the laser, polygon and Galvo are disabled. The other internal components continue to function for fast switching to normal mode.↵

... [38]

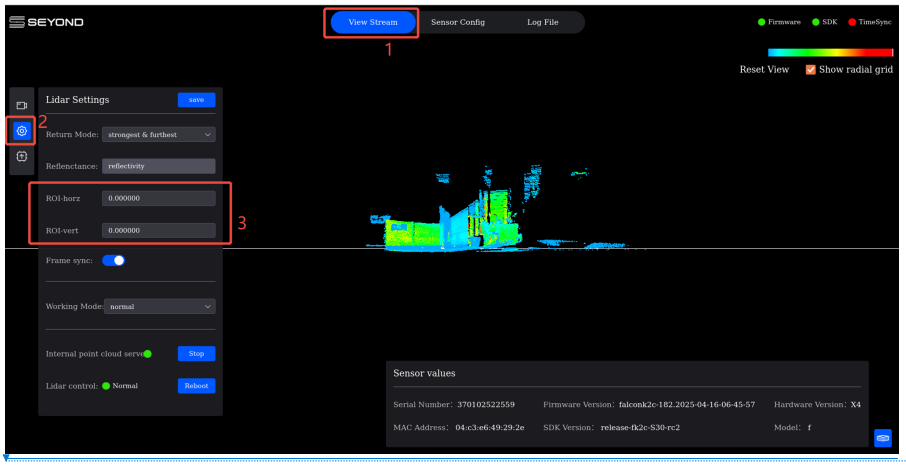
削除: ↵

書式変更: inno-说明, 間隔 段落前： 0 pt, 段落後： 0 pt

書式変更: 標準

削除: PCS

書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.42 字, 行間： 1 行



Enter the ROI region position.

- ROI-horz defines the horizontal center position of the ROI region, with a range of –60° to +60°.
- ROI-vert defines the vertical center position of the ROI region, with a range of –12.4° to +14.1° (the actual configurable range depends on the customer's Scan Pattern).

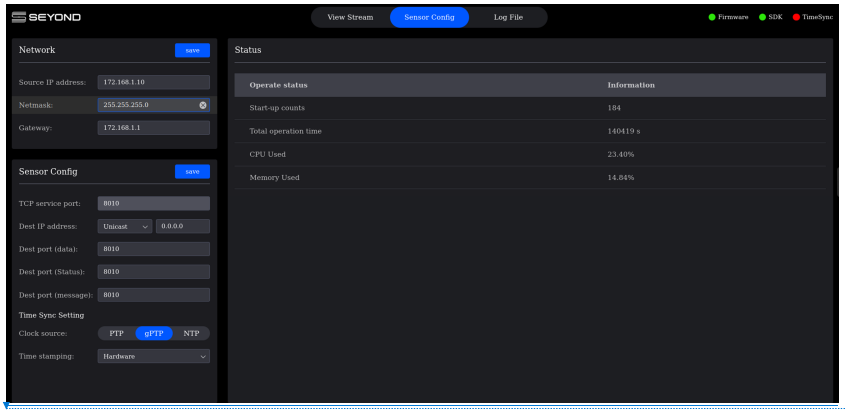
Both ROI-horz and ROI-vert are measured in degrees (°).

- After changing the ROI center position, click Save.

Upon power cycling, the LiDAR will automatically reset to the saved ROI center position.

Change the LiDAR IP address

1. Go to **Sensor Config** > **Network**.



2. The IP address, netmask address, and gateway address of the LiDAR can be modified according to user needs. Click **Save** to save the changes.

削除:

書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.4 字, 行間： 1 行

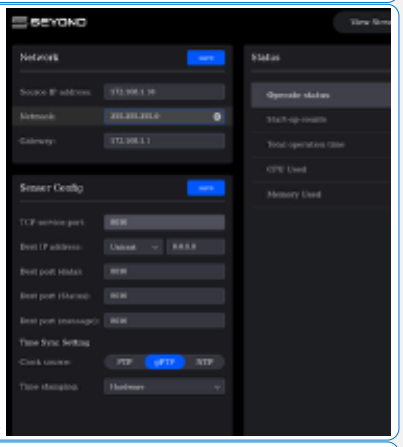
書式を変更: フォントの色：テキスト 1

削除: Enter the position of the ROI area. ROI-horz is the horizontal center position of the ROI area, with a value range from -60 to 60; ROI-vert is the vertical center position of the ROI area, with a value range from -13 to 13 (the actual configurable range depends on the customer's scan pattern). Both ROI-horz and ROI-vert are meas ... [39]

書式を変更: フォント：(英) Microsoft YaHei

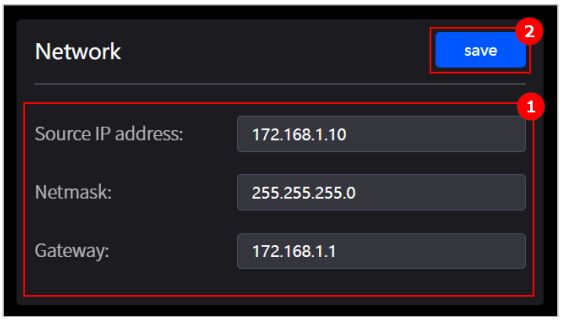
書式変更: inno-一级无序列表, インデント：左： 0 mm, ぶら下げインデント： 4.4 字

削除:

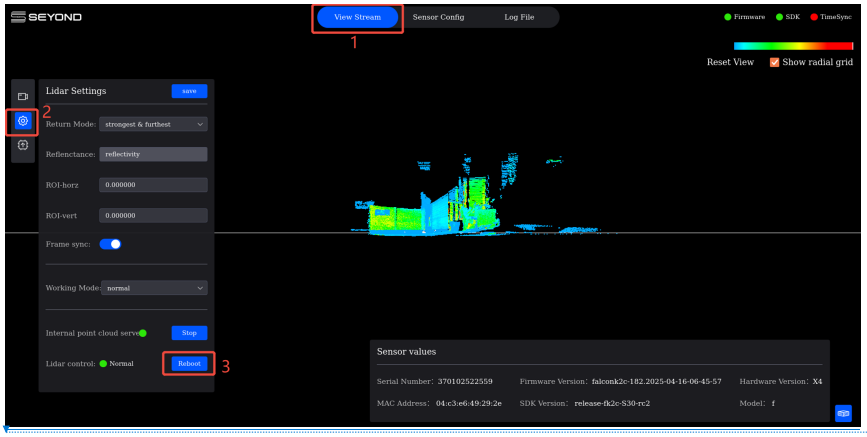


書式変更: 行間： 1 行

削除: ↵



3. Select **View Stream** > LiDAR **Settings**. Click **Reboot** to reboot the LiDAR.



4. The IP address will be reset after rebooting. Be sure to use the new IP address when logging into the ILA.

Time synchronization

Go to **Sensor Config** > **Sensor Config**.

Falcon K2 supports PTP, gPTP and NTP time synchronization method.

削除: PCS

書式変更: 行間： 1 行

削除:

削除: ↵

書式変更: 行間： 1 行

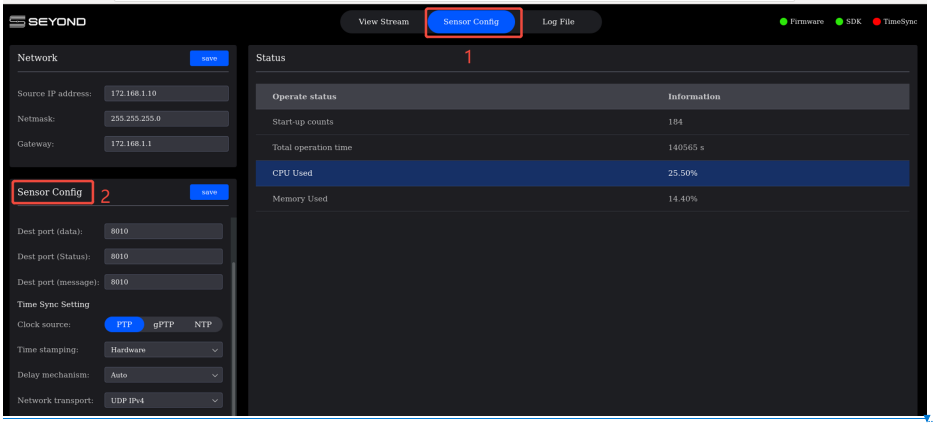
書式を変更: フォント：(英) Microsoft YaHei

書式変更: inno-一级有序步骤

削除: Currently,

削除: as the

書式変更: 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行



3.1.1.3 PTP time synchronization

PTP (Precision Time Protocol) is a high-precision time synchronization protocol designed to ensure accurate timestamp alignment between devices. Two synchronization methods are available:

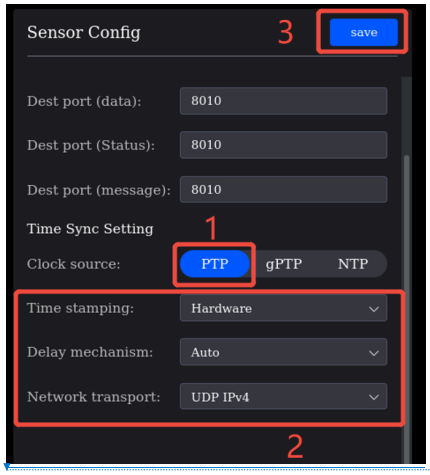
- Hardware Timestamp Synchronization

  Achieves sub-microsecond-level accuracy through hardware-level timing signals.
- Software Timestamp Synchronization

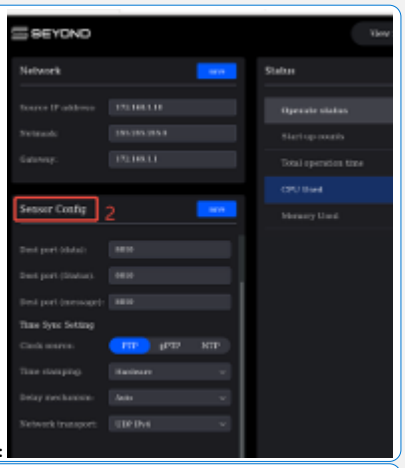
  Achieves tens of microseconds accuracy using software-based time stamping.

Configuration Procedure

1. Change the physical interface for PTP time synchronization in **ptp4l.service**.
2. Users should choose the appropriate timing method based on actual conditions and configure accordingly. Click **save** to save the settings.



削除:



書式変更: inno-图片

削除: PTP (Precision Time Protocol) is a high-accuracy time synchronization protocol. PTP time synchronization is divided into Hardware timestamp synchronization (sub-microsecond accuracy) and Software timestamp synchronization (tens of microseconds accuracy).

書式変更: リスト段落, インデント：左： 12.7 mm

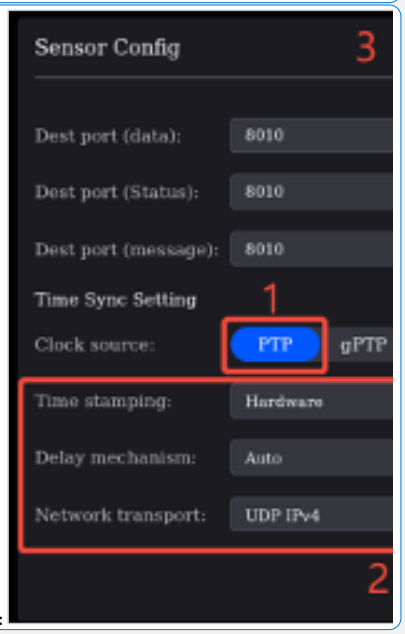
書式を変更: フォント：太字

書式変更: 標準, 間隔 段落前： 3 pt, 段落後： 3 pt

書式変更: 行間： 1 行

削除:

削除:



Note

PTP WL: PTP whitelist. PTP whitelist. Only the devices specified by the PTP whitelist can be the source clock in the PTP time synchronization. Any devices not in the whitelist cannot synchronize time with the LiDAR. The whitelist will take effect after powering off and on the LiDAR.

3. Perform a reboot to enable the settings. Check if the time has been synchronized on **Log File**.

3.1.1.4 gPTP time synchronization

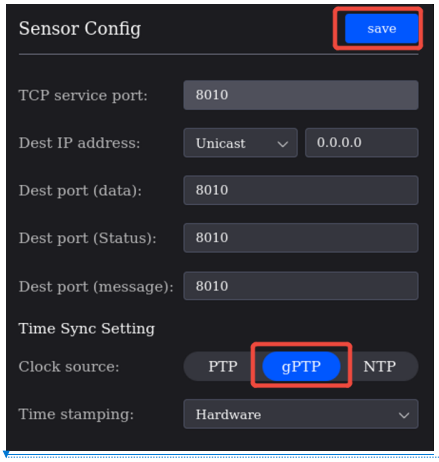
When using the gPTP (generalized Precision Time Protocol) synchronization mode, ensure that all network nodes and devices—from the time synchronization server to the LiDAR—support PTP time synchronization.

The gPTP synchronization method includes two timestamp synchronization modes:

- Hardware Timestamp Synchronization: Provides sub-microsecond accuracy.
- Software Timestamp Synchronization: Provides tens of microseconds accuracy.

Configuration Procedure

1. Change the physical interface for PTP time synchronization in **ptp4l.service**.
2. Users should choose the appropriate timing method based on actual conditions and configure accordingly. Click **save** to save the settings.



Note

PTP WL: PTP whitelist. PTP whitelist. Only the devices specified by the PTP whitelist can be the source clock in the PTP time synchronization. Any devices not in the whitelist cannot synchronize time with the LiDAR. The whitelist will take effect after powering off and on the LiDAR.

3. Perform a reboot to enable the settings. Check if the time has been synchronized on **Log File**.

3.1.1.5 NTP time synchronization

Network Time Protocol (NTP) is a networking protocol for clock synchronization between computer systems over

削除: hard

削除: of the LiDAR

削除: ↵

書式を変更: フォント : (英) Microsoft YaHei

書式変更: inno-一级有序步骤, インデント : 左 : 0 mm, ぶら下げインデント : 4.42 字, 間隔 段落前 : 0 pt, 段落後 : 0 pt, タブ位置: 3.43 字(なし)

削除: Make sure that all network nodes support PTP time synchronization before adopting gPTP as the time synchronization mode. gPTP time synchronization is also divided into Hardware timestamp synchronization (sub-microsecond accuracy) and Software timestamp synchronization (tens of microseconds accuracy).

書式変更: リスト段落, 間隔 段落前 : 3 pt, 段落後 : 3 pt, 箇条書き + レベル : 1 + 整列 : 6.3 mm + インデント : 12.7 mm

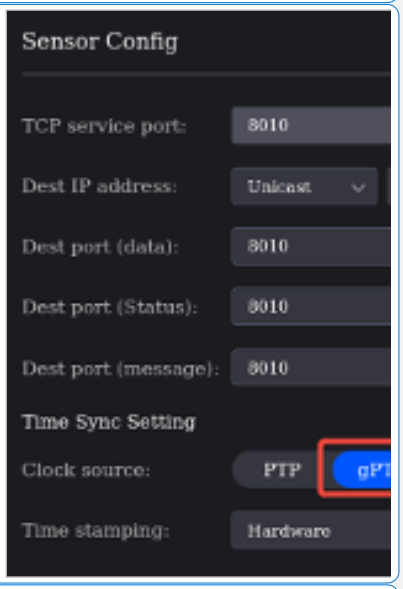
書式を変更: フォント : 太字

書式変更: 標準, 間隔 段落前 : 3 pt, 段落後 : 3 pt

書式変更: 行間 : 1 行

削除: ↵

削除:



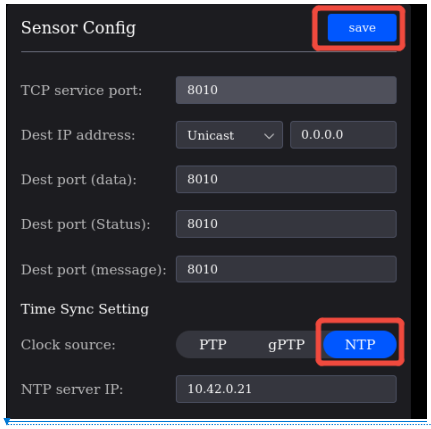
削除: hard

削除: of the LiDAR

書式変更: 行間 : 1 行

packet-switched, variable-latency data networks (precision at few microseconds).

1. Select **NTP**. Enter the IP address of the Master in **NTP server IP**. Click **save** to save the settings.

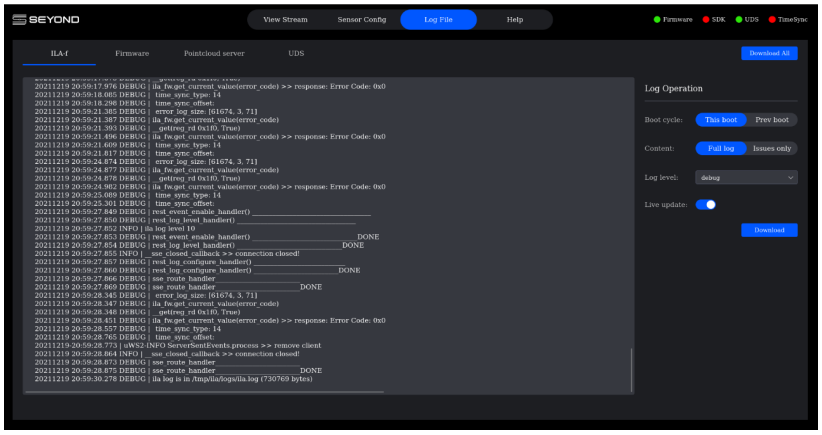


2. Perform a reboot to enable the settings. Check if the time has been synchronized on **Log File**.

View/download logs

Users can view and download various types of log files to verify operation records and alarm information.

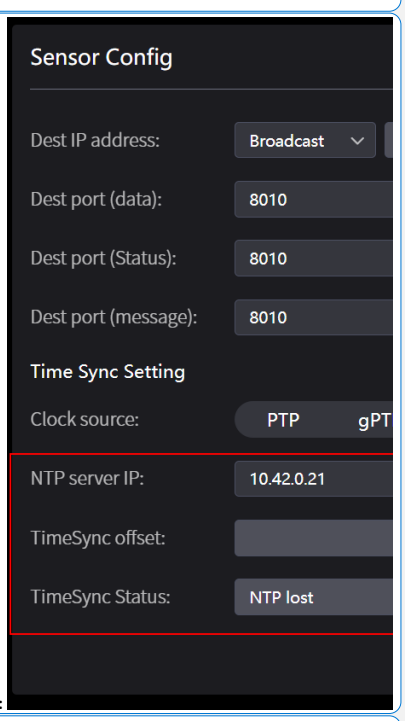
1. Navigate to the [Log File] page.
2. Select the type of log. Users can choose from **ILA-f (web page related logs), Firmware, Pointcloud server, and UDS** types of logs.



3. (Optional) Set the filtering criteria of the logs.
   - Time range: Select **Prev boot** or **This boot** to choose whether to display the last 100 log messages generated before this boot or those generated after this boot.

削除:

書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.42 字, 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行



削除:

削除: hard

削除: of the LiDAR

削除:

書式を変更: フォント：(英) Microsoft YaHei

書式変更: inno-一级有序步骤, インデント：左： 0 mm, ぶら下げインデント： 4.42 字

削除: Users can view and download different types of logs to confirm operation records and alarm information.

削除: Go to **Log File**.

書式変更: 行間： 1 行

書式変更: 行間： 1 行

書式変更: インデント：左： 6 mm, ぶら下げインデント： 4.42 字, 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行

- Type of log: Select Issues only or Full log to choose whether to display only the problem or all logs.
- Log level: Click Log level and select the log level to be displayed. The log level is described in the following table.

4. Users can view the logs on the left side or click 【Download】 to download the corresponding log.

Severity Level	Description
fatal	Indicates a critical and unrecoverable error. Such errors cause the application to terminate.
critical	Represents an irreversible error that prevents the system from operating normally.
error	Indicates general errors or exceptions encountered during operation.
temp	Currently not in active use.
warning	Provides warning messages, indicating potential risks or abnormal conditions.
debug	Contains information useful for debugging the application.
info	Highlights general operational information during program execution.
trace	Outputs detailed messages for tracing program flow.
detail	Provides more detailed output than the trace level.
verbose	Outputs messages even more detailed than the trace level (used for deep analysis).
exception	Records exception-related information that occurs during execution.

