LUMA X
LUMA X UV

a fast, long-range, optical underwater communication system

Manual

Ver 1.7

HYDROMEA

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Contents

WARNING:

- **bright LED light source, do not look directly at emitter**
- **a few people may experience epileptic seizures when viewing flashing lights**

1   Introduction

The LUMA X is an optical modem for fast, reliable wireless underwater communication. Each LUMA X is a full transceiver and thus capable of half-duplex communication (transmission and reception).

Note: this manual applies to the LUMA X as well as the LUMA X-UV. Throughout the manual all references to LUMA X also apply to LUMA X-UV except for when there is an explicit differentiation.

2   Operation

Note: while submerging the LUMA X, a small number of bubbles may come out of the pressure compensation vent at the connector end of the modem. When LUMA X is back on the surface a small amount of water may come out of the vent.

2.1   Initial setup guide

Note: before first operation, the LUMA X needs to be configured.

The following sections describe the initial network setup and LUMA configuration.

On factory default, LUMA X has the default IP address 192.168.102.101, and will send telemetry to a host computer that has the IP address 192.168.102.100. The first step is thus to set the host computer to this address for the initial configuration.

For the purpose of initial setup and testing, the default network configuration and IP addresses are used, as shown in Figure 1. For operational use, the IP addresses of the LUMA X modem and the computers connected to them can be configured differently to suit individual network requirements.

Note: As the LUMA modems form a bridge, they should not be connected to the same cabled network (i.e. do not plug both modems into the same switch). Doing so may lead to a loop in the network, where one LUMA picks up traffic from the other LUMA and feeds it back to the switch, flooding the network with packets. The modems should be connected to two separate cabled networks as shown below.
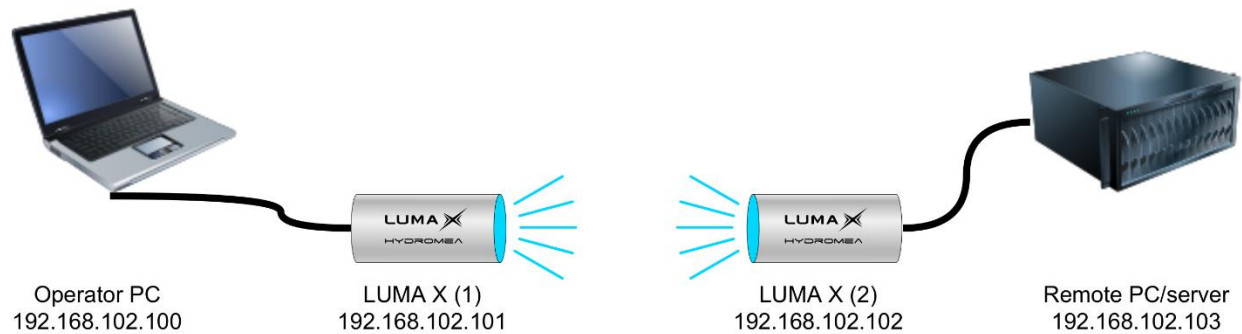
Operator PC   LUMA X (1)   LUMA X (2)   Remote PC/server
192.168.102.100   192.168.102.101   192.168.102.102   192.168.102.103

Figure 1: Typical initial test setup

2.1.1 Windows 10 setup

On Windows 10 this is set up as follows:

