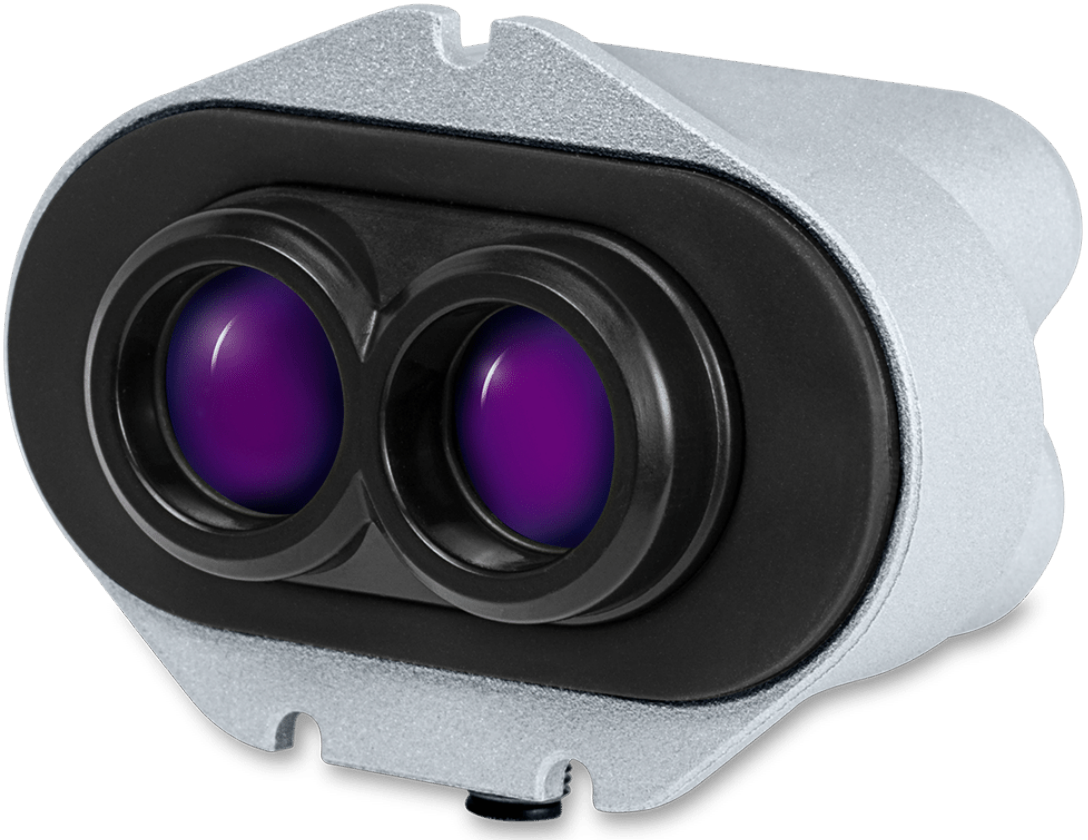
LW24 LiDAR sensor

MicroLiDAR for obstacle detection



Disclaimer

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FM 654831

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Overview

The LW24/C is an IP67 LiDAR sensor designed for applications where communication interfaces Serial and I2C or RS232 are required. The LW24/C LiDAR sensor uses a time-of-flight system to make very fast, accurate distance and speed measurements. The LW24/C LiDAR is effective in most weather conditions, even in direct sunlight. The LW24/C is virtually immune to background light, wind, and noise, making it an ideal sensor to detect unexpected obstacles. The LW24/C can take up to 388 readings per second and the configurable features and multiple hardware interfaces make the LW24/C easy to connect with different types of controllers.

Product support

This document supports the following devices:

Product	Hardware	Firmware	Supported
LW24/C/SI	1	2.0.0	Yes

Revision	Date	Notes
0	01/01/2022	Initial release

Specifications

Performance	
Range	0.2 ... 100 m / 0.6 ... 328 ft (white wall in daylight conditions)
Update rate	48 ... 388 readings per second
Resolution	1 cm / 0.033 ft
Accuracy	±10 cm / ±0.33 ft
Connections	
Power supply voltage	4.5 V ... 5.5 V
Power supply current	55 mA typical
Outputs & interfaces	Serial and I2C (3.3 V TTL, 5V tolerant)
Form Factor	
Dimensions	35 mm x 47 mm x 38 mm / 1.4” x 1.85” x 1.5”
Weight	28.7 g / 1.01oz (excluding cables)
Enclosure rating	IP67
Optical	
Approvals	FDA: 1710193-000 (2020/09)
Laser safety	Class 1M (refer to www. lightware.co.za/safety for full details)
Optical aperture	10 mm
Beam divergence	< 0.5°
Environmental	
Operating temperature	-10 ... + 50°C / 14 ... 122 °F

Shipping temperature	- 40 ... + 80 °C / - 40 ... +176 °F
Accessories	
Main cable	Tensility International Corp Straight 4 position female to wire, 1.83 m (DigiKey: 839-1553-ND)
Optional	Tensility International Corp Right-angled 4 position female to wire, 1.83 m (DigiKey: 839-10-03635-ND)
Default settings	
Serial port settings	115200 baud, 8 data bits, 1 stop bit, no parity, no handshaking
I2C address	0x66 (Hex), 102 (Dec)
Update rate	48 readings per second

Quickstart guide

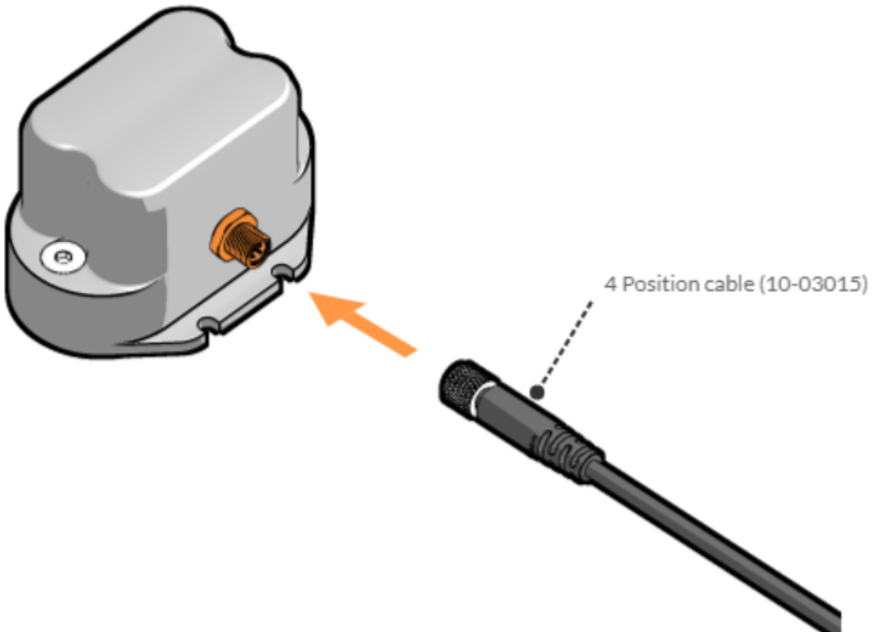
LightWare Studio is an application (available for Windows, macOS, and Linux) that can configure, update, and visualize data for the LW24/C.

In this guide we will use LightWare Studio to view distance data from the LW24/C.

LightWare Studio can be found here. Download the version compatible with your operating system and proceed with installation. You can safely install over an existing version of LightWare Studio if you are upgrading.

Insert the communication cable into the LW24/C and a serial to USB adaptor.

