Compact water and dust resistant LiDAR sensor

Features

- *Application:* *A dust and water resistant sensor for distance and height measurement*
- *Key features:* *Water and dust resistant, small size*
- *Measuring range:* *0.2 … 100 m (LW20/C) or 0.2 … 50 m (LW20/B)*
- *Size:* *30 mm x 20 mm x 43 mm*
- *Weight:* *20g*
- *Measuring speed:* *48 … 388 readings per second (configurable)*
- *Interfaces:* *Serial or I2C and servo driver*
- *Integration:* *Ardupilot compatible and LightWare Terminal*
- *Safety:* *Eye safe laser emission Class 1M*
- *Environmental:* *IP 67 rating*

FM 654831

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Product ordering codes

Model family	Model name	Model description
LW20	LW20/B (50 m)	LiDAR sensor, max 50 m
LW20	LW20/C (100 m)	LiDAR sensor, max 100 m

Disclaimer

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1. Overview

The LW20 is a small form factor, water resistant LiDAR sensor that measures the distance to objects by timing a laser flash. Accuracy is not generally affected by the colour or texture of the target surface, nor the angle of incidence of the laser beam. The LW20 is tolerant to changes in background lighting conditions, wind and noise.

Please note that the LW20 requires correct grounding to reduce the effects of electromagnetic interference.

The following capabilities are included in the LW20 as standard:

- Measurement to the nearest detected surface (first return).
- Measurement to the farthest detected surface (last return).
- Selectable filters to adjust the dynamic response to moving targets.
- Adjustable measuring update rate.
- Internal status monitoring.
- Servo driver for scanning applications.

There are two communication interfaces available using a common set of wires:

- A serial port (3.3V logic level) with configurable baud rate to connect to a host controller.
- An I2C serial bus (3.3V logic level and 3.3k pull up resistors) with configurable address as an alternative to the serial port when multiple devices are connected on a common bus.

Application software support is available from the LightWare $2p repository.

The LW20 LiDAR is rated laser Class 1M eye safe. Do not view the laser with magnifying optics such as microscopes, binoculars or telescopes.

2. Specifications

Performance	
Range	LW20/C: 0.2 ... 100 m (white wall in daylight conditions) LW20/B: 0.2 ... 50 m (white wall in daylight conditions)
Resolution	1 cm
Update rate	40 ... 388 readings per second
Accuracy	±10 cm
Connections	
Power supply voltage	4.5 V ... 5.5 V
Power supply current	100 mA
Outputs & interfaces	Serial and I2C (3.3 V)
Mechanical	
Dimensions	30 mm x 20 mm x 43 mm
Weight	20 g (excluding cables)
Optical	
Laser safety	Class 1M (Refer to www.lightware.co.za/safety for full details)
Optical aperture	28 mm x 15 mm
Beam divergence	<0.5°
Environmental	
Operating temperature	-10 ... +50°C
Approvals	FDA: 1710193-000 (2020/09)
Enclosure rating	IP67
Accessories	
Main cable	Main cable - 5 way with shield, 32 AWG
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
Main cable connections	
Black	GND - power supply negative
Red	+5V - power supply positive (4.5V to 5.5V at 100mA)
Yellow	TXD/SDA - serial data transmitted or data for I2C
White	RXD/SCL - serial data received or clock for I2C
Blue	Servo control line
Shield	Earth point to reduce EMI

3. Quickstart guide

Caution

The LW20 contains a laser and should never be aimed at a person or an animal. Do not look at the beam directly with optical instruments.

- Download the .KJV9 CTG6GTOKPCN application to your PC or laptop.
- Install and start the application by following the prompts.
- Connect the LW 20 to the PC using a serial (3.3V UART) to USB adaptor.
- The LW 20 will automatically be detected by the application.
- Press the <↑> keyboard key to engage serial communication mode (if you are using an alternative Terminal emulation program, send the character string <**UU**>. The LW 20 will reply with a product code, firmware revision and hardware revision number.

```
p:SF20,1.7.0,12
```

- Press the <**ESC**> keyboard key and the LW20 will display a live data stream - first distance signal, last distance signal, alarm A status and alarm B status - in the LightWare Terminal application window.

```
...
2.68   2.68   1   1
2.68   2.68   1   1
2.68   2.68   1   1
...
```

