CE30-A Solid State Array LiDAR
Operation Manual

Benewake (Beijing) Co., Ltd.
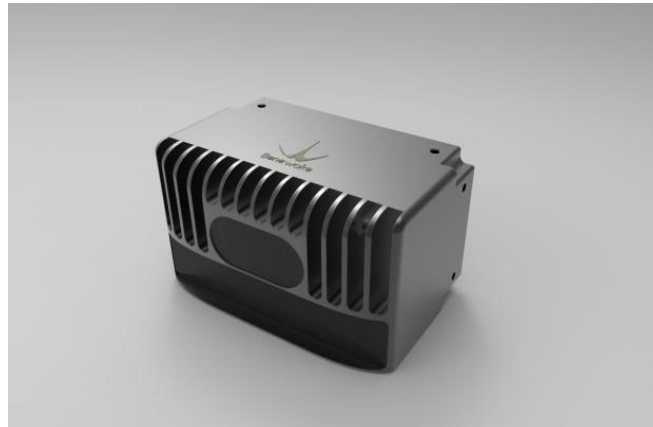
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1   CE30 Introduction

CE30 is an IR DE-LiDAR developed on the basis of ToF principle. With the optimized obstacle avoidance mode, the detecting region of interest can be set up. The single-point projection distance of the nearest obstacle can be transferred through CANBUS. Compared with single-channel scanning LiDARs, CE30 does not contain any rotating components. The reliability of long-time work and a wider vertical detection range can be ensured.

Product Properties

➢   Complete solid-state LiDAR

➢   Array detection

➢   Horizontal field of view: > 120°; vertical field of view: 9°

➢   Set region of interest in the obstacle avoidance mode

➢   Calculate the nearest point and output with CANBUS
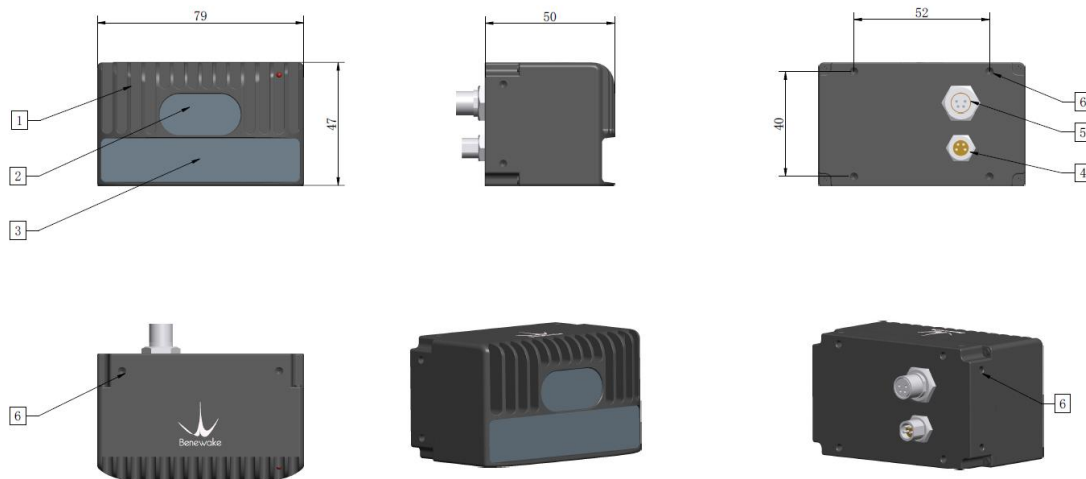
1. Shell
2. Receiving panel (working area, no coving)
3. Sending panel (working area, no coving)
4. Power supply/CANBUS (M8 aerial socket)
5. Ethernet port (M8 aerial socket)
6. Equipment installing hole (M3)

Fig. 1 Outline of DELIADAR CE30

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2   Indicator Instruction

1.   Blue light: ready state, ready for connection and running

2.   Blue flash: running state

3.   Red flash: missing of relevant running files

4.   Red light: fatal error (abnormal signal, abnormal interface communication, abnormal I2C, etc.)
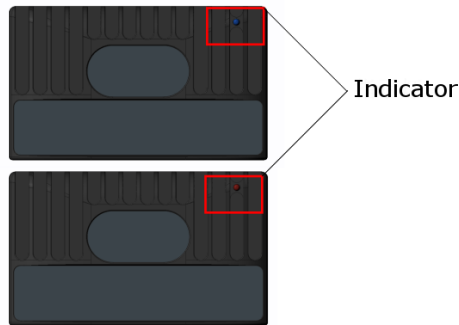