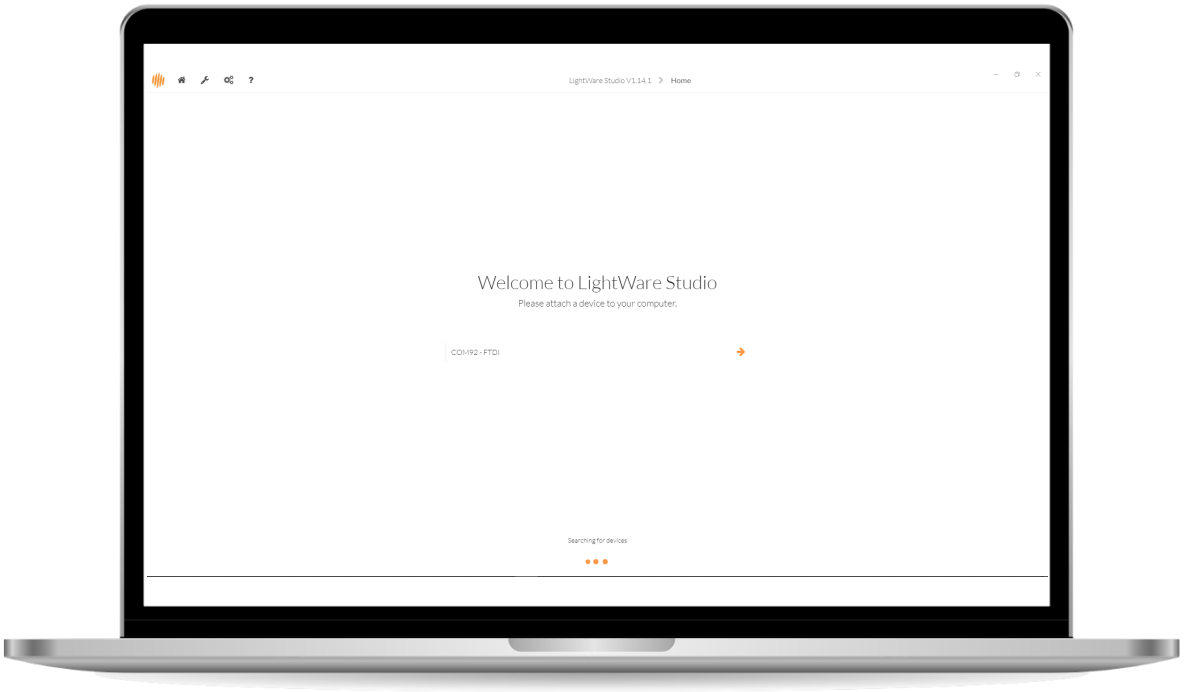
> You will need a serial to USB adaptor to connect the LW24/C to a computer. Any serial TTL 3.3 V USB adaptor will work, this guide uses one available from LightWare LLC here.



LW24/C being connected to a cable

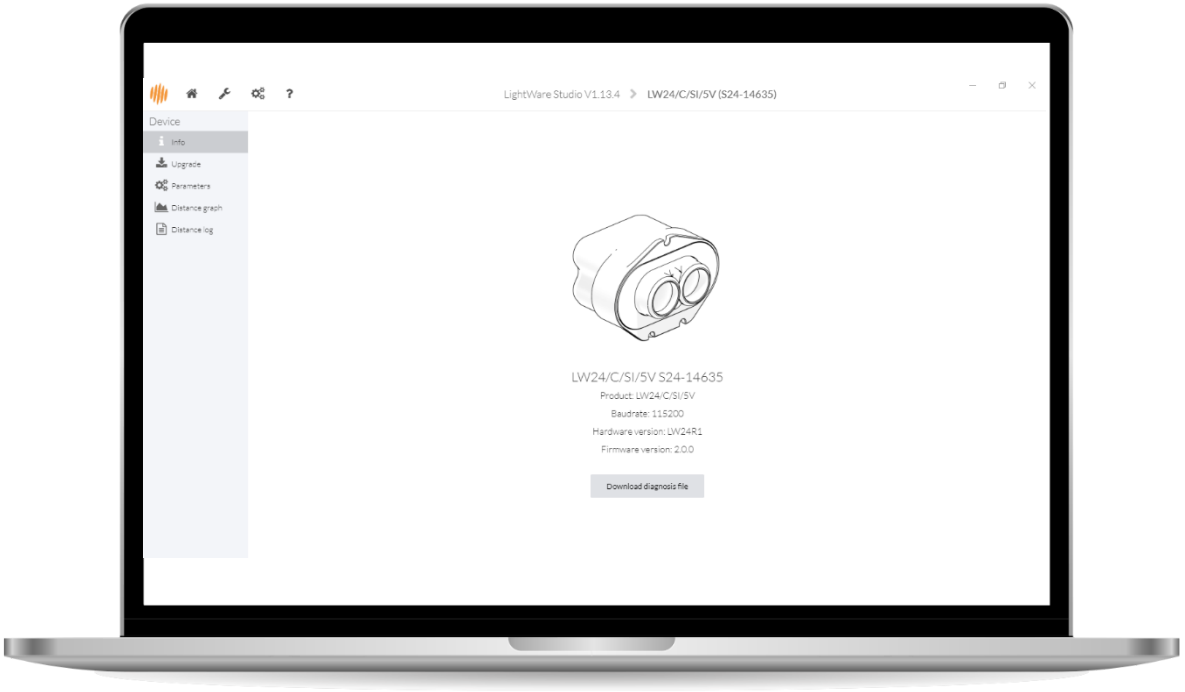
Windows users: Please wait for Windows to install the generic communication driver after connecting the LW24/C for the first time.

Run LightWare Studio. You will be presented with a home screen that shows devices connected to your computer. Your USB adaptor will be recognized and displayed here.



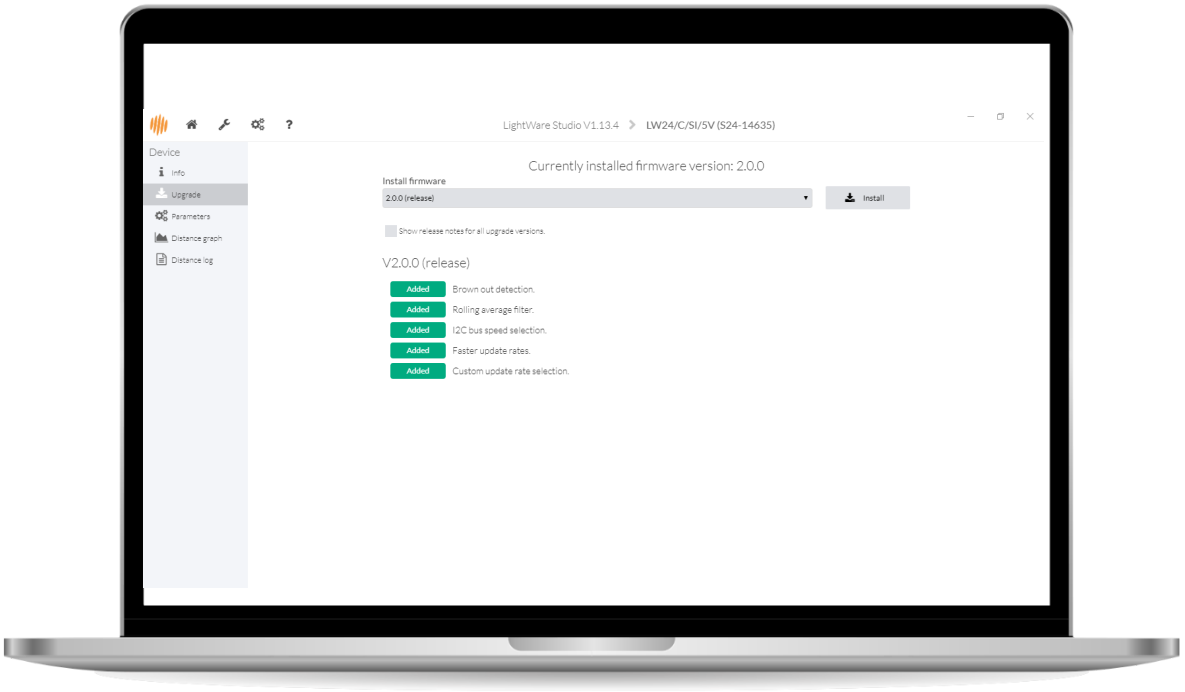
LightWare Studio device connection screen

You can register your device by clicking on the Register to receive firmware update notifications banner.
Click on the USB adaptor to establish a connection. From here you can access tools to inspect and configure the LW24/C.