View version information

Check the device serial number, hardware version, and SDK version information in the **View Stream** > **Sensor values**.

System shutdown

To shut down the system, disconnect the power supply.

The system will power off automatically once the power is disconnected

書式を変更: フォント : 太字 (なし)
書式を変更: フォント : 太字 (なし)
書式を変更: フォント : 太字 (なし)
書式付きの表
削除:
削除:
書式変更: inno-図片
削除:
削除: the LiDAR
削除: Disconnect the power supply to shut down the LiDAR.

3.2 Operate in ROS

This section is specifically for Ubuntu 18.04 with ROS version melodic.

Start the system

1. Connect the power supply to start the LiDAR.
2. The LiDAR completes initialization and generates data after powering on for 11 to 18 seconds.

Note

The LiDAR does not have a power switch. It will become operational when power is applied.

Capture the point cloud data

Note

Ensure the system is powered on before starting the ROS driver. The ROS driver needs to be restarted after the LiDAR is shut down or the software is restarted.

For instructions on installing the ROS environment, please refer to http://wiki.ros.org/.

1. Confirm the computer IP address settled the same subnet as the LiDAR.
2. Connect the computer to LiDAR and ensure the Ethernet connection. For the detailed connection, see *cable connection*.

Note

It is recommended to use the ping command to confirm smooth connectivity between the master control and the LiDAR, with a return value as shown.

```
demo@demo-OMEN-by-HP-Laptop-16-b0xxx:~$ ping 172.168.1.10
PING 172.168.1.10 (172.168.1.10) 56(84) bytes of data.
64 bytes from 172.168.1.10: icmp_seq=1 ttl=64 time=0.100 ms
64 bytes from 172.168.1.10: icmp_seq=2 ttl=64 time=0.155 ms
64 bytes from 172.168.1.10: icmp_seq=3 ttl=64 time=0.159 ms
^C
--- 172.168.1.10 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2052ms
rtt min/avg/max/mdev = 0.100/0.138/0.159/0.026 ms
demo@demo-OMEN-by-HP-Laptop-16-b0xxx:~$
```

3. View the system details and obtain the corresponding driver. Copy the driver to the root directory of the system. Execute the following command to install the driver.

```
sudo dpkg -i <package.deb>
```

Note

In this step, package.deb refers to the name of the LiDAR driver package. Please obtain the latest version of the driver according to your requirements.

To acquire the appropriate driver package, please contact your Seyond technical support staff.

Table 5 System Version Support

System Version	CPU Category	Support Status
Ubuntu 18.0.4	ARM	Supported
	X86	Supported
Ubuntu 20.0.4	ARM	Supported
	X86	Supported

4. Run ROS. The return value when the driver is installed correctly is shown in the figure.

削除: ↵

書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.42 字, 行間： 1 行

削除: ↵

書式変更: inno-说明

削除: Obtain

削除: ↵

削除: 。

書式を変更: 段落フォント

削除: Change

削除: to

削除: with

削除: ↵

書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.42 字, 行間： 1 行

削除: ↵

書式変更: inno-图片

書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.42 字, 行間： 1 行

削除: ↵

書式変更: inno-示例, 間隔 段落前： 6 pt, 段落後： 6 pt

削除: Note↵
In this step, package.deb represents the name of the LiDAR's driver package. Please obtain the latest version of the driver based on the actual situation.

roscore

Note

If any abnormalities occur while acquiring data through ROS1 or ROS2, try executing the following command before retrieving data again:

source /opt/ros/<distro>/setup.bash

5. Start the ROS1 driver to acquire LiDAR data.

//View and acquire the live point cloud data via the UDP port (default)

roslaunch seyond start.launch lidar_ip:=172.168.1.10 udp_port:=8010

//View and acquire the live point cloud data via the UDP port (default)

roslaunch seyond start.launch lidar_ip:=172.168.1.10 tcp_port:= 8010

//Packet mode

roslaunch seyond start.launch lidar_ip:=172.168.1.10 udp_port:=8010 packet_mode:=true

Note

Default LiDAR_ip_Address is 172.168.1.10. Default UDP_port and tcp_port are 8010.

Note

In packet mode, data is published to the /iv_packets topic in inno_pc format.

The stored data occupies approximately one-fourth of the memory size compared to data stored from the /iv_points topic.

However, this data format requires Seyond's proprietary ROS driver for playback.

For playback instructions, refer to the section "Replaying PCAP Files."

書式変更: inno-示例, 間隔 段落前： 6 pt, 段落後： 6 pt

削除: ↵
Obtain

削除: the LiDAR point cloud data.

削除: The return value when point cloud data is correctly retrieved is shown in the figure.

削除: <#>Obtain the point cloud data via the TCP port.↵
source /opt/ros/<ros_version>/setup.bash↵
roslaunch innovusion_pointcloud innovusion_points.launch device_ip:= <device_ip> port:=< TCP_port >↵

削除: <#>Obtain

削除: <#>.

書式を変更: フォント : (英) Calibri, 10.5 pt

書式変更: 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行

書式を変更: フォント : 10.5 pt

書式変更: 行間： 1 行

書式を変更: フォント : (英) Calibri, 10.5 pt

書式変更: 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行

書式を変更: フォント : 10.5 pt

書式変更: 行間： 1 行

書式を変更: フォント : (英) Calibri, 10.5 pt

書式変更: 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行

削除: source /opt/ros/<ros_version>/setup.bash↵
roslaunch innovusion_pointcloud innovusion_points.launch device_ip:= <device_ip> udp_port:= <UDP_port>↵

削除: The d

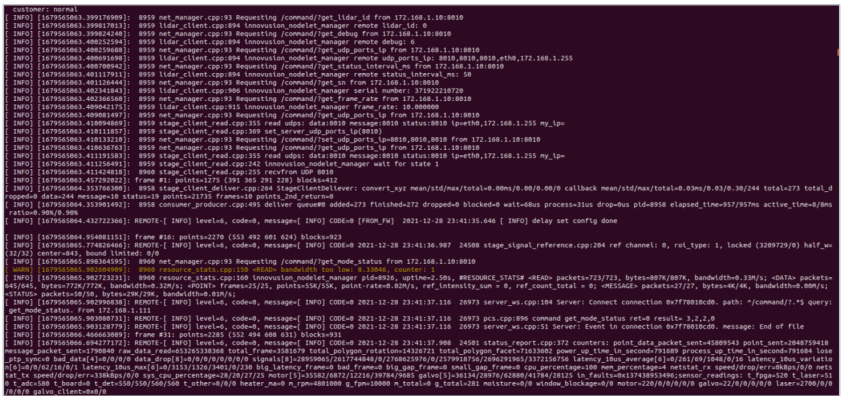
削除: device_

削除: ip

削除: The d

削除: is

書式変更: 両端揃え



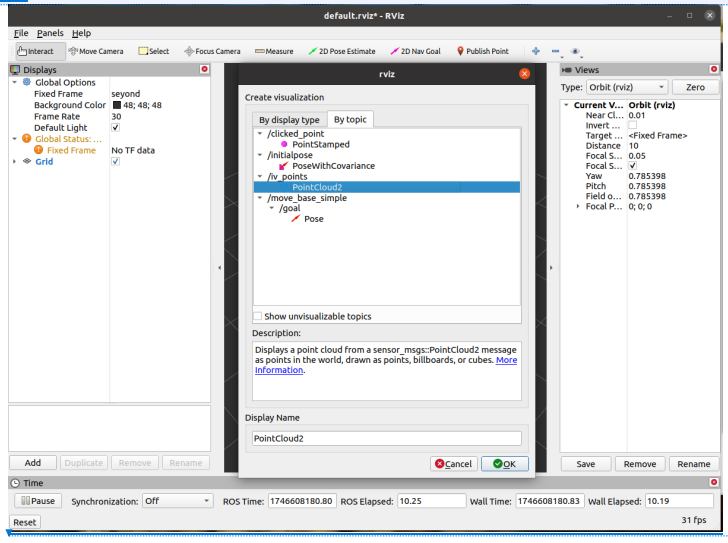
View LiDAR point cloud status

Note

Before checking the LiDAR point cloud status, please ensure that point cloud data has been successfully acquired.

1. Run the graphical tool **rviz**. The rviz client will open.

```
rviz -f seyond
```



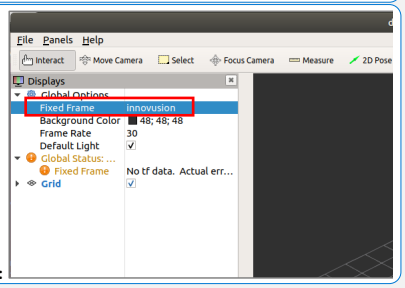
2. Add and adjust PointCloud2.

   i. Add PointCloud2 to the **Displays**.

削除: Before viewing the LiDAR point cloud status, please ensure that the point cloud data has been correctly obtained....

削除: innovusion

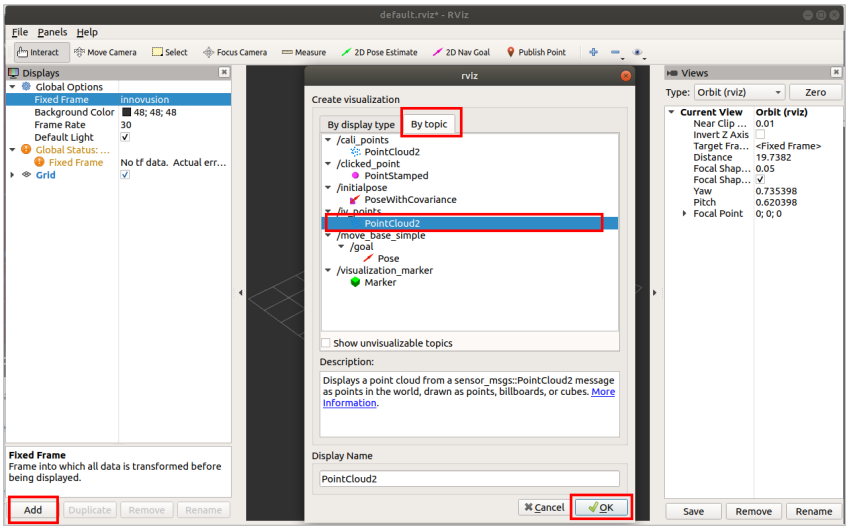
削除:



a. Click **Add**.

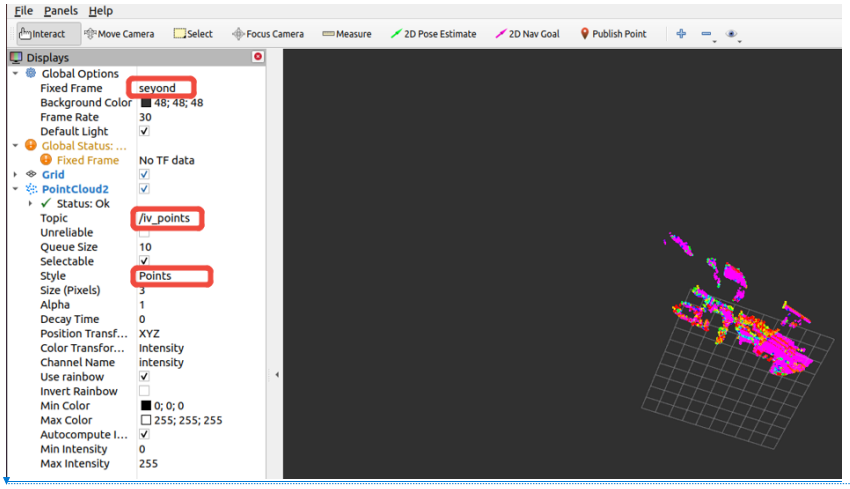
b. Select [By topic] > [iv_points] > [PointCloud2].

c. Click **OK**.



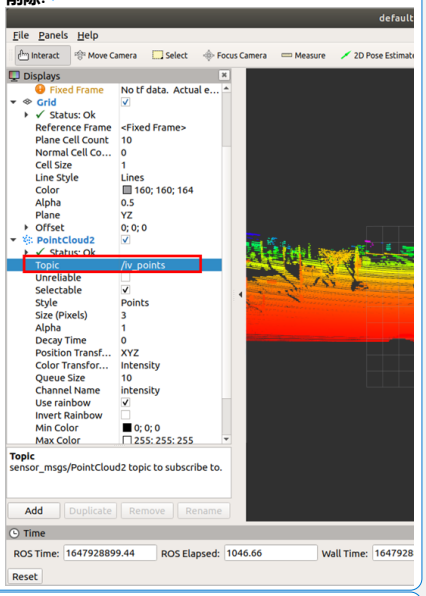
ii. Select **PointCloud2** > **Topic** , change the **Topic** value to **/iv_points**.

iii. Select **PointCloud2** > **Style** , change the **Style** value to **Points**.



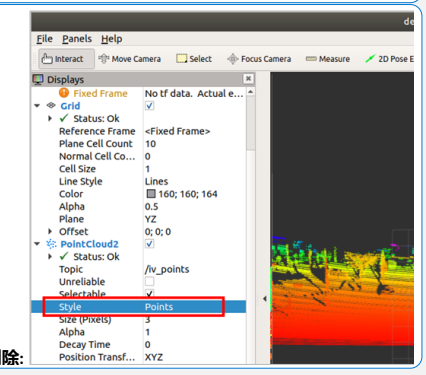
削除: .

削除:



書式変更: inno-二级有序步骤

削除:



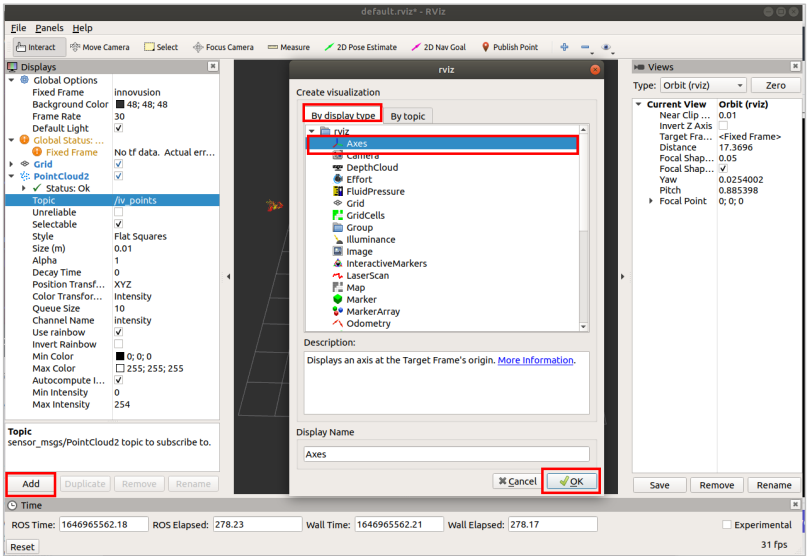
Note

For multi-LiDAR configurations, you need to add multiple PointCloud2 nodes, with each node's topic name corresponding to the configured LiDAR frame_topic

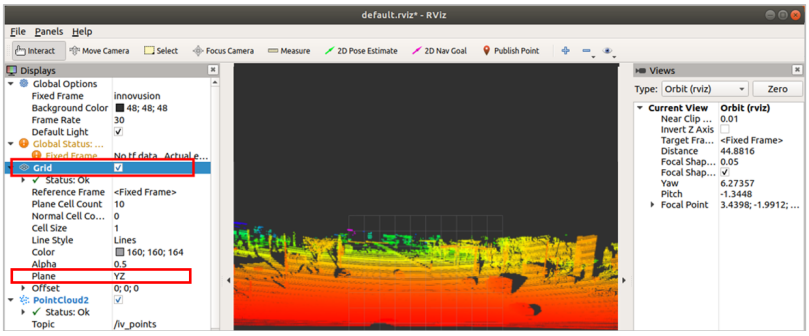
書式变更: inno-说明

3. (Optional) It is possible to change the angle and distance of the real-time point cloud status to get more information as needed.

- Add **Axes** to display the coordinate system to the diagram as a reference.
  a. Select Add > By display type > Axes.
  b. Click **OK** to add **Axes**.
  c. Check **Axes** to display the coordinate system.



- Select **Grid** to add the grid to the diagram as a reference. Grid is enabled by default when rviz is started.
- Set the **plane** value to view the point cloud status under different coordinate systems. The **Plane** options are **XY**, **XZ**, and **YZ**.



Record LiDAR point cloud data

Users can record LiDAR point cloud data in .bag format within the ROS environment.

Note

Before recording the point cloud data of the LiDAR, please ensure that point cloud data has been correctly acquired through ROS.

For detailed instructions on how to acquire point cloud data, refer *obtaining point cloud data.*

1. Execute the following command to record point cloud data in .bag format. Recording starts from the execution time.

```
rosbag record /iv_points -o inno // Starts recording point cloud data in the current directory, file named "inno-Yr-Mo-Dy-Hr-Min-Sec.bag"。
```

```
demo@demo-OMEN-by-HP-Laptop-16-b0xxx:~$ rosbag record /iv_points -o inno
[ INFO] [1646810706.460522054]: Subscribing to /iv_points
[ INFO] [1646810706.463553818]: Recording to 'inno_2022-03-09-15-25-06.bag'.
```

2. Press **Ctrl+C** to stop recording the point cloud data.
3. (Optional) Execute the `ls -a` command to check the directory of recorded point cloud data.

```
^Cdemo@demo-OMEN-by-HP-Laptop-16-b0xxx:~$ ls -a
.                                   Python-2.7.15.tgz
..                                  .ros
.bash_history                       ros-driver-test-public_ubuntu1604-kinetic-jsk-ceres.tar
.bash_logout                        ros-driver-test-public_ubuntu1804-melodic-jsk-ceres
.bashrc                             .ros_kinetic
.cache                              ros-kinetic-innovusion-driver-release-2.4.0-rc226-arm-public.deb
.conda                              ros-melodic-innovusion-driver-release-2.4.0-rc224-arm-public.deb
.config                             ros-melodic-innovusion-driver-release-2.4.0-rc226-arm-public.deb
.dbus                               ros-melodic-innovusion-driver-release-2.4.0-rc226-public.deb
examples.desktop                    .rviz
.gnupg                              .rviz_kinetic
google-chrome-stable_current_amd64.deb .ssh
.gvfs                               .sudo_as_admin_successful
.ICEauthority                       .thunderbird
inno_2022-03-09-15-25-06.bag        公共的
.innovusion                         模板
.local                              图片
.mozilla                            文档
.nv                                 下载
.pki                                音乐
.profile                            桌面
demo@demo-OMEN-by-HP-Laptop-16-b0xxx:~$ rosbag record /iv_points -o inno
[ INFO] [1646811350.997787571]: Subscribing to /iv_points
[ INFO] [1646811351.000001151]: Recording to 'inno_2022-03-09-15-35-50.bag'.
^Cdemo@demo-OMEN-by-HP-Laptop-16-b0xxx:~$ ls -a
.                                   Python-2.7.15.tgz
..                                  .ros
.bash_history                       ros-driver-test-public_ubuntu1604-kinetic-jsk-ceres.tar
```

削除: ROS can be used to record the point cloud data of the LiDAR in bag format

削除: confirm

削除: the

削除: obtained

削除: in

削除: information

削除: obtain

削除: see

書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.42 字, 行間： 1 行

削除:

削除: ,

削除:

書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.42 字, 行間： 1 行

Replay LiDAR point cloud data

Users can replay LiDAR point cloud data files in .bag format through the ROS environment.

削除: **Replay the point cloud data in bag format in ROS environment.**

Note

Before replaying LiDAR point cloud data, please confirm that the recorded point cloud data file has been obtained.