Fig. 2 Indicator Drawing

3   Software Operation Instruction

1.   Connect all the accessories in accordance with Fig. 3 Illustration for Connection of Components.
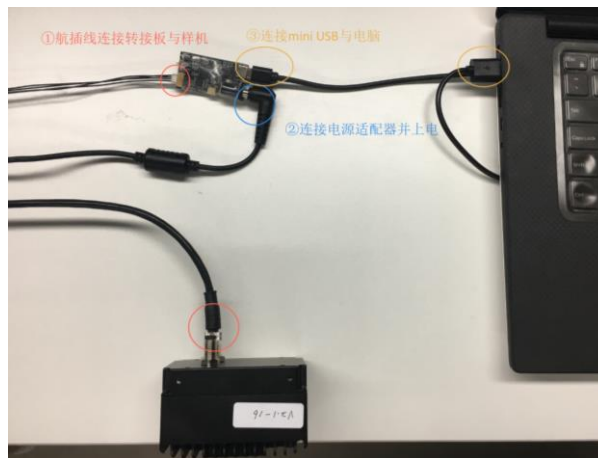
Fig. 3 Illustration for Connection of Components

2.   Plug into 12V-DC2.5 power. The supply current must be above 2A. Connect the mini USB interface on the adapter plate with the computer.

3.   Wait for about 35s for normal start of the LiDAR. Then the heartbeat packet is transferred with blue light flashing, indicating the state of waiting orders.

Operate according to Fig. 4 to start the software. Demonstration and data recording can be achieved with the software.

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Fig. 4 Illustration of Software Functions

Note

① The software could automatically identify two kinds of UART: one for data and another is for debugging information. Please choose appropriate UART number in accordance with computer properties.

② Default setting of obstacle avoidance area is 35 cm in half-width of the ROI and 400 cm in depth.

③ Start/ stop test button

④ View data by rolling the window

⑤ Button of data recording （In unit of minute. When multiple clicks of the button within one minutes, only the data of the last click will be recorded.）

⑥ Position of the nearest obstacle detected by LiDAR

⑦ Obstacle avoidance region: with presence of an object, as shown in Fig. 4 above, the software will label the area between LiDAR and the obstacle as the safe zone with coloring, or else the background will be white.

⑧ Running state

⑨ Single-point mode

If the single-point mode is chosen, as shown in Fig. 5 below, the software will indicate the specific position of the obstacle in ROI. (Instruction: during the measurement of a wide flat obstacle, the output angle might be the angle of any point on the object, because the LiDAR only outputs one point.)

Fig. 5 Illustration of Single-point Mode

4 Description on Line Sequence

Fig. 6 Description on Line Sequence: Red - positive, Black - negative, Green - CANH, White – CANL

Attention!

① Current of power adapter shall be above 2A.

② During energization of LiDAR, there is merely a slim chance of prolonged starting time. If LiDAR is not started after 2 minutes, it is recommended to disconnect the power supply and reboot it.

③ After testing, please make sure to disconnect the power supply first.

5 Installation Instruction

The front working surface of LiDAR should exceed or at least parallel with the installation platform, see Fig. 7.

Fig. 7 Recommendations on LiDAR Installation Position. The front working surface of LiDAR must exceed or at least be parallel with the installation platform. Otherwise, there may be certain interference and influence the data accuracy.

6 Method of Center Calibration

1. There might be deflection of the LIDAR after installation in the robot. Calibration shall be done to ensure the normal warning and obstacle avoidance of the forward area.

2. As shown in Fig. 8, click the "0 angle calibration" button on the software, and calibration instruction will be shown in Fig. 9.

Fig. 8 Software "0 Angle Calibration" button

Fig. 9 Illustration of Center Calibration Function. Specify the front direction and calibrate after installation. This operation only changes the coordinates without influencing the accuracy.

3. Put a 2 cm-wide white rod (whose height must exceed the installation height of LiDAR) at 2m in front of the robot, and empty ±30° of the LiDAR's detecting region. Remove all the high-reflective objects within the ROI.
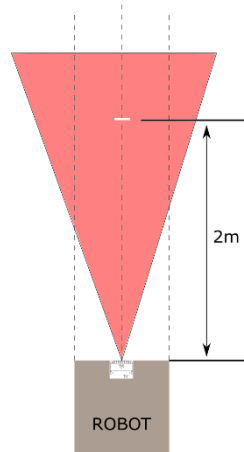

Fig. 10 Illustration of Center Calibration Operation. There shall not be any obstacle in front area and no moving objects in operation.

4. Press the calibration button after setting up environment.

5. Wait for 2 seconds for calibration. Distance data will be automatically uploaded, and the calibration results will be stored after disconnecting the power supply. Please be cautious with this operation.