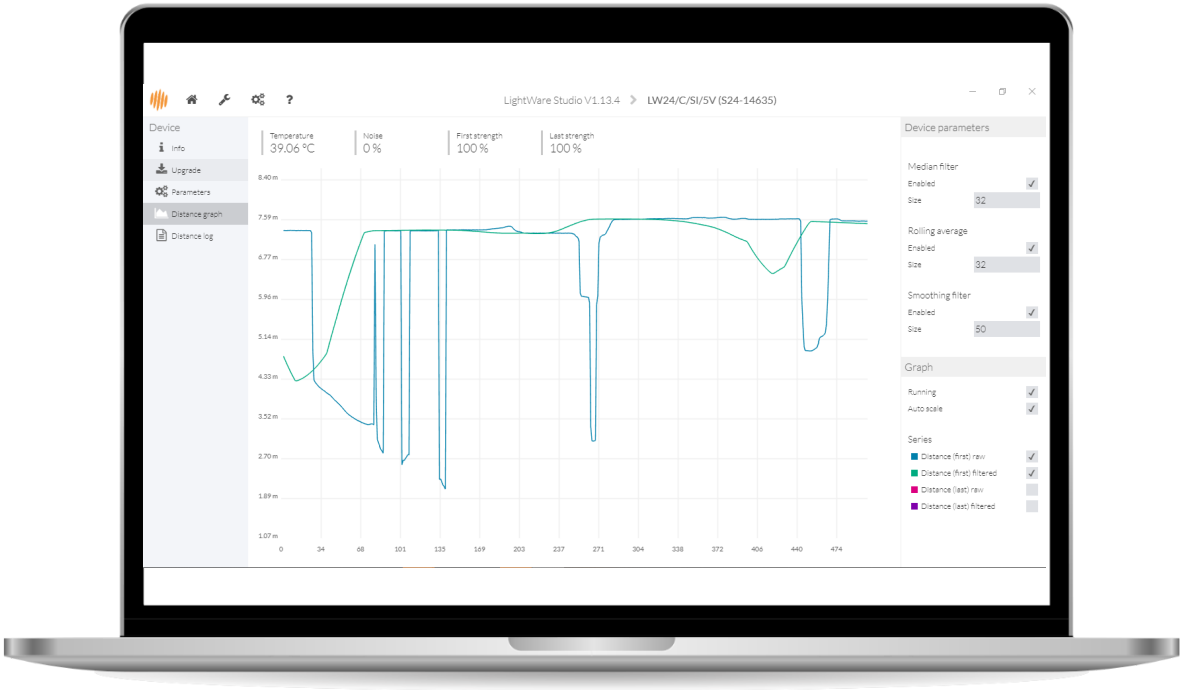
LightWare Studio device information screen

Click on the Upgrade tool in the left panel. It is recommended to make sure your LW24/C has the latest firmware. You can see the changes that have been made to each version, and the option of downgrading is also available. If you choose to upgrade, then click the Install button and follow the instructions.



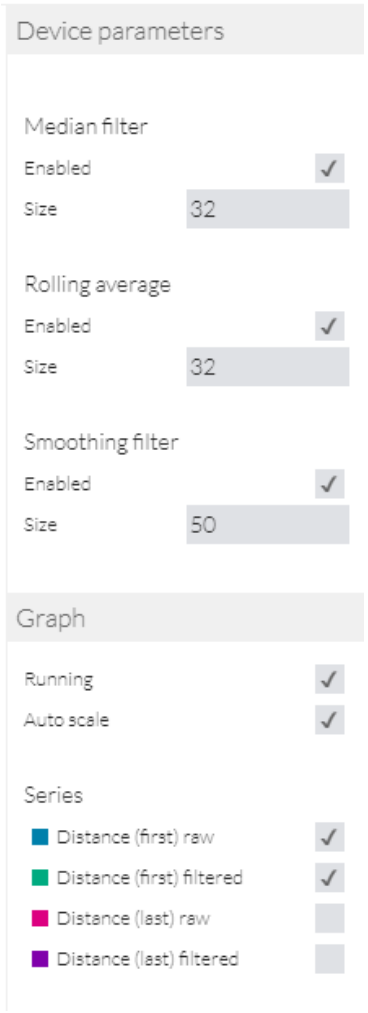
LightWare Studio device upgrade screen.

Click the Distance tool in the left panel. This tool shows you distance readings gathered by the LW24/C. Feel free to point the LW24/C at various surfaces to measure their distances.



LightWare Studio LW24/C scanning screen.

Parameters are shown in the panel on the top right of the *LightWare Studio* window. Modify these parameters to fit your application.



LightWare Studio LW24/C scanning parameters.

For a detailed breakdown on what the parameters do and how they affect the operation of the LW24/C, see the operating concepts section.

What's next?

The next step is to integrate the LW24/C into your platform of choice. Please follow one of the integration guides, or consult the communication protocol reference for building your own system to interact with the LW24/C.

Package contents

The LW24/C box includes:

1 x LW24/C MicroLiDAR unit

1 x Tensility straight DigiKey: 839-1553-ND

Optional:
1 x Tensility 90 degree DigiKey: 839-10-03635-ND

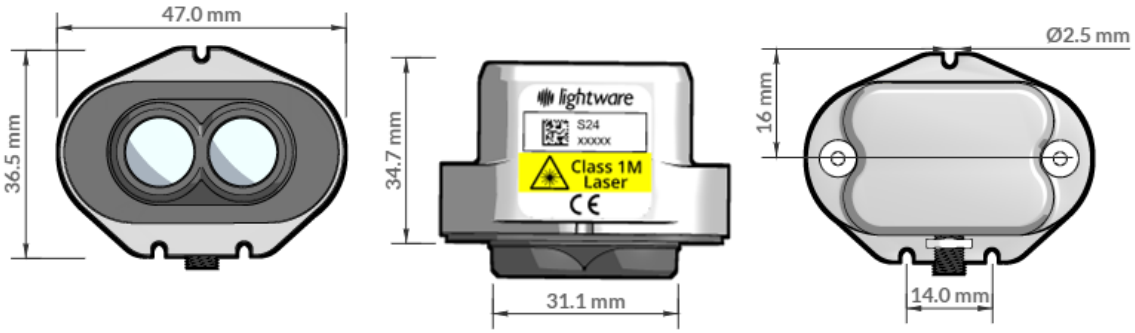
5 x M2 x 12 Pan slotted screw)