- Press the <**SPACE**> key to display the main menu. This menu includes a list of all the settings that can be changed in the unit:

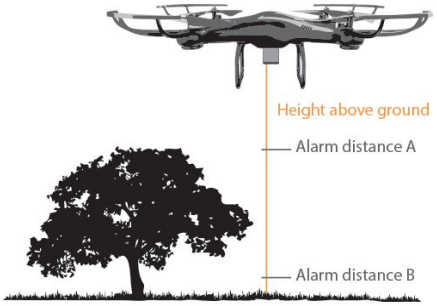
```
                *** LW20 V16 Firmware: V1.7.0 ***
                        Serial: S20-*****
————————————————————————————————————————————————
1: Measurement update rate                  55 per sec
2: Serial port baud rate                    115200
3: I2C address                              0x66
4: Zero distance offset trim                0.00 m
5: Number of lost results before out of range  25
6: Alarm A distance                         10.00 m
7: Alarm B distance                         5.00 m
8: Alarm hysteresis                         0.10 m
————————————————————————————————————————————————

  <-  Use arrow keys to navigate  ->
```

- Change the settings to suit your application.
- Unplug the USB adaptor when finished.

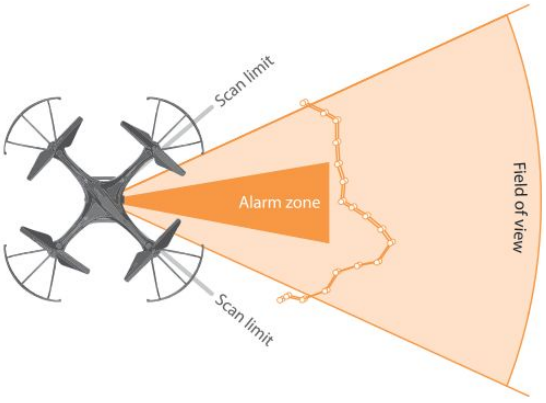
Once the settings have been entered, your host controller can communicate with the LW20 through the serial or I2C ports. API support is available from the LightWare $2p=epository.

Sensors have a resolution of 1 centimeter and the accuracy of each measurement is ±10 centimeter. Laser precise distance measurements provide the exact height above ground level for multi-copter drones to set off alarms when the ground gets too close. The LW20 is able to measure the first and last return signals when there is more than one object in the laser beam - objects must be separated by approximately 5 meters before they are seen as separate return signals. For terrain following applications, this enables a drone to track the closest tops of trees, and measure the height above ground simultaneously, to get information about potential collisions.



Measuring exact height above ground

The LW20 outputs measurements from 48 readings per second, to a maximum of 388 readings per second. The slower reading rate gives better measuring range for forwards-facing obstacle detection. The faster reading rate is better for scanning applications. By adding a small digital servo, the LW 20 has built-in drivers to allow the unit to scan the area ahead of autonomous vehicles. Ideal for sense-and-avoid navigation, the LW20 can either stream the measured data to the communication ports for "SLAM(Stop Look Assess and Manage)" mapping, or analysed internally to look for potentially hazardous alarm conditions.



Collision avoidance zones

There are two enclosure options available, the LW20 and the SF20. The LW20 is a sealed waterproof IP67 unit suitable for outdoor applications. Weighing less than 20 grams (excluding cables), it is ideal for applications where the weight and size are important. The SF20 is an open frame, 10 gram unit, suitable for OEM applications when low mass is the defining specification. The SF20 is not waterproof.

The SF20 / LW20 includes serial, I2C and alarm outputs that can be easily connected to a flight controller or a standard processing platform. Each interface on the SF20 / LW20 can be configured using a simple software menu.

The SF20 / LW20 LiDAR is rated laser Class 1M eye safe. Do not view the laser with magnifying optics such as microscopes and telescopes.

4. Connection guide

Caution

The LW20 laser rangefinder contains a laser and should never be aimed at a person or an animal. Do not look at the beam directly with optical instruments.

You can communicate with the LW20 unit in a number of ways:

4.1. Communication with a controller

The LW20 is designed to communicate with a host controller. This controller can be a single board computer, flight controller, PC or laptop.

There are two communications interfaces available, serial and I2C. The LW20 will wait for the first command to confirm which communication mode to select (serial or I2C). The first command will not get a response.

