YDLIDAR

YDLDIAR SDM15 DEVELOPMENT MANUAL^{ALPHA}

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CONTENTS

1 WORKING MECHANISM

The YDLIDAR SDM15 Series (hereinafter referred to as SDM15) system has 3 working modes: idle mode, scan mode, stop mode.

➢ **Idle mode:** When the SDM15 is powered on, it defaults to the idle mode. In the idle mode, the SDM15 's scan unit does not work and the laser does not light up.

➢ **Scan mode:** When SDM15 enters the scan mode, the scan unit lights up the laser and starts to work, continuously sampling the external environment, and outputting it in real time after background processing.

➢ **Stop mode:** When there is an error in SDM15 operation, such as abnormal scan, self-test failure, etc., SDM15 will automatically turn off the scan unit and feedback the error code.

2 SYSTEM COMMUNICATION

2.1 Communication Mechanism

SDM15 uses the serial port to interact with external devices for commands and data. When an external device sends a system command to SDM15, SDM15 resolves the system command and returns a corresponding reply message. According to the command content, SDM15 switches the corresponding working status. According to the content of the message, the external system can parse the message and obtain the response data.
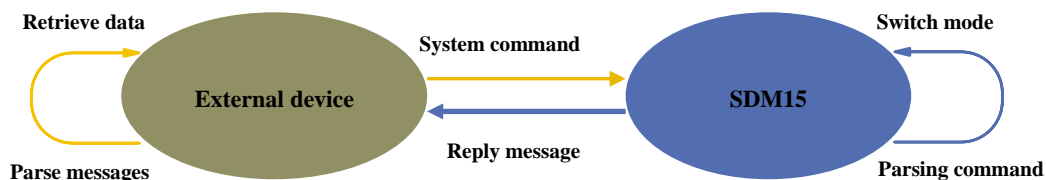
FIG 2 YDLIDAR SDM15 SYSTEM COMMUNICATION

2.2 System Command

By sending relevant system commands, the external system can set the corresponding working status of SDM15 and obtain corresponding data. The system commands issued by SDM15 are as follows:

CHART 1 YDLIDAR SDM15 SYSTEM COMMAND

System Command	Description	Mode Switching	Answer Mode
0x60	Start scanning	Scan mode	Sustained response
0x61	Stop scanning	Stop mode	Single response
0x62	Get device information	No	Single response
0x63	Lidar self-test	No	Single response
0x64	Set output frequency	No	Single response
0x65	Set filtering	No	Single response
0x66	Set serial port baud rate	No	Single response
0x67	Format output data	No	Single response
0x68	Restore factory settings	No	Single response

2.3 System Messages

The system message is a response message that the system feeds back based on the received system command. According to different system commands, the reply mode and response content of the system message are also different. There are three kinds of response modes: no response, single response, continuous response.

No response means that the system does not return any messages. A single response indicates that the system's message length is limited, and the response ends once. Sustained response means that the system's message length is infinite and needs to send data continuously, such as when entering the scan mode.

The single response and continuous response messages use the same data protocol. The contents of the protocol are: packet header, packet type, data length, data segment and check code, and are output through the serial port hexadecimal system.

CHART 2 YDLIDAR SDM15 SYSTEM MESSAGE DATA PROTOCOL

Packet Header	Packet Type	Data Length	Data Segment	CheckSum
2 Bytes	1 Byte	1 Byte	N Bytes	1 Byte

➢ **Packet header:** SDM15's message sign is unified as 0x55AA.
➢ **Packet type:** Please see Chart 1 for the type of system command.
➢ **Data length:** Indicates the length of response data.
➢ **Data segment:** The response content under different system commands feedback different data contents, and their data format is also different.
➢ **CheckSum:** Check the sum of all data except the checksum.

Note: The SDM15 data communication adopts the little-endian mode and the low-order mode.

3 DATA PROTOCOL

3.1 Start Scan

When sending the command to SDM15, SDM15 enters the scan mode and continues to output scan data.

Sending:

Packet head		Command type	Data length	CheckSum
0xAA	0x55	0x60	0x00	0x5F

SDM15 has two output data formats, standard data format and Pixhawk data format, which can be switched by command (please see 3.8 Set Output Data Format for details).

1) Standard data format (default):

Reply:

Packet head		Command type	Data length	Data segment			CheckSum
0xAA	0x55	0x60	0x04	Distance uint16	Intensity uint8	Disturb uint8	LSB

Set the data segment as 92 06 AB 0D. Since the system is in small-end mode, the distance data is 0x0692.

➢ **Distance value:** 0x0692 = 1682mm
➢ **Intensity value:** 0xAB = 171
➢ **Disturb value:** 0x0D = 13

2) Pixhawk data format:

The output is in the form of a character string, with the unit of m. If the distance is 1.68m, the output string is 1.68.

3.2 Stop Scan

When sending the command to SDM15, SDM15 stops scan and enters idle mode.

Sending:

Packet head		Command type	Data length	CheckSum
0xAA	0x55	0x61	0x00	0x60

Reply:

Packet head		Command type	Data length	CheckSum
0xAA	0x55	0x61	0x00	0x60

3.3 Obtain Version Information

Under idle mode, send the command to SDM15 and return version information.