1. Run ROS. The return value when the driver is installed correctly is shown in the image.

```
roscore
```

2. Run the graphical tool **rviz**.

```
Rviz -f seyond
```

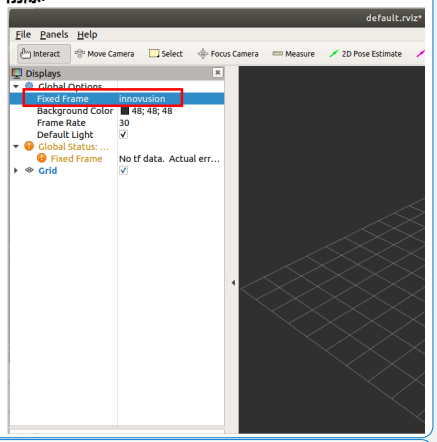
3. Replay LiDAR point cloud data in **rviz**.

```
rosbag play <filename.bag>
```

4. in RViz, select the corresponding point cloud for visualization.

削除: Select **Global Options** > **Fixed Frames**, change the value to **innovusion**

削除:



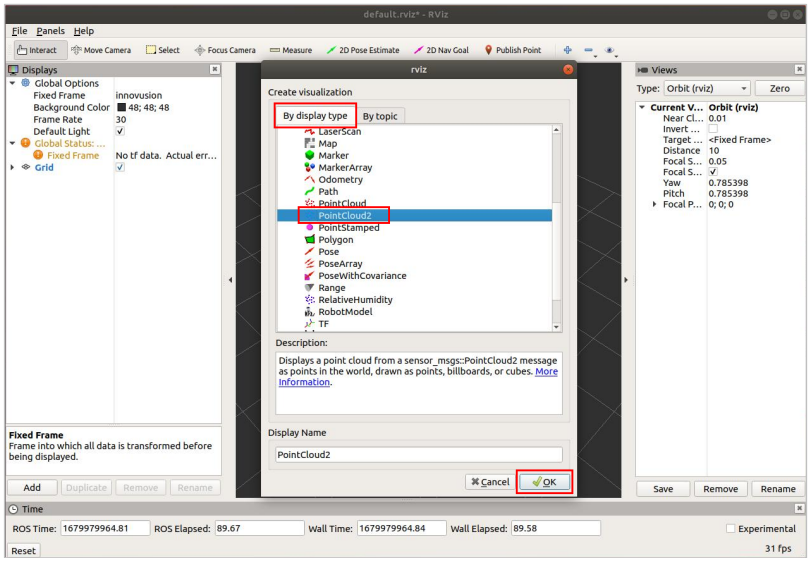
書式変更: inno-一级有序步骤, 段落番号 + レベル : 1 + 番号のスタイル : 1, 2, 3, … + 開始 : 1 + 配置: 左 + 整列 : 0 mm + インデント : 7.8 mm

5. Adjust parameters in PointCloud2.

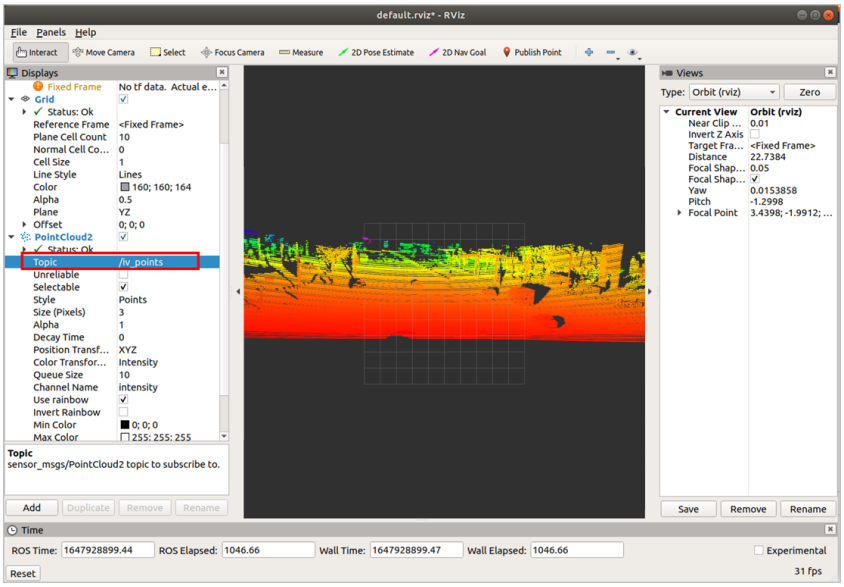
   i. Add **PointCloud2** to the **Displays.**

      a. Select Add > By display type > PointCloud2.

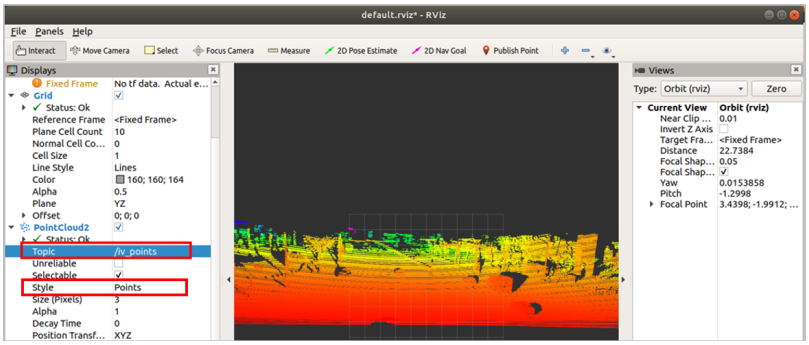
      b. Click **OK**.



   ii. Select **PointCloud2** >**Topic** , change the **Topic** value to **/iv_points**.



iii. Select **PointCloud2** > **Style**, change the **Style** value to **Points**.

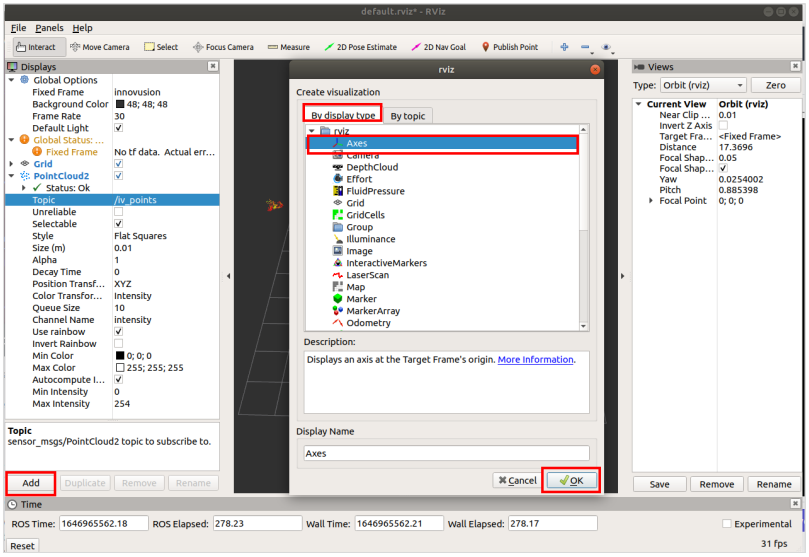


6. (Optional) It is possible to change the angle and distance of the real-time point cloud status to get more information as needed.

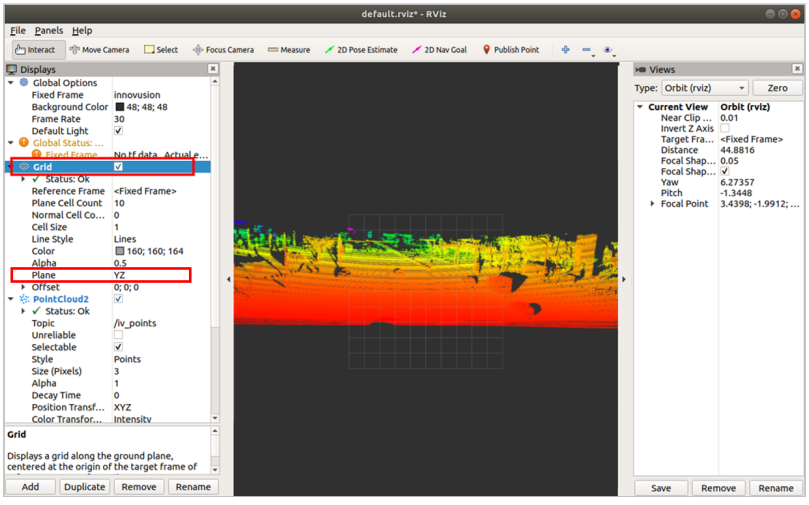
- Select **Axes** to add the coordinate system to the diagram as a reference.

  a. Select Add > By display type > Axes.

  b. Click **OK** to add **Axes**.



- Select **Grid** to add the grid to the diagram as a reference. Grid is enabled by default when **rviz** is started.
- Set the **plane** value to view the point cloud status under different coordinate systems. The available **Plane** values are **XY**, **XZ**, and **YZ**.



7. Press **Space** to pause playback of the point cloud data file.

Configure reflectance mode

Note

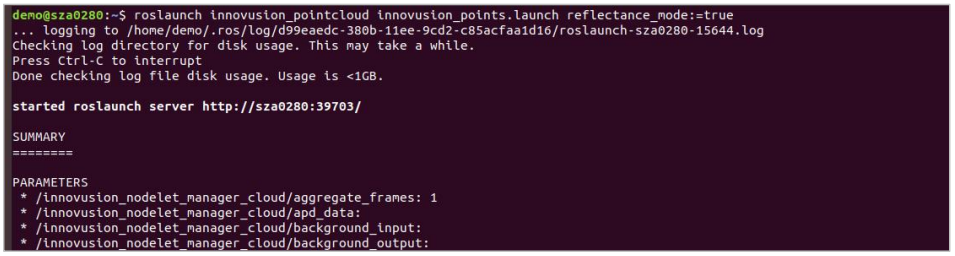
Before recording the point cloud data of the LiDAR, please confirm that the point cloud data has been obtained correctly in ROS.

```
roslaunch innovusion_pointcloud innovusion_points.launch reflectance_mode:=<true/false>
```

[Parameter description]

reflectance_mode： The LiDAR's reflectance mode. The value for reflectance mode can be either true or false.

- A value of false means that the reflectance mode of the LiDAR is selected as intensity. The return value in intensity mode is the echo read directly by LiDAR. The intensity varies with the influence of the factors including object distance, object reflectivity, beam angle, etc.
- A value of true means that the reflectance mode of the LiDAR is selected as reflectivity. The return value in reflectivity mode is the calculated result based on the intensity and rectified with the object distance, beam angle and other parameters.



Configure the return mode

Note

Before recording the point cloud data of the LiDAR, please confirm that the point cloud data has been obtained correctly in ROS.

```
roslaunch innovusion_pointcloud innovusion_points.launch multiple_return:=<return_mode>
```

[Parameter description]

multiple_return: the echo received when a laser is emitted once.

- A default value of 1 means the single return mode.
- A value of 2 means the strongest + 2 strongest return mode.
- A value of 3 means the strongest & furthest return mode.

```
demo@sza0280:~$ roslaunch innovusion_pointcloud innovusion_points.launch multiple_return:=1
... logging to /home/demo/.ros/log/d99eaedc-380b-11ee-9cd2-c85acfaa1d16/roslaunch-sza0280-15740.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://sza0280:44597/

SUMMARY
========

PARAMETERS
 * /innovusion_nodelet_manager_cloud/aggregate_frames: 1
 * /innovusion_nodelet_manager_cloud/apd_data:
 * /innovusion_nodelet_manager_cloud/background_input:
 * /innovusion_nodelet_manager_cloud/background_output:
 * /innovusion_nodelet_manager_cloud/cali_data:
 * /innovusion_nodelet_manager_cloud/calibration:
 * /innovusion_nodelet_manager_cloud/continue_live: 1
 * /innovusion_nodelet_manager_cloud/coordinate_mode: 0
 * /innovusion_nodelet_manager_cloud/debug_ref_time:
 * /innovusion_nodelet_manager_cloud/delay_correction:
 * /innovusion_nodelet_manager_cloud/device_ip: 172.168.1.10
 * /innovusion_nodelet_manager_cloud/e_data:
 * /innovusion_nodelet_manager_cloud/extended_packet_format: False
 * /innovusion_nodelet_manager_cloud/fe_data:
 * /innovusion_nodelet_manager_cloud/file_rewind: 0
 * /innovusion_nodelet_manager_cloud/file_skip_in_k: 0
 * /innovusion_nodelet_manager_cloud/frame_id: innovusion
 * /innovusion_nodelet_manager_cloud/interactive: False
 * /innovusion_nodelet_manager_cloud/interactive_byte: 1
 * /innovusion_nodelet_manager_cloud/lidarhome:
 * /innovusion_nodelet_manager_cloud/manager: innovusion_nodele...
 * /innovusion_nodelet_manager_cloud/max_range: 2000.0
 * /innovusion_nodelet_manager_cloud/min_range: 0.4
 * /innovusion_nodelet_manager_cloud/model:
 * /innovusion_nodelet_manager_cloud/motion_hint_file:
 * /innovusion_nodelet_manager_cloud/multiple_return: 1
 * /innovusion_nodelet_manager_cloud/name_value_pairs:
 * /innovusion_nodelet_manager_cloud/nps: False
```

(Optional) Convert a file in rosbag format to a file in pcd format

1. Run ROS. The return value is shown in the figure below.

```
roscore
```

```
demo@demo-OMEN-by-HP-Laptop-16-b0xxx:~$ roscore
... logging to /home/demo/.ros/log/a09b36de-9f71-11ec-874a-c85acfaa1d16/roslaunch-demo-OMEN-by-HP-Laptop-16-b0xxx-9812.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://demo-OMEN-by-HP-Laptop-16-b0xxx:42677/
ros_comm version 1.14.12


SUMMARY
========

PARAMETERS
 * /rosdistro: melodic
 * /rosversion: 1.14.12

NODES

auto-starting new master
process[master]: started with pid [9822]
ROS_MASTER_URI=http://demo-OMEN-by-HP-Laptop-16-b0xxx:11311/

setting /run_id to a09b36de-9f71-11ec-874a-c85acfaa1d16
process[rosout-1]: started with pid [9833]
started core service [/rosout]
```

2. Convert a .bag format file to a .pcd format file.

```
rosrun pcl_ros pointcloud_to_pcd input:=/iv_points
```

3. Play a .bag format file.

```
rosbag play <filename.bag>
```

削除:

書式变更: inno-图片

削除:

書式变更: inno-示例

Shut down the LiDAR

To shut down the system, disconnect the power supply. The system will power off automatically once the power is disconnected.

削除: Disconnect the power supply to shut down the LiDAR

3.3 Operate in ROS2 environment

The operations described in this chapter apply only to Ubuntu 20.04 with ROS Foxy.

Capture the point cloud data

Note

Ensure the system is powered on before starting the ROS driver.

The ROS driver needs to be restarted after the LiDAR is shut down or the software is restarted.

For instructions on installing the ROS environment, please refer to http://wiki.ros.org/.

1. Ensure the computer IP address to the same subnet with the LiDAR.
2. Connect the computer to LiDAR and ensure the Ethernet connection. For the detailed connection, see *cable connection*.

Note

It is recommended to use the ping command to confirm smooth connectivity between the master control and the LiDAR, with a return value as shown.

```
demo@demo-OMEN-by-HP-Laptop-16-b0xxx:~$ ping 172.168.1.10
PING 172.168.1.10 (172.168.1.10) 56(84) bytes of data.
64 bytes from 172.168.1.10: icmp_seq=1 ttl=64 time=0.100 ms
64 bytes from 172.168.1.10: icmp_seq=2 ttl=64 time=0.155 ms
64 bytes from 172.168.1.10: icmp_seq=3 ttl=64 time=0.159 ms
^C
--- 172.168.1.10 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2052ms
rtt min/avg/max/mdev = 0.100/0.138/0.159/0.026 ms
demo@demo-OMEN-by-HP-Laptop-16-b0xxx:~$
```

3. View the system details and obtain the corresponding driver. Copy the driver to the root directory of the system. Execute the following command to install the driver.

```
sudo dpkg -i <package.deb>
```

```
leilei@LT0429:~/Downloads/seyond_ros_driver-main/src/seyond_lidar_ros/src/seyond_sdk/3.103.4/ros-seyond$ ls
seyond-ros2-foxy-3.103.4-rv3.6.3-arm.deb
seyond-ros2-foxy-3.103.4-rv3.6.3-x86.deb
seyond-ros2-galactic-3.103.4-rv3.6.3-arm.deb
seyond-ros2-galactic-3.103.4-rv3.6.3-x86.deb
seyond-ros2-humble-3.103.4-rv3.6.3-arm.deb
seyond-ros2-humble-3.103.4-rv3.6.3-x86.deb
seyond-ros2-jazzy-3.103.4-rv3.6.3-x86.deb
seyond-ros-melodic-3.103.4-rv3.6.3-arm.deb
seyond-ros-melodic-3.103.4-rv3.6.3-x86.deb
seyond-ros-noetic-3.103.4-rv3.6.3-arm.deb
seyond-ros-noetic-3.103.4-rv3.6.3-x86.deb
seyond_sw_ros.tar.gz
leilei@LT0429:~/Downloads/seyond_ros_driver-main/src/seyond_lidar_ros/src/seyond_sdk/3.103.4/ros-seyond$ sudo dpkg -i seyond-ros2-humble-3.103.4-rv3.6.3-x86.deb
[sudo] password for leilei:
Selecting previously unselected package seyond-humble-driver.
(Reading database ... 309485 files and directories currently installed.)
Preparing to unpack seyond-ros2-humble-3.103.4-rv3.6.3-x86.deb ...
Unpacking seyond-humble-driver (3.103.4-rv3.6.3) ...
Setting up seyond-humble-driver (3.103.4-rv3.6.3) ...
leilei@LT0429:~/Downloads/seyond_ros_driver-main/src/seyond_lidar_ros/src/seyond_sdk/3.103.4/ros-seyond$
```

Note

In this step, package.deb refers to the name of the LiDAR driver package. Please obtain the latest version of the driver according to your requirements.

To acquire the appropriate driver package, please contact your Seyond technical support staff.

Table 5 System Version Support Status

System Version	CPU Category	Support Status
Ubuntu 20.0.4	ARM	Supported
	X86	Supported

削除: ↵

削除: This section is specifically for Ubuntu 20.04 with ROS version foxy.

削除: Obtain

削除: 。

削除: Change

書式変更: 行間： 1 行

書式変更: インデント：左 0 字

削除: ↵

書式変更: inno-图片

削除: ↵

書式変更: 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行

書式変更: inno-示例, 間隔 段落前： 3 pt, 段落後： 3 pt

書式変更: インデント：左 0 字

削除: In this step, package.deb represents the name of the LIDAR's driver package. Please obtain the latest version of the driver based on the actual situation. ↵

書式変更: inno-说明

書式付きの表

System Version	CPU Category	Support Status
Ubuntu 22.0.4	ARM	Supported
	X86	Supported

4. Capture LiDAR point cloud

```
//Capture the point cloud data via UDP (default with UDP mode, udp_port:=8010)
ros2 launch seyond_start.py lidar_ip:=<device_ip> udp_port:=<UDP_port>
example:
ros2 launch seyond_start.py lidar_ip:=172.168.1.10 udp_port:=8010
//Capture the point cloud data via TCP (not recommended)
ros2 launch seyond_start.py lidar_ip:=<device_ip> port:=<TCP_port>
example:
ros2 launch seyond_start.py lidar_ip:=172.168.1.10 tcp_port:=8010
//packet mode
ros2 launch seyond start.py packet_mode:=true
```

Note

The default device_ip is 172.168.1.10. The default TCP_port and UDP_port is 8010.

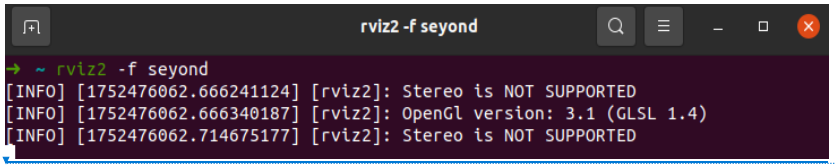
View LiDAR point cloud data

Note

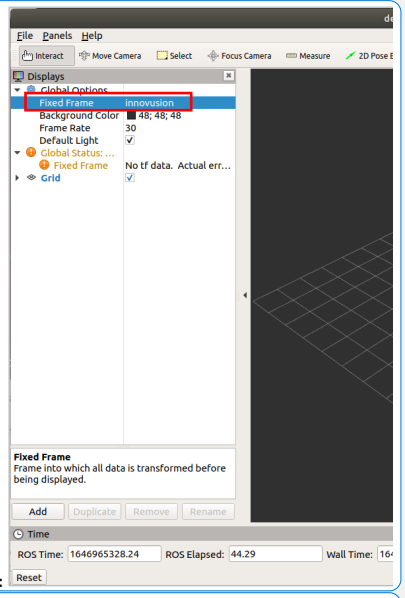
Before viewing the point cloud data, please confirm that the point cloud data has been obtained.

