Module 4 Series

Introduction

Egismos latest generation of Laser distance measurement modules offers measuring ranges up to 20 meters. The LDK Model 3 series are compact units with the smallest dimensions ever: only 48.9 x 26 x 13 mm. They are designed for users to easily connect the Laser measurement unit to a PC or an MCU through RS232 communication (UART TTL). The unit has a 1mm resolution and an accuracy of ±3.0mm along with a sampling rate up to 3 Hz.

The typical UART output uses a serial RS232 with a standard communication transmission protocol, which is the most common configuration for PC serial communications today. The common line speed has a Baud Rate of 19200.

Features

* Distance measuring capacity.
* RS-232 serial port connectivity.
* Compact dimensions: 48.9 x 26 x 13 mm.

Product Code of Product

Items	Model Number	Distance Measuring Range	Communication mode
LDM :	2M : Model 2	08: 8 meters	RS: RS-232
Laser Distance Measuring Module	3M : Model 3	20: 20 meters	BT: Bluetooth
	4M : Model 4	30: 30 meters	
	5M : Model 5	40: 40 meters	

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Example: LDK-4M-40-RS

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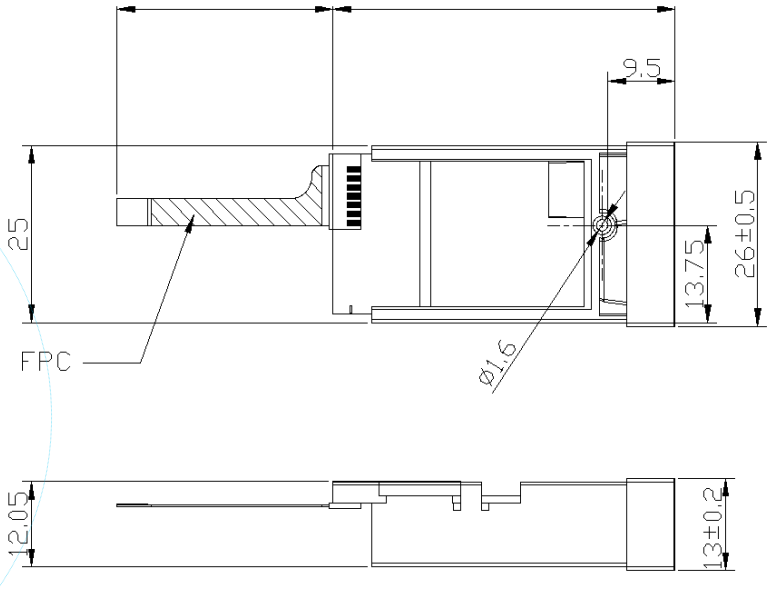
Laser Distance Measuring

Specifications (T=25℃)

Items	
Model Name	LDK-4M-40-RS
Measuring Range	0.03 ~ 40 meters
Measure Accuracy	± 3.0 mm @ 25°C
Measure Rate	1 ~ 3 Hz
Mechanical Dimension	48.9x26x13 mm
Distance Resolution	1 mm
Starting Current	Min. 300mA, Typ. 500mA
Operating Current	<150 mA
Operating Voltage(DC)	2.5 ~ 3.3 V
Transmission Mode	RS-232 TTL (UART)
Transmission Interfaces	Female USB "B" connector
Baud Rate	19200
Operating Temperature	0 ~ 40 ℃
Storage Temperature	-25 ~ 60 ℃
Weight	~9g
Laser Beam Size	2.5 x 5 mm @ 3 meter (FWHM)
Laser Wavelength	620~690 nm
Laser Safety	<1 mW (Class 2)