- go to → *Settings* → *Network & Internet* → *Ethernet* (in left column) → *Network and Sharing Center* (in right column) → *Change adapter settings* (in left column) → right click on Ethernet adapter → *Properties* → select Internet Protocol Version 4 (TCP/IPv4) → *Properties*
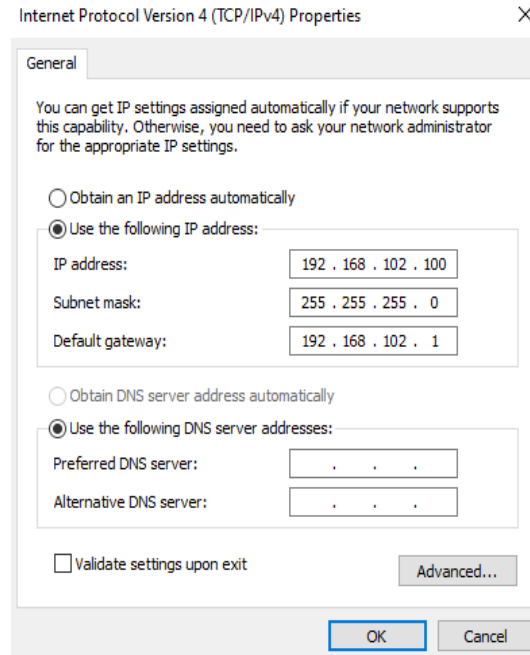- set the address as shown in Figure 2

Figure 2: Windows 10 network settings

Verifying the IP address setting:

- Open a command line: → *Windows PowerShell*

- Type: *ipconfig /all*
- You should see the IPv4 address setting shown in Figure 3


```
Ethernet adapter Ethernet 2:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Intel(R) PRO/1000 MT Desktop Adapter #2
   Physical Address. . . . . . . . . : 08-00-27-91-8C-2B
   DHCP Enabled. . . . . . . . . . . : No
   Autoconfiguration Enabled . . . . : Yes
   IPv4 Address. . . . . . . . . . . : 192.168.102.100(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.102.1
   NetBIOS over Tcpip. . . . . . . . : Enabled
```

Figure 3: IPv4 address settings for LumaConf

On the remote PC, repeat the procedure, but set the IP address to 192.168.102.103.

2.1.2   LUMA X setup

Once the host computer's IP address is set correctly the connection to the LUMA X can be tested.

- Connect **only one** LUMA X to a computer via an Ethernet connection using Hydromea's power/data cable.
- Connect the LUMA X to a suitable supply voltage (12 V – 36 V) using Hydromea's power/data cable.
- (Optional step) To test that the IP address has been set correctly, the computer should now be able to ping the LUMA X on its default IP address 192.168.102.101 and the modem should respond to it.
    - Windows 10: Open a command line: → *Windows PowerShell*
    - enter *ping 192.168.102.101*

- Open a browser, and enter 192.168.102.101 into the address field. The LUMA X web interface main page should appear (see Figure 4)

All LUMA X are factory-set to boot-up into *config* mode and their factory-set IP address is 192.168.102.101.

In order to use several LUMA X within the same network for configuration and testing, they need to be set to differing IP addresses. Please follow the steps in the following section to change the IP address of the second modem.

2.1.3 Setting the IP address

For the initial test, modem (1) can remain at the default IP address. The other modem (2) has to be set to a new IP address that is unique within the subnet. For the initial example, we use 192.168.102.102.

- Plug in **only** modem number (2) and navigate your browser to 192.168.102.101
- Click on the menu item "IP change"

- Enter the new IP address 192.168.102.102 (for the second modem)

- Click "Set". The new IP address is now temporarily applied, and the page will reload showing the new IP address:

- To store the new setting to flash memory, click "Save". The modem is now set to the new IP address.

2.1.4 Setting modems to Active Mode

The LUMA X has two modes of operation: *config* and *active*.

The *config* mode is the inactive mode and the modem will not forward data between the ethernet cable and the optical interface.

After setting the configuration, LUMA X can be switched to *active* mode. It will now behave as a bridge device, forwarding any traffic from the cable side via the optical link. This effectively connects the networks on both sides, comparable to a cabled connection between two switches or end devices.

For purposes of the initial test, we will leave all parameters on default values, and switch the two modems to "*active"* to establish a link.

- Plug in the first modem and power it up, load the web interface (as previously)
- Click on the menu item "Parameters"
- Change "Default start state" to "*Active*"
- Click "Set"
- Click "Save"
- Unplug the modem, repeat all steps with the second modem.
- At the next power-up, the modems will operate in "*active"* mode.