7   Head Dissipation Component and Reference Design

In normal operation, the CE30 LiDAR has an average heat power consumption of around 5W. As shown below is the reference design of heat dissipation component of CE30 LiDAR. Users have the option to design heat dissipation component depending upon actual installation requirements and application scenario.
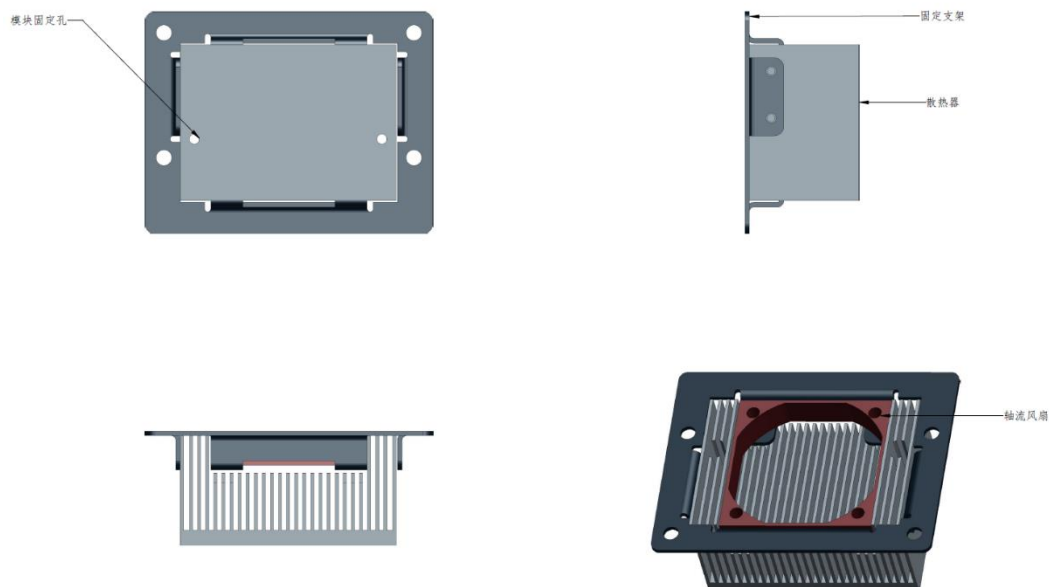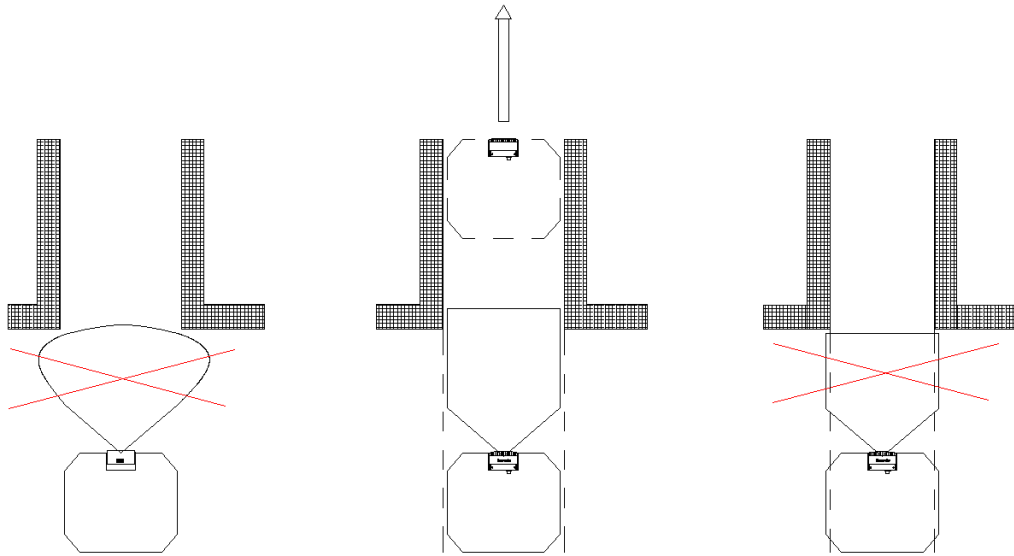

Fig. 11 Optional Heat Dissipation Component

ToF激光雷达 & SLAM解决方案
ToF LiDAR & SLAM Solution

8 Application Case

8.1 Accurate Crossing

Case 1 ROI width shall be same as robot width, ensuring accurate crossing.
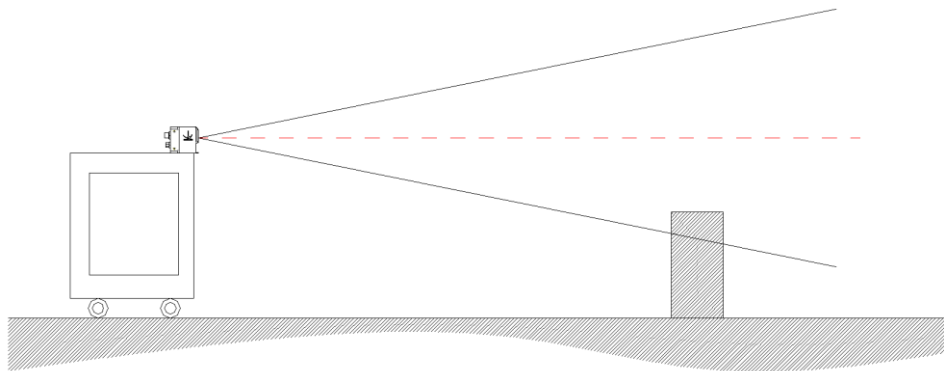
8.2 Detection of Low Obstacles

