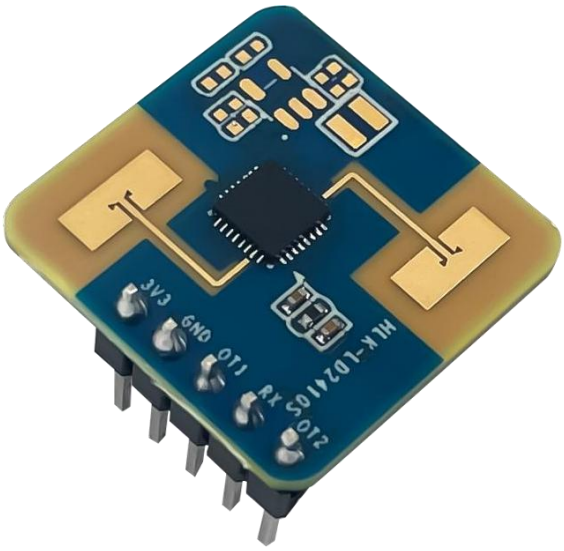
Shenzhen Hi-Link Electronic Co., Ltd.

HLK-LD2410S

Low Power Human Presence Sensor Module

Serial Communication Protocol

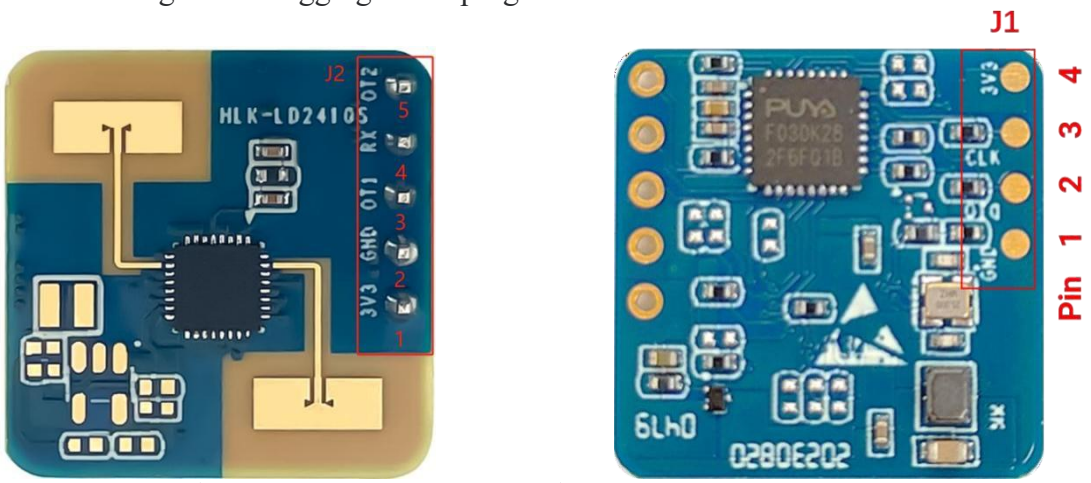


Content

1. Hardware description

1.1. Hardware LD2410S

Figure 1-1 shows both sides of the hardware LD2410S. The hardware LD2410S reserve five pin holes (factory supplied pins) called J2 for power supply and communication. J1 is the SWD interface for burning and debugging MCU programs.



（a）Front （b）Back

Figure 1-1 Front and rear of the hardware LD2410S

For details about the pins of J1 and J2, see Table 1-1 and Table 1-2.