The modems are now ready. Connect the first modem to the Operator PC, and connect the second modem to a remote PC (e.g. a second laptop, or an ethernet-capable remote device). The operator PC should be set to IP address 192.168.102.100. The remote PC should be set to IP address 192.168.102.103 (this IP address is given as an example for the initial setup – it can be chosen freely within the same subnet).

Power up the modems on both sides. The boot-up takes up to 10 seconds.

On the operator PC, open a Shell, and type:

ping 192.168.102.103

If everything is configured correctly, the modems will visibly flash with blue light, and the ping will show the response from the remote PC.

The optical link is now ready and will forward any ethernet traffic from one side to the other side.

Note that ambient light, artificial light sources (fluorescent office lighting, LED lamps, screens, sunlight) may interfere with the optical channel and disrupt communication. If a link cannot be established, try to turn of lights, or cover the modems with an opaque sheet of cardboard or cloth while ensuring line of sight between the modems. Ideally the modems should be separated by at least 1 meter, as the receiver may saturate at very close range.

3   Modem configuration

This chapter will describe the modem configuration in detail.

There are two ways to configure LUMA X, the built-in web interface as well as *LumaConf*, an external program. The web interface is the preferred way to configure LUMA X. *LumaConf* offers some additional test features that provide several performance metrics for a two-modem connection.

This chapter details the configuration of LUMA X using the web interface and chapter 4 explains the configuration via *LumaConf*.

3.1   LUMA X web configuration menu

3.1.1 Main page

Figure 4: main page of the web-based configuration-UI

This page provides information about the current revision of the hardware, firmware and API. It also provides the firmware's SHA and the unique processor ID.
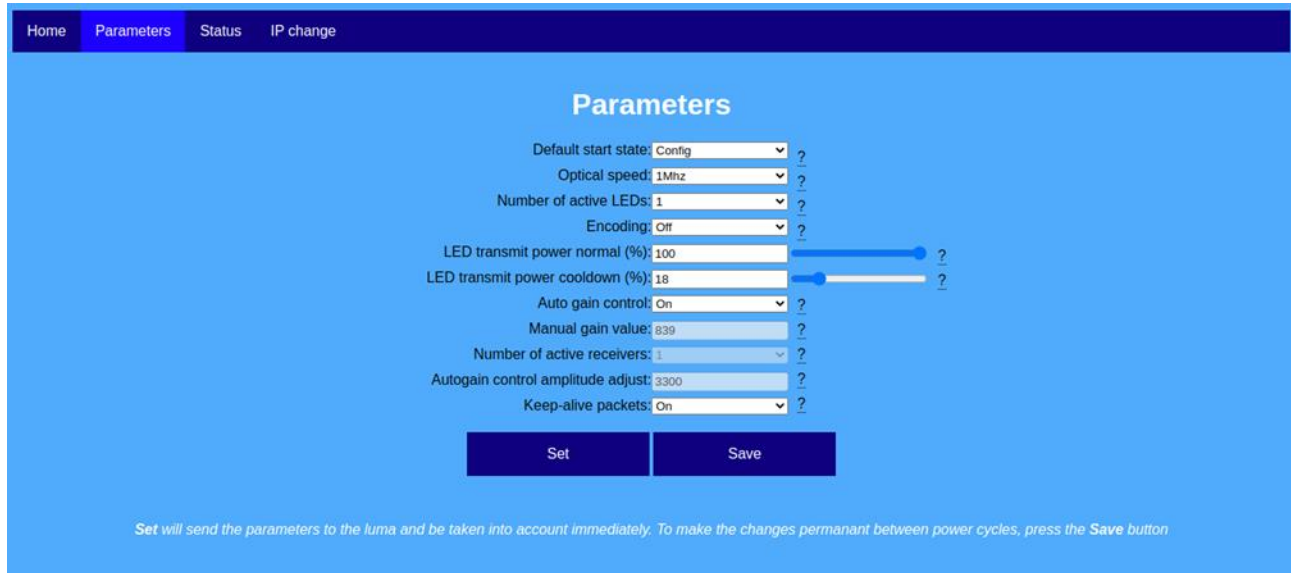
3.1.2 Parameters page

Figure 5: parameter page of the web-based configuration-UI

This is the main configuration page for the LUMA X. Hovering over the "?" next to each parameter provides a short description.