1. Execute the rviz2 command to launch the graphical visualization tool RViz in ROS2. After execution, the following output appears, indicating that the RViz client has been successfully opened.

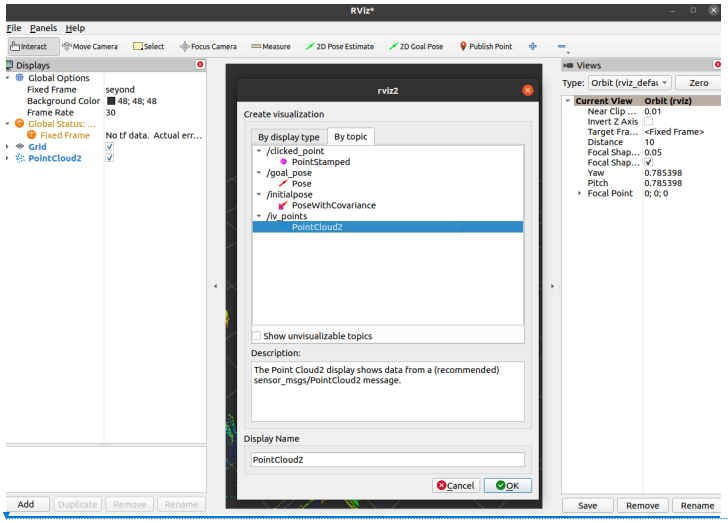
```
rviz2 -f seyond
```



2. Add and adjust **PointCloud2**.
   i. Add **PointCloud2** to the **Displays**.
      a. Click **Add**.
      b. Select By display topic > PointCloud2.
      c. Click **OK**.

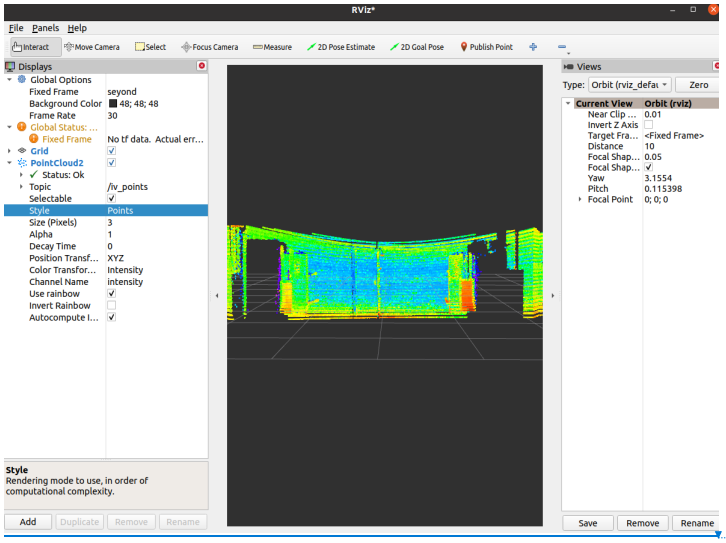


コメントの追加 [LS1]: Please check the capture po ... [41]
削除: ... [40]
削除: Obtain the point cloud data via TCP. ... [43]
書式を変更: フォント：10.5 pt
書式変更 ... [42]
削除: Method One ... [45]
書式変更 ... [44]
書式変更 ... [46]
削除: Obtain...apture the point cloud data via TCP ... [47]
書式を変更: フォント：10.5 pt
削除: Method One ... [49]
書式変更 ... [48]
書式変更 ... [50]
削除: udp
削除: tcp
削除: -1
削除: Method Two ... [52]
書式変更 ... [51]
削除: Please notice that the LiDAR transmits the dat ... [53]
書式変更: inno-说明
書式変更 ... [54]
削除: Start the graphical tool **rviz**. The return value ... [55]
削除: innovusion
書式変更 ... [56]
削除:
書式変更: 行間：1 行



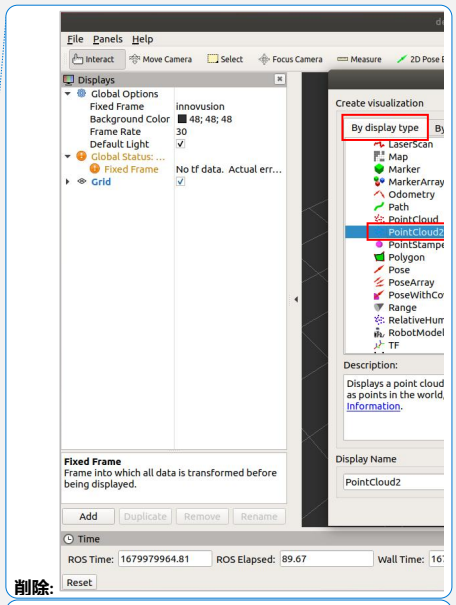
ii. Select **PointCloud2** > **Topic** , change the **Topic** value to **/iv_points**.

iii. Select **PointCloud2** > **Style**, change the **Style** value to **Points**.



3. (Optional) It is possible to change the angle and distance of the real-time point cloud status to get more information as needed.

- Select **Axes** to add the coordinate system to the diagram as a reference.
  a. Select Add > By display type > Axes.

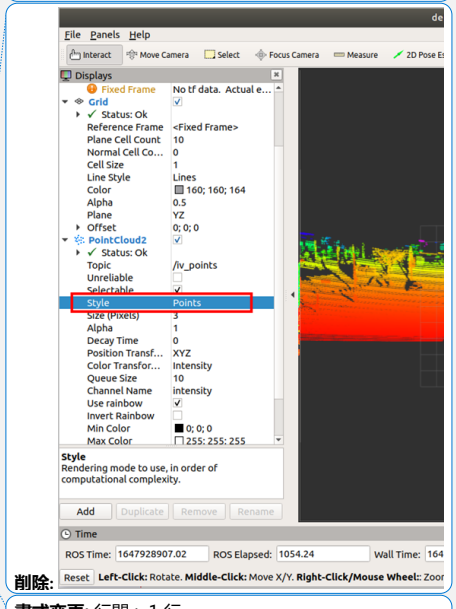


削除:

削除: ... [57]

書式変更: inno-二级有序步骤, インデント：左： 8 mm, ぶら下げインデント： 4.42 字

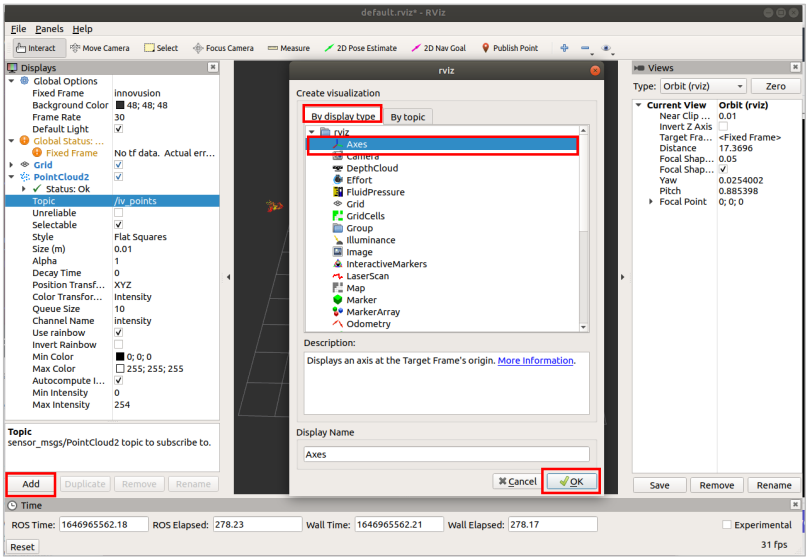
書式変更: インデント：左： 8 mm, ぶら下げインデント： 4.42 字, 行間： 1 行



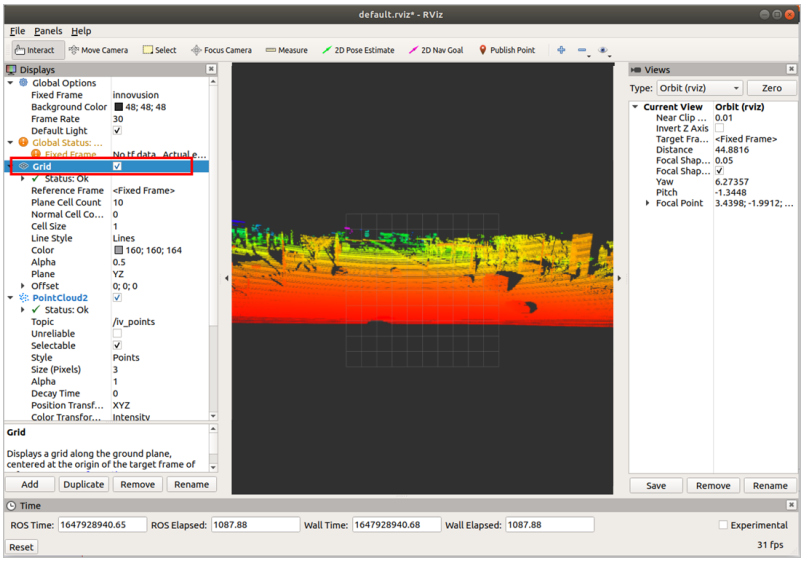
削除:

書式変更: 行間： 1 行

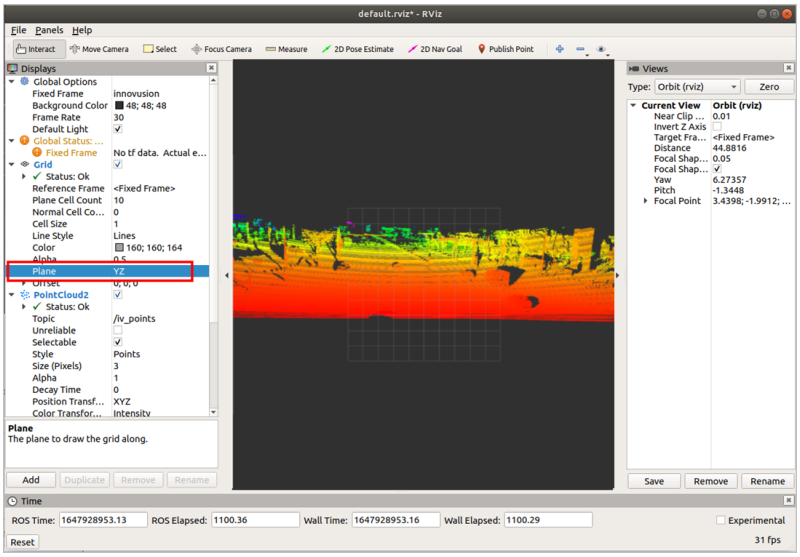
b. Click **OK** to add **Axes**.



- Select **Grid** to add the grid to the diagram as a reference. Grid is enabled by default when rviz is started.



- Set the **plane** value to view the point cloud status under different coordinate systems. There are three options: **XY**, **XZ**, and **YZ**.



Replay LiDAR point cloud data

It is possible to replay the point cloud data in pcap format in ROS environment.

Note

Before replaying LiDAR point cloud data, please ensure that a recorded point cloud data file is available.

1. Open a new terminal window and execute the rviz to launch the graphical visualization tool RViz in ROS.

```
rviz2 -f seyond
```

```
demo@sza0682:~$ ros2 run rviz2 rviz2
[INFO] [1691389803.621535541] [rviz2]: Stereo is NOT SUPPORTED
[INFO] [1691389803.621596887] [rviz2]: OpenGl version: 4.6 (GLSL 4.6)
[INFO] [1691389803.637049672] [rviz2]: Stereo is NOT SUPPORTED
```

2. Open a new terminal window and execute the following command to replay the LiDAR point cloud data in RViz.

```
ros2 bag play <bag-file> -l
```

3. In RViz, select the corresponding point cloud for visualization. For detailed instructions, refer to the section “Viewing LiDAR Point Cloud Status.”

[Parameter description]

削除: Before playing back LiDAR point cloud data, please ensure that you have obtained the recorded point cloud data files

削除: Run the graphical tool **rviz**. The return value and **rviz** interface are shown below

削除: `ros2 run rviz2 rviz2`

書式変更: 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行

書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.42 字, 行間： 1 行

削除: Execute the following command in rviz to replay LiDAR point cloud data

削除: `ros2 run innovusion publisher --ros-args -p device_ip:=<data_ip> -p pcap_file:=<pcap_file> -p udp_port:=<data_port> [-p packet_rate:=<playback_rate>] | [-p file_rewind:=<file_rewind>]`

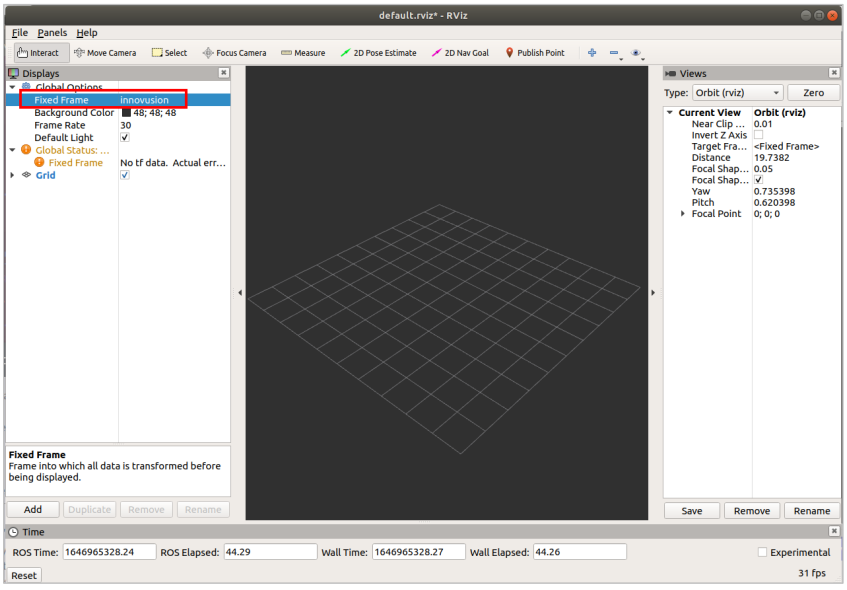
書式変更: 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行

書式を変更: フォント：(英) +本文のフォント (Calibri), 太字 (なし) , フォントの色：テキスト 1

書式変更: inno-一级有序步骤, インデント：左： 0 mm, ぶら下げインデント： 4.42 字, 段落番号 + レベル：1 + 番号のスタイル：1, 2, 3, … + 開始：1 + 配置: 左 + 整列： 0 mm + インデント： 7.8 mm

- device_ip: The IP address of the LiDAR from which the data was captured.
- pcap_file: The file name to be replayed.
- UDP port: The UDP port of the LiDAR from which the data was captured.
- packet_rate(Optional): The replay speed of the file. The default value is 20.
  - When the play_rate=0, the play speed is as fast as possible.
  - When the play_rate≤100, the unit of play speed is MB/s. e.g., When play_rate=50. the play speed is at 50 MB/s.
  - When the play_rate>100, the play speed=play_rate/10000.0. e.g., When play_rate=15000. the play speed is at 1.5 times.
- file_rewind(Optional): The number of times file is replayed.
  - A default value of 0 means no repeat.
  - A negative value means the file will be repeated indefinitely until the program is manually stopped.

4. Select **Global Options** > **Fixed Frames**, change the value to **innovusion**.



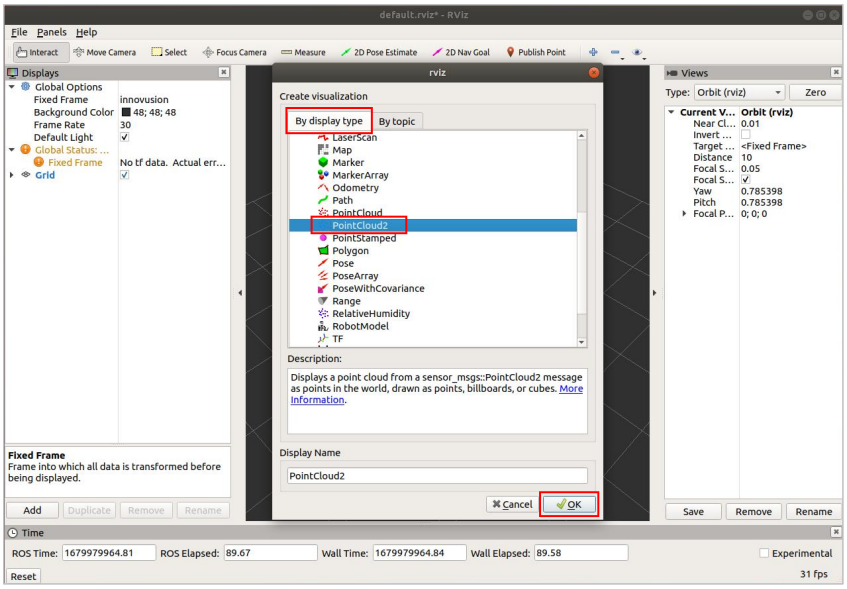
5. Adjust parameters in PointCloud2.
   i. Add P**ointCloud2** to the **Display**.
      a. Select Add > By display type > PointCloud2.
      b. Click **OK**.

削除:

書式変更: インデント：左： 2.48 字, ぶら下げインデント： 4.42 字, 間隔 段落前： 3 pt, 段落後： 3 pt, 行間：1 行

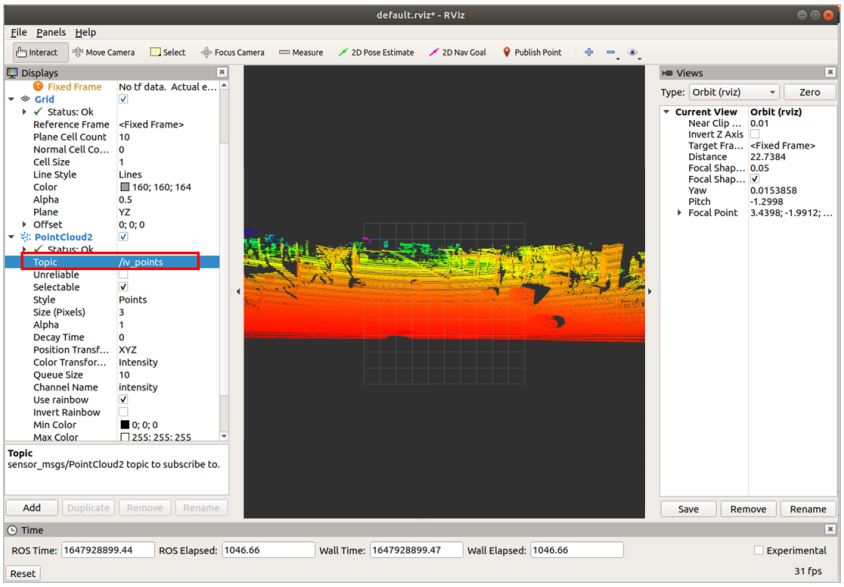
書式変更: インデント：左： 2.48 字, ぶら下げインデント： 4.42 字, 間隔 段落前： 3 pt, 段落後： 3 pt, 行間：1 行

書式変更: 行間： 1 行

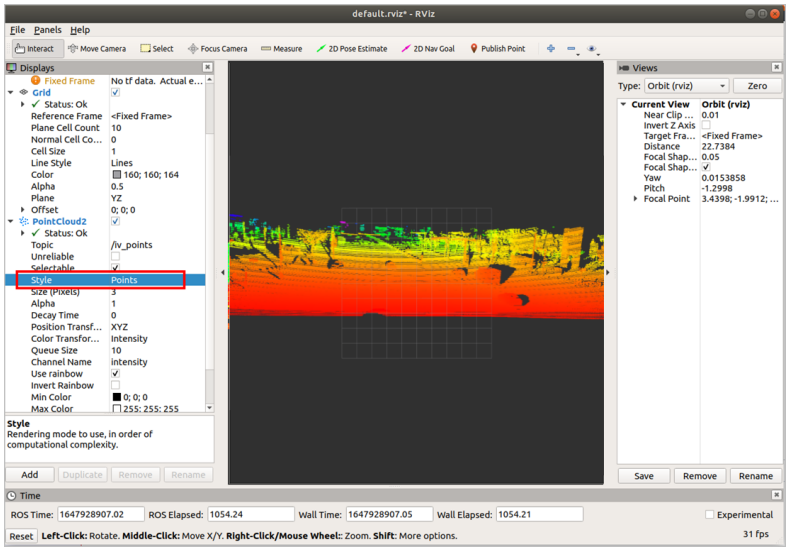


ii. Select **PointCloud2** > **Topic**, change the **Topic** value to **/iv_points**.