Table 1-1 J1 pin description

J#PIN#	Name	Function	Remark
J1Pin1	GND	Grounding	-
J1Pin2	DIO	SWDInterface data cable	0~3.3V
J1Pin3	CLK	SWDInterface clock line	0~3.3V
J1Pin4	3V3	Power input	3.0V~3.6V, Typ. 3.3V

Table 1-2 J2 pin description

J#PIN#	Name	Function	Remark
J1Pin1	3V3	Power input	3.0V~3.6V, Typ. 3.3V
J1Pin2	GND	Grounding	-
J1Pin3	OT1	UART_TX	0~3.3V
J1Pin4	RX	UART_RX	0~3.3V
J1Pin5	OT2	IO, which is used to report the detection status: the high level is manned, and the low level is unmanned	0~3.3V

2. Communication protocol

This communication protocol is mainly used by users who need to do secondary development without visual tools. HLK-LD2410S battery-powered Ultra-low power consumption The human body has a millimeter-wave sensor to communicate with the outside world through a serial port (TTL level). Sensor data output and parameter configuration commands are carried out under this protocol. The default baud rate of the serial port on the sensor is 115200. The port has 1 stop bit and no parity bit.

The basic process for parameter configuration using commands is as follows:

1.Enter the command mode.

2.Set parameter commands or obtain parameter commands.

3.Exit the command mode.

HLK-LD2410S data communication uses a small-endian format, and all data in the following table is hexadecimal.

2.1. Format of reported data

Table 2-1 Reported data formats describes the formats of the data reported by sensors. There are three types of HLK-LD2410S report data, namely, minimal data report format, standard data report format, and automatic threshold progress report data format. By default, the sensor reports the minimalist data format. Standard data reporting format is used to match the upper computer tools; The automatic threshold progress reporting data format is used only when automatic thresholds are generated.

Table 2-1 Reported data formats

Minimal data	**Frame head**	**Target state**			**Object distance**			**Frame end**
	6E	1 byte（0/1 indicates no one; 2/3 Indicate someone）			2 bytes（unit：cm）			62
Standard data	**Frame head**	**Intra-frame data length**	**Data type**	**Target state**	**Object distance**	**Reserved Bits**	**Energy values for each distance gate**	**Frame end**
	F4 F3 F2 F1	2 bytes	0x01	1 byte（0/1 indicates no one; 2/3 Indicates someone）	2 bytes（unit：cm）	2 bytes	64 bytes	F8 F7 F6 F5
Automatic threshold	**Frame head**	**Intra-frame data length**	**Data type**	**Threshold generation progress**				**Frame end**

progress data	F4 F3 F2 F1	2 bytes	0x03	2 bytes (progress *100)	F8 F7 F6 F5

2.2. Send commands and ACK

2.2.1. Switch the module output mode

This command is used to switch the module output mode.

Command word: 0x007A

Command value: 00 00 00 01 00 00 Standard data output mode

00 00 00 00 00 00 Minimal data output mode

Returned value: 00 00 successfully set

Send data:

Frame head	Intra-frame data length	Command word	Parameter values	Frame end
FD FC FB FA	08 00	7A 00	00 00 01 00 00 00	04 03 02 01

ACK (Success) :

Frame head	Intra-frame data length	Command word	Parameter values	Frame end
FD FC FB FA	04 00	7A 01	00 00	04 03 02 01

2.2.2. Read the firmware version command

This command reads the sensor firmware version.

Command word：0x0000

Command value：None

Returned value： 2 bytes major version number + 2 bytes minor version number + 2 bytes patch version number

Send data:

Frame head	Intra-frame data length	Command word	Frame end
FDFCFBFA	0200	0000	04030201

ACK (Success) :

Frame head	Intra-frame data length	Command word	Major version	Minor version	Patch version	Frame end
FD FC FB FA	08 00	00 01	0x100	0x 00	0x 00	04 03 02 01

[1]In this table, x represents the version number

[1]

2.2.3. Enable configuration command

Any other command sent to the sensor can be executed only after this command is sent. Otherwise, it is invalid.

Command word: 0x00FF

Command value: 0x0001

Return value: 2-byte protocol version（0x0001）

Send data：

Frame head	Intra-frame data length	Command word	Command value	Frame end
FD FC FB FA	0400	FF00	0100	04030201

ACK（Success）：

Frame head	Intra-frame data length	Command word	Enable	Protocol version number	buffer size	Frame end
FD FC FB FA	0800	FF01	0000	0300	8000	04030201

2.2.4. End configuration command

This command enables the sensor to stop the parameter configuration mode and resume the working mode. If you want to run 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 succeeded, 1 failed)

Send data:

Frame head	Intra-frame data length	Command word	Frame end
FDFCFBFA	0200	FE00	04030201

ACK(Success):

Frame head	Intra-frame data length	Command word	ACK	Frame end
FDFCFBFA	0400	FE01	00 00	04030201

2.2.5. Write Serial number command

This command writes the sensor serial number.

