

Delta2B 360° 2D LiDAR Scanner - Protocol Guide

1. Protocol Guide

The LiDAR Scanner uses UART (3.3V TTL @ Baud Rate: 230400) to communicate with external devices. The communication is unidirectional from the LiDAR to the external device. The host device does not need to acknowledge transmissions. All data is transmitted in Hex.

The guide will explain how to extract distance measurement data and device health information from the received data.

2. Frame Structure

Each transmission follows this frame structure:

Start Byte	Frame Size	Protocol Version	Frame Type	Payload Type	Payload Size	Payload	Checksum
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	Index	Notes
Start Byte	0	1 byte, Fixed to 0xAA
Frame Size	1 - 2	2 bytes, Size of the frame in bytes from the Start Byte to the end of the Payload. Does not include Checksum. MSB first
Protocol Version	3	1 byte, Fixed to 0x00
Frame Type	4	1 byte, Fixed to 0x61
Payload Type	5	1 byte, To differentiate between different payload types. See table below
Payload Size	6 - 7	2 bytes, Size of the frame payload MSB first

Payload	8 - n	n bytes, Frame payload
Checksum	n+1 - n+2	2 bytes, MSB first

2.1. Payload Types

Payload Type	Payload Identifier	Payload Length	Note
Distance Measurement	0xAD	(3N+5) bytes	where N is number of samples
Device Error	0xAE	1 unsigned byte	Payload represents rotation speed with 0.05r/s resolution

2.1.1 Distance Measurement

Transmission of distance measurement data from scanner.

Payload Identifier: 0xAD

Payload Length: (3N+5) bytes where N is number of samples

Payload Scheme:

Byte	Description
Byte 0	1 byte, unsigned - Rotation speed - resolution 0.05r/s
Bytes 1 - 2	2 bytes, signed - MSB first - Angle offset - resolution 0.01°
Bytes 3 - 4	2 bytes, unsigned - MSB first - Starting angle for the frame - resolution 0.01°
Byte 5	1 byte, unsigned - Sample ID - Can be discarded
Byte 6 - 7	2 bytes, unsigned - MSB First - Distance value for first sample
Byte 8	1 byte, unsigned - Sample ID - Can be discarded
Byte 9 - 10	2 bytes, unsigned - MSB First - Distance value for second sample
...	Repeat for N samples

2.1.1.1 Calculating the Angle for Nth Distance Measurement

Angle for nth sample = Starting angle + $22.5^\circ(n-1)/N$

Where:

N = Number of distance samples = (length of payload - 5)/3

Each frame carries the distance measurements for a 22.5° sweep.

2.1.2 Device Error

Indicates a device error - rotation speed is too low to perform measurements

Payload Identifier: `0xAE`

Payload Length: 1 byte

Payload:

Unsigned byte - Rotation speed with 0.05r/s resolution

3. Checksum Calculation

The checksum is a 16-bit number, created by adding up all of the bytes from the frame. The checksum calculation is a standard CRC-16 checksum.

The following is an demonstration of the checksum calculation in C:

```
u16 CRC16(u8 *Start_Byte,u16 Num_Bytes)
{
    u16 Checksum = 0;
    while (Num_Bytes--)
    {
        // CRC
        Checksum += *Start_Byte++;
    }
    return Checksum;
}
```

4. Example

4.1 Example 1 - Distance Measurement

Frame:

```
AA 00 4F 00 61 AD 00 47 79 00 40 72 42 3C 05 6D 37 05 8A 3A 05 93 34 05 9C
35 05 AD 35 05 B8 35 05 C6 35 05 D5 34 05 E5 36 05 F2 31 06 07 2D 06 16 2E
06 2B 2E 06 40 36 06 52 35 06 67 32 06 61 2D 06 45 2B 06 22 2B 06 03 31 05
DF 30 05 C6 DC 27
```

Breakdown:

AA : Start Byte
00 4F : Frame Size = 0x004F = 79 bytes (not including the CRC)
00 : Protocol Version
61 : Frame Type
AD : Payload Type
00 47 : Payload Size = 0x0047 = 71 bytes
79 : Rotation Speed = (0x79 => 121) x 0.05r/s = 6.05r/s
00 40 : Angle Offset = (0x40 => 64) * 0.01° = 0.64°
72 42 : Starting Angle = (0x7242 => 29250) * 0.01° = 292.5°
3C : Sample ID #1
05 6D : Distance Measurement #1 = (0x056D => 1389) * 0.25mm = 347.25mm
37 : Sample ID #2
05 8A : Distance Measurement #2 = (0x058A => 1418) * 0.25mm = 354.5mm
.....
30: Sample ID #22
05 C6: Distance Measurement #22 = (0x05C6 => 1478) * 0.25mm = 369.5mm
DC 27 : CRC 0xDC27

4.2 Example 2 - Device Error

Frame:

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

Breakdown:

AA: Start Byte
00 09 : Frame Size = 0x0009 = 9 Bytes (not including the CRC)
00 : Protocol Version
61 : Frame Type
AE: Payload Type
00 01: Payload Size = 0x0001 = 1 byte
C9 : Payload: Rotation Speed = (0xC9 = 201) * 0.05r/s = 10.05r/s
02 2C: CRC 0x022c