The serial port is a one-to-one protocol that lets a single LW20 talk to a single host controller. The serial interface uses 3.3 V logic to transmit results and receive commands.

Multiple LW20's with an I2C port can be connected onto an I2C bus. The I2C interface uses 3.3 V logic to receive commands from a master device.

The communication language for both the serial and I2C ports is based on ASCII commands and messages. Command strings take the form of simple mnemonics and results are provided as text strings.

A command string is made up of:

- A directive that indicates what action to take
- A channel that represents a functional block containing related information
- An index that determines which value is being acted on
- A numeric value if needed
- <**CR**><**LF**> indicates the end of the command

There are four different directives, each using a single ASCII character:

?	Fetch a value
#	Write a value
$	Stream live results
%	Save changes

There are six channels available inside the LW20:

P	The Product channel contains product related information
L	The Laser channel contains all laser related information
S	The Servo channel contains all servo related information
C	The Communication channel handles serial and I2C data
A	The Alarm channel provides alarm status information

A typical command sent by the host controller would be:

?PN<CR><LF>

Which means: What is your Product Name?

The SF20 / LW20 would reply with:

PN:LW20 <CR><LF>

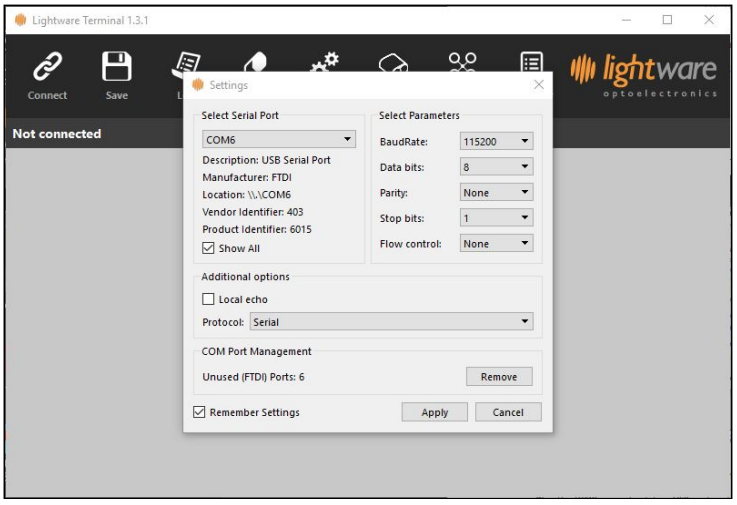
Which means: Product Name : LW20

Full details of the communication language are given in Section 7.3.

4.2. Human Machine Interface (HMI) communication with a USB converter cable

- Download the LightWare Terminal application from www.lightware.co.za onto your PC or laptop. Open the installer package and follow the installation instructions. Everything needed for communicating with the unit will automatically be installed.
- Connect the serial port of the LW20 to the USB port on a PC or laptop using a serial UART TTL (3.3 V logic, 5 V power) to USB adapter such as the TTL-232R-3V3-WE converter cable from FTDI. This will allow for communication and power supply to the LW20. A red indicator light will show that the unit is powered up.

- Start the LightWare Terminal application and click on the "**Settings**" icon and set the baud rate to "115200". Select the correct "Protocol" for your communication type and the correct USB port. You can tick the "Remember settings" box if you intend to use this configuration again. Click "**Apply**" the change to close the dialog window.



- Click the "**Connect**" icon to open a communication port.

- Press the < ↑ > keyboard key to engage serial communication mode (if you are using an alternative Terminal emulation program, send the character string <**UU**>. The LW20 will reply with a product code, firmware revision and hardware revision number.

```
p:SF20,1.7.0,12
```

- Press the <**ESC**> keyboard key and the LW20 will display a live data stream - first distance signal, last distance signal, alarm A status and alarm B status - in the LightWare Terminal application window.

```
...
2.68   2.68   1   1
2.68   2.68   1   1
2.68   2.68   1   1
...
```

- The live data stream displays the first distance signal, last distance signal, alarm A status and alarm B status. The servo live data stream (if it is attached) displays the aiming angle, first distance signal, last distance signal, alarm A status and alarm B status.
- Press the <**SPACE**> key to display the main menu. This menu includes a list of all the settings that can be changed in the unit: