Shenzhen Hi-Link Electronic Co.,Ltd
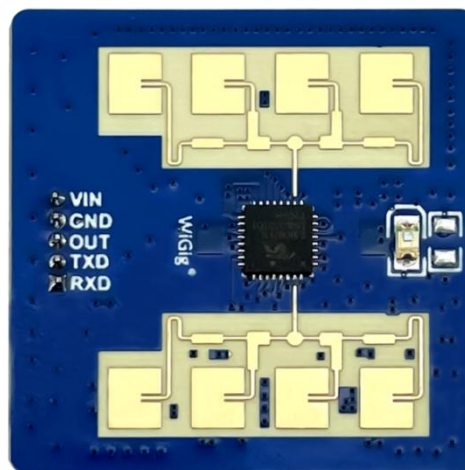
HLK-LD2411-S

Human Distance Sensing Module Serial Communication Protocol

Content
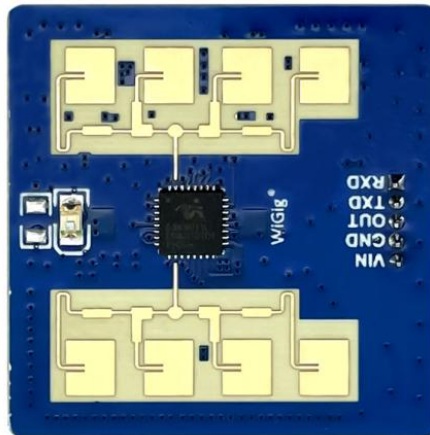
1   Communication Protocol

The LD2411-S communicates with the outside world through a serial port (TTL level). The data output and parameter configuration commands of the radar are carried out under this protocol. The default baud rate of the radar serial port is 256000, 1 stop bit, no parity bit.

1.1 Pin Definition

Pin	Symbols	Name	Function
1	OUT	OUT	Reserved
2	UART_Tx	Serial port Tx	Serial port Tx pin
3	UART_Rx	Serial port Rx	Serial port Rx pin
4	GND	Power ground	Power ground
5	VCC	Power input	Power supply input 5V

1.2 Use And Configuration

1.2.1 Typical Application Circuits

LD2411-S module directly through the serial port in accordance with the prescribed protocol for the output of detection results data, serial output data contains the target state and distance auxiliary information, etc., the user can be used flexibly according to the specific application scenarios.

The module power supply voltage is 5V and the power supply capacity of the input power supply is required to be greater than 200mA.
Default baud rate for serial port is 256000, 1 stop bit, no parity bit.

1.2.2 The Role Of Configuration Parameters

Users can modify the configuration parameters to the module through the serial port of LD2411-S to adapt to different application requirements.

The configurable radar detection parameters include the following:

- **Maximum range of motion**

Set the maximum detectable distance, and only moving human targets that appear within this maximum distance will be detected and output the results.

Maximum 717cm, (the actual detection of the farthest distance of 600cm, more than this range of data will be inaccurate).

- **Recent range of motion**

Set the nearest detectable distance, only moving human targets that appear within this distance will be detected and the result will be output.

Minimum 30cm.

- **Maximum micro-movement range**

Set the maximum detectable distance, only the micro-motion human target that appears within this maximum distance will be detected and output the result.

Maximum 425cm (the actual detection of the furthest micro-motion distance of 350cm, more than this range of data will be inaccurate).

- **Recent micro-movement range**

Set the nearest detectable distance, only the micro-movement human target that appears within this distance will be detected and output the result.

- **Unattended waiting time**

Set the unmanned waiting time, if the target is not detected after the time, the micro-motion/motion status will no longer be output.

Range 0-65535 (Unit 100ms)

1.3 Protocol Format

1.3.1 Protocol Data Format

The LD2411-S uses small-end format for serial data communication, and all data in the following tables are in hexadecimal.

1.3.2 Command Protocol Frame Format

The format of the protocol-defined radar configuration commands and ACK commands is shown in Table 1 to Table 4.

Table 1 Send command protocol frame format

Frame header	Length of data in the frame	Intra-frame data	End of frame
FD FC FB FA	2 bytes	See Table 3	04 03 02 01

Table 2 Data format in the sent frame

Command word (2 bytes)	Command value (N bytes)

Table 3 ACK command protocol frame format

Frame header	Length of data in the frame	Intra-frame data	End of frame
FD FC FB FA	2 bytes	See Table 5	04 03 02 01

Table 4 ACK intra-frame data format

Send command word | 0x0100 (2 bytes)	Return value (N bytes)

1.4 Distance Data Output Protocol

   LD2411-S output radar detection result through serial port, the default output target basic information, including target status, target distance, this set of radar module one-way transmission, frame header and frame tail are different.
Note: 1. After sending the enable configuration, the module will no longer output the distance data, and can only output the data again if you exit the enable configuration.

1.4.1 Reported Data Frame Format

Table 5 Format of reported data

Frame header	Data type	Distance data	End of frame
AA AA	See Table 6	xx-xx	55 55

Module sending data: distance (in cm)

AA AA	02	3F 00	55 55

   A set of data of data type 02 distance 3f 00 was received and parsed as follows:
   Micromotion target, distance is 63cm (hex 003f, converted to decimal 63)

Table 6 Data types

Type	Description
00	No target
01	Campaign Target
02	Micromotion Target

1.5 Send Command With ACK

1.5.1 Enabling Configuration Commands

Send this command to configure the parameters of the module.

Any other commands issued to the radar must be executed after this command is issued, otherwise they are invalid.

Command word: 0x00FF

Command value: 0x0001

Return value: 2 bytes ACK status (0 success, 1 failure) + 2 bytes protocol version (0x0001) + 2 bytes buffer size (0x0040)

Sending data:

FD FC FB FA	04 00	FF 00	01 00	04 03 02 01

Radar ACK (success):

FD FC FB FA	08 00	FF 01	00 00	01 00	40 00	04 03 02 01

1.5.2 End Configuration Command

End the configuration command and the radar resumes working mode after execution. If you need to issue other commands again, you need to send the enable configuration command first.

Command word: 0x00FE

Command value: none

Return value: 2-byte ACK status (0 success, 1 failure)

Sending data:

FD FC FB FA	02 00	FE 00	04 03 02 01

Radar ACK (success):

FD FC FB FA	04 00	FE 01	00 00	04 03 02 01

1.5.3 Set Parameter Command

To set the general parameters, you need to send the enable command first before you can set.

Command word: 0x0067

Command value: none

Return value: 2-byte ACK status (0 success, 1 failure)

Table 7 Parameter command explanation

Frame header	Length	Command	Reserved	Maximum range of motion	Reserved	Fixed	Recent range of motion
FD FC FB FA	20 00	67 00	00 00	CD 02	00 00	01 00	1E 00
Reserved	**Fixed**	**Maximum micro-movement range**	**Reserved**	**Fixed**	**Recent micro-movement range**	**Reserved**	**Fixed**
00 00	02 00	A9 01	00 00	03 00	1E 00	00 00	04 00
No one duration	**Reserved**	**End of frame**					
14 00	00 00	04 03 02 01					

Range of motion (in cm):   min 30   max 717
Micromotion range (in cm):   min. 30   max. 425
No one waiting time (unit 100ms):   20

Radar ACK (success):

FD FC FB FA	**04 00**	**67 01**	**00 00**	**04 03 02 01**

1.5.4 Read Parameter Command

This command allows you to read the current configuration parameters of the radar.
Command word: 0x0073
Command value: none

Sending data:

FD FC FB FA	**02 00**	**73 00**	**04 03 02 01**

Radar ACK:
Range of motion (in cm):   min 30   max 717
Micromotion range (in cm):   min. 30   max. 425
No one waiting time (unit 100ms):   20

Table 8 Parameter command responses

Frame header	Length	Command	Reserved	Maximum range of motion	Recent range of motion	Maximum micro-movement range
FD FC FB FA	36 00	73 01	00 00	CD 02	1E 00	A9 01

Recent micro-movement range	No one duration	Complementary 0	This segment of data is reserved unused	End of frame
1E 00	14 00	00 00	.....	04 03 02 01

1.5.5 Read firmware version command

This command reads the radar firmware version information.

