Shenzhen Hi-Link Electronic Co., Ltd.

HLK-LD2410D

Human presence sensing module

Serial Communication Protocol

Version：V1.01 Revised date：2025-5-21

Content

1. Communication protocol

This communication protocol is mainly used by users who engage in secondary development without relying on visualization tools. HLK-LD2410D 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 115200, with 1 stop bit and no parity bit.

1.1. protocol format

1.1.1.Protocol Data Format

The serial data communication of HLK-LD2410D uses the small end format, and all data in the following table is in hexadecimal.

1.1.2.Command protocol frame format

The radar configuration command and ACK command formats defined by the protocol are shown in Tables 1 to 4.

Table 1 Format of Command Protocol Frame for Sending

frame header	Intra frame data length	Intra frame data	End of Frame
FD FC FB FA	2 bytes	See Table 2	04 03 02 01

Table 2 Format of Data Sent in a Frame

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

Table 3 ACK Command Protocol Frame Format

frame header	Intra frame data length	Intra frame data	End of Frame
FD FC FB FA	2 bytes	See Table 4	04 03 02 01

Table 4 ACK Frame Data Format

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

1.2. Sending commands and ACKs

1.2.1.Enable configuration commands

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

Command word: 0x00FF

Command value: 0x0001

Return value: 2-byte ACK status (0 successful, 1 failed)+2-byte protocol version (0x0001)+2-byte buffer size (0x0040)

Sending data:

frame header	Intra frame data length	Command word	Command value	End of Frame
FD FC FB FA	04 00	FF 00	01 00	04 03 02 01

Radar ACK (successful):

frame header	Intra frame data length	Command word	ACK	protocol version	buffer size	End of Frame
FD FC FB FA	08 00	FF 01	00 00	01 00	40 00	04 03 02 01

1.2.2.End configuration command

End the configuration command and execute it to restore the radar to working mode. If you need to issue other commands again, you need to first send the enable configuration command.

Command word: 0x00FE

Command value: None

Return value: 2-byte ACK status (0 successful, 1 failed)

Sending data:

frame header	Intra frame data length	Command word	Command value
FD FC FB FA	02 00	FE 00	04 03 02 01

Radar ACK (successful):

frame header	Intra frame data length	Command word	ACK	End of Frame
FD FC FB FA	04 00	FE 01	00 00	04 03 02 01

1.2.3.Maximum distance door and unmanned duration parameter configuration command

This command sets the maximum detection range gate (motion&stationary) of the radar (configuration range 2-8), as well as the unmanned duration parameter (configuration range 0-65535 seconds). Please refer to the table below for specific parameter numbers. This configuration value will not be lost in case of power failure.

Command word: 0x0060

Command value: 2-byte maximum motion distance gate+4-byte maximum motion distance gate parameter+2-byte maximum stationary distance gate+4-byte maximum stationary distance gate parameter+2-byte unmanned duration word+4-byte unmanned duration parameter

Return value: 2-byte ACK status (0 successful, 1 failed)

Table 5 0x0060 Protocol Parameter Words

Parameter	Parameter numbers
Maximum movement distance door	0x0000
Maximum static distance door	0x0001
Unmanned duration	0x0002

Sending data: Maximum distance door 8 (moving&stationary), unmanned duration 5 seconds

frame header	Intra frame data length	Command word	Parameter numbers	Max distance door parameter	Maxmovement distance door character
FD FC FB FA	14 00	60 00	00 00	08 00 00 00	01 00

Max static distance gate parameter	Max static distance door character	Unmanned duration	End of Frame
08 00 00 00	02 00	05 00 00 00	04 03 02 01

Radar ACK (successful):

End of Frame	Intra frame data length	Command word	ACK	End of Frame
FD FC FB FA	04 00	60 01	00 00	04 03 02 01

1.2.4.Read parameter command

This command can read the current configuration parameters of the radar.