Command word: 0x0010

Command value: 2 bytes serial number length + 8 bytes serial number

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

Send data: (for example： SN is 12345678)

Frame head	Intra-frame data length	Command word	Serial number length	Serial number	Frame end
FD FC FB FA	0C00	10 00	0800	31 32 33 34 35 36 37 38	04 03 02 01

ACK(Success):

Frame head	Intra-frame data length	Command word	ACK	Frame end
FD FC FB FA	0400	1001	0000	04030201

2.2.6. Read serial number command

This command reads the sensor serial number.

Command word：0x0011

Command value：None

Return value：2-byte ACK status (0 succeeded, 1 failed) + 2-byte serial number length + 8-byte serial number

Send data:

Frame head	Intra-frame data length	Command word	Frame end
FDFCFBFA	0200	1100	04030201

Sensor ACK： （Success, serial number: 12345678）

Frame head	Intra-frame data length	Command word	ACK	Serial number length	Serial number	Frame end
FDFCFBFA	0E00	1101	0000	0800	3132333435363738	04030201

2.2.7. Write generic parameter commands

This command is used to set the general parameters of a sensor.

Command word: 0x0070

Command value: (2-byte parameter word + 4-byte parameter value)*N

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

Send data: (For example： "Detect farthest distance gate" =12; "Detect nearest distance gate" = 0; "No one delay time (seconds)" = 40; “Status reporting Frequency” = 0.5 Hz. "Distance reporting frequency" = 0.5Hz; “Response Speed” = Normal）

Frame head	Intra-frame data length	Command word	Detect the farthest distance gate	Detect the nearest distance gate
FDFCFBFA	2600	7000	05000C000000	0A0000000000

Unattended delay time (s)	Frequency of status reporting	Frequency of distances reporting	Respond speed	Frame end
060028000000	020005000000	0C0005000000	0B0005000000	04030201

ACK（Success）：

Frame head	Intra-frame data length	Command word	ACK	Frame end
FDFCFBFA	0400	7001	0000	04030201

Table 2-2 describes the parameters and value ranges of common parameters.

Table 2-2 The definition of Parameter word and value range of the common parameter

Name of parameter	Parameter word	Range of value	Unit
Detect the farthest distance gate	05	1~16	-
Detect the nearest distance gate	0A	0~16	-
Unmanned delay time	06	10~120	s
Frequency of status reporting	02	0.5~8（0.5 step）	Hz
Frequency of distance reporting	0C	0.5~8（0.5 step）	Hz
Response speed	0B	5(Normal)/ 10(Fast)	-

2.2.8. Read common parameter commands

This command reads the configuration parameters of the sensor.

Command word：0x0071

Command value: (2 bytes parameter word)*N

Return value: (4bytes parameter word)*N

Send data:

Frame head	Intra-frame data length	Command word	Detect the farthest distance gate	Detect the nearest distance gate
FD FC FB FA	0E 00	71 00	05 00	0A 00
Unattended delay time (s)	**Frequency of status reporting**	**Frequency of distances reporting**	**Respond speed**	**Frame end**
06 00	02 00	0C 00	0B 00	04 03 02 01

ACK: (Successful example:

"Detect farthest distance gate" = 12; "Detect nearest distance gate" = 0; "No one delay time (seconds)" = 40; “Status reporting Frequency” = 0.5 Hz. "Distance reporting frequency" = 0.5Hz; “Response Speed” = Normal)

Frame header	Intra-frame data length	Command word	ACK	Detects the farthest distance gate	Detects the nearest distance gate
FD FC FB FA	1A 00	71 01	00 00	0C 00 00 00	00 00 00 00
Unattended delay time (s)	**Frequency of status reporting**	**Frequency of distances reporting**		**Respond speed**	**Frame end**
28 00 00 00	05 00 00 00	05 00 00 00		05 00 00 00	04 03 02 01

2.2.9. Automatically update the threshold command

This command is used to automatically update the threshold.