Note: No change will become effective until the *Set* button has been pressed. After power-cycling the modem the parameters will revert to the previous setting. Pressing the *Save* button will store the new set of parameters into the LUMA X flash memory and make it the new permanent set of parameters.

Default Start State	Config Active	The state which the LUMA X will boot into. This is factory-set to *config*, but for normal operation this should be set to *active.* The mode will be applied at the next power-up.
Optical speed	1 MHz 2 MHz 4 MHz 6 MHz 8 MHz 10 MHz	Speed of the optical link. Note that higher transmit speeds mean less range. Both sides have to be set to the same speed.
Number of active LED banks	1 2 3 4 5	Number of LED banks used for transmission. Increasing the number of banks increases the transmission range and power consumption.
Encoding	On Off	Enabling Encoding, improves the link quality at the cost of throughput
LED transmit power normal	1% - 100%	Power level of LEDs during normal operation. Note: if 2 LUMA X are very close to each other (less than 50 cm), packet loss can be reduced by reducing LED power.
LED transmit power cooldown	1% - 100%	Power level of LEDs during cooldown operation, when the modem cools down from 55°C to 50°C.
Auto gain control	On Off	The LUMA X will adapt to the ambient light level by changing the receiver gain. Note: this should be enabled in an environment which experiences ambient light changes.
Gain value	0-4000	Receiver gain If *Auto gain control* is *on*, the current gain value is displayed, but cannot be changed. If *Auto gain control* is *off*, it is a mutable parameter.
Number of active receivers	1 2 3 4	The LUMA X modem has 4 receivers and any number of them can be active. If *Auto gain control* is *on*, this will be selected automatically by the LUMA X during active operation, otherwise it is a settable parameter. If *Auto gain control* is *off*, it is a mutable parameter.
Autogain control	0-4000	This is the target value for the auto-gain algorithm. The factory default value is normally the best choice. In some situations, this parameter can be adjusted based on a gain

amplitude adjust		tuning procedure (contact Hydromea for assistance if required).
Keep-alive packets	On Off	When on, the modem will send short packets every 1-2 seconds, which helps to maintain optimal gain settings. When off, the modem will not emit any light unless there is data traffic, but there may be packet loss immediately after longer pauses in data flow until the gain control can adjust.

Table 1: parameters within the web-based configuration UI

3.1.3 Status page

Figure 6: status page of the web-based configuration-UI

This page provides information about the current status of the LUMA modem and is updated once every second. All information provided refers to the last one-second-window.

Temperature LUMA	Temperature (in degree Celsius) of the optical transceiver. When it reaches 55°C the modem will automatically reduce the power to the transmitter LEDs until the temperature has dropped to 50°C
Throughput received (kbps)	Average data rate for data received
Packets CRC errors	Number of packets discarded in last second due to CRC error (indicator for the stability of the link)
Packets received	Number of error-free packets received within the last second
Packets lost	Number of packets lost within last second between successfully received packets. Note: if no packet is successfully received, lost packets cannot be tracked.

Table 2: modem and link information provided by the web-based configuration UI

3.1.4 IP address change page

Figure 7: IP-setting page of the based configuration-UI

This page lets you modify the IP address of the web-based configuration interface (which you are using right now). The current IP address of the of the web-based configuration interface is displayed and can be changed. Changing the IP address and pressing *Set* button will immediately change the IP address, however this change is not permanent and the change would be reverted during a power-cycling. After pressing *Set* button, the webpage will try to reconnect to the web-based configuration interface using the new IP address. After reloading the page, the new IP address will be shown and a *Save* button is available. Pressing the *Save* will store the new IP address in the modem's flash memory, thus making the change permanent.

Figure 8: saving the IP address to flash in the web-based configuration-UI

4 Modem configuration and testing using *LumaConf*

In addition to the web-based user interface, the *LumaConf* software offers some additional features. It is available here:

https://files.hydromea.com/luma/LumaConf_lumaX.zip

Note: when starting *LumaConf* you will get a "Windows protected your PC"-notification, as *LumaConf* is currently not yet signed. Please click on "more info" and then on "Run anyway".

To configure LUMA X we recommend using the web-based interface (see chapter 3.1).

LumaConf offers a built-in test tool to assess the quality of a link between two modems. LumaConf also provides an option to upgrade or reflash the modem's firmware. These two capabilities are only available in *LumaConf*.

The LUMA X has two modes of operation: *config* and *active*.

The *config* mode is the inactive mode and the modem will not forward data which it receives optically onto the Ethernet cable. When using *LumaConf* to change LUMA X's configuration the modem needs to be in *config* mode.

To use *LumaConf*, ensure that the LUMA X is connected to a computer via Ethernet and that it is powered up. After the start of *LumaConf* you will see the console shown in Figure 10.

The upper half of the *LumaConf* console provides the control elements outlined in Table 3.

Note: If *LumaConf* cannot connect to the LUMA X, it will display "No LUMA connected". Verify that your host PC is set to the IP address **192.168.102.100** (or respectively, the address specified as the "**Host IP address**" in the LUMA X parameters).

You may also need to disable the firewall for *LumaConf*.

In Windows 10:

- → *Settings* → *Network & Internet* → *Windows Firewall* (in center column) → *Allow an app through the firewall*
- Check *LumaConf* as shown in Figure 9
- The LUMA X should immediately appear on the *LumaConf* user interface.
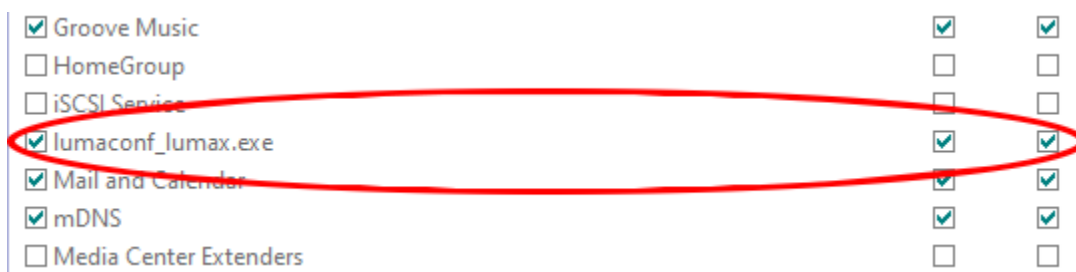

Figure 9: Windows 10 firewall exception settings for LumaConf

Figure 10: LumaConf main console

1	**Selector** for the interface to communicate with LUMA X (Ethernet, serial/USB). The serial interface can only be used to change the LUMA X's IP address, update its firmware and to reset it to factory settings.
2	**Selector** for the baud rate of the serial interface (only selectable when a serial interface is selected in **1**)
3	**Selector** for LUMA X. If multiple LUMA X are detected, their last IP address byte will be displayed in this drop-down list. The LUMA X which is to be configured can then be selected from this list.

4	**Button** to refresh the list of parameters in the bottom section of *LumaConf* for the LUMA X selected in **3**.
5	**Button** that puts the LUMA X specified in **3** into *config* mode. This will change the lower half of the *LumaConf* console so that the modem parameters can now be changed. Note: this will only be required if the attached modem is currently in *active* state and will thus not be automatically visible in *LumaConf*. Clicking on *Config mode* will bring up a box requiring you to enter the *Configuration IP address* of the attached LUMA X. If the configuration IP address is unknown, you can factory reset the LUMA X (see section 4.2 which will reset the *Configuration IP address* to 192.168.102.101 and set the default state to *config* and thereby ensures that the LUMA X will show up in *LumaConf* after a reboot.
6	**Button** that saves the parameters shown in the lower half of *LumaConf* into the LUMA X's flash memory.
7	**Button** that loads the parameters from the LUMA X's flash memory, thus canceling any unsaved changes.
8	**Button** that starts a communication test between two LUMA X. See section 4.3 for details.
9	**Button** that will open a dialog to run a defined communication test between two connected LUMA X. This will output a logfile for troubleshooting. For more details see section 4.4
10	**Button** that starts the firmware bootloader dialog for IP address change, firmware update or factory reset. See section 4.2 for details.
11	**Button** to convert a previously generated log file into a graph. For more details see section 4.5
12	Hardware version of the LUMA X
13	Software version of the LUMA X
14	Firmware version of the LUMA X