Sending:

Packet head		Command type	Data length	CheckSum
0xAA	0x55	0x62	0x00	0x61

Reply:

Packet head		Command type	Data length	Data segment	CheckSum
0xAA	0x55	0x62	0x14	.. ..	LSB

Data length=0x14, that is, the number of bytes of response content is 20; This response is a single response, and the content of this data segment meets the following data structure:

> **Model number:** One byte device model, such as the model code of SDM15 is 160;
> **Firmware Version:** 1 byte, indicate firmware version;
> **Hardware version:** 2 bytes. The low byte is the major version number, and the high byte is the minor version number;
> **Serial number:** 16 bytes, the only factory serial number.

3.4 Lidar Self-test

In idle mode, send this command to SDM15, SDM15 performs. Self-test and returns the Self-test result.

Sending:

Packet head		Command type	Data length	CheckSum
0xAA	0x55	0x63	0x00	0x62

Reply:

Packet head		Command type	Data length	Data segment	CheckSum
0xAA	0x55	0x63	0x22	Selftest	LSB

➢ **The meaning of data segment is as follows:**

CHART 3 MEANING OF DATA SEGMENT IN RESPONSE MESSAGE

Self-test Result	Self-test Error Code	Self-test Data
1 Byte	1 Byte	32 Bytes

Self-test result: 0x01 indicate pass, 0x00 indicate abnormal.

3.5 Setting Output Frequency

In idle mode, send this command to SDM15 to configure SDM15 output frequncy.

Sending:

Packet head		Command type	Data length	Data segment	CheckSum
0xAA	0x55	0x64	0x01	ScanFreq	LSB

Reply:

Packet head		Command type	Data length	Data segment	CheckSum
0xAA	0x55	0x64	0x01	ScanFreq	LSB

Among them, the data segment is the output frequency parameter (uint8), including five output frequencies (ScanFreq), namely: 10Hz, 100Hz, 200Hz, 500Hz, 1000Hz, 1800Hz output frequency (default is 100Hz), and the code is as follows:

CHART 4 OUTPUT FREQUENCY SETTING DISCRIPTION

	0x00	0x01	0x02	0x03	0x04	0x05
ScanFreq	10Hz	100Hz	200Hz	500Hz	1000Hz	1800Hz

3.6 Set Filtering

In idle mode, send the command to SDM15 to configure the SDM15 output filter on or off.

Sending:

Packet head		Command type	Data length	Data segment	CheckSum
0xAA	0x55	0x65	0x01	Filter	LSB

Reply:

Packet head		Command type	Data length	Data segment	CheckSum
0xAA	0x55	0x65	0x01	Filter	LSB

Among them, the data segment is the filter switch flag Filter (uint8), 0x00 means to turn off the filter, 0x01 means to turn on the filter (default on).

3.7 Set Baud Rate

In idle mode, send the command to SDM15 to configure SDM15 baud rate.

Sending:

Packet head		Command type	Data length	Data segment	CheckSum
0xAA	0x55	0x66	0x01	BaudRate	LSB

Reply:

Packet head		Command type	Data length	Data segment	CheckSum
0xAA	0x55	0x66	0x01	BaudRate	LSB

Among them, the data segment is the baud rate parameter (uint8), which contains five baud rates, namely: 230400, 460800, 512000, 921600 and 1500000. The codes are shown in the following table (460800 by default):

CHART 5 BAUD RATE SETTING DESCRIPTION

	0x00	0x01	0x02	0x03	0x04
BaudRate	230400	460800	512000	921600	1500000

Note: After setting baud rate, users need to power on again to take effect.

3.8 Set Output Data Format

In idle mode, send the command to SDM15 to configure SDM15 output data format.

Sending:

Packet head		Command type	Data length	Data segment	CheckSum
0xAA	0x55	0x67	0x01	Format	LSB

Reply:

Packet head		Command type	Data length	Data segment	CheckSum
0xAA	0x55	0x67	0x01	Format	LSB

Among them, the data segment is the format parameter (uint8), 0x00 represents the standard data format, and 0x01 represents the pixhawk data format.

3.9 Restore Factory Settings

In idle mode, send the command to SDM15 to restore the factory settings.

Sending:

Packet head		Command type	Data length	CheckSum
0xAA	0x55	0x68	0x00	0x67

Reply:

Packet head		Command type	Data length	CheckSum
0xAA	0x55	0x68	0x00	0x67

4 ATTENTION

During command interaction with SDM15, except for the stop scan command, other commands cannot be interacted in scan mode, which may easily lead to message parsing errors.

SDM15 will not automatically start scan when it is powered on. When it is necessary to start scanning, send the start scan command to enter the scan mode. When it is necessary to stop scanning, send the stop scan command to enter the idle mode.

To start SDM15 normally. The recommended process as follow:

The first step is to send the command to get the version number;

The second step is to send the self-test command and obtain the self-test results;

The third step is to send the start ranging command to obtain ranging data.

5 REVISION

Date	Version	Content
2022-08-29	0.1.0	The 1st release
2023-01-31	0.1.1	1) Correct the calculation method of check code 2) Change the description of selftest response package 3) Add instructions for setting data format
2023-02-08	0.1.2	Add SN code resolution for version information in 3.3 Section