5 x M2 hex nut

5 x Flat washer

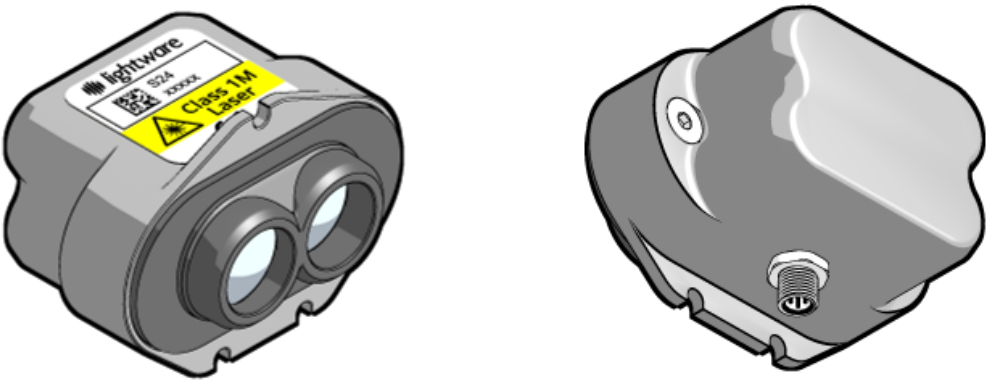
Hardware

Dimensions



LW24/C dimensions

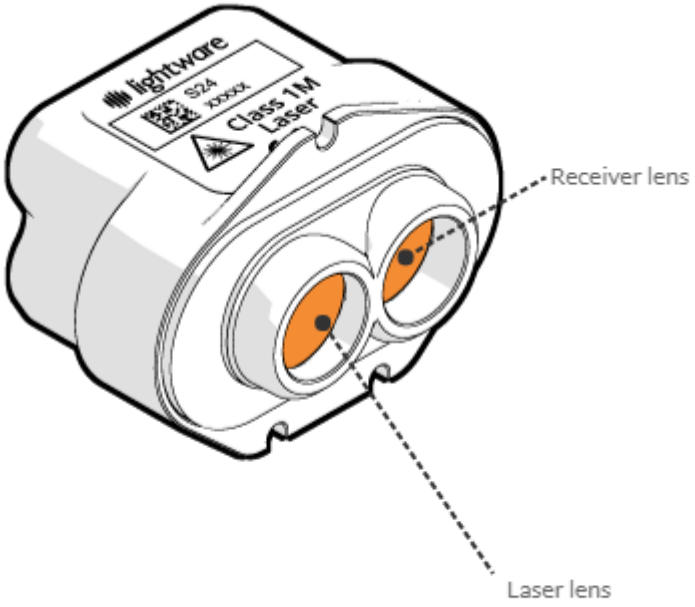
Components



LW24/C view from above and below

Optical assembly

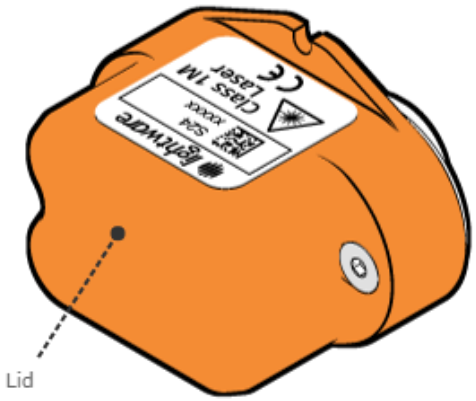
The optical assembly comprises the laser and receiver lenses.



LW24/C optical assembly

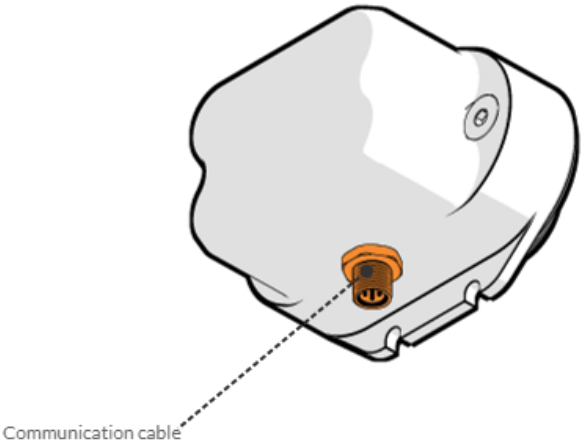
Heatsink & EMI shield

The lid lowers EMI radiation entering or leaving the LW24/C. It also acts as a heatsink to draw heat away from the LW24/C.



LW24/C shield

Connectors & indicators



LW24/C connectors & indicators

Communication cable pinout

Communication cable pinout

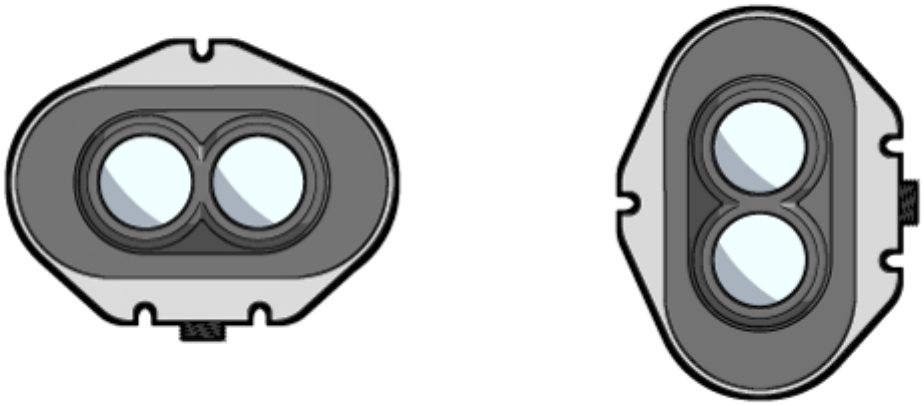
Pin	Function	Notes
1	+5V	4.5 V ... 5.5 V, 55mA I(typical)
2	RXD/SDA	RXD when using Serial, SDA when using I2C.
3	TXD/SCL	TXD when using Serial, SCL when using I2C.
4	GND	Ground

Installation

Mounting

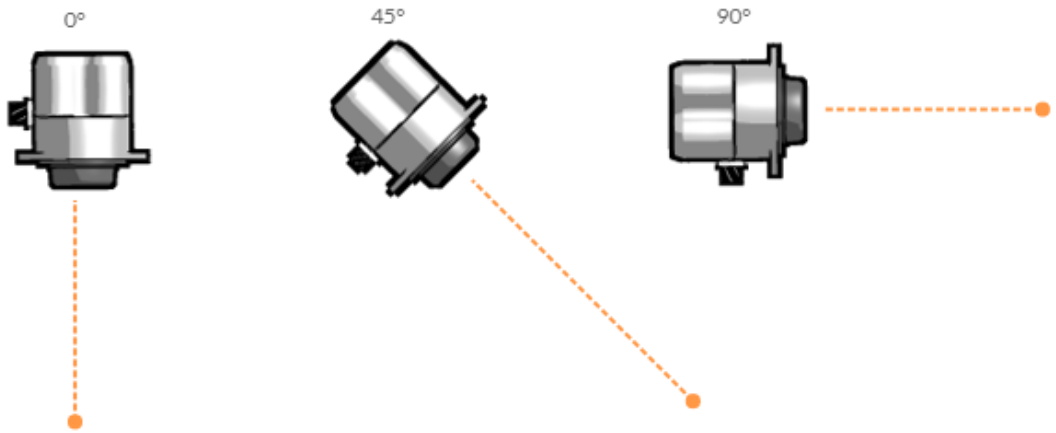
Make sure the LW24/C is functional before installation. You can use LightWare Studio to verify operation. See the quick start with LightWare Studio for details.

The LW24/C requires a clear line-of-sight to measure distance to a target surface. It can be mounted with a vertical or horizontal lens orientation.



LW24/C mounting orientations

The LW24/C can be mounted in a downward facing orientation for altimetry, terrain following or precision landing applications. For terrain following, install the rangefinder at an angle to reduce lag time in reaction. The angle depends on the speed traveled, and the overall system lag, but should be between 20 and 45 degrees. The LW24/C can be mounted forward facing orientation for sense-and-avoid or position-hold applications.



LW24/C mounting directions

Take note:

- Make sure the LW24/C is securely mounted to prevent false readings or damage.
- Allow for proper ventilation.
- Secure the communication cable to prevent it from pulling on the connector.