Outline Dimensions



unit: mm

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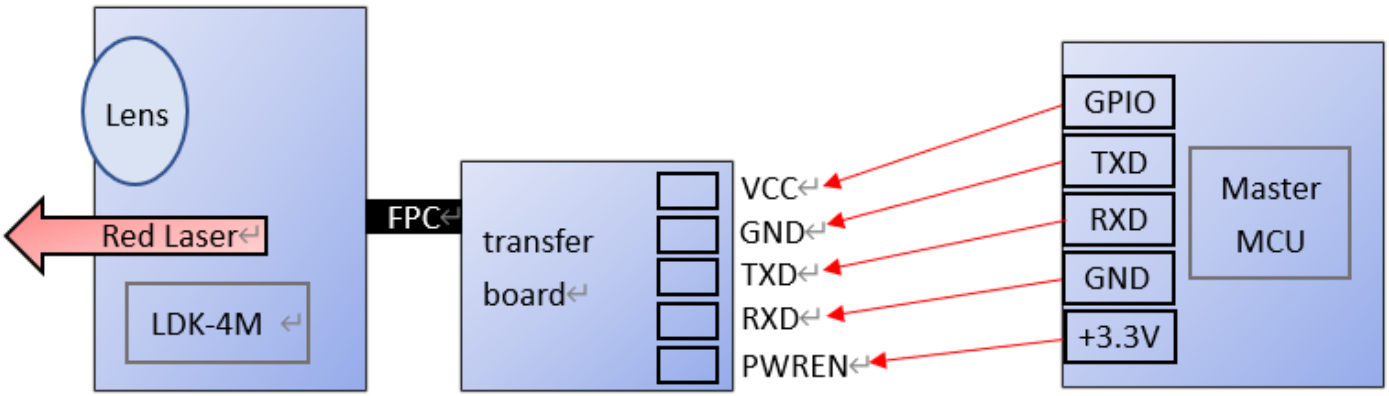
FPC Pin Definition

PIN	Name	Function	Default	Description
1	PWREN	Digital Input	LOW	Power enable, active HIGH
2	TXD	Digital Output	HIGH	UART Transmitter
3	RXD	Digital Input	HIGH	URAT Receiver
4	GND			Power Ground
5	GND			Power Ground
6	VCC	Power		Power Supply
7	VCC	Power		Power Supply

Connection

Transfer Board Wiring Reference



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Electrical Characteristics

Value	Symbol	Min	Typical	Max	Unit
Voltage Input	Vin	2.5	3.0	3.3	V
Current Input	Iin	300	500	-	mA
UART Rx Logic 1	Vuth	3.0	3.3	3.4	V
UART Rx Logic 0	Vutl	-0.3	0	0.8	V
UART Tx Logic 1	Vurh	3.0	3.3	3.4	V
UART Tx Logic 0	Vurl	-0.3	0	0.3	V
Power Enable Logic 1	Vpeh	3.0	3.3	Vin+0.3	V
Power Enable Logic 0	Vpel	-0.3	0	0.1	V

Absolute maximum ratings

Note: When exceeding one or more of the limiting values, permanent damages may be caused to the module!

Operating conditions	Min	Max	Unit
VCC	-0.3	5.5	V
GND	-	0	V
TXD	-0.3	VCC+0.3	V
RXD	-0.3	VCC+0.3	V
nRST	-0.3	4.0	V
Operating Temperature	0	+40	℃
Storage Temperature	-25	+60	℃

Please note that the normal operating voltage is DC 2.5~3.3V. Voltage inputs between DC 3.3~5.5V would not damage the module immediately but would damage the module over the long term. Don't input any voltage above DC 3.3V!