Command word：0x0009

Command value：00 02 Trigger factor

00 01 Retention factor

00 78 Scanning time

Return value：2 bytes (progress *100)

Send data：

Frame header	Intra-frame data length	Command word	Trigger factor	Retention factor	Scanning time	Frame end
FD FC FB FA	**08 00**	**09 00**	**02 00**	**01 00**	**78 00**	**04 03 02 01**

ACK（Success）

Automatic threshold progress data	Frame head	Intra-frame data length	Data type	Threshold generation progress	Frame end
	F4 F3 F2 F1	2bytes	0x03	2 bytes (progress *100)	F8 F7 F6 F5

2.2.10. Write the trigger threshold parameter command

This command is used to set the triggering threshold for the distance gate from 0 to 15 of a sensor.

Command word: 0x0072

Command value: (2-byte parameter word+ 4-byte parameter value)*N

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

Send data: (For example: Trigger threshold= [50, 46, 34, 32, 32, 32, 32, 32, 50, 46, 34, 32, 32, 32, 32, 32])

Frame head	Intra-frame data length	Command word	0 distance gate Trigger threshold	1 distance gate Trigger threshold	2 distance gate Trigger threshold	3 distance gate Trigger threshold
FDFCFB FA	6200	7200	000032 000000	01002E 000000	02002E 000000	030020 000000
4 distance gate Trigger threshold	5 distance gate Trigger threshold	6 distance gate Trigger threshold	7 distance gate Trigger threshold	8 distance gate Trigger threshold	9 distance gate Trigger threshold	10 distance gate Trigger threshold
040020 000000	050020 000000	060020 000000	070020 000000	080032 000000	09002E 000000	0A0020 000000
11 distance gate Trigger threshold	12 distance gate Trigger threshold	13 distance gate Trigger threshold	14 distance gate Trigger threshold	15 distance gate Trigger threshold	Frame end	
0B001E 000000	0C001E 000000	0D001E 000000	0E001E 000000	0F001E 000000	04030201	

ACK(Success):

Frame head	Intra-frame data length	Command word	ACK	Frame end
FDFCFBFA	0400	7201	0000	04030201

2.2.11. Read trigger threshold parameter command

This command is used to read the trigger threshold parameters of the distance gate from 0 to 15 of a sensor.

Command word: 0x0073

Command value: (2-byte parameter word) * N

Ruturn value: (4-byte parameter value) * N

Send data:

Frame head	Intra-frame data length	Command word	0 distance gate Trigger threshold	1 distance gate Trigger threshold	2 distance gate Trigger threshold	3 distance gate Trigger threshold
FDFCFBFA	2200	7300	0000	0100	0200	0300
4 distance gate Trigger threshold	5 distance gate Trigger threshold	6 distance gate Trigger threshold	7 distance gate Trigger threshold	8 distance gate Trigger threshold	9 distance gate Trigger threshold	10 distance gate Trigger threshold
0400	0500	0600	0700	0800	0900	0A00
11 distance gate Trigger threshold	12 distance gate Trigger threshold	13 distance gate Trigger threshold	14 distance gate Trigger threshold	15 distance gate Trigger threshold	Frame end	
0B00	0C00	0D00	0E00	0F00	04030201	

ACK(Success): (For example:Trigger threshold= [50, 46, 34, 32, 32, 32, 32, 32, 50, 46, 34, 32, 32, 32, 32, 32])

Frame head	Intra-frame data length	Command word	ACK	0 distance gate Trigger threshold	1 distance gate Trigger threshold	2 distance gate Trigger threshold
FDFCFBFA	4400	7301	0000	32000000	2E000000	22000000
3 distance gate Trigger threshold	4 distance gate Trigger threshold	5 distance gate Trigger threshold	6 distance gate Trigger threshold	7 distance gate Trigger threshold	8 distance gate Trigger threshold	9 distance gate Trigger threshold
20000000	20000000	20000000	20000000	20000000	32000000	2E000000

10 distance gate Trigger threshold	11 distance gate Trigger threshold	12 distance gate Trigger threshold	13 distance gate Trigger threshold	14 distance gate Trigger threshold	15 distance gate Trigger threshold	Frame end
20000000	1E000000	1E000000	1E000000	1E000000	1E000000	04030201

2.2.12. Write the hold threshold command

This command is used to write the hold threshold of the distance gate from 0 to 15 of a sensor.

Command word: 0x0076

Command value: (2-byte parameter word + 4-byte parameter value) * N

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

Send data: (example:Holding threshold= [15, 15, 15, 15, 15, 15, 15, 15, 09, 09, 09, 09, 09, 09, 09, 09])

Frame head	Intra-frame data length	Command word	0 distance gate holding threshold	1 distance gate holding threshold	2 distance gate holding threshold	3 distance gate holding threshold
FDFCFBFA	6200	7600	00000F 000000	01000F 000000	02000F 000000	03000F 000000
4 distance gate holding threshold	5 distance gate holding threshold	6 distance gate holding threshold	7 distance gate holding threshold	8 distance gate holding threshold	9 distance gate holding threshold	10 distance gate holding threshold
04000F 000000	05000F 000000	06000F 000000	07000F 000000	080009 000000	090009 000000	0A0009 000000
11 distance gate holding threshold	12 distance gate holding threshold	13 distance gate holding threshold	14 distance gate holding threshold	15 distance gate holding threshold	Frame end	
0B0009 000000	0C0009 000000	0D0009 000000	0E0009 000000	0F0009 000000	04030201	

ACK(Success):

Frame head	Intra-frame data length	Command word	ACK	Frame end
FDFCFBFA	0400	7601	0000	04030201

2.2.13. Read the hold threshold parameter command

This command is used to read the hold threshold parameters of the distance gate from 0 to 15

of a sensor.

Command word: 0x0077

Command value: (2-byte parameter word) * N

Return value: (4-byte parameter value) * N

Send data:

Frame head	Intra-frame data length	Command word	0 distance gate holding threshold	1 distance gate holding threshold	2 distance gate holding threshold	3 distance gate holding threshold
FDFCFB FA	2200	7700	0000	0100	0200	0300
4 distance gate holding threshold	5 distance gate holding threshold	6 distance gate holding threshold	7 distance gate holding threshold	8 distance gate holding threshold	9 distance gate holding threshold	10 distance gate holding threshold
0400	0500	0600	0700	0800	0900	0A00
11 distance gate holding threshold	12 distance gate holding threshold	13 distance gate holding threshold	14 distance gate holding threshold	15 distance gate holding threshold	Frame end	
0B00	0C00	0D00	0E 00	0F00	04030201	

ACK(Success): (Example:Holding threshold= [15, 15, 15, 15, 15, 15, 15, 15, 09, 09, 09, 09, 09, 09, 09, 09])

Frame head	Intra-frame data length	Command word	ACK	0 distance gate holding threshold	1 distance gate holding threshold	2 distance gate holding threshold
FDFCFB FA	4400	7701	0000	0F000000	0F000000	0F000000
3 distance gate holding threshold	4 distance gate holding threshold	5 distance gate holding threshold	6 distance gate holding threshold	7 distance gate holding threshold	8 distance gate holding threshold	9 distance gate holding threshold
0F000000	0F000000	0F000000	0F000000	0F000000	09000000	09000000
10 distance gate holding threshold	11 distance gate holding threshold	12 distance gate holding threshold	13 distance gate holding threshold	14 distance gate holding threshold	15 distance gate holding threshold	Frame end
09000000	09000000	09000000	09000000	09000000	09000000	04030201

3. Version history

Version	Time	Modification
1.00	2024/8/23	First edition

Technical support and contact information

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