Command word: 0x0061

Command value: None

Return value: 2-byte ACK status (0 successful, 1 failed)+header (0xAA)+maximum distance gate N (0x08)+configured maximum motion distance gate+configured maximum stationary distance gate+distance gate 0 motion sensitivity (1 byte)+ ..+Distance gate N motion sensitivity (1 byte)+Distance gate 0 static sensitivity (1 byte)+ ..+static sensitivity of distance gate N (1 byte)+unmanned duration (2 bytes)

Sending data:

frame header	Intra frame data length	Command word	End of Frame
FD FC FB FA	02 00	61 00	04 03 02 01

Radar ACK: (Successful, maximum distance gate 8, configured motion distance gate 8, stationary distance gate 8, 0-8 motion sensitivity 20, 0-8 stationary sensitivity 25, unmanned duration 5 seconds)

frame header	Intra frame data length	Command word	ACK	Intra frame data header	Max distance door	Max movement distance door	Max static distance door
FD FC FB FA	1C 00	61 01	00 00	AA	08	08	08

Energy value of the 0 motion distance door	Energy value of the 1st motion distance door	Energy value of the 2nd motion distance door	Energy value of the 3rd motion distance door	Energy value of the 4th motion distance door	Energy value of the 5th motion distance door	Energy value of the 6th motion distance door	Energy value of the 7th motion distance door	Energy value of the 8th motion distance door
14	14	14	14	14	14	14	14	14

Energy value of static distance door 0	Energy value of static distance door No.1	Energy value of the 2nd static distance door	Energy value of the No. 3 static distance door	Energy value of the 4th static distance door	Energy value of the 5th static distance door	Energy value of static distance door No.6	Energy value of the 7th static distance door	Energy value of the stationary distance door on the 8th
19	19	19	19	19	19	19	19	19

Unmanned duration	End of Frame
05 00	04 03 02 01

1.2.5.Enable Engineering Mode Command

This command opens the radar engineering mode. After opening the engineering mode, the energy values of each distance gate will be added to the radar report data. For detailed format, please refer to 1.3.2 Target Data Composition. After the module is powered on, the engineering mode is turned off by default, and this configuration value is lost in case of power failure.

Command word: 0x0062

Command value: None

Return value: 2-byte ACK status (0 successful, 1 failed)

Sending data:

frame header	Intra frame data length	Command word	End of Frame
FD FC FB FA	02 00	62 00	04 03 02 01

frame header	Intra frame data length	Command word	ACK	End of Frame
FD FC FB FA	04 00	62 01	00 00	04 03 02 01

Radar ACK (successful):

1.2.6.Close Engineering Mode Command

This command turns off the radar engineering mode. After closing, please refer to 1.3.2 Target Data Composition for the format of radar reporting data.

Command word: 0x0063

Command value: None

Return value: 2-byte ACK status (0 successful, 1 failed)

Sending data:

frame header	Intra frame data length	Command word	End of Frame
FD FC FB FA	02 00	63 00	04 03 02 01

Radar ACK (successful):

frame header	Intra frame data length	length	ACK	End of Frame
FD FC FB FA	04 00	63 01	00 00	04 03 02 01

1.2.7.Distance door sensitivity configuration command

This command configures the sensitivity of the distance gate, and the configuration value is not lost in case of power failure. It supports both individual configuration of each distance gate and simultaneous configuration of all distance gates to a unified value. If all distance gate sensitivities are set to the same value at the same time, the distance gate value needs to be set to 0xFFFF.

Command word: 0x0064

Command value: 2-byte distance gate word+4-byte distance gate value+2-byte motion sensitivity

word+4-byte motion sensitivity value+2-byte static sensitivity word+4-byte static sensitivity value

Return value: 2-byte ACK status (0 successful, 1 failed)

Table 6 0x0064 Protocol Parameter Words

Parameter	Parameter numbers
Distance door	0x0000
Motion sensitivity words	0x0001
Static sensitivity word	0x0002

40Sending data: Configure the motion sensitivity of door 3 to 40 and the static sensitivity to 40

frame header	Intra frame data length	Command word	Distance Gate Character	Distance threshold value
FD FC FB FA	14 00	64 00	00 00	03 00 00 00
Movement distance door character	**Sensitivity of motion distance door**	**Static distance door character**	**Static distance door sensitivity**	**End of Frame**
01 00	28 00 00 00	02 00	28 00 00 00	04 03 02 01