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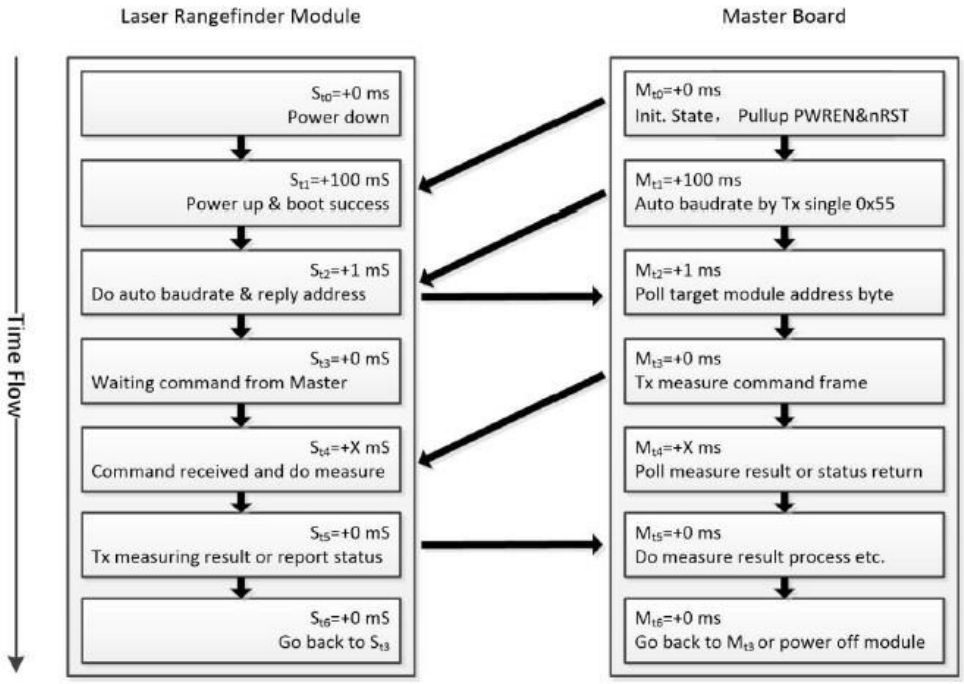
Operation Protocol

UART Interface

- Baud rate: 19200
- Start bit: 1 bit
- Data bits: 8 bit
- Stop bit: 1 bit
- Parity: none

Control flow chart

All communication commands are issued by the master board, the laser rangefinder module acts as the slave that answers to the master's request. The Ask & Answer flow through UART commands is shown in Figure



In its initial state, the module (slave) is in power-down mode before the master pulls the PWREN up. After PWREN is pulled up, and if nRST had been used before, please also remember to de-assert the nRST by pulling it up again. The module will take about 100 milliseconds to proceed to self-boot then the master transfers 1 byte data 0x55 to the slave. If it succeeds, the slave will reply 1 byte data to the master which is the slave own address (default address is 0x00). After this step, the communication between master and slave is established and now the master can send commands to the slave.

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Frame

Bytes	0	1		2	3	4	5	6	7	8
Bits	[7:0]	[7]	[6:0]	[7:0]	[7:0]	[7:0]	[7:0]	[7:0]	[7:0]	[7:0]
Name	HEAD	RW	ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM

HEAD: 0xAA start, 0xEE on error

RW: 0 the master writes to the slave, 1 the master reads from the slave

ADDRESS: only 7-bits; 0x00 to 0x7F ; default address 0x00 , reserved for the broadcast address 0x7F

REGISTER: may not be present when **RW** is 1 ; always starts with **zero**

PAYLOAD COUNT: count of payload bytes

PAYLOAD: response bytes

CHECKSUM: (RW+ADDRESS) bytes + **REGISTER** bytes + **PAYLOAD COUNT** bytes + all **PAYLOAD** bytes, ignoring overflows

Registers

Register	Description
0x00 0x00	System status code
0x00 0x10	Module address
0x00 0x12	Module measure result offset
0x00 0x20	Initiate measure
0x00 0x22	Measure result
0x00 0x0C	Read firmware version
0x00 0x0E	Read serial number
0x01 0xBE	Laser diode control

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Commands

Read Firmware Version

Request:

Bytes	0	1	2	3	4
Name	HEAD	RW/ ADDRESS	REGISTER		CHECKSUM
Data	0xAA	0x80=0x80 + 0x00	0x00	0x0C	0x8C