Table 3: control section of LumaConf

Note: For normal operation, the user should set the parameter *Default state* to *active* in *LumaConf* and *Save*, allowing the LUMA X to start into *active* mode at the next power-up. Both LUMA X of a communication link need to be in *active* mode for normal operation.

4.1 *LumaConf parameters*

Successfully setting a LUMA X into *config* mode makes the parameters in the lower half of the *LumaConf* main console changeable. Table 1 in chapter 3.1.2 provides an explanation of the parameters.

The only additional parameter not present in the web interface is the "Host IP address". This is the target address where LUMA sends the telemetry to, and has to match the IP address of the PC where LumaConf is running.

4.2 Firmware upgrade and factory reset

In order to upgrade the firmware of LUMA X or carry out a factory-reset, LUMA X must be put into *Bootloader* mode. The following steps will upgrade LUMA X firmware and/or carry out a factory reset:

- Start *LumaConf*
- Ensure that the LUMA X is connected to a computer through the serial connection. This is most easily achieved by using Hydromea's power/data cable-box which provides a serial connection through a USB-to-serial conversion within the power/data cable and can be accessed via a micro-USB port.
- Ensure that the LUMA X is connected to a power supply
- In *LumaConf* set *Interface* to the correct serial port
- Click on *Firmware update* within *LumaConf.* This will open the *Bootloader* dialog box (see Figure 11).
- Cycle the power for LUMA X
- The user now has a few seconds after start-up to discover the LUMA X by clicking the *Discover* button. Once it appears in the *Devices* window, the LUMA X will stay in bootloader mode and more options will be available to the user.
  - **Firmware update+factory reset:** select the proper firmware file by clicking on *Select …* and then start the update by clicking on *Write Flash*. Wait for the progress bar to reach 100%. After a firmware update a factory reset will also be carried out automatically.
    Note: please make sure that you select the proper firmware image, the last digits of the filename LX######### need to match the serial number engraved on the modem.
  - **Factory reset only:** clicking on *Clear Settings* will factory reset all LUMA X settings.
- Clicking on *start Application* will cause the attached LUMA X to exit the bootloader and restart. The LUMA X will restart in *config* mode as a firmware update will also cause a factory reset which sets the *Default state* after reboot to *config*.
- Closing the bootloader window and selecting Ethernet in *Interface* will then lead to the LUMA X showing up in *LumaConf*.

