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Delta-2A communication interface protocol

[Delta-2A]

Shenzhen Shanchuan Robot Co., Ltd.

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Table of contents

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one. Introduction to Radar Communication

Delta-2A LiDAR communicates with external devices through UART TTL level and only supports simplex

Communication (that is, the lidar actively sends data frames to external devices), and the external devices only need to extract valid data from the data frames.

The data is enough, no response is required, all the data in the communication frame are data in hexadecimal format.

The radar rotates and measures for one week, and scans to obtain the information of evenly distributed points around it (the angle and distance of the points).

Leave). The sdk is to receive and analyze the data and get the information of each lap point. A circle of 360° is divided into 16 equal parts

The frame reports the scanning information (see the command word list below) frame, so the starting angles of each frame of 16 frames are obtained respectively.

Is 0° (zero point - see specification for position), 22.5°, 45°, 67.5°, 90°...270°, 292.5°, 315,

337.5°, 360°. 16 frames of data add up to a complete circle, the total number of points in one circle = 16 * the number of points per frame;

The total number of points in each frame can be obtained by calculating the number of distances according to the scanned information frame (number of distances = total number of points). per frame

Data point information (angle and distance): The distance of the Nth point in a frame is the N distance value in the scan information frame,

The angle corresponding to the distance of the Nth point in that frame = the starting angle of this frame + (N-1)*22.5/(the total of each frame

Points), so that a frame of point information (angle and distance) is available.

According to the communication protocol defined in this article, the communication data can be parsed, and the real-time measurement information and

Health status information.

two. Communication frame structure

The communication frame consists of frame header, frame length, frame type, command word, parameter length, parameter, and check code.

Mainly used for lidar to actively upload measurement information, fault information, etc. to the external host, the host only needs to

The effective data can be extracted from the communication frame uploaded by the radar, and no response is required.

The command frame format is as follows:

Frame Header Frame Length Protocol Version Frame Type Command Word Parameter Length Parameter Check Code							

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Frame header: The frame header field occupies 1 Byte and is fixed at 0xAA.

Frame length: The frame length field occupies 2Bytes. The frame length is calculated from the frame header to the byte before the check code.

Highs come first, lows come after.

Protocol version: The address code field occupies 1Byte, and the default is 0x00.

Frame Type: The frame type field occupies 1 Byte and is fixed at 0x61.

Command word: The command word field occupies 1 Byte and is an identifier to distinguish different commands.

Parameter length: The parameter length occupies 2 Bytes, which is the length of the valid data in the data frame.

Parameters : The parameter field is the valid data for the command.

Check code: The check code field is the cumulative sum of 16 bits, occupying two bytes, with the high order in the front and the low order in the back.

Calculation: The accumulated sum from the beginning of the frame to the previous byte of the check code.

Command word list:

Command word	**description**	**parameter length**	**parameter description**
0xAD	measurement information	(3N+5)Bytes	0Bytes: radar speed value, 8 bits unsigned number, the minimum resolution is 0.05r/s (that is, the speed value is 1, and the corresponding speed is 0.05r/s) 1ÿ2Bytes: zero offset, 16 bits signed number, high order first, The low position is at the rear, and the minimum resolution is 0.01° (zero offset: radar adjustment test information, no need after parsing) 3 ÿ 4Bytes: The starting angle value of this data frame, 16 bits unsigned number, high-order first, low 5 Bytes: Signal value corresponding to distance value 1, 8 bits unsigned number (signal

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			Number value: radar debugging information, not used after parsing) 6ÿ7Bytesÿ Distance value 1,16 bits unsigned number, high order first, low order last 8Bytesÿ Signal value corresponding to distance value 2, 8 bits unsigned number (signal value: thunder debug information, not used after parsing) 9ÿ10Bytesÿ Distance value 2,16 bits unsigned number, high order first, low order last ..... 3N + 2Bytes: the signal value corresponding to the distance value N, 8 bits unsigned Number (signal value: radar debugging information, not used after analysis) 3N + 3 ÿ 3N + 4Bytesÿ Distance value N, 16 bits unsigned number, high order first, low order last Remark: 1. Angle value range: 0 ~ 36000 2. Angular resolution: 0.01° (that is, the angle value is 1, and the corresponding angle is 0.01°) The distance resolution is 0.25mm (that is, the distance value is 1, corresponding to the actual distance is 0.25mm) 3. Angle calculation:

			Example: Distance n (n is 1\~N, N is the distance points in this frame) corresponding angle calculation: N = (parameter length - 5)/3 Angle from distance n = starting angle value + 22.5°*(n - 1)/N
0xAE device health	information	1Byte	Equipment speed failure Speed value, 8 bits unsigned number, the minimum resolution is 0.05r/s

three. Check code calculation

The communication frame check algorithm of this protocol adopts 16-bit cumulative sum. The following is the routine for calculating the check code.

for reference.

```
//=============================================
 =================================

// checksum calculation

// *Start_Byte: start byte

// Num_Bytes: the length of the calculated data

// Return value: 16-bit check code

//=============================================
 =================================

u16 CRC16(u8 *Start_Byte,u16 Num_Bytes)

{
```

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```
    u16 Checksum = 0;

    while (Num_Bytes--)

    { // Calculate CRC

        Checksum += *Start_Byte++;

    }

    return Checksum;

}
```

Four. Communication frame instance analysis

0. Resolution in the protocol: actual measurement data = value in communication * resolution

Actual speed = speed value in communication * resolution (0.05r/s)

Actual distance = distance value in communication * resolution (0.25mm)

Actual angle = angle value in communication * resolution (0.01°)

1. Measure the data frame:

AA 00 9A 01 61 AD 00 92 82 00 87 69 78 00 00 00 46 21 3A 54 23 78

00 00 00 00 00 00 91 33 60 82 32 F7 93 32 EB 6D 32 E0 51 21 88 00 00

00 5D 21 88 66 21 8D 68 21 BF 41 32 D4 86 33 02 4D 32 E0 89 51 48 8E

51 48 92 51 48 8C 51 48 63 50 19 6D 51 48 7C 51 64 92 51 64 89 51 48

90 51 64 89 51 48 93 51 64 4B 53 2D 57 59 BA 43 2F 78 41 2E E4 00 00

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00 54 2E DE 6B 2E E4 6B 2F 50 58 2E E4 7E 2F 64 5D 2F 78 3F 5A 0B 5A

5B FD 57 5B D3 5B 5C 28 59 5C 28 59 5B FD 5E 5E 32 35 BC

AA: frame header

00 9A: The frame length is 0x009A (note: only the frame length of the instance frame, not the actual length of the radar)

01: Protocol version

61: Frame Type

AD: command word

00 92: Valid data length 0x0047

82: Radar speed 130*0.05r/s (resolution)=6.50r/s

00 87: Zero offset

69 78: starting angle 27000*0.01°(resolution)=270°

00: Signal letter 1

00 00: Distance value 1 is 0*0.25mm (resolution)=0mm

46: Signal value 2

21 3A: Distance value 2 is 8506*0.25mm (resolution)=2126mm

....

5E: Signal value 47

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5E 32: Distance value 47 is 24114*0.25mm (resolution)=6028mm

35 BC: Check code 0x35BC=(AA+00+9A+…+FD+5E+5E+32)

2. Radar RPM fault frame:

AA 00 09 00 61 AE 00 01 69 02 2C

AA: Frame header identification.

00 09: The frame length is 0x0009 (ie 9) bytes (excluding CRC code)

00: Protocol version

61: Frame Type

AE: command word

00 01: Valid data length 0x0001

C9: radar speed 0xC9, that is, 201*0.05r/s (resolution) = 10.05r/s

02 2C: Check code 0x022c