RW 0x80 = 10000000 in binary (RW = 1 , the master reads from the slave)

ADDRESS 0x00

LENGTH 5

Response:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xAA	0x80	0x00	0x0C	0x00	0x01	0x9B	0x1D	0x45

LENGTH 9

The firmware version is 0x9B1D

Read Serial Number

Request:

Bytes	0	1	2	3	4
Name	HEAD	RW/ ADDRESS	REGISTER		CHECKSUM
Data	0xAA	0x80=0x80 + 0x00	0x00	0x0E	0x8E

RW 0x80 = 10000000 in binary (RW = 1 , the master reads from the slave)

ADDRESS 0x00

LENGTH 5

Response:

Bytes	0	1	2	3	4	5	6	7	8	9	10
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD				CHECKSUM
Data	0xAA	0x80	0x00	0x0E	0x00	0x02	0x73	0x8A	0xB2	0x68	0xA7

LENGTH 11

The Serial number is 0x738AB268

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Set Laser On

Request:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x01	0xBE	0x00	0x01	0x00	0x01	0XC1

ADDRESS 0x00

REGISTER set 0x01 0xBE

PAYLOAD set 0x00 0x01 -- turn on

LENGTH 9

Response:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x01	0xBE	0x00	0x01	0x00	0x01	0XC1

LENGTH 9

Now, You can aim the target

Set Laser OFF

Request:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x01	0xBE	0x00	0x01	0x00	0x00	0XC0

ADDRESS 0x00

REGISTER set 0x01 0xBE

PAYLOAD set 0x00 0x00 -- turn off

LENGTH 9

Response:

Bytes	0	1	2	3	4	5	6	7	8
Name	Head	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x01	0xBE	0x00	0x01	0x00	0x00	0XC0

LENGTH 9

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Set Module Address

Request:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x00	0x10	0x00	0x01	0x00	0x01	0X12

ADDRESS set 0x00 to 0x01

LENGTH 9

Response:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x00	0x10	0x00	0x01	0x00	0x01	0X12

LENGTH 9

Now, The module address is 0x01

Set Plus Offset

For example: Set an offset of +123 mm, Maximum offset +127mm

Request:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x00	0x12	0x00	0x01	0x00	0x7B	0X8E

ADDRESS 0x00

PAYLOAD set 0x00 0x7B (0X7B)=+123mm (Decimal)

LENGTH 9

Response:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x00	0x12	0x00	0x01	0x00	0x7B	0X8E

LENGTH 9

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Set Minus Offset

For example: Set an offset of -123 mm, Maximum offset -128mm.

Request:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD	COUNT	PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x00	0x12	0x00	0x01	0xFF	0x85	0x97

ADDRESS 0x00

PAYLOAD set 0xFF 0x85 (0xFF85)= -123mm (Decimal)

LENGTH 9

Response:

Bytes	0	1	2	3	4	5	6	7	8
Name	Head	RW/ ADDRESS	REGISTER		PAYLOAD	COUNT	PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x00	0x12	0x00	0x01	0xFF	0x85	0x97

LENGTH 9

Single Auto Measurement

Request:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD	COUNT	PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x00	0x20	0x00	0x01	0x00	0x00	0x21

ADDRESS 0x00

PAYLOAD set 0x00 0x01

LENGTH 9

Response: See also the Measurement Result

Single Slow Measurement

Request:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD	COUNT	PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x00	0x20	0x00	0x01	0x00	0x01	0x22

ADDRESS 0x00

PAYLOAD set 0x00 0x01

LENGTH 9

Response: See also the Measurement Result

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Single Fast Measurement

Request:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x00	0x20	0x00	0x01	0x00	0x02	0x23

ADDRESS 0x00

PAYLOAD set 0x00 0x02

LENGTH 9

Response: See also the Measurement Result

Continuous Auto Measurement

Request:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x00	0x20	0x00	0x01	0x00	0x04	0x25