Note: a limited set of options is available in the *Bootloader* menu when one or multiple LUMA X is/are connected via Ethernet and in *config* mode. In this case the *Bootloader* window will list all LUMA X connected to the network with their last IP byte as an index. The only available actions in this mode are reading the unique serial number of a LUMA X by clicking on *Get Info* which then shows the serial number in *Processor ID* or to soft reset the attached modem(s) by clicking on *Reset.*
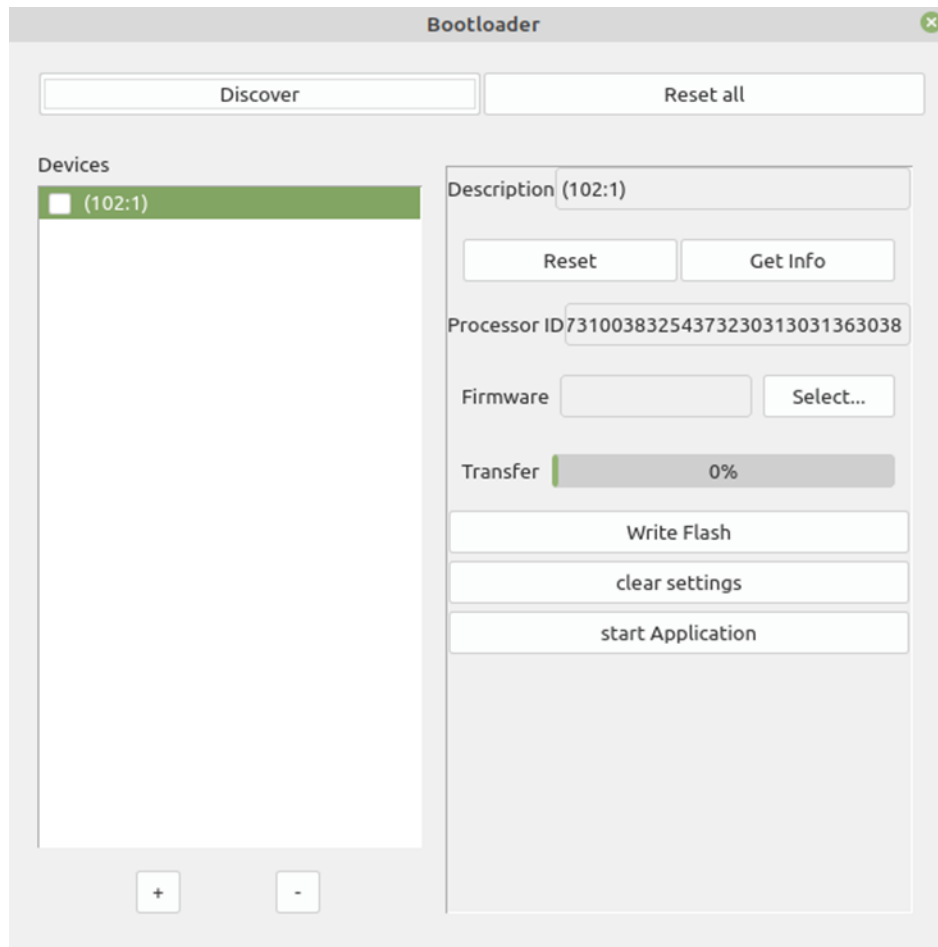
Figure 11: Bootloader section of LumaConf for upgrading the firmware or factory reset of LUMA X

Discover	Query and display all connected LUMA X.
Reset all	Reset all connected LUMA X
Get info	Retrieve the processor ID of the selected LUMA X
Firmware	(only in serial) selects the firmware cfi file for upgrade
Write Flash	(only in serial): Programs the firmware to the LUMA X. It is completed once the transfer progress bar reaches 100%. In case of transfer error, the bar will regress to 0%
Clear settings	(only in serial): Will factory-reset the parameters on the LUMA X, such as its IP address and the *config/active* mode into *config*.
Start application	(only in serial): Will start the LUMA X. Note: power cycling the LUMA X and closing the Firmware upgrade window will not put LUMA X into bootloader mode and it will start normally as well.

4.3 Communication test

When two LUMA X are connected via Ethernet and are in *config* mode, a communication test can be carried out using a simple communication test tool built into *LumaConf*.

Clicking on *Comm. test* with 2 LUMA X connected opens a window shown in Figure 12. Checking one of the *Send random data* options (low or high throughput) will make the corresponding modem send random data. The rate at which the data is received by the other modem will then be displayed on the opposite side. For example, Figure 12 shows a LUMA X with the last byte of its *Configuration IP address* being 102 sending random data with high throughput which is received by LUMA X with the last byte of its *Configuration IP address* being 101 at 10 Mbps. Both modems can send random data at the same time which allows you to test the half-duplex channel between both modems. Please note that operating the modem at a high-power level and a high data rate while not submerged in water will quickly increase the modem temperature which is also displayed in the communication test utility.