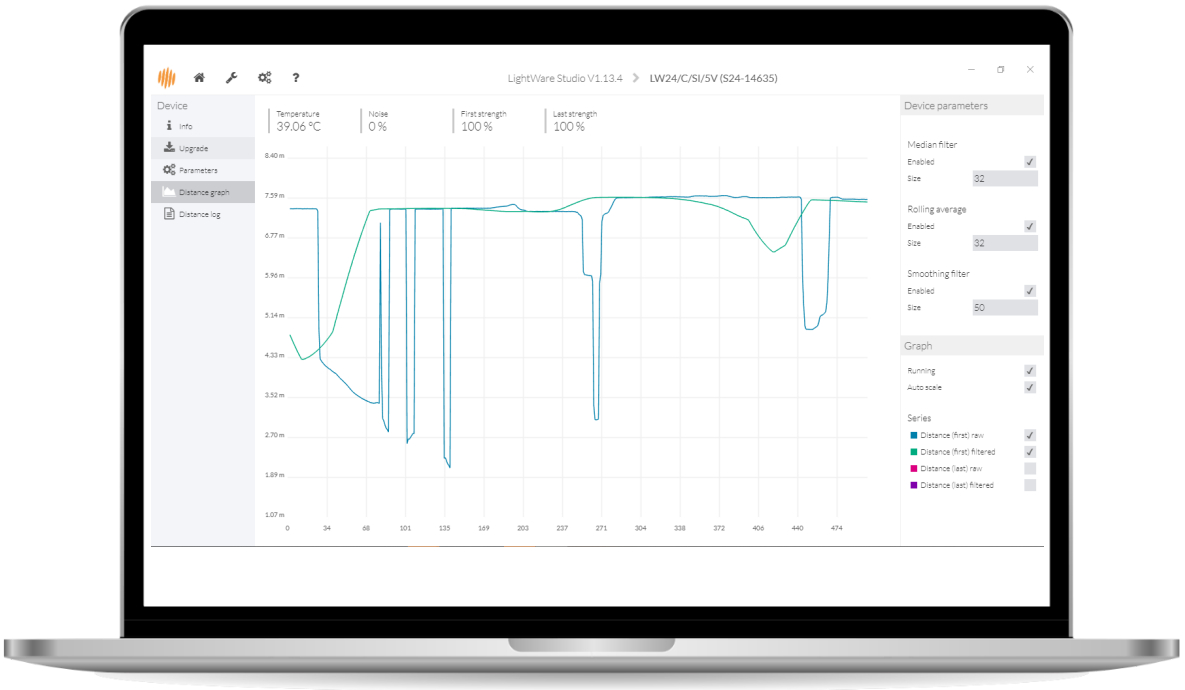
Ensure that nothing is in the path of the laser beam. Ensure that no shiny or highly reflective surfaces are near the path of the beam.

Operating concepts

Distance measuring

The LW24/C is a single point distance measuring LiDAR. It uses time of flight technology to determine the distance of a target at a configurable update rate of 48 Hz to 388 Hz.

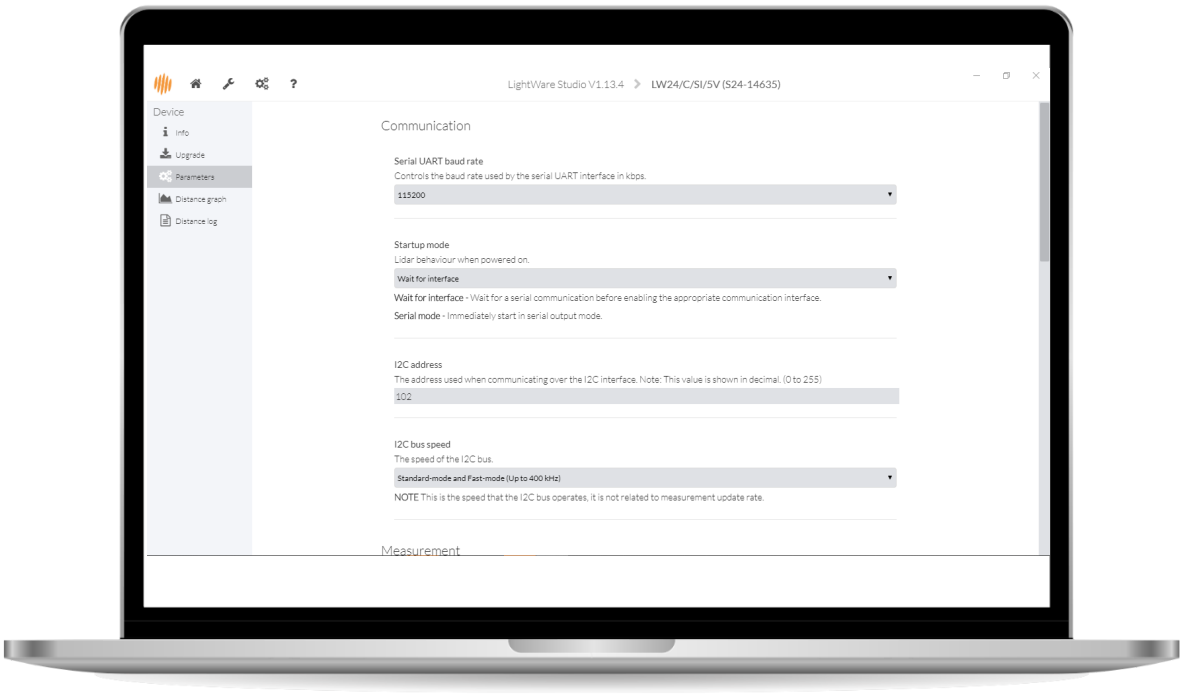
The LW24/C can be connected to a host controller with the serial or I2C interface. The serial port (3.3 V logic level, 5 V tolerant) has a configurable baud rate. The I2C serial bus (3.3 V logic level and 3.3 k pull up resistors, 5 V tolerant) has a configurable address and is an alternative to the serial port when multiple devices are connected on a common bus.



LightWare Studio showing measurements from the LW24/C

Parameters

LW24/C parameters can be adjusted with LightWare Studio or from the platform of your choice through the serial or I2C communication interfaces.



LightWare Studio parameters screen

Serial port baud rate

Controls the baud rate used by the serial UART interface in kbps.

(The baud rate should be as high as possible to accommodate high measurement update rates.)

Startup mode

Determines the communication behavior of the LW24/C when turned on.

I2C address

The address used to communicate on the I2C bus.

I2C bus speed

The speed of the I2C bus

Update rate

The number of measurements per second. From 48 Hz to 388 Hz.

Zero distance offset

An offset applied to the measured distance value.

Lost signal threshold

The number of failed measurements before a loss of signal is reported.

Enable median filter

The median filter is used to disregard short unwanted measurements.

Median filter size

Determines response time of median filter.

Enable rolling average filter

The rolling average filter averages over a specified number of distance measurements.

Rolling average size

The number of distance measurements to use for the rolling average filter.

Enable smoothing filter

The smoothing filter is used to remove noise from the measurements.

Smoothing filter strength

Determines response of the smoothing filter.

Firmware change log

Upgrading firmware

The LW24/C firmware can be upgraded by using LightWare Studio. Download LightWare Studio here.

> Follow the Quick start with LightWare Studio guide for details on downloading and using LightWare Studio.

2.0.0

Notes:

- Initial release.

Safety & maintenance

Safety overview

The LW24/C should not be disassembled or modified in any way. The laser eye safety rating depends on the mechanical integrity of the optics and electronics. There are no user serviceable parts and maintenance, or repair must only be carried out by the manufacturer or a qualified service agent.

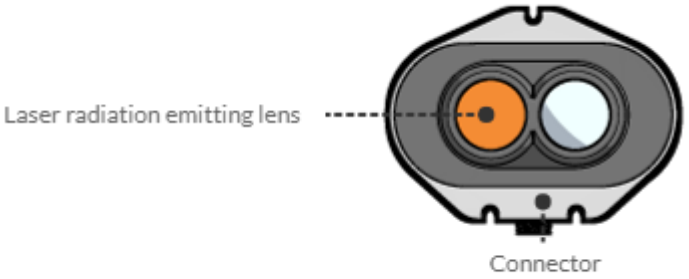
Always observe the following safety precautions when operating the LW24/C. Failure to comply with these precautions or specific warnings given in this product guide violates the safety standards of the intended use for the sensor and may damage the sensor. LightWare LLC assumes no liability for failure to comply with these requirements.

The LW24/C is not field serviceable. For any repairs, the equipment should be completely isolated, removed then packaged carefully. Please visit LightWare LLC's refund policy for Return Merchandise Authorization (RMA) details, or contact support@lightwarelidar.com.

Laser eye safety

The LW24/C emits ionizing laser radiation. The level of the laser emission is Class 1M which indicates that the laser beam is safe to look at with the unaided eye, but must not be viewed using binoculars or other optical devices. Notwithstanding the safety rating, avoid looking into the beam and switch the unit off when working in the area.

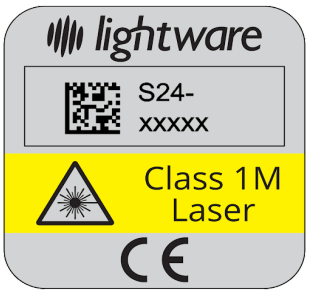
The laser eye safety rating depends on the mechanical integrity of the optics and electronics, if these are damaged do not continue using the LW24/C.



Laser emitting lens

The LW24/C is rated laser Class 1M eye safe. Class 1M laser is safe for all conditions of use however it is not safe to view the laser through magnifying optics such as microscopes, binoculars, or telescopes.

The use of optical instruments with this product will increase eye hazard.



Class 1M laser radiation label

Electrical safety

- Check all electrical connections are isolated and that there are no exposed wires.
- Make sure the power supplied to the device does not exceed the maximum rated voltages which are specified in the technical specifications section.
- The electrical wiring layout of this device is provided in the hardware section.

Mechanical safety

- Ensure that there is adequate airflow permitted for the sensor.
- The mechanical dimensions for mounting the LW24/C are provided in the hardware overview.

Laser radiation information

Specification	Value/AEL	Notes
Eye safety classification	Class 1M	
Laser wavelength	905 nm	
Pulse width	16 ns	
Pulse frequency	20 kHz	
Average power	< 2.5 mW	
NOHD	15 m	Distance beyond which binoculars may be used safely.

Approximate values only. Please contact LightWare LLC if further information is required.

Service & maintenance

The LW24/C is not field serviceable. For any repairs, the equipment should be completely isolated, removed then packaged carefully. Please visit LightWare LLC's refund policy for Return Merchandise Authorization (RMA) details, or contact support@lightwarelidar.com

Cleaning

Use a dry and clean microfiber cloth to gently wipe across the lenses of the sensor, taking care not to scratch the surface of the lenses.

Serial interface

Overview

> We suggest using the pre-built APIs for communicating with the LW24/C where possible.

The LW24/C uses a packet based binary protocol which can be accessed over the serial and I2C interfaces. All higher-level APIs (C, Python, JavaScript) use this protocol to function.

If you require more control than the existing APIs offer or need to port the protocol to a different platform, then you can use the information here to build a compatible system.

Communication is performed using encapsulated packets for both sending and receiving data. Every packet that is sent to the LW24/C is known as a request and a correctly formatted request will always be replied to with a response. There are cases where the LW24/C will send a request packet to the host, these packets are considered streaming packets as they arrive without a direct request from the host - they do not require a response from the host.

> Streaming data is only available through the Serial interface.

Requests are made using one of the available commands and are either flagged as read or write. When a read request is issued then the response will contain the requested data. When a write request is issued then the contents of the response will vary depending on the command.

Default serial interface properties

- Baud rate: 115200
- Data: 8 bit
- Parity: none
- Stop: 1 bit
- Flow control: none

Packets

A packet for both requests and responses is composed of the following bytes:

	Header			Payload		Checksum	
Byte:	Start	Flags Low	Flags High	ID	Data 0 .. N	CRC Low	CRC High

The Start byte is always 0xAA and indicates the beginning of a packet. It is important to verify that the payload length is between (inclusive) 0 to 1023 and that the checksum is valid before processing a packet, rather than just relying on the start byte.

The Flags bytes form a 16 bit integer that represents the payload length and read/write status of the packet. The payload length is inclusive of the ID byte and the required number of data bytes. The write bit is set to 1 to indicate write mode, or 0 to indicate read mode.

**Bit:*	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Payload length (0 to 1023)										Reserved					W

The ID byte represents which command the request/response relates to.

There will be between 1 and 1023 Payload bytes (inclusive) depending on the command type. Each command under the detailed command descriptions section documents how the data bytes are used. The ID byte will always be present in the payload.

The CRC bytes form a 16 bit checksum value used to validate the integrity of the packet data. Every byte in the packet except for the CRC itself is included in the checksum calculation.

Checksum

Each packet has a 2 byte checksum which is used to validate data integrity. The algorithm is CRC-16-CCITT 0x1021. The CRC must be correctly formed for the LW24/C to accept and process packets. Below are some examples in various languages for CRC calculation:

C/C++

```
uint16_t createCRC(uint8_t* Data, uint16_t Size)
{
  uint16_t crc = 0;

  for (uint32_t i = 0; i < Size; ++i)
  {
    uint16_t code = crc >> 8;
    code ^= Data[i];
    code ^= code >> 4;
    crc = crc << 8;
    crc ^= code;
    code = code << 5;
    crc ^= code;
    code = code << 7;
    crc ^= code;
  }

  return crc;
}
```

JavaScript

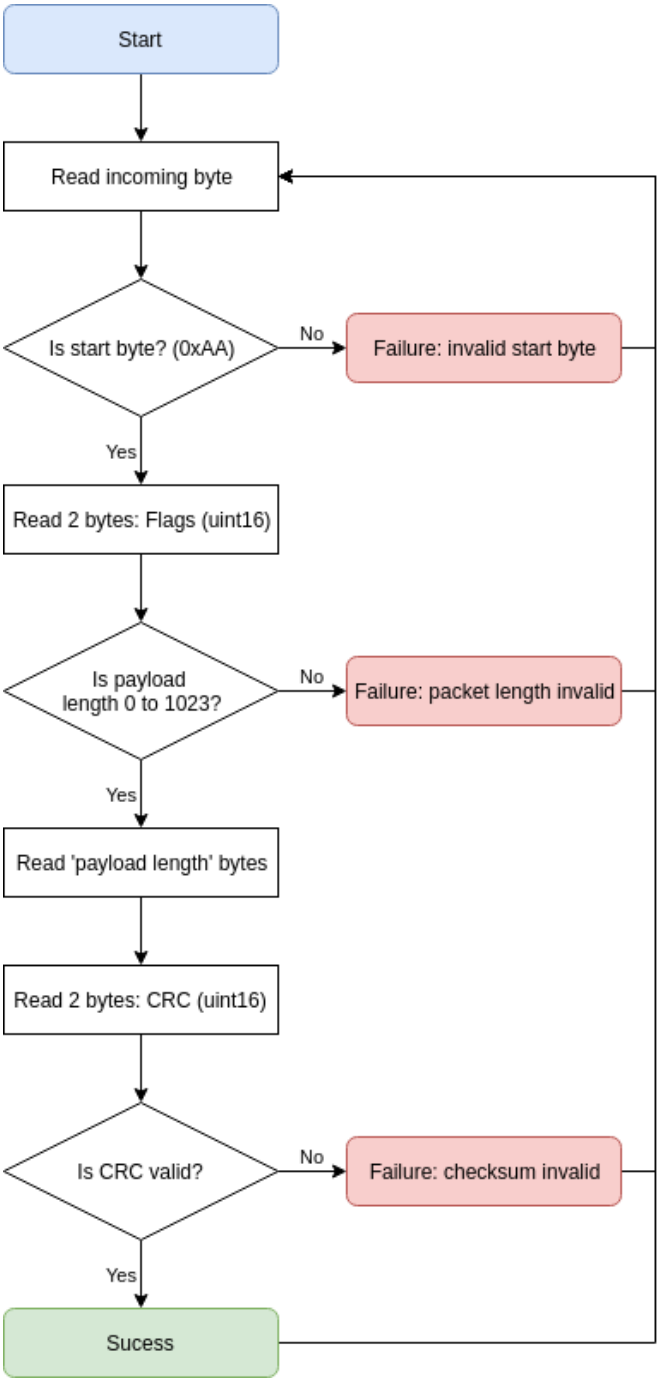
```
function createCRC(data, size) {
  let crc = 0;
```

```
  for (let i = 0; i < size; ++i) {
    let code = crc >>> 8 & 0xFF;
    code ^= data[i] & 0xFF;
    code ^= code >>> 4;
    crc = crc << 8 & 0xFFFF;
    crc ^= code;
    code = code << 5 & 0xFFFF;
    crc ^= code;
    code = code << 7 & 0xFFFF;
    crc ^= code;
  }

  return crc;
}
```

Receiving packets

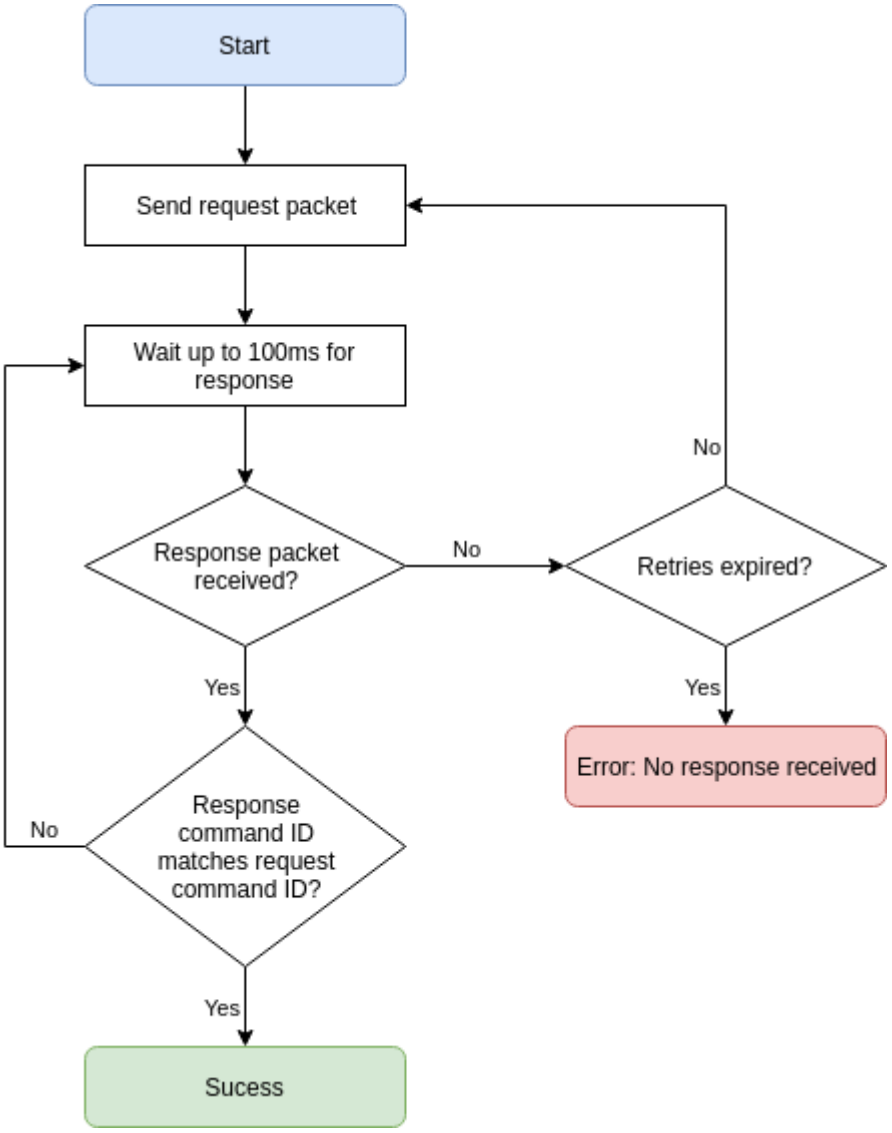
Here is the process for reading the raw serial byte stream and identifying packets. Once a packet has been successfully read it can be processed based on its command ID.



> If the packet length or checksum is invalid, then it is technically more correct to roll the incoming stream back to when the start byte was found. However, in practice this has little appreciable impact.

Handling request & response

Every request sent to the LW24/C will receive a response, it is often useful to use the response to determine if the request was received and processed. Here is the recommended procedure for sending a command request and reading the response:



The values used for timeout or number of retries should be tuned to the specific application.

I2C interface

Overview

> We suggest using the pre-built APIs for communicating with the LW24/C where possible.

The LW24/C uses a packet based binary protocol which can be accessed over the serial and I2C interfaces. All higher-level APIs (C, Python, JavaScript) use this protocol to function.

If you require more control than the existing APIs offer or need to port the protocol to a different platform, then you can use the information here to build a compatible system.
The LW24/C will always be the slave on the I2C interface. Therefore, data will only be transmitted when requested by the master.

> Streaming data is only available through the Serial interface.

Requests are made using one of the available commands. When a read request is issued then the response will contain the requested data. When a write request is issued then there is no response generated.

Default I2C interface properties

- Address: 0x66

Command list

If a command is not readable or writable then it can only be received from the LW24/C and not sent to it.

ID	Name	Description	RW	Read bytes	Write bytes	Persists
0	Product name	Product name	R	16	-	-
1	Hardware version	Hardware revision	R	4	-	-
2	Firmware version	Firmware revision	R	4	-	-
3	Serial number	Serial number	R	16	-	-
7	UTF8 text message	Human readable text message	-	-	-	-
9	User data	16 byte store for user data	RW	16	16	Y
10	Token	Next usable safety token	R	2	-	-
12	Save parameters	Store persistent parameters	W	-	2	-
14	Reset	Restart the unit	W	-	2	-
16	Stage firmware	Upload firmware file pages	RW	4	130	-
17	Commit firmware	Apply staged firmware	RW	4	0	-
27	Distance output	Distance output configuration	RW	4	4	Y
30	Stream	Current data stream type	RW	4	4	N
44	Distance data in cm	Measurement distance data in cm	R	varies	-	-
45	Distance data in mm	Measurement distance data in mm	R	varies	-	-
50	Laser firing	Is laser firing?	RW	1	1	N
57	Temperature	Measured temperature	R	4	-	-
66	Update rate	Data sampling update rate	RW	2	2	Y
74	Noise	Measured background noise	R	4	-	-
75	Zero offset	This adjusts the zero-distance position in mm	RW	4	4	Y

76	Lost signal counter	Set number of lost signal conditions	RW	4	4	Y
79	Baud rate	Serial baud rate	RW	1	1	Y
80	I2C address	I2C address	RW	1	1	Y
82	Median filter enable	Enable/disable the median filter	RW	1	1	Y
83	Set median filter size	Set the median filter size	RW	4	4	Y
84	Smoothing filter enable	Enable/disable the median filter	RW	1	1	Y
85	Set smoothing filter factor	Set the smoothing intensity/factor	RW	4	4	Y
93	Rolling average enable	Enables rolling average	RW	1	1	Y
94	Rolling average size	Size of rolling average	RW	4	4	Y

Command descriptions

0. Product name

A 16 byte string indicating the product model name. This will always be LW24/C followed by a null terminator. You can use this to verify the LW24/C is connected and operational over the selected interface.

Read	Write	Persists
16 byte string	-	-

1. Hardware version

The hardware revision number as a uint32.

Read	Write	Persists
uint32	-	-

2. Firmware version

The version of currently installed firmware is represented as 4 bytes. This can be used to identify the product for API compatibility. The product support section details which firmware versions this document applies to.

1	2	3	4
Patch	Minor	Major	Reserved

Read	Write	Persists
4 bytes	-	-

3. Serial number

A 16 byte string (null terminated) of the serial identifier assigned during production.

Read	Write	Persists
16 bytes	-	-

7. UTF8 text message

Serial interface only

A null terminated ASCII string. The LW24/C will send this command when it needs to communicate a human readable message.

Read	Write	Persists
-	-	-

9. User data

This command allows 16 bytes to be stored and read for any purpose.

Read	Write	Persists
16 bytes	16 bytes	Yes

10. Token

Current safety token required for performing certain operations. Once a token has been used it will expire and a new token is created.

Read	Write	Persists
16 bytes	16 bytes	Yes

12. Save parameters

Several commands write to parameters that can persist across power cycles. These parameters will only persist once the Save parameters command has been written with the appropriate token. The safety token is used to prevent unintentional writes and once a successful save has completed the token will expire.

Read	Write	Persists
–	uint16	–

14. Reset

Writing the safety token to this command will restart the LW24/C.

Read	Write	Persists
–	uint16	–

16. Stage firmware

The first part of uploading firmware to the LW24/C is to stage the data. This command accepts pages of the firmware, each 128 bytes long, and an index to indicate which page is being uploaded. Pages are created by dividing the firmware upgrade file into multiple 128 byte chunks.

When writing to this command, use the following data structure:

Byte offset	Data type	Name	Description
0x00	uint16	Page index	The index of the page currently being uploaded
0x02	128 bytes	Page data	The byte data of the page currently being uploaded

When reading this command, or analysing its response after writing a page, the packet will contain an int32 error code:

Value	Description
0 to 1000	Index of successfully written page
-1	Page length is invalid
-2	Page index is out of range
-3	Flash failed to erase
-4	Firmware file has invalid header
-5	Flash failed to write
-6	Firmware is for a different hardware version or firmware version is too low
-7	Firmware is for a different product

Read	Write	Persists
uint32	130 bytes	-

17. Commit firmware

The second part of uploading firmware to the LW24/C is to commit the staged data. Once the firmware data has been fully uploaded using the 16. Stage Firmware command, then this command can be written to (with 0 bytes).

When reading this command, or analysing its response after writing, the packet will contain an int32 error code:

Value	Description
-1	Firmware integrity check failed
1	Firmware integrity check passed and firmware committed

Once the firmware is committed, a reboot is required to engage the new firmware. This can be done by cycling power to the LW24 or by sending the 14. Reset command.
After the unit has rebooted the firmware version should be checked to ensure the new firmware is installed.

Read	Write	Persists
uint32	0 bytes	-

27. Distance output

This command configures the data output when using the 44. Distance data command. Each bit toggles the output of specific data.

Bit	Output
0	First return raw
1	First return filter
2	First return strength
3	Last return raw
4	Last return filter
5	Last return strength
6	Background noise
7	Temperature

Read	Write	Persists
uint32	uint32	No

30. Stream

The LW24/C can continuously output data without individual request commands being issued. Reading from the Stream command will indicate what type of data is being streamed. Writing to the Stream command will set the type of data to be streamed.

Value	Streamed data
0	disabled
5	44. Stream distance data cm
6	45.Stream distance data mm

> Streaming commands will only output on the serial and USB interface. While it is possible to read and write the Stream command over I2C, the resulting streamed data will not be retrievable.

Read	Write	Persists
uint32	uint32	No

44. Distance data in cm

This command contains distance data as measured by the LW24/C. The data included will vary based on the configuration of the 27. Distance output command.

This command can be read at any time however if 30. Stream is set to 5 then this command will automatically output at the measurement update rate.

The data will be packed in order based on the bits set in the Distance output parameter.

Data output bit	Description	Size
0	First return raw [cm]	`int16`
1	First return filtered [cm]	`int16`
2	First return strength [%]	`int16`
3	Last return raw [cm]	`int16`
4	Last return filtered [cm]	`int16`
5	Last return strength [%]	`int16`
6	Background noise	`int16`
7	Temperature [1/100 degC]	`int16`

Read	Write	Persists
varies	-	-

45. Distance data in mm

This command contains distance data as measured by the LW24/C. The data included will vary based on the configuration of the 27. Distance output command.

The data will be packed in order based on the bits set in the Distance output parameter.

Data output bit	Description	Size
0	First return raw [mm]	int32
1	First return filtered [mm]	int32
2	First return strength [%]	int32
3	Last return raw [mm]	int32
4	Last return filtered [mm]	int32

5	Last return strength [%]	int32
6	Background noise	int32
7	Temperature [1/100 degC]	int32

Read	Write	Persists
varies	-	-

50. Laser firing

Reading this command will indicate the current laser firing state. Writing to this command will enable or disable the firing of the laser.

Value	Description
0	Disabled
1	Enabled

Read	Write	Persists
uint8	uint8	No

57. Temperature

Reading this command will return the temperature in 100ths of a degree.

Read	Write	Persists
uint32	-	-

66. Update Rate

This controls the update rate of the LW24/C.

Reading this command will return the current update rate. Writing this command will set the update rate.
The update rate is selected from the following table:

Command value	Update rate samples/second
1	48
2	55
3	64
4	77
5	97
6	129

7	194
8	388

Read	Write	Persists
uint8	uint8	Yes

74. Noise

Reading this command will return the level of background noise.

Read	Write	Persists
uint32	-	-

75. Zero offset

Changing this offset value will change the Zero distance position for the output. This value is written and read in mm.

Read	Write	Persists
int32	int32	Yes

76. Lost signal counter

The lost signal counter is used to determine the number of lost signal returns that needs to be generated before a lost signal indication is output on the distance value. The lost signal indication on the distance output value is -1000.

Read	Write	Persists
int32	int32	Yes

79. Baud rate

The baud rate as used by the serial interface. This parameter only takes effect when the serial interface is first enabled after power-up or restart.

Reading this command will return the baud rate. Writing to this command will set the baud rate.

Value	Baud rate [bps]
0	9600
1	19200
2	38400
3	57600
4	115200
5	230400
6	460800
7	921600

Read	Write	Persists
uint8	uint8	Yes

80. I2C address

Reading this command will return the I2C address. Writing this command will set the I2C address.

> The I2C address value is in decimal.

Read	Write	Persists
uint8	uint8	Yes

82. Median filter enable

Reading this command will return the status of the median filter. Writing this command will set the status of the median filter.

Value	Description
0	disabled
1	enabled

Read	Write	Persists
uint8	uint8	Yes

83. Median filter size

Reading this command will return the size of the median filter. Writing this command will set the size of the median filter.

The valid range is 3 to 32.

Read	Write	Persists
uint32	Uint32	Yes

84. Smoothing filter enable

Reading this command will return the status of the smoothing filter. Writing this command will set the status of the smoothing filter.

Value	Description
0	disabled

1	enabled

Read	Write	Persists
uint8	uint8	Yes

85. Smoothing factor

Reading this command will return the strength of the smoothing filter. Writing this command will set the strength of the smoothing filter.

The valid range is 0 to 100.

Read	Write	Persists
Uint32	Uint32	Yes

93. Rolling average enable

Reading this command will return the status of the rolling average filter. Writing this command will set the status of the rolling average filter.

Value	Description
0	disabled
1	enabled

Read	Write	Persists
uint8	uint8	Yes

94. Rolling average size

Reading this command will return the size of the rolling average filter. Writing this command will set the size of the rolling average filter.

The valid range is 2 to 32.

Read	Write	Persists
Uint32	Uint32	Yes

Document revision

Revision	Date	Comments
Rev 0	2022/03/03	First edition