書式変更: インデント：左： 8 mm, ぶら下げインデント： 4.42 字, 行間： 1 行



iii. Select **PointCloud2** > **Style** , change the **Style** value to **Points**.



6. (Optional) It is possible to change the angle and distance of the real-time point cloud status to get more information as needed.

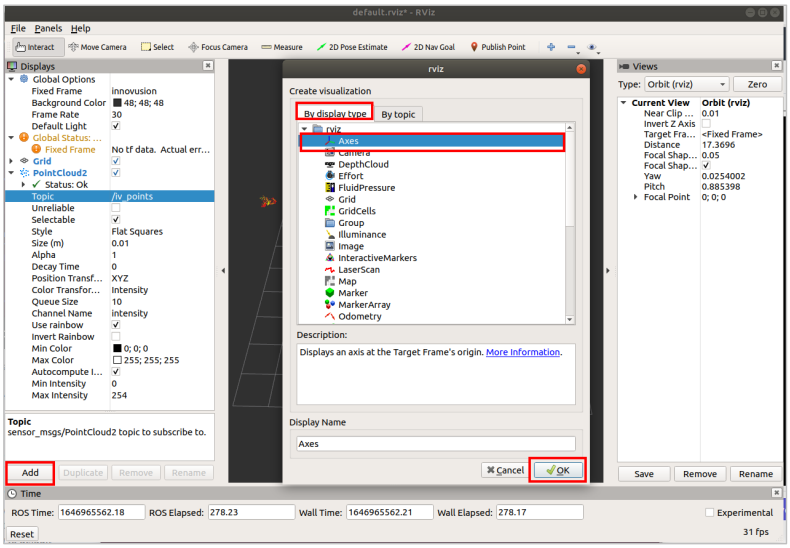
書式変更: インデント：左： 0 mm, ぶら下げインデント： 4.42 字, 行間： 1 行

- Select **Axes** to add the coordinate system to the diagram as a reference.

書式変更: 行間： 1 行

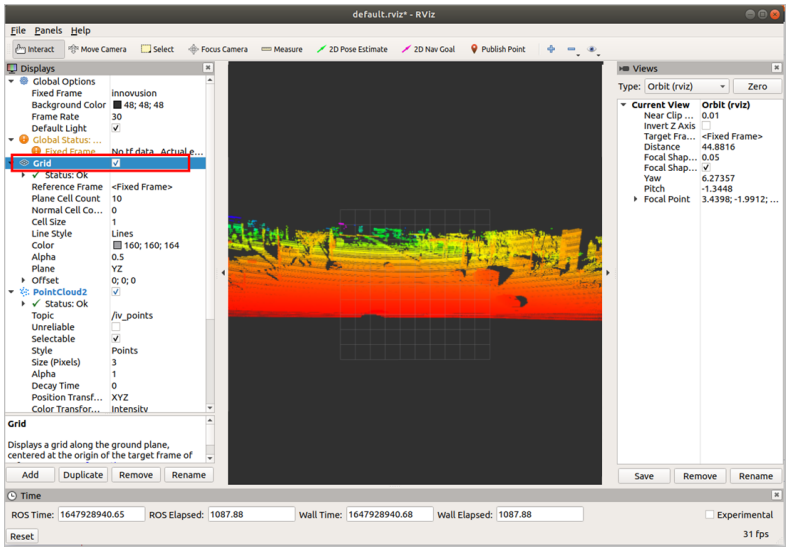
a. Select Add > By display type > Axes.

b. Click **OK** to add **Axes**.



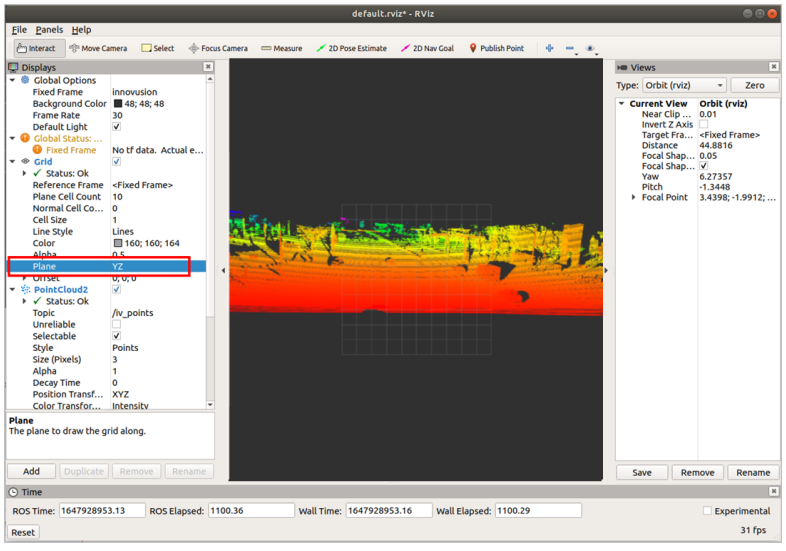
- Select **Grid** to add the grid to the diagram as a reference. Grid is enabled by default when rviz is started.

書式変更: インデント：左： 6 mm, ぶら下げインデント： 4.42 字, 行間： 1 行



- Set the **plane** value to view the point cloud status under different coordinate systems. The **Plane** options are **XY**, **XZ**, and **YZ**.

書式変更: インデント：左： 6 mm, ぶら下げインデント： 4.42 字, 行間： 1 行



7. Press **Space** to pause playback of the point cloud data file.

Convert the reference coordinates of the displayed point cloud

Note

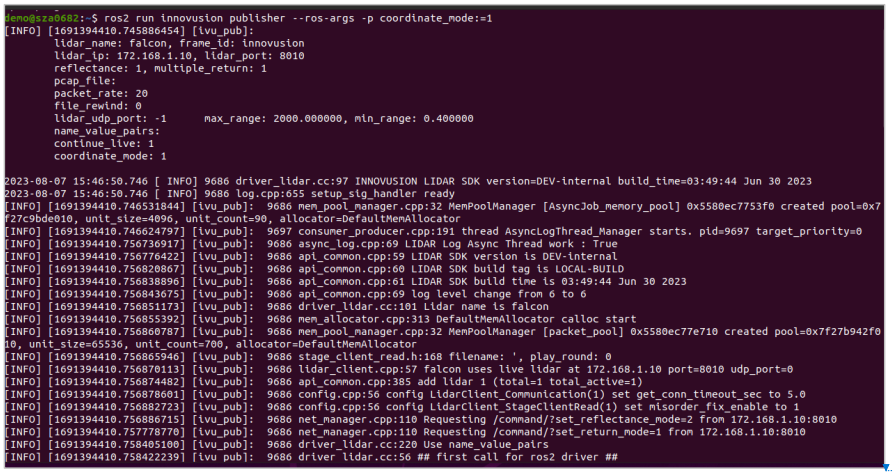
Before viewing the point cloud data, please confirm that the point cloud data can be obtained correctly.

```
ros2 run innovusion publisher --ros-args -p coordinate_mode:=<select_mode>
```

[Parameter description]

coordinate_mode: The reference coordinates of the displayed point cloud, ranging from 0 to 4. A default value of 0 means that the X-axis is pointing up, the Y-axis is pointing right, and the Z-axis is pointing forward, see section 1.4 Structural Description for details.

- A value of 1 means the X-axis points to the right, the Y-axis forwards, and the Z-axis upwards.
- A value of 2 means the X-axis points to the right, the Y-axis upwards, and the Z-axis forwards.
- A value of 3 means the X-axis points forwards, the Y-axis to the right (reversed), and the Z-axis upwards.
- A value of 4 means the X-axis points forwards, the Y-axis upwards, and the Z-axis to the right.



Configure the reflectance mode

Before configuring the reflectance mode, please ensure that the point cloud data has been correctly obtained. For information on how to obtain point cloud data, refer to section 3.3.1 Obtain Point Cloud Data.

```
ros2 run innovusion publisher --ros-args -p reflectance_mode:=<reflectance_mode>
```

[Parameter description]

reflectance_mode: reflectance mode of the LiDAR. The value of reflectance mode can be either false or true.

- A value of false means that the reflectance mode of the LiDAR is selected as intensity. The return value in intensity mode is the echo read directly by LiDAR. The intensity varies with the influence of the factors including object distance, object reflectivity, beam angle, etc.

削除:

削除:

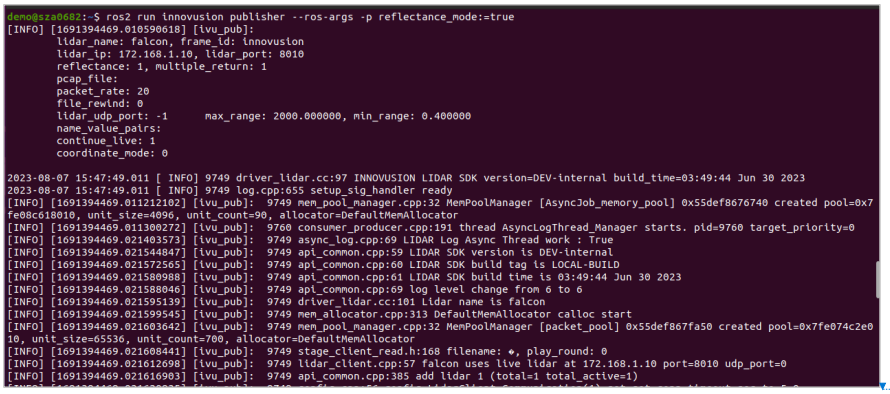
書式変更: インデント：左： 6 mm, ぶら下げインデント： 4.42 字, 行間： 1 行

削除:

書式変更: inno-图片

書式変更: インデント：左： 6 mm, ぶら下げインデント： 4.42 字, 行間： 1 行

- A value of true means that the reflectance mode of the LiDAR is selected as reflectivity. The return value in reflectivity mode is the calculated result based on the intensity and rectified with the object distance, beam angle and other parameters.



削除:

書式変更: inno-图片

Configure the return mode

Before configuring the echo mode, please ensure that the point cloud data has been correctly obtained. For information on how to obtain point cloud data, refer to section 3.3.1 Obtain Point Cloud Data.

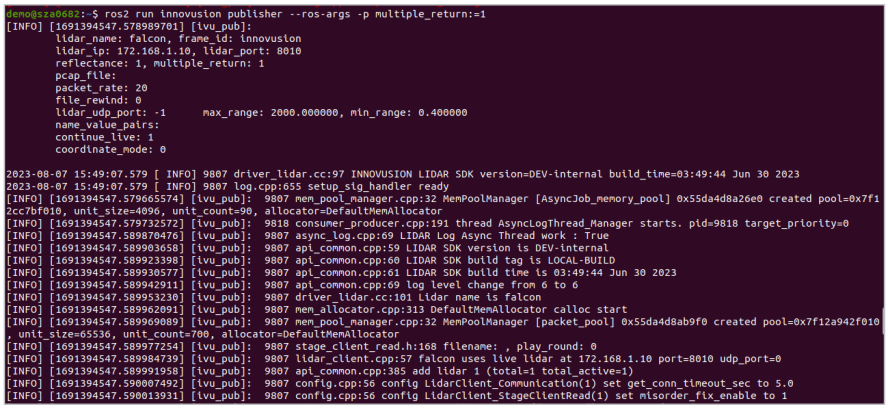
```
ros2 run innovusion publisher --ros-args -p multiple_return:=<return_mode>
```

[Parameter description]

multiple_return: the echo received when a laser is emitted once.

- A default value of 1 means the single return mode.
- A value of 2 means the strongest + 2 strongest return mode.
- A value of 3 means the strongest & furthest return mode.

書式変更: インデント : 左： 2.48 字, ぶら下げインデント： 4.42 字, 間隔 段落前： 3 pt, 段落後： 3 pt, 行間 : 1 行



Change the distance limitation for the displayed point cloud

削除:

Note

Before changing the distance limit of the point cloud data, please ensure that the point cloud data has been correctly obtained. For information on how to obtain point cloud data, refer to section 3.3.1 Obtain Point Cloud Data.

```
ros2 run innovusion publisher --ros-args -p max_range:=<max_distance> -p min_range:=<min_distance>
```

削除:

[Parameter description]

- max_range: The maximum distance of the displayed point cloud in meter, up to 2000.0.
- min_range: The minimum distance of the displayed point cloud in meter, down to 0.4.

書式変更: インデント：左： 6 mm, ぶら下げインデント： 4.42 字, 間隔 段落前： 3 pt, 段落後： 3 pt, 行間：1 行

```
demo@sza0683:~$ ros2 run innovusion publisher --ros-args -p multiple_return:=1
[INFO] [1691394547.578989701] [ivu_pub]:
        lidar_name: falcon, frame_id: innovusion
        lidar_ip: 172.168.1.10, lidar_port: 8010
        reflectance: 1, multiple_return: 1
        pcap_file:
        packet_rate: 20
        file_rewind: 0
        lidar_udp_port: -1      max_range: 2000.000000, min_range: 0.400000
        name_value_pairs:
        continue_live: 1
        coordinate_mode: 0

2023-08-07 15:49:07.579 [ INFO] 9807 driver_lidar.cc:97 INNOVUSION LIDAR SDK version=DEV-internal build_time=03:49:44 Jun 30 2023
2023-08-07 15:49:07.579 [ INFO] 9807 log.cpp:655 setup_sig_handler ready
[INFO] [1691394547.579665574] [ivu_pub]:  9807 mem_pool_manager.cpp:32 MemPoolManager [AsyncJob_memory_pool] 0x55da4d8a26e0 created pool=0x7f1
2cc7bf010, unit_size=4096, unit_count=90, allocator=DefaultMemAllocator
[INFO] [1691394547.579732572] [ivu_pub]:  9818 consumer_producer.cpp:191 thread AsyncLogThread_Manager starts. pid=9818 target_priority=0
[INFO] [1691394547.589870476] [ivu_pub]:  9807 async_log.cpp:69 LIDAR Log Async Thread work : True
[INFO] [1691394547.589903658] [ivu_pub]:  9807 api_common.cpp:59 LIDAR SDK version is DEV-internal
[INFO] [1691394547.589923398] [ivu_pub]:  9807 api_common.cpp:60 LIDAR SDK build tag is LOCAL-BUILD
[INFO] [1691394547.589930577] [ivu_pub]:  9807 api_common.cpp:61 LIDAR SDK build time is 03:49:44 Jun 30 2023
[INFO] [1691394547.589942911] [ivu_pub]:  9807 api_common.cpp:69 log level change from 6 to 6
[INFO] [1691394547.589953230] [ivu_pub]:  9807 driver_lidar.cc:101 Lidar name is falcon
[INFO] [1691394547.589962091] [ivu_pub]:  9807 mem_allocator.cpp:313 DefaultMemAllocator calloc start
[INFO] [1691394547.589969089] [ivu_pub]:  9807 mem_pool_manager.cpp:32 MemPoolManager [packet_pool] 0x55da4d8ab9f0 created pool=0x7f12a942f010
, unit_size=65536, unit_count=700, allocator=DefaultMemAllocator
[INFO] [1691394547.589977254] [ivu_pub]:  9807 stage_client_read.h:168 filename: , play_round: 0
[INFO] [1691394547.589984739] [ivu_pub]:  9807 lidar_client.cpp:57 falcon uses live lidar at 172.168.1.10 port=8010 udp_port=0
[INFO] [1691394547.589991958] [ivu_pub]:  9807 api_common.cpp:385 add lidar 1 (total=1 total_active=1)
[INFO] [1691394547.590007492] [ivu_pub]:  9807 config.cpp:56 config LidarClient_Communication(1) set get_conn_timeout_sec to 5.0
[INFO] [1691394547.590013931] [ivu_pub]:  9807 config.cpp:56 config LidarClient_StageClientRead(1) set misorder_fix_enable to 1
```

Shut down the LiDAR

削除:

To shut down the system, disconnect the power supply.

The system will power off automatically once the power is disconnected.

3.4 Operate on MetaView

削除: Disconnect the power supply to shut down the LiDAR.

MetaView is a specified software that provides viewing, recording, and replaying point cloud and other functions to help optimize usage for your Seyond LiDAR. MetaView can be run on multiple operating systems including Linux, MacOS and Windows. This chapter takes operations on Windows as an example.

The MetaView operations in this chapter are based on the 1.5.1 version.

Start the System

1. Connect the power supply to start the LiDAR.
2. The LiDAR completes initialization and generates data after powering on for 11 to 18 seconds.

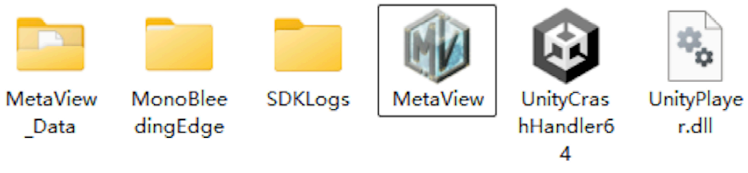
書式変更: インデント : 左 0 字

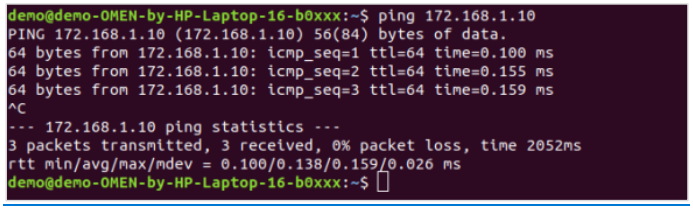
Note

The LiDAR does not have a power switch. It will become operational when power is applied.

Get started

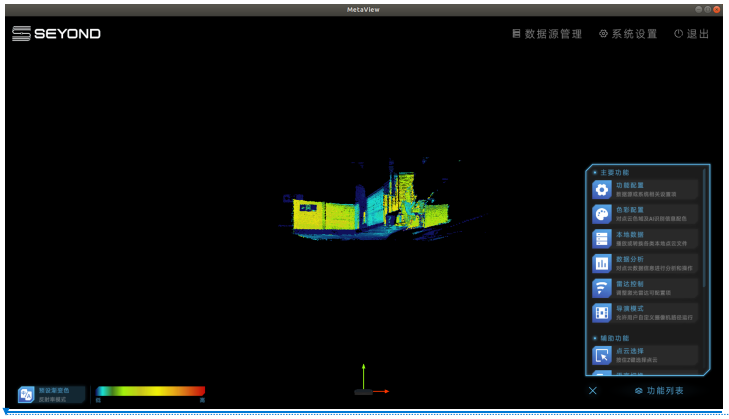
Unzip the MetaView package. Double-click to start MetaView.





Main interface

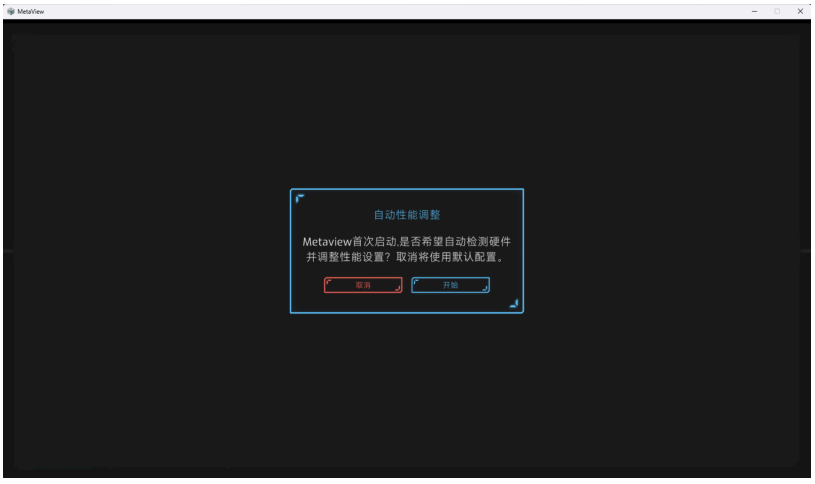
1. The main interface of MetaView can be divided into three functional areas:
   - The bottom right corner is the quick function button area for invoking features.
   - The bottom left corner shows the basic information and color spectrum control area.
   - The center of the screen is the point cloud display area and the functional window display area.