Command word: 0x000a

Command value: none

Return value: 2 bytes ACK status (0 success, 1 failure) + 2 bytes firmware type (0x0001) + 2 bytes major version number + 4 bytes minor version number

Sending data:

FD FC FB FA	02 00	00 00	04 03 02 01

Radar ACK (success):

FD FC FB FA	0C 00	A0 01	00 00	00 01	07 01	16 15 09 22	04 03 02 01

The corresponding version number is V1.07.22091615

1.5.6 Set Serial Port Baud Rate

This command is used to set the baud rate of the serial port of the module. The configured value is not lost when power is lost, and the configured value takes effect after restarting the module.

Command word: 0x00A1

Command value: 2-byte baud rate selection index

Return value: 2-byte ACK status (0 success, 1 failure)

Table 9 Serial port baud rate selection

Baud rate selection index value	Baud rate
0x0001	9600
0x0002	19200
0x0003	38400
0x0004	57600
0x0005	115200
0x0006	230400
0x0007	256000
0x0008	460800

The factory default value is 0x0007, which is 256000

Sending data:

FD FC FB FA	04 00	A1 00	07 00	04 03 02 01

Radar ACK (success):

FD FC FB FA	04 00	A1 01	00 00	04 03 02 01

1.5.7 Restore Factory Settings

This command is used to restore all the configuration values to their non-factory values, which take effect after rebooting the module.

Command word: 0x00A2

Command value: none

Return value: 2-byte ACK status (0 success, 1 failure)

Sending data:

FD FC FB FA	02 00	A2 00	04 03 02 01

Radar ACK (success):

FD FC FB FA	04 00	A2 01	00 00	04 03 02 01

1.5.8 Reboot Module

The module receives this command and will automatically restart after the answer is sent.

Command word: 0x00A3

Command value: none

Return value: 2-byte ACK status (0 success, 1 failure)

Sending data:

FD FC FB FA	02 00	A3 00	04 03 02 01

Radar ACK (success):

FD FC FB FA	04 00	A3 01	00 00	04 03 02 01

1.5.9 Bluetooth Settings

This command is used to control the Bluetooth on or off, the Bluetooth function of the module is on by default.

After receiving this command, a reboot is required for the function to take effect.

Command word: 0x00A4

Command value: 0x0100 Turn on Bluetooth   0x0000 Turn off Bluetooth

Return value: 2-byte ACK status (0 success, 1 failure)

Sending data: (Turn on bluetooth)

FD FC FB FA	04 00	A4 00	01 00	04 03 02 01

Radar ACK (success):

FD FC FB FA	04 00	A4 01	00 00	04 03 02 01

1.5.10 Get MAC Address

This command is used to query the MAC address

Command word: 0x00A5

Command value: 0x0001

Return value: 2 bytes ACK status (0 success, 1 failure) + 1 byte fixed type (0x00) + 3 bytes MAC address (address is in big terminal order)

Sending data:

FD FC FB FA	04 00	A5 00	01 00	04 03 02 01

Radar ACK (success):

FD FC FB FA	0A 00	A5 01	00 00	8F 27	2E B8	0F 65	04 03 02 01

The mac address queried is: 8F 27 2E B8 0F 65

1.6 Radar Command Configuration Method

1.6.1 Radar Command Configuration Steps

The process of executing a configuration command by LD2411-S radar consists of two parts: the upper computer "sends the command" and the radar "replies to the command ACK". If the radar does not reply with ACK or fails to reply with ACK, it means the radar fails to execute the configuration command.

As mentioned earlier, before sending any other commands to the radar, the developer needs to send the "enable configuration" command and then send the configuration command within the specified time. After the commands are configured, send the "end configuration" command to inform the radar that the configuration is finished.

For example, if you want to read the radar configuration parameters, first the upper computer sends the "enable configuration" command; after receiving a successful radar ACK, then send the "read parameters" command; after receiving a successful radar ACK, finally send the "end configuration" command; after receiving a successful radar ACK, it indicates that the complete action of reading parameters is finished.

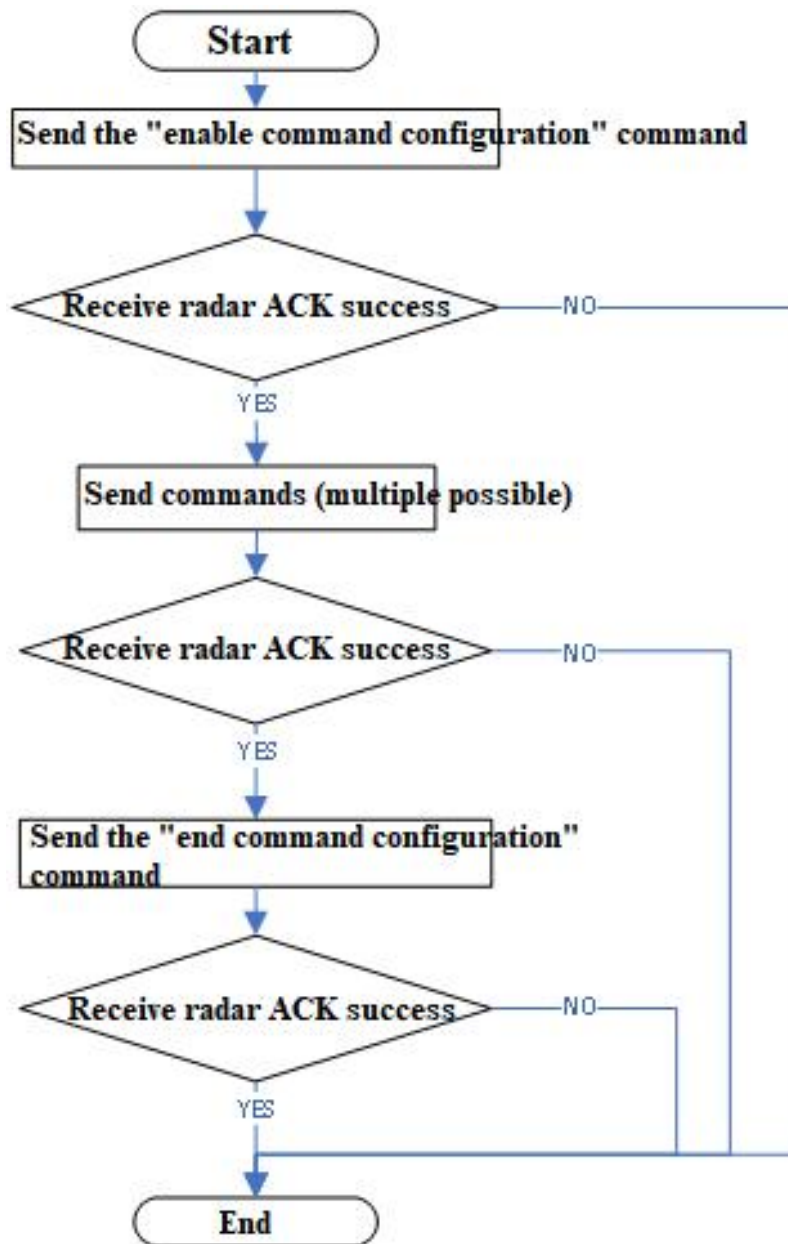The radar command configuration flow is shown in the following figure.

Figure 1 Radar command configuration flow

2   Revision Record

Data	Version	Modified content
2023-3-29	1.00	Initial version
2023-4-20	1.01	Amend part of the content

3   Technical Support And Contact Information

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