ADDRESS 0x00

PAYLOAD set 0x00 0x04

LENGTH 9

Response: See also the Measurement Result

Continuous Slow Measurement

Request:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x00	0x20	0x00	0x01	0x00	0x05	0x26

ADDRESS 0x00

PAYLOAD set 0x00 0x05

LENGTH 9

Response: See also the Measurement Result

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Continuous Fast Measurement

Request:

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xAA	0x00	0x00	0x20	0x00	0x01	0x00	0x06	0x27

ADDRESS 0x00

PAYLOAD set 0x00 0x06

LENGTH 9

Response: See also the Measurement Result

Exit Continuous Measurement

Transfers one byte 0x58 (upper case character X) to stop the continuous measurement mode immediately The continuous measurement mode will keep replying measurement distances up to 255 times unless the master breaks the measuring cycles.

Measure Result

Normal Response

Bytes	0	1	2	3	4	5	6	7	8	9	10	11	12
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD(DISTANCE)				PAYLOAD(SQ)		CHECKSUM
Data	0xAA	0x00	0x00	0x22	0x00	0x03	0x00	0x00	0x09	0x4F	0x00	0x45	0xC2

LENGTH 13

distance is 0x94F (0x00 0x00 0x09 0x4F) = 2383 mm (Decimal)

signal quality (SQ) is 0x45 (0x00 0x45)

-- a lower signal quality number stands for a stronger laser signal and a more reliable distance result

Error Response

Bytes	0	1	2	3	4	5	6	7	8
Name	HEAD	RW/ ADDRESS	REGISTER		PAYLOAD COUNT		PAYLOAD		CHECKSUM
Data	0xEE	0x00	0x00	0x00	0x00	0x01	0x00	0x06	0x07

LENGTH 9

The status code is 0x00 0x06 -- invalid measure result

see also the Status Code

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Measurement Mode

Each measurement mode has 3 working attributes

- **Auto**

  In this mode, the module adjusts its measuring speed according to the environmental conditions of the laser and the target

- **Slow**

  The speed is set to its minimum to increase the measurement accuracy

- **Fast**

  The speed is set to its maximum, but the accuracy will be lower

Status Codes

Status Code	Description
0x00 0x00	No error
0x00 0x01	Power input too low, power voltage should >= 2.2V
0x00 0x02	Internal error, don't care
0x00 0x03	Module temperature is too low(< -20℃)
0x00 0x04	Module temperature is too high(> +40℃)
0x00 0x05	Target out of range
0x00 0x06	Invalid measure result
0x00 0x07	Background light too strong
0x00 0x08	Laser signal too weak
0x00 0x09	Laser signal too strong
0x00 0x0A	Hardware fault 1
0x00 0x0B	Hardware fault 2
0x00 0x0C	Hardware fault 3
0x00 0x0D	Hardware fault 4
0x00 0x0E	Hardware fault 5
0x00 0x0F	Laser signal not stable
0x00 0x10	Hardware fault 6
0x00 0x11	Hardware fault 7
0x00 0x81	Invalid Frame

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Notice

1. User should always remember to turn OFF the power of the Laser Distance Measuring Kit when the measurement is complete, as keeping the power on might reduce the life-time of the Laser and of the light receiving element inside the Laser Distance Measuring Kit.
2. Resistors of a few hundred Ohm are preferentially added between the pins UART Rx, UART Tx and the user's MCU in order to limit the voltage discrepancy between the two systems that would lead to current loss.
3. Measure Accuracy ± 3.0 mm @ 25°C, room environment.
   The outdoor measurement accuracy can be roughly calculated using the following formula.
   Accuracy reference (mm) = (L-20) x C x 0.3 +2
   L: measure distance (M), C: constant=1
4. The measure rate changes automatically based on reflectance and environmental conditions.
5. Continuous testing at low temperatures(0℃) should not exceed 30 minutes.
6. Measurement targets should avoid direct light exposure.

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