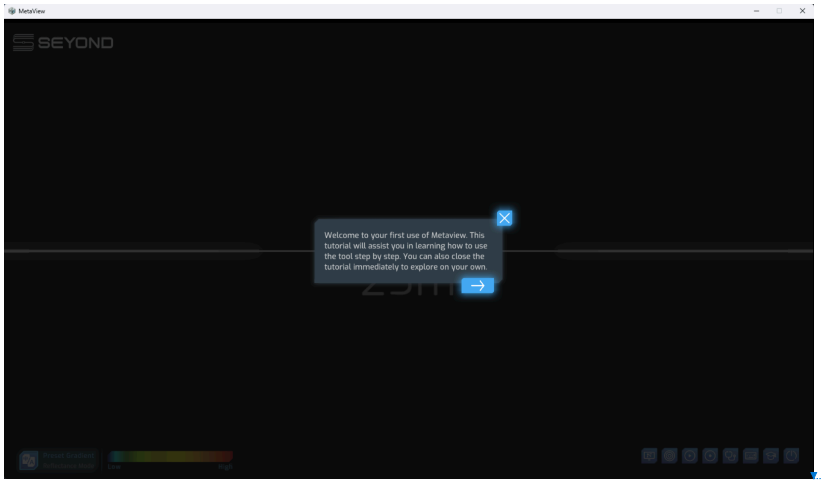
削除:

コメントの追加 [LS2]: Need a picture in Enligsh to replace

2. Upon first run, you can choose to execute the automatic performance test feature, which will automatically adjust the settings of MetaView.



3. After completing the performance adjustments, the first-time user tutorial will be automatically triggered. Users can choose to follow the tutorial to complete the beginner's guide, or close the tutorial. The tutorial can be manually reopened later.



削除: ↵

書式変更: inno-图片

Basic operations

書式変更: 行間： 1 行

You can perform all functions through the most basic MetaView operations.

3.4.1.1 Control viewport

1. Keyboard function: You can control the angle of the view via the keyboard.
   - Hold the **W** / **A** / **S** / **D** keys to move forward, left, backward, and right, respectively.
   - Hold the **Q** / **E** keys to move vertically up and down.
   - Hold the ↑ ↓ ← → keys to rotate the view.

書式変更: インデント：左： 6 mm, ぶら下げインデント： 4.42 字, 行間： 1 行

2. Mouse function: It is strongly recommended to use a combination of keyboard and mouse to control the angle of the view for the best operating experience.
   - Hold the left mouse button and drag to rotate the view.
   - Hold the middle mouse button and drag to pan the view.
   - Hold the right mouse button and drag forward or backward to zoom in or out.

書式変更: インデント：左： 6 mm, ぶら下げインデント： 4.42 字, 行間： 1 行

Note

You can increase the moving speed by holding the **left Shift key** while using the above key combinations.

3.4.1.2 Shortcuts

In MetaView, you can use the following shortcuts to enhance your experience.

書式変更: 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行

1. Show the specified Point Cloud Data

   Hold the **Z** key while drag the **left mouse** button to select a point cloud area. Release the **left mouse** button when done selecting to automatically calculate the point cloud information for the selected area, which is very useful for gaining a deeper understanding of the point cloud data.

書式変更: 行間： 1 行

書式変更: インデント：左： 7.8 mm, 行間： 1 行

2. Data Play/Pause

   Press the **Spacebar** to quickly pause/resume playback while playing online point clouds or replaying

書式変更: インデント：左： 0 mm, 行間： 1 行

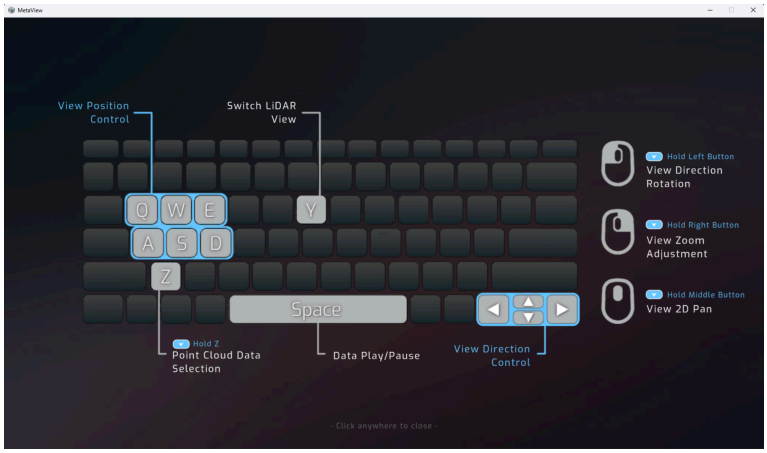
local point cloud data.

3. Toggle LiDAR View

   Press the **Y** key to immediately switch to the LiDAR view between the actual view of angle and the default view.

Note

You can always click the third-last keyboard icon "" to view the keyboard layout diagram; everything you want to know is right there.



Connect to LiDAR

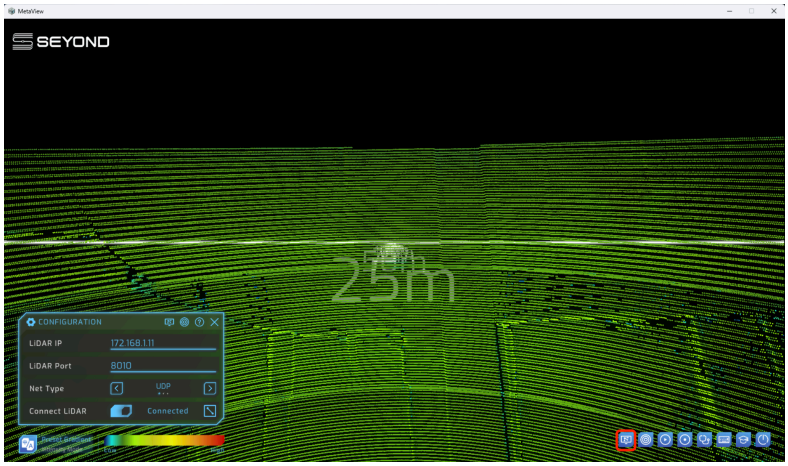
Let's get started with connecting to the LiDAR; please ensure that your computer and LiDAR are on the same network segment.

1. Click in the bottom right corner to open the LiDAR Network Control Panel.
2. The default LiDAR IP is 172.168.1.10 and the port is 8010 by default. However, if the LiDAR is not set to default settings and you need to change the target IP or port, please turn off the connection switch before making any changes.
3. We strongly recommend using the default UDP method to connect to the LiDAR for the best connection experience. When dealing with some specific point frequency LiDARs or special scanning modes, connecting via TCP or WebSocket may result in poor performance.

書式変更: 行間： 1 行

書式変更: 間隔 段落前： 3 pt, 段落後： 3 pt, 行間： 1 行

書式変更: 行間： 1 行



Note

Please refer to this document for troubleshooting possible issues during the connection process: UDP Connection Diagnostics.

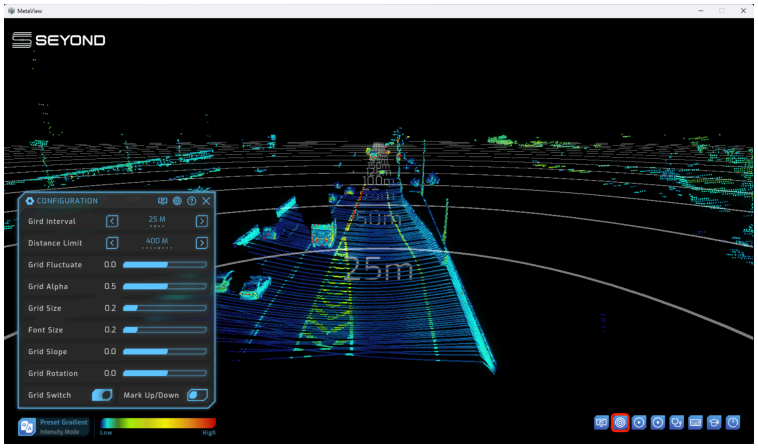
書式変更: inno-说明

削除:

Radial Grid

This feature provides a simple circular distance grid for displaying point cloud data at near and far distances.

Click the to open the control window.



- Grid Interval

  Controls the interval between each grid line.

- Distance Limit

  Controls the maximum distance of the grid.

- Grid Fluctuate

  Controls the vertical positioning of the grid.

- Grid Alpha

  Controls the transparency of the grid.

- Grid Size

  Controls the thickness of the grid lines.

- Font Size

  Controls the font size of the distance text on the grid.

- Grid Slope

  Controls the vertical rotation of the grid.

- Grid Rotation

  Controls the horizontal rotation of the grid.

- Grid Switch

  Toggles the grid on or off.

- Mark Up/Down

  Controls whether the text floats above the grid.

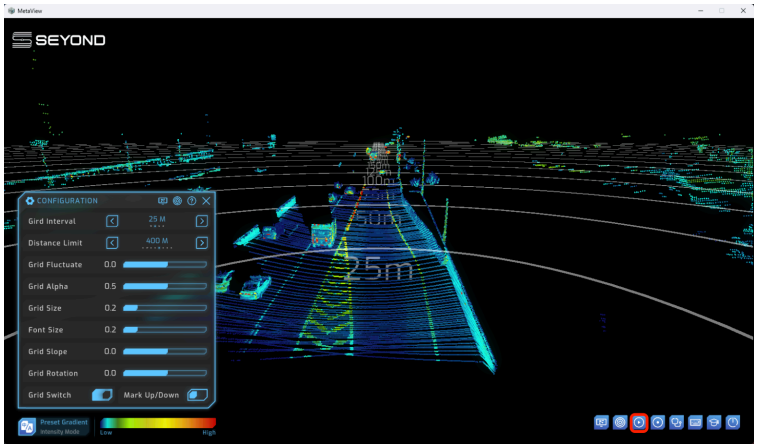
Data Playback

The local file system includes two modules: local file playback and local file format conversion. It supports playback of files in formats like inno_pc, inno_pc_xyz, pcd (binary/ASCII), pcap, bag, csv, and record, but does not support playback of raw formats.

3.4.1.3 Local File Player

The local file player is a point cloud playback tool similar to a video player. Like a video player, it also has features such as file selection, play/pause/resume/stop, previous/next frame, speed control, progress dragging (not supported for ASCII PCD format), and total frames display.

Click  to open the control window.

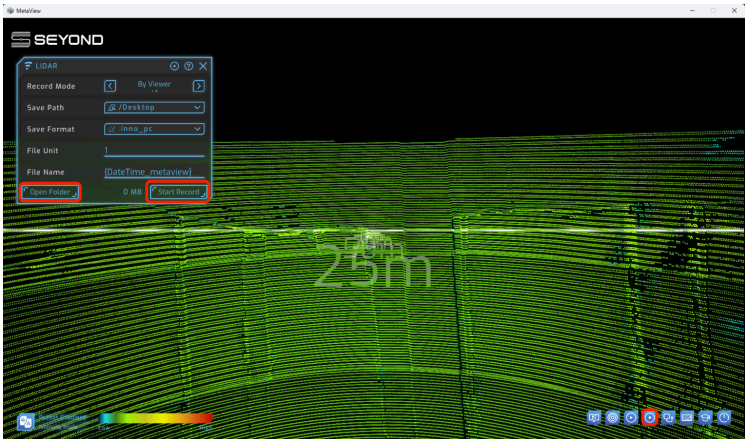


1. Click the folder icon on the left, and the system file picker will automatically pop up. Select the point cloud file you want to play, and it will start playing.
2. If you see an important point cloud frame and wish to save it for analysis, you can pause the playback and then click the PCD file icon. This way, you can obtain the PCD file of that particular point cloud frame.

Data Recording

Data recording allows you to quickly record a specified length of LiDAR point cloud data.

Click to open the control window.



1. Recording is divided into two modes.
   - The default is **By Viewer** mode, which uses built-in tools to record data. It has strong LiDAR compatibility, but limited format support.
   - The other is **By LiDAR** mode, which saves the LiDAR data directly. This mode has weaker LiDAR compatibility, but supports more formats.

Note
Please connect to the LiDAR before recording. You can set up the connection by clicking on the network settings button in the lower right corner of the function area.

2. Once the setup is complete, click the record button Start Record to start recording.
3. After recording is completed, you can click Open Folder to open the file save directory.

UDP Connection Diagnostics

書式変更: 行間： 1 行

When using UDP to connect to the LiDAR, especially during the initial connection, MetaView may not be able to retrieve LiDAR data due to some specific reasons. You can use this feature for testing and verification.
Click to open the control window.

3.4.1.4 IP connection diagnose

IP connection diagnose is used to confirm whether the target device's IP address is connecting properly. By using the ping command, you can determine if the network connection is properly and check for any delays.

Troubleshooting suggestions:

1. Check Network Connection
   - Ensure that the computer's Ethernet cable is correctly connected, or that the wireless network is connected to the correct SSID.
   - Check if network devices (such as switches, routers) are functioning properly.
2. Check IP Address Configuration
   - Ensure that the computer's IP address is configured correctly. You can use the ipconfig (Windows) or ifconfig (Linux/Mac) commands to view the current IP configuration.
   - Ensure there are no IP address conflicts, meaning no other devices on the network are using the same IP address.
3. Check LiDAR Device Status
   - Ensure the target LiDAR is powered on and connected to the network.
   - Check if the device's network interface is working properly.

3.4.1.5 Firewall Testing

Firewall Testing is used to confirm whether a firewall is blocking necessary network communications. An enabled firewall may block communication on certain ports or protocols, affecting the normal operation of the device, and result disconnection between the SDK and the LiDAR.

Note

This issue is common on strictly managed Windows devices. For security-sensitive Linux/Mac users, you may opt not to enter a sudo password to skip this check.

Troubleshooting suggestions:

1. Windows
   i. Check Firewall Status
      a. Open Control Panel > System and Security > Windows Defender Firewall.
      b. Ensure the firewall is turned off, and check for any blocking rules.
   ii. Allow Applications through the Firewall
      a. In **Windows Defender Firewall**, click on Allow an app or feature through Windows Defender Firewall.
      b. Check and ensure that necessary applications are allowed.
   iii. Create Inbound/Outbound Rules
      a. In **Advanced Settings**, create new inbound or outbound rules to allow specific ports or programs through the firewall.
   iv. Temporarily Disable Firewall for Testing
      a. In Windows Defender Firewall, select Turn Windows Defender Firewall on or off to temporarily disable the firewall for testing.
2. Linux
   i. Check Firewall Status (using iptables or firewalld)
      a. Use sudo iptables -L to view current iptables rules.
      b. For firewalld, use sudo firewall-cmd --state to check the status.
   ii. Add Firewall Rules
      a. Use sudo iptables -A INPUT -p tcp --dport 80 -j ACCEPT to allow a specific port.
      b. For firewalld, use sudo firewall-cmd --add-port=80/tcp --permanent to add a rule, then sudo firewall-cmd --reload to reload the configuration.
   iii. Temporarily Disable Firewall for Testing
      a. Use sudo systemctl stop firewalld or sudo systemctl stop iptables to stop the firewall.
3. Mac
   i. Check Firewall Status
      a. Open System Preferences > Security & Privacy > Firewall.
      b. Ensure the firewall is turned off.
   ii. Allow Applications through the Firewall
      a. In the **Firewall** tab, click **Firewall Options** to add or remove allowed applications.

iii. Manage Firewall via Command Line

a. Use sudo /usr/libexec/ApplicationFirewall/socketfilterfw --add /path/to/app to allow a specific application.

iv. Temporarily Disable Firewall for Testing

a. Use sudo /usr/libexec/ApplicationFirewall/socketfilterfw --setglobalstate off to turn off the firewall.

3.4.1.6 VLAN Testing

Some LiDAR devices come with VLAN functionality enabled by default, which may prevent the SDK from receiving data packets sent by the LiDAR, thereby making it impossible to display the point cloud.
Troubleshooting suggestions:
If this item displays abnormally, you can resolve it using the command echo set_i_config network vlan 0 | nc -nv YOUR_IP_ADDRESS 8002 -w 1 in the command line or terminal. Note that you need to restart the LiDAR to apply the settings after executing the command.

3.4.1.7 Network Mode Testing

Issues with multicast and broadcast are often due to a mismatch or lack of support in the local environment or network device configurations on the LiDAR side, preventing the host computer from receiving packets from the LiDAR.
Troubleshooting suggestions:

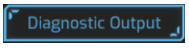
1. Broadcast Mode
   - Check if the LiDAR is configured in broadcast mode and is on the same subnet with the host computer.
   - Check if network devices (such as switches, routers) support broadcasting and are not blocking broadcast traffic.
2. Multicast Mode
   - If the LiDAR is configured in multicast mode, check that the multicast address is within the valid range (224.0.0.0 to 239.255.255.255).
   - Ensure network devices support multicast and have IGMP (Internet Group Management Protocol) enabled to manage multicast groups.
3. Unicast Mode
   - Ensure that the LiDAR's unicast address matches the IP address of the host computer.
   - Check the subnet masks of the LiDAR and the host computer to ensure they are on the same subnet.
   - Ensure that network devices are not blocking unicast traffic.

3.4.1.8 SDK Library Testing

Check for older versions of SDK in the system libraries to confirm potential version conflicts. Older SDK libraries may

be incompatible with newer versions, causing functional anomalies or crashes.
Troubleshooting suggestions:
For Linux/Mac versions, if this issue arises, check the usr/lib or usr/local/lib folders for files starting with libinnolidar. If they exist, delete them and restart MetaView.

3.4.1.9 Dual IP Testing

As the LiDAR may have multiple connectable IPs, dual IP testing is used to confirm whether the current connection IP is the UDP IP. Typically, LiDAR has only one dedicated UDP sending IP, which defaults to 172.168.1.10.
Troubleshooting suggestions:
You can try clicking the diagnostic output button 

to view the diagnostic log file DiagnosticLog.txt. The field "LiDAR UDP Output IP" is indicates the LiDAR UDP IP.

3.4.1.10 Network Stability Monitoring

Once successfully connected, the diagnostic tool will continue to perform additional data monitoring to diagnose network stability. This check updates approximately every 30 seconds. Under normal conditions, the packet loss rate should be 0%. If the network environment is poor, this value may slightly increase. If the value is significantly high, please check the status of the network environment.

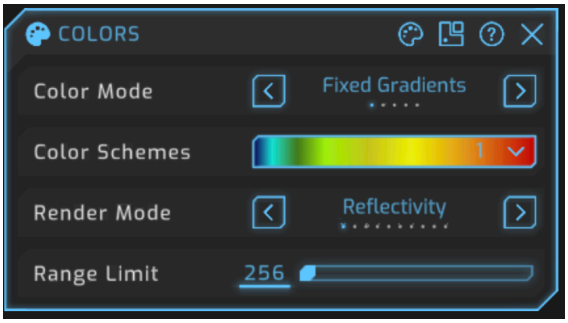
Color Configuration

書式変更: 行間： 1 行

Color configuration allows users to adjust the color of the point cloud based on different point cloud attributes or coloring needs.

3.4.1.11 Color Range Adjustment

This is the point cloud color preview area  . From left to right, it represents the point cloud attribute values from low to high. You can click here to open the color configuration panel or hover your mouse over this area to view the color information.



Color Mode includes five color modes and three rendering modes. The colors in fixed Gradient mode and Fixed Solid Color mode are preset, whereas the Custom Gradient mode and Custom Multi-type mode allow for customizable color schemes. Users can highly customize the coloring of the point cloud through this panel.

1. Color Modes

- Fixed Gradient Mode: Uses preset gradient colors to color the point cloud.

- Custom Gradient Mode: Uses highly customizable gradient colors to color the point cloud.
- Fixed Solid Color Mode: Uses preset solid color gradients to color the point cloud.
- Custom Multi-type Mode: Special mode, requires custom point cloud files, not recommended for non-specific business use.
- Camera Render Mode: Special mode, requires a network camera, not recommended for non-specific business use.

2. Color Schemes

Note
After selecting a color or gradient, don't forget to click the "confirm" button.

- Fixed Gradient Mode: Offers 110+ preset gradient colors.
- Custom Gradient Mode: You can change the desired color by clicking the color bar to open the color picker.

a. In the gradient editor, left-click below the gradient bar to add a gradient marker. Right-click on a gradient marker to delete it.

b. In the gradient editor, drag the gradient markers and place them wherever you want, the gradient bar will adjust according to your settings.

c. In the gradient editor, left-click on a gradient marker to select its color, then left-click the color button below to view the color editor panel.

d. In the color editor, you can select your preferred color like any other color picker or directly enter Hex codes to select a color.

- Fixed Solid Color Mode: Provides 30+ preset black to solid color gradients.
- Custom Multi-type Mode: Special mode, requires custom point cloud files, not recommended for non-specific business use.

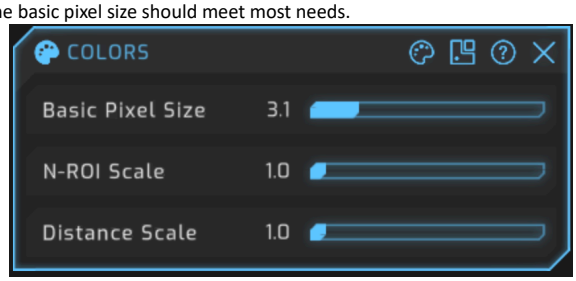
Note
Defining multi-type mode **only** provides color configurations for specific data sources recognized by AI. Each object type has a **unique** color type. Click the numbers to modify the color of the corresponding type.

- Camera Mode: ※Special mode requires connecting to a network camera, not recommended for non-specific business use.

3. Rendering Modes
   - Reflectivity Coloring Mode: The system will try to find the reflectivity field of the current point cloud to color it.
   - Intensity Coloring Mode: The system will try to find the intensity field of the current point cloud to color it.
   - Distance Coloring Mode: The shader will cyclically color the point cloud based on the distance of each point from the origin.
   - Channel Mode: The shader uses a uniform red-blue RGB gradient template to color the point cloud based on channel information and upper/lower limits.
   - Scan Line Mode: The shader uses a uniform red-blue RGB gradient template to color the point cloud based on scan line information and upper/lower limits.
   - Index Mode: The shader uses a uniform red-blue RGB gradient template to color the point cloud based on index information and upper/lower limits.
   - Region of Interest (ROI) Mode: The shader uses a uniform red-blue RGB gradient template to color the point cloud based on ROI information and upper/lower limits.
   - Facet Mode: The shader uses a uniform red-blue RGB gradient template to color the point cloud based on face information and upper/lower limits.
   - Topic Number Mode: The shader uses a uniform red-blue RGB gradient template to color the point cloud based on topic information and upper/lower limits.
   - Multiple Returns Mode: The shader uses a uniform red-blue RGB gradient template to color the point cloud based on multiple return information and upper/lower limits.
4. Range Limitations
   In reflectivity/intensity coloring modes, range limitations control the upper limits of reflectivity/intensity values used for coloring. For example, Falcon K uses a maximum of 256. Users can adjust this based on the LiDAR used or special requirements.

3.4.1.12 Pixel Size Adjustment

This panel provides three interfaces to control the pixel size of the point cloud. Users can adjust according to usage. Generally, adjusting the basic pixel size should meet most needs.



- Basic Pixel Size: Adjusting the basic pixel size changes the global pixel size.
- Non-ROI Area Scaling: Adjusting the non-ROI size changes the pixel size outside the ROI area.
- Distance Proportional Scaling: Adjusting distance scaling allows the point cloud to scale according to the distance from the origin.

4 Frame Synchronization

Before using the frame synchronization feature, ensure that the PTP (Precision Time Protocol) time synchronization function is operating normally. It is recommended to use hardware timestamp synchronization.

1. Enable Frame Synchronization Feature.

```
echo set_i_config frame_sync enable 1|nc -nv <LIDAR_IP> <tcp_port> -w1
```

```
echo get_i_config time |nc -nv <LIDAR_IP> <tcp_port> -w1  //确认帧同步功能是否开启
```

```
demo@demo-OMEN-by-HP-Laptop-16-b0xxx:~$ echo set_i_config frame_sync enable 1 | nc -nv 172.168.1.10 8002 -w1
Connection to 172.168.1.10 8002 port [tcp/*] succeeded!
done.


demo@demo-OMEN-by-HP-Laptop-16-b0xxx:~$ echo get_i_config frame_sync | nc -nv 172.168.1.10 8002 -w1
Connection to 172.168.1.10 8002 port [tcp/*] succeeded!
[frame_sync]
enable = 1
target_time = 0
```

Note:

A return value of enable=1 indicates successful activation.

<tcp_port> defaults to 8002.

2. Specify Synchronization Time and Angle as Required.

```
echo set_i_config frame_sync target_time <target_time> {[h_angle <h_angle>]| [v_angle <v_angle>]}
```

```
demo@demo-OMEN-by-HP-Laptop-16-b0xxx:~/桌面$ echo set_i_config frame_sync target_time 20
set_i_config frame_sync target_time 20
```

【Parameter Description】

- target_time： The target synchronization time, ranging from 0-99, in milliseconds (ms).
- h_angle： The horizontal angle at the target synchronization point, default is 90 degrees (°).
- v_angle： The vertical angle at the target synchronization point, default is 90 degrees (°). This indicates that at target_time, the frame synchronizes to the bottom left corner of the point cloud.

3. Confirm Frame Synchronization Status.

```
curl http://<LIDAR_IP>:<LIDAR_PORT>/command/?get_frame_sync_stats
```

【Parameter Explanation】

- target_time： The set target synchronization time at a specified angle, in milliseconds (ms).
- h_angle： The set horizontal angle of the synchronization point, in degrees (°).
- v_angle： The set vertical angle of the synchronization point, in degrees (°).
- Precision： The set synchronization precision, currently not modifiable, in milliseconds (ms).
- Value： Current frame synchronization status, where 0 represents not synchronized, and 1 represents synchronized.
- time_sync_start_ms： The time when this frame synchronization adjustment began, in milliseconds (ms).
- cost_time_ms： The time taken for this frame synchronization, i.e., from the start time to when synchronization first succeeds, in milliseconds (ms).

Appendix A: Upgrade the LiDAR

1. Obtain an .img format upgrade package and connect the computer/master control unit that holds the upgrade package to the LiDAR, ensuring the network is connected.

Note

If needed, please contact Seyond staff to obtain the .img format upgrade package. The upgrade package includes both firmware and software upgrades.

2. Change the IP address so that the computer's IP address is in the same subnet as the LiDAR's IP address.
3. Open the Chrome browser and enter the LiDAR IP in the address bar.

Note

The default LiDAR IP address is 172.168.1.10.

It is recommended to use the ping command to confirm smooth connectivity between the master control and the LiDAR, with a return value as shown.

4. Click on **Recovery/Update File**。

5. Click **Choose File** ， which will open the 【Open】 window, then select the required upgrade package.

6. Click 'Start Recovery/Update' to begin the upgrade.
7. After the upgrade is complete, power off and restart the system.
8. (Optional) You can view the version information on the 【System info】 page.

Appendix B: Installing linuxptp Service

Note

This section only explains how to install the linuxptp service online on Ubuntu systems. If there is a need for offline installation of linuxptp, please contact Seyond staff.

1. Install Dependencies.

```
sudo apt update
sudo apt install build-essential git
```

2. Clone the linuxptp source code repository.

```
git clone https://git.code.sf.net/p/linuxptp/code linuxptp
cd linuxptp
```

3. Switch to a specific version.

```
git checkout <version_tag>
```

4. Compile linuxptp.

```
make
```

5. Install linuxptp.

```
sudo make install
```

6. Verify the installation of linuxptp and confirm its version.

```
ptp4l -v
phc2sys -v
```

Appendix C: Command Line Format Explanation

Format	Meaning
< >	Indicates that the portion enclosed in < > must be replaced with an actual value during command configuration.
[ ]	Indicates that the portion enclosed in [ ] is optional during command configuration.
[x | y | …]	Indicates a choice must be made between multiple options.
//	Lines starting with // denote comment lines

Appendix D: Common Troubleshooting

Table 23: Common Issues and Solutions

No.	Fault Symptom	Troubleshooting Steps
1	Network connection failure	1 . Check if the power supply voltage is normal.
		2 . Ensure the power source is securely plugged in.
		3 . Check if the power supply current is normal.
		4 . Verify the software configuration is correct.
		5 . Power off for at least one minute, then power on and test again.
		6 . Ensure the Ethernet cable is properly connected.
		7 . Check if network lights are flashing.
		8 . Check if the host computer's network card is functioning properly, or replace the computer and test again.
		9 . Ensure the host computer’s network card supports gigabit speeds.
		10 . Verify the host computer’s IP address to ensure it is on the same local network as the device.
2	Point cloud display incorrect or not displaying	1 . Check if the firewall on the host computer is turned off.
		2 . Use Wireshark packet capture tool to check if data packets are complete
		3 . Check if the window is obstructed.
		4 . Power off for at least one minute, then power on and test again.
3	Excessive noise in point cloud	1 . Check if the window is contaminated.
		2 . Check if the target object is highly reflective.
		3 . Power off for at least one minute, then power on and test again.
4	Incorrect point cloud field of view	1 . Check if the window is contaminated.
		2 . Check if the window is obstructed.
		3 . Verify the software configuration is correct.

No.	Fault Symptom	Troubleshooting Steps
		4 . Power off for at least one minute, then power on and test again.
5	Ranging capability below standard	1 . Check if the window is contaminated.
		2 . Consider the visibility conditions of the weather.
		3 . Check if the window is obstructed.
		4 . Verify if the LiDAR mechanical hardware settings are correct.
		5 . Power off for at least one minute, then power on and test again.
6	Unable to synchronize time	1 . Check if the time synchronization interface connection is normal.
		2 . Verify if the timing service is running properly.

Appendix E: Abbreviations and Terminology

Table 24: Abbreviations

Abbreviation	Full Name
AC	Alternating Current
DC	Direct Current
ETH	Ethernet
FAQ	Frequently Asked Questions
FOV	Field of View
GEN	Generation
GND	Ground
GPS	Global Positioning System
H × W × D	Height × Width × Depth
IP	Internet Protocol
LiDAR	Light Detection and Ranging
MAC	Media Access Control
MEC	Multi-Access Edge Computing
NTP	Network Time Protocol
PPS	Pulse Per Second
PTP	Precision Time Protocol
PWR	Power
ROI	Region of Interest
ROS	Robot Operating System
SDK	Software Development Kit
SN	Serial Number
SW	Software
TCP	Transmission Control Protocol
TOF	Time of Flight
UDP	User Datagram Protocol

Table 25: Specialized Terms

Term	Definition
Class 1 Laser Product	A laser product where exposure to laser radiation under normal operating conditions does not exceed the emission limits that are considered safe for the eyes at the corresponding wavelength and emission duration.
NTP	Network Time Protocol (NTP) is a protocol used to synchronize computer clocks to Internet time servers, such as those received via radio or satellite receivers, or modem services.
PTP	Precision Time Protocol (PTP) is a high-accuracy time synchronization protocol primarily used for precise time synchronization between devices, but can also be adapted for frequency synchronization between them.
Installer	An installer refers to personnel who have professional training and extensive experience in the relevant field, fully understand the application of protective devices on machinery, and can assess their safety status.
Commissioning Personnel	Commissioning personnel are individuals with professional training and extensive experience in the relevant field, who fully understand the application of protective devices on machinery and can assess their safety status.
Time-of-Flight Measurement	Time-of-flight measurement determines distance by measuring the interval between when a signal is emitted and when it is received, as described in the Working Principle section.
Laser Product	Any product or component combination used to constitute or prepare to constitute a laser or laser system. Electronic product components sold to other manufacturers as a component do not fall under laser products.
Laser	A device that primarily generates or amplifies electromagnetic radiation in the wavelength range of 180 nanometers to 1 millimeter through a controlled laser emission process.
Laser Device	A combination of laser products or a laser product containing lasers.
Host Computer	A computer that can directly issue control commands. Commands from the host are first sent to the subordinate machine, which then controls the device accordingly. The subordinate machine intermittently reads device status data, converts it into digital signals, and feeds it back to the host.
Configuration Personnel	Configuration personnel should possess professional knowledge and experience in the relevant field, have sufficient experience, and be able to evaluate whether the machine is in a safe operating state after using protective devices.
Eye Safety	Although the product design meets Class 1 eye safety standards, to maximize personal safety, do not use magnification devices (such as microscopes, magnifying glasses) to look directly at the laser during transmission.
Maintenance Personnel	Qualified maintenance personnel are those who have professional training and extensive experience in the relevant field, fully understand the application of protection devices on machinery, and have been guided by machine operation supervisors.
Automotive Ethernet	Automotive Ethernet is a new local area network technology used to connect electronic units within vehicles.

削除:

書式付きの表

書式変更: 左揃え

APPENDIX H Multi-Scene Functionality

H.1 Overview

The **Multi-Scene feature** allows users to dynamically select from multiple scan patterns on Falcon LiDAR sensors.

This capability is unique to the Falcon Series and provides enhanced flexibility for a wide range of application scenarios.

The feature supports up to **8 additional scan patterns** and includes **6 pre-configured scan patterns** designed to cover the most common application needs.

Availability:

- Falcon K1: Firmware v5.4.33 and later
- Falcon K2C: Firmware v1.82 and later

H.2 Operation of the Multi-Scene Functionality

Switching between scan patterns does not require re-programming.

Users can control this feature via **TCP** or **CURL** commands.

By default, this feature is **disabled (OFF)**.

The Multi-Scene feature can be controlled using the nc (netcat) utility or equivalent TCP client.

Check whether the Multi-Scene feature is enabled

echo get_i_config multi_scene enable | nc 172.168.1.10 8001

Note: 172.168.1.10 8001 are the default LiDAR IP address and port.

Replace with the actual LiDAR IP address and port number in use.

Default value = **0**, meaning the feature is **OFF**.

Enable the Multi-Scene feature

echo set_i_config multi_scene enable 1 | nc 172.168.1.10 8001

Check the current scan pattern ID

echo get_i_config multi_scene scene_id | nc 172.168.1.10 8001

*curl "*http://172.168.1.10:8010/command/?get_multi_scene_id

Default Scene ID = **0**

Available range = **0–8**

Change to a different scan pattern

echo set_i_config multi_scene scene_id 3 | nc 172.168.1.10 8001curl "http://172.168.1.10:8010/command/?set_multi_scene_id scene_id"

After command execution, the new scan pattern is applied immediately.

Settings will remain active until manually changed or overwritten.

書式変更: 間隔 段落前： 0 pt

書式変更: 間隔 段落前： 6 pt

書式変更: 間隔 段落前： 0 pt

書式変更: インデント：左： 0 mm, ぶら下げインデント： 8.64 字, 間隔 段落前： 0 pt

書式変更: インデント：左： 0 mm, ぶら下げインデント： 8.64 字, 間隔 段落前： 0 pt

書式変更: 間隔 段落前： 0 pt

書式変更: インデント：左： 0 mm, ぶら下げインデント： 8.64 字, 間隔 段落前： 0 pt

書式変更: 左揃え

書式を変更: フォント：(日) Calibri, フォントの色：ユーザー設定の色 (RGB(14,14,14))

書式変更: 標準, 間隔 段落前： 0 pt

H.3 Definition of Scene IDs

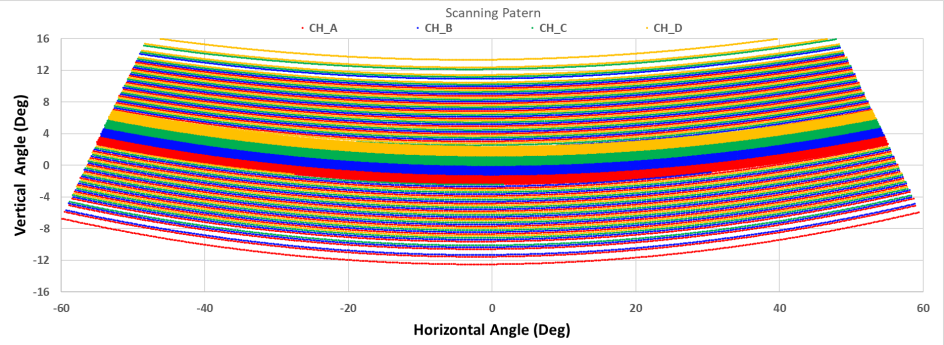
書式変更: 間隔 段落前： 0 pt

書式付きの表

Scene ID	Description	Typical Use Case
0	Default Scan Pattern	Standard factory configuration
1	Uniform	Evenly distributed scanning lines
2	Datasheet Default (Two ROIs)	Dual-region scanning for near/far detection
3	High Density	Dense scan pattern for high-resolution environments
4	Uniform 5 Hz	Slow scan rate for static scene mapping
5	Uniform 15 Hz	Balanced scan rate for general navigation
6	Uniform 20 Hz	High-speed scan for dynamic applications
7, 8	Reserved / Legacy FK Pattern	Reserved for future firmware updates

Scene ID:0 Default Scan Pattern

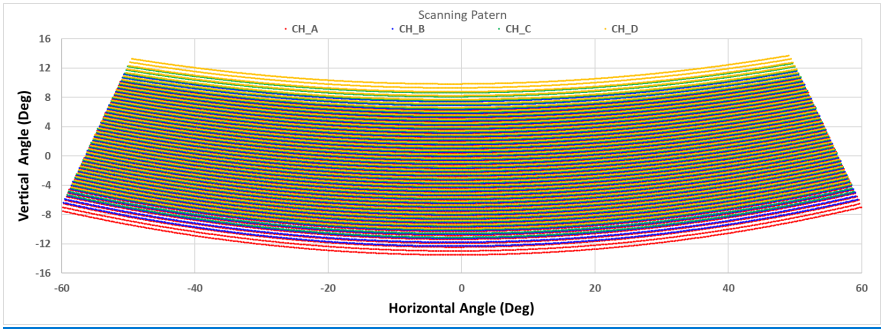
書式変更: インデント：左： 0 mm, ぶら下げインデント： 8.64 字, 間隔 段落前： 0 pt



Frame Rate (FPS)	10
Max_distance_for_10%_Target (m)	250
Max_distance (m)	500
V_Res in ROI (deg)	0.08
H_Res in ROI (deg)	0.089
V_Res in Sparse (deg)	0.24
H_Res in Sparse (deg)	0.178
Lines per frame	152
Vertical FOV	25

Scene ID:1 Uniform Scanning (Without ROI)

書式変更: インデント : 左： 0 mm, ぶら下げインデント： 8.62 字, 間隔 段落前： 0 pt

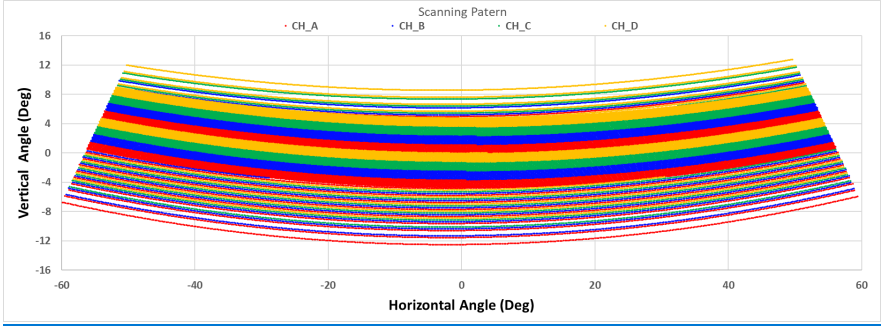


Frame Rate (FPS)	10
Max_distance_for_10%_Target (m)	250
Max_distance (m)	500
V_Res in Sparse (deg)	0.13
H_Res in Sparse (deg)	0.125
Lines per frame	152
Vertical FOV	23.5

Scene ID: 2 With two ROIs (Dual ROI to achieve 9.6)

書式を変更: フォント : 12 pt, 太字

書式変更: 左揃え, 間隔 段落前： 6 pt, 段落後： 6 pt, 行間： 1 行, 改ページ時 1 行残して段落を区切らない

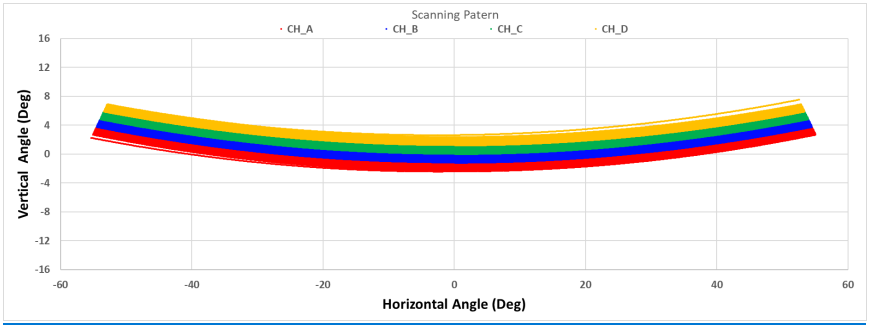


Frame Rate (FPS)	10
Max_distance_for_10%_Target (m)	250
Max_distance (m)	500
V_Res in ROI (deg)	0.1
H_Res in ROI (deg)	0.089
V_Res in Sparse (deg)	0.24
H_Res in Sparse (deg)	0.178
Lines per frame	148
Vertical FOV	21

Scene ID:3 High Resolution

書式を変更: フォント : 12 pt, 太字

書式変更: 左揃え, 間隔 段落前： 6 pt, 段落後： 6 pt, 行間： 1 行, 改ページ時 1 行残して段落を区切らない

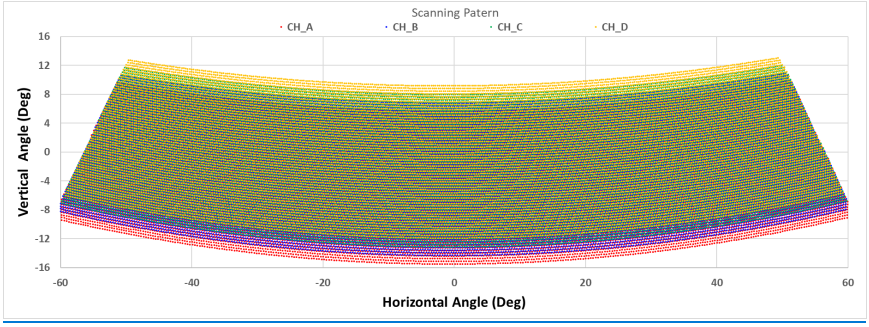


Frame Rate (FPS)	10
Max_distance_for_10%_Target (m)	250
Max_distance (m)	500
V_Res in ROI (deg)	0.053
H_Res in ROI (deg)	0.055
V_Res in Sparse (deg)	0.24
H_Res in Sparse (deg)	0.11
Lines per frame	96
Vertical FOV	4.8

Scene ID:4 Uniform Scanning – Maximize vFOV, operation with 5Hz

書式を変更: フォント : 12 pt, 太字

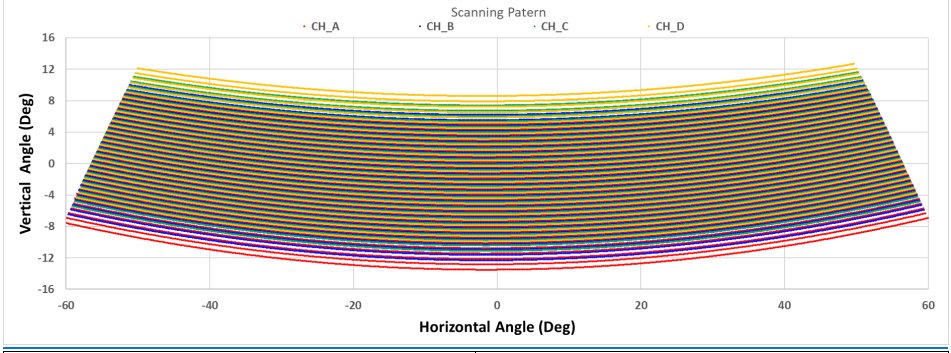
書式変更: 間隔 段落前： 6 pt, 段落後： 6 pt, 行間： 1 行



Frame Rate (FPS)	5
Max_distance_for_10%_Target (m)	250
Max_distance (m)	500
V_Res in Sparse (deg)	0.09
H_Res in Sparse (deg)	0.09
Lines per frame	232
Vertical FOV	25

Scene ID: 5 High frame rate, uniform scanning with 15fps

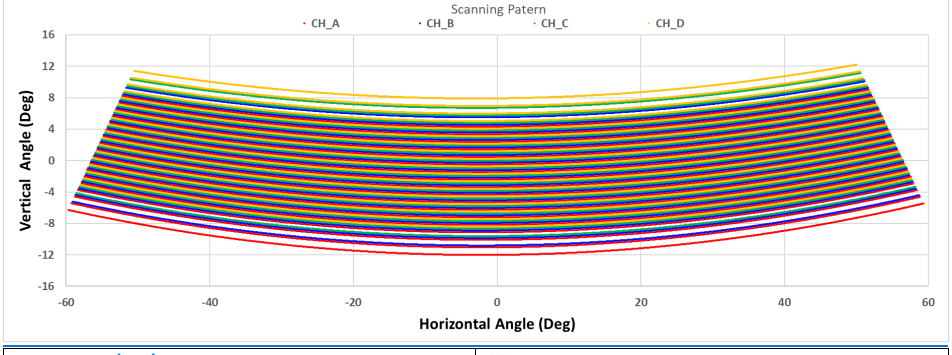
書式変更: 間隔 段落前： 6 pt, 段落後： 6 pt



Frame Rate (FPS)	15
Max_distance_for_10%_Target (m)	250
Max_distance (m)	500
V_Res in Sparse (deg)	0.17
H_Res in Sparse (deg)	0.15
Lines per frame	112
Vertical FOV	22

Scene ID: 6 High frame rate, uniform scanning with 20fps

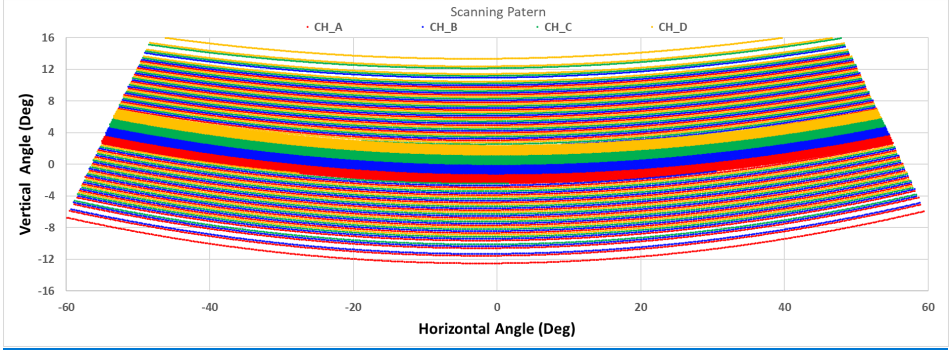
書式変更: 間隔 段落前： 6 pt, 段落後： 6 pt



Frame Rate (FPS)	20
Max_distance_for_10%_Target (m)	250
Max_distance (m)	500
V_Res in Sparse (deg)	0.24
H_Res in Sparse (deg)	0.14
Lines per frame	72
Vertical FOV	20

Scene ID: 7,8 Reserved for customized scanning pattern (default setting to the same as Scene ID 0)

書式変更: 間隔 段落前： 6 pt, 段落後： 6 pt



Frame Rate (FPS)	10
Max_distance_for_10%_Target (m)	250
Max_distance (m)	500
V_Res in ROI (deg)	0.08
H_Res in ROI (deg)	0.089
V_Res in Sparse (deg)	0.24
H_Res in Sparse (deg)	0.178
Lines per frame	152
Vertical FOV	25

ページ 3: [1] 削除 Leilei SHINOHARA 2025/10/13 15:27:00

ページ 5: [2] 削除 Leilei SHINOHARA 2025/10/13 15:38:00

ページ 5: [3] 書式変更 Leilei SHINOHARA 2025/10/13 15:47:00

間隔 段落前： 6 pt, 段落後： 6 pt, 行間： 1 行

ページ 5: [4] 書式変更 Leilei SHINOHARA 2025/10/13 16:07:00

インデント : 左： 6.3 mm, ぶら下げインデント： 3.57 字, 間隔 段落前： 0.6 行, 段落後： 0.6 行,

行間： 1 行, 箇条書き + レベル : 1 + 整列： 6.3 mm + インデント： 12.7 mm

ページ 5: [5] 書式変更 Leilei SHINOHARA 2025/10/13 15:44:00

箇条書き + レベル : 1 + 整列： 6.3 mm + インデント： 12.7 mm

ページ 5: [6] 削除 Leilei SHINOHARA 2025/10/13 15:43:00

ページ 5: [7] 書式変更 Leilei SHINOHARA 2025/10/13 16:07:00

inno-一级无序列表, インデント : 左： 6.3 mm, ぶら下げインデント： 3.57 字, 1 行の文字数を

指定時に右のインデント幅を自動調整する, 間隔 段落前： 0.6 行, 段落後： 0.6 行, 箇条書き +

レベル : 1 + 整列： 6.3 mm + インデント： 12.7 mm

ページ 5: [8] 削除 Leilei SHINOHARA 2025/10/13 15:48:00

ページ 5: [9] 書式を変更 Leilei SHINOHARA 2025/10/13 15:48:00

フォント : (日) Microsoft YaHei, 14 pt, 上付き/下付き(なし)

ページ 5: [10] 削除　Leilei SHINOHARA　2025/10/13 15:48:00

ページ 5: [11] 削除　Leilei SHINOHARA　2025/10/13 15:59:00

ページ 5: [12] 書式変更　Leilei SHINOHARA　2025/10/13 16:02:00

標準, 1 行の文字数を指定時に右のインデント幅を自動調整しない, 間隔 段落前 : 6 pt, 段落後 : 6 pt

ページ 5: [13] 書式を変更　Leilei SHINOHARA　2025/10/13 16:02:00

フォント : (英) Calibri, (日) Microsoft YaHei, 14 pt

ページ 5: [14] 書式変更　Leilei SHINOHARA　2025/10/13 16:02:00

1 行の文字数を指定時に右のインデント幅を自動調整する, 間隔 段落前 : 0 pt, 段落後 : 0 pt, 行間 : 倍数 1.2 li

ページ 7: [15] 削除　Leilei SHINOHARA　2025/10/13 16:06:00

1.1

ページ 7: [16] 削除　Leilei SHINOHARA　2025/10/13 16:12:00

ページ 7: [17] 書式変更　Leilei SHINOHARA　2025/10/13 16:13:00

インデント : 左 : 0 mm, ぶら下げインデント : 4.42 字, 行間 : 1 行

ページ 7: [18] 削除　Leilei SHINOHARA　2025/10/13 16:15:00

1.

ページ 7: [19] 書式変更　Leilei SHINOHARA　2025/10/13 16:13:00

インデント : 左 : 0 mm, ぶら下げインデント : 4.42 字, 行間 : 1 行

ページ 7: [20] 削除　Leilei SHINOHARA　2025/10/13 16:18:00

2.

ページ 11: [21] 削除　Leilei SHINOHARA　2025/10/13 16:34:00

ページ 11: [22] 書式変更　Leilei SHINOHARA　2025/10/13 16:44:00

リスト段落, 1 行の文字数を指定時に右のインデント幅を自動調整する, 間隔 段落前 : 0 pt,

段落後 : 0 pt, 箇条書き + レベル : 1 + 整列 : 6.3 mm + インデント : 12.7 mm

ページ 11: [23] 書式変更　Leilei SHINOHARA　2025/10/13 16:44:00

リスト段落, インデント : 左 : 12.7 mm, 1 行の文字数を指定時に右のインデント幅を自動調

整する, 間隔 段落前 : 0 pt, 段落後 : 0 pt

ページ 11: [24] 書式変更　Leilei SHINOHARA　2025/10/13 16:44:00

リスト段落, 1 行の文字数を指定時に右のインデント幅を自動調整する, 間隔 段落前 : 0 pt,

段落後 : 0 pt, 箇条書き + レベル : 1 + 整列 : 6.3 mm + インデント : 12.7 mm

ページ 11: [25] 削除　Leilei SHINOHARA　2025/10/13 16:44:00

ページ 11: [26] 書式変更　Leilei SHINOHARA　2025/10/13 16:46:00

リスト段落, 1 行の文字数を指定時に右のインデント幅を自動調整する, 間隔 段落前： 0 pt,

段落後： 0 pt, 箇条書き + レベル : 1 + 整列： 6.3 mm + インデント： 12.7 mm

ページ 11: [27] 書式変更　Leilei SHINOHARA　2025/10/13 16:48:00

最初の行： 0 字, 箇条書き + レベル : 1 + 整列： 6.3 mm + インデント： 12.7 mm

ページ 11: [28] 書式変更　Leilei SHINOHARA　2025/10/13 16:48:00

リスト段落, 箇条書き + レベル : 1 + 整列： 6.3 mm + インデント： 12.7 mm

ページ 11: [29] 削除　Leilei SHINOHARA　2025/10/13 16:46:00

ページ 11: [30] 削除　Leilei SHINOHARA　2025/10/13 16:46:00

ページ 18: [31] 書式を変更　Leilei SHINOHARA　2025/10/13 17:38:00

フォント : 太字 (なし)

ページ 18: [31] 書式を変更　Leilei SHINOHARA　2025/10/13 17:38:00

フォント : 太字 (なし)

ページ 18: [31] 書式を変更　Leilei SHINOHARA　2025/10/13 17:38:00

フォント : 太字 (なし)

ページ 18: [32] 書式を変更　Leilei SHINOHARA　2025/10/13 17:12:00

フォント : 太字 (なし)

ページ 18: [32] 書式を変更　Leilei SHINOHARA　2025/10/13 17:12:00

フォント : 太字 (なし)

ページ 18: [32] 書式を変更　Leilei SHINOHARA　2025/10/13 17:12:00

フォント : 太字 (なし)

ページ 18: [33] 書式を変更　Leilei SHINOHARA　2025/10/13 17:12:00

フォント : 太字 (なし)

ページ 18: [33] 書式を変更　Leilei SHINOHARA　2025/10/13 17:12:00

フォント : 太字 (なし)

ページ 18: [33] 書式を変更　Leilei SHINOHARA　2025/10/13 17:12:00

フォント : 太字 (なし)

ページ 18: [34] 書式を変更　Leilei SHINOHARA　2025/10/13 17:12:00

フォント : 太字 (なし)

ページ 18: [34] 書式を変更　Leilei SHINOHARA　2025/10/13 17:12:00

フォント : 太字 (なし)

ページ 18: [34] 書式を変更　Leilei SHINOHARA　2025/10/13 17:12:00

フォント : 太字 (なし)

ページ 18: [35] 書式変更　Leilei SHINOHARA　2025/10/13 17:30:00

インデント : 左 : 6 mm, ぶら下げインデント : 4.42 字, 間隔 段落前 : 3 pt, 段落後 : 3 pt, 行間 :

1 行

ページ 18: [36] 書式変更　Leilei SHINOHARA　2025/10/13 17:30:00

インデント : 左 : 6 mm, ぶら下げインデント : 4.42 字, 間隔 段落前 : 3 pt, 段落後 : 3 pt, 行間 :

1 行

ページ 18: [37] 書式を変更　Leilei SHINOHARA　2025/10/13 17:31:00

フォント : 太字 (なし) , スペル チェックと文章校正を行う

ページ 18: [37] 書式を変更　Leilei SHINOHARA　2025/10/13 17:31:00

フォント : 太字 (なし) , スペル チェックと文章校正を行う

ページ 18: [37] 書式を変更　Leilei SHINOHARA　2025/10/13 17:31:00

フォント : 太字 (なし) , スペル チェックと文章校正を行う

ページ 18: [37] 書式を変更　Leilei SHINOHARA　2025/10/13 17:31:00

フォント : 太字 (なし) , スペル チェックと文章校正を行う

ページ 19: [38] 削除　Leilei SHINOHARA　2025/10/13 17:21:00

ページ 20: [39] 削除　Leilei SHINOHARA　2025/10/13 17:26:00

ページ 39: [40] 削除　Leilei SHINOHARA　2025/10/13 18:53:00

3.

ページ 39: [40] 削除　Leilei SHINOHARA　2025/10/13 18:53:00

4.

ページ 39: [40] 削除　Leilei SHINOHARA　2025/10/13 18:53:00

5.

ページ 39: [41] コメントの追加 [LS1]　Leilei SHINOHARA　2025/10/13 12:12:00

Please check the capture point cloud data with TCP, if the commands are correct

ページ 39: [42] 書式変更　Leilei SHINOHARA　2025/10/13 18:55:00

インデント : 左 : 7.8 mm, 行間 : 1 行, 行頭文字または番号を削除

ページ 39: [43] 削除　Leilei SHINOHARA　2025/10/13 14:55:00

ページ 39: [43] 削除　Leilei SHINOHARA　2025/10/13 14:55:00

ページ 39: [44] 書式変更　Leilei SHINOHARA　2025/10/13 18:55:00

間隔 段落前 : 3 pt, 段落後 : 3 pt, 行間 : 1 行

ページ 39: [45] 削除　Leilei SHINOHARA　2025/10/13 12:03:00

ページ 39: [45] 削除　Leilei SHINOHARA　2025/10/13 12:03:00

ページ 39: [45] 削除　Leilei SHINOHARA　2025/10/13 12:03:00

ページ 39: [45] 削除　Leilei SHINOHARA　2025/10/13 12:03:00

ページ 39: [46] 書式変更　Leilei SHINOHARA　2025/10/13 18:55:00

インデント : 左 : 4 mm, 最初の行 : 4 mm, 間隔 段落前 : 3 pt, 段落後 : 3 pt, 行間 : 1 行

ページ 39: [47] 削除　Leilei SHINOHARA　2025/10/13 12:06:00

ページ 39: [47] 削除　Leilei SHINOHARA　2025/10/13 12:06:00

ページ 39: [48] 書式変更　Leilei SHINOHARA　2025/10/13 18:55:00

間隔 段落前 : 3 pt, 段落後 : 3 pt, 行間 : 1 行

ページ 39: [49] 削除　Leilei SHINOHARA　2025/10/13 12:06:00

ページ 39: [49] 削除　Leilei SHINOHARA　2025/10/13 12:06:00

ページ 39: [50] 書式変更　Leilei SHINOHARA　2025/10/13 18:55:00

インデント : 左 : 4 mm, 最初の行 : 4 mm, 間隔 段落前 : 3 pt, 段落後 : 3 pt, 行間 : 1 行

ページ 39: [51] 書式変更　Leilei SHINOHARA　2025/10/13 18:55:00

間隔 段落前 : 3 pt, 段落後 : 3 pt, 行間 : 1 行

ページ 39: [52] 削除　Leilei SHINOHARA　2025/10/13 12:10:00

ページ 39: [53] 削除　Leilei SHINOHARA　2025/10/13 12:11:00

ページ 39: [53] 削除　Leilei SHINOHARA　2025/10/13 12:11:00

ページ 39: [54] 書式変更　Leilei SHINOHARA　2025/10/13 19:00:00

インデント : 左 : 0 mm, ぶら下げインデント : 4.42 字, 行間 : 1 行

ページ 39: [55] 削除　Leilei SHINOHARA　2025/10/13 18:59:00

1.

ページ 39: [56] 書式変更　Leilei SHINOHARA　2025/10/13 19:01:00

間隔 段落前 : 3 pt, 段落後 : 3 pt, 行間 : 1 行

ページ 40: [57] 削除　Leilei SHINOHARA　2025/10/13 12:14:00

i.