Radar ACK (successful):

frame header	Intra frame data length	Command word	ACK	End of Frame
FD FC FB FA	04 00	64 01	00 00	04 03 02 01

Send data: Configure the motion sensitivity of all distance doors to 40 and the static sensitivity to 40

frame header	Intra frame data length	Command word	Distance Gate Character	Distance threshold value	Movement distance door character
FD FC FB FA	14 00	64 00	00 00	FF FF 00 00	01 00

Sensitivity of motion distance door	Static distance door character	Static distance door sensitivity	End of Frame

28 00 00 00	02 00	28 00 00 00	04 03 02 01

Radar ACK (successful):

frame header	Intra frame data length	Command word	ACK	End of Frame
FD FC FB FA	04 00	64 01	00 00	04 03 02 01

1.2.8.Read firmware version command

This command reads the radar firmware version information.

Command word: 0x00A0

Command value: None

Return value: 2-byte ACK status (0 successful, 1 failed)+2-byte firmware type (0x0001)+2-byte major version number+4-byte minor version number.

Sending data:

frame header	Intra frame data length	Command word	End of Frame
FD FC FB FA	02 00	A0 00	04 03 02 01

雷达 ACK(成功)：

frame header	Intra frame data length	Command word	ACK	Firmware type	Major version	Minor version number	End of Frame
FD FC FB FA	0C 00	A0 01	00 00	00 01	01 03	00 00 00 02	04 03 02 01

The corresponding version number is V3.01.02000000

1.3. Radar Data Output Protocol

HLK-LD2410D outputs radar detection results through a serial port and defaults to outputting basic target information, including target status, motion energy value, stationary energy value, motion distance, stationary distance, and other information. If the radar is configured in engineering mode, it will additionally output energy values for each distance gate (motion&stationary). Radar

data is output in the prescribed frame format.

1.3.1.Report data frame format

The radar reporting message frame format defined by the protocol is shown in Tables 7 and 8. The definition of reported data type values in normal working mode and engineering mode is shown in Table 9.

Table 7 Format of Reported Data Frame

Frame header	Intra frame data length	Intra frame data	End of frame
F4 F3 F2 F1	2 bytes	See Table 8	F8 F7 F6 F5

Table 8 Format of data frames within frames

data type	head	target data	tail	check
1 byte (see Table 9)	0xAA	See Table 10 and Table 12	0x55	0x00

Table 9 Data Type Description

Data type value	Describe
0x01	Engineering Mode Data
0x02	Basic target information data

1.3.2.Target data composition

The target data content reported by the radar will change according to the working mode of the radar. In normal working mode, the radar defaults to outputting basic information data of the target; After being configured in engineering mode, the radar will add energy value information for each distance gate after the basic information data of the target. Therefore, the basic information of the target will always be output in the radar report data, while the energy value information of the distance gate requires command enablement to be output.

In normal working mode, the composition of target data reported by the radar is shown in Table 10, and the definition of target state values is shown in Table 11. The composition of the target data frame in engineering mode is shown in Table 12, with additional data added to the data reported in normal working mode.

Table 10 Composition of Basic Target Information Data

Target State	Target distance of movement (cm)	Energy value of motion target	Distance to stationary target (cm)	Static target energy value	Detection distance (cm)
1 byte (see Table 11)	2 bytes	1 byte	2 bytes	1 byte	2 bytes

Table 11 Explanation of Target State Values

Target state value	Describe
0x00	No target
0x01	Moving Target
0x02	stationary target
0x03	Moving&stationary targets

Table 12 Composition of Engineering Mode Target Data

Add the following data after the target basic information data in Table 10

...	Max movement distance door N	Max static distance door N	Movement distance door 0 energy value	...	Motion distance door N energy value	Static distance door 0 energy value	. . .	Static distance gate N energy value	Photosensitive detection value	OUT pin output status
...	1 byte	1 byte	1 byte	...	1 byte	1 byte	. . .	1 byte	1 byte	1 byte

Light sensitivity detection value range: 255, OUT pin output status: 0 unmanned, 1 manned

Reported data instance:

Report data in normal working mode:

Frame header	Intra frame data length	Intra frame data	End of frame

F4 F3 F2 F1	0D 00	02 AA 02 51 00 00 00 00 3B 00 00 55 00	F8 F7 F6 F5

Report data in engineering mode:

Frame header	Intra frame data length	Intra frame data	End of frame
F4 F3 F2 F1	23 00	01 AA 03 1E 00 3C 00 00 39 00 00 08 08 3C 22 05 03 03 04 03 06 05 00 00 39 10 13 06 06 08 04 FF 01 55 00	F8 F7 F6 F5

Example analysis:

F4 F3 F2 F1 frame header

23 00 Intra frame data length

01 Engineering mode

AA Intra frame data header

03 Target state value

1E 00 Distance of motion target

3C Energy value of motion target

00 00 Static target distance

39 Static target energy value

00 00 Detection range

08 08 Max moving distance door, max stationary distance door

3C 22 05 03 03 04 03 06 05 Motion distance door energy value (9)

00 00 39 10 13 06 06 08 04 Static distance gate energy value (9)

FF photosensitive (no photosensitive, default value 255)

01 Out status

55 00 Tail verification

F8 F7 F6 F5 End of Frame

1.4. Radar command configuration method

1.4.1.Radar command configuration steps

The process of executing a configuration command for the HLK-LD2410D radar includes two steps: the upper computer sends the command and the radar responds with an ACK command. If the radar does not respond with an ACK or fails to respond with an ACK, it indicates that the radar has failed to execute the configuration command.

As mentioned earlier, before sending any other commands to the radar, developers need to first send the "Enable Configuration" command and then send the configuration command within the specified time. After the command configuration is completed, send the "End Configuration" command to inform the radar configuration that it has ended.

For example, to read radar configuration parameters, the upper computer first sends the "Enable Configuration" command; After receiving the radar ACK successfully, send the "Read Parameters" command; After receiving the radar ACK successfully, finally send the "End Configuration" command; After the radar ACK is successful, it indicates that the complete parameter reading action has ended.

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

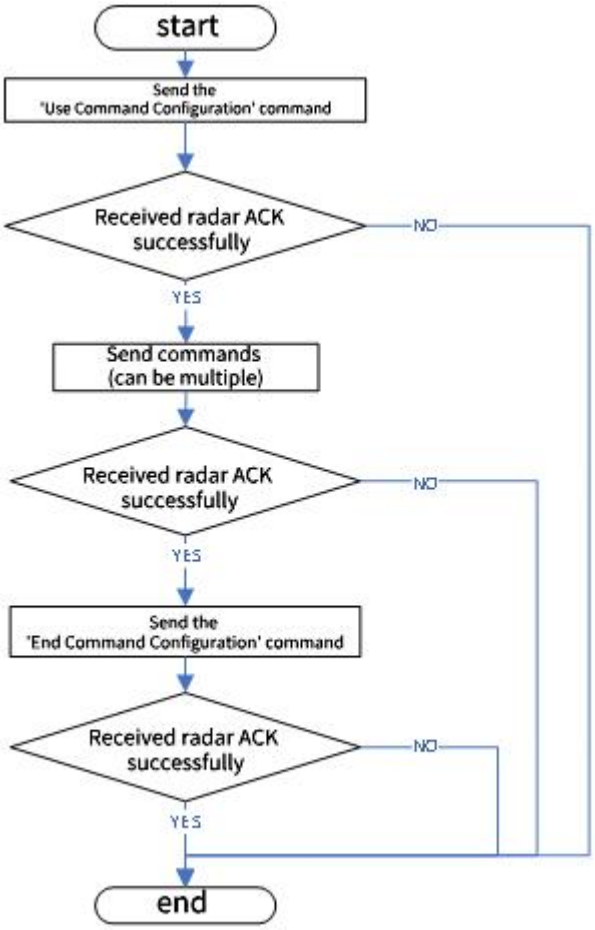

Figure 1 Radar Command Configuration Process

Appendix A Document Revision Record

Version	Number revision scope	Date
V1.00	Initial version	2025-05-13
V1.01	modifies some document errors.	2025-05-21