Fig. 12 An Application of Obstacle Avoidance Mode. Compared to 2D single-channel scanning LiDAR (as shown with red line), CE30-A can better avoid low obstacles on the ground.

9 Influence Factors of Measurement

9.1 Multi Optical Path

Based on ToF LiDAR principle, if there are multiple echo regions as shown in the figure below at the working height of the radar, the multi-path phenomenon will be triggered: the LiDAR receives the light returned by the path 1 and the path 2 at the same time, which may result in a larger measurement value.
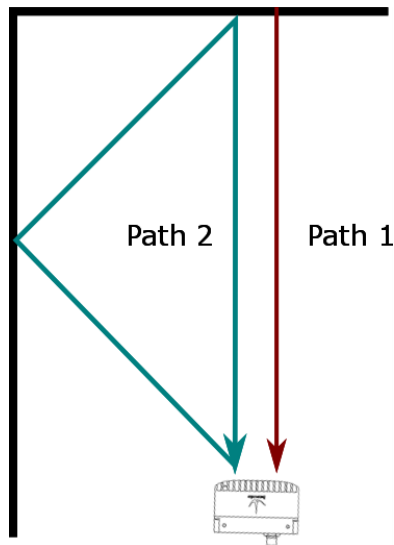
Fig. 13 Multi optical path phenomenon

9.2 Stray Light

As shown below, when solid-state ToF LiDAR is working, in addition to the light reflected by the object 1, the light scattered by object 2 and object 3 that close to the LiDAR will enter the lens. Such stray light can lead to a deviation of the object 1's ranging.
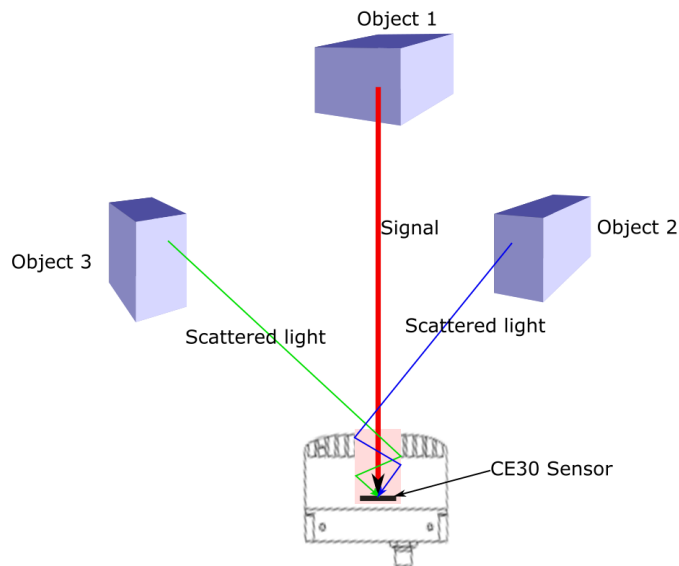

Fig. 14 Illustration of stray light
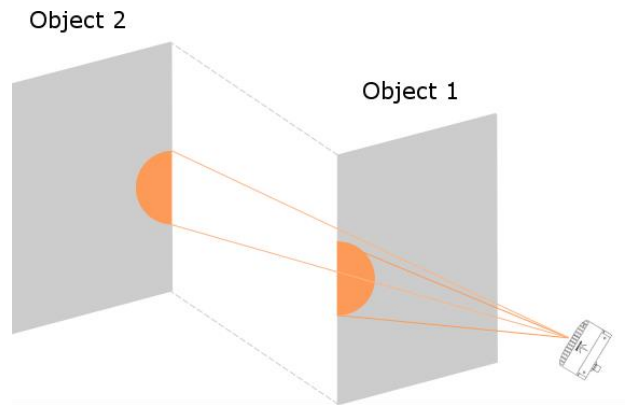
9.3 Multi Distance Objects

Fig. 15 Multi distance objects

The light radiated by the LiDAR is reflected by the object onto the sensor of the LiDAR. If some pixels receive signals from both front and rear obstacles at the same time, the output distance of this pixel may be the value between the two obstacles. The degree of deviation is related to the distance between the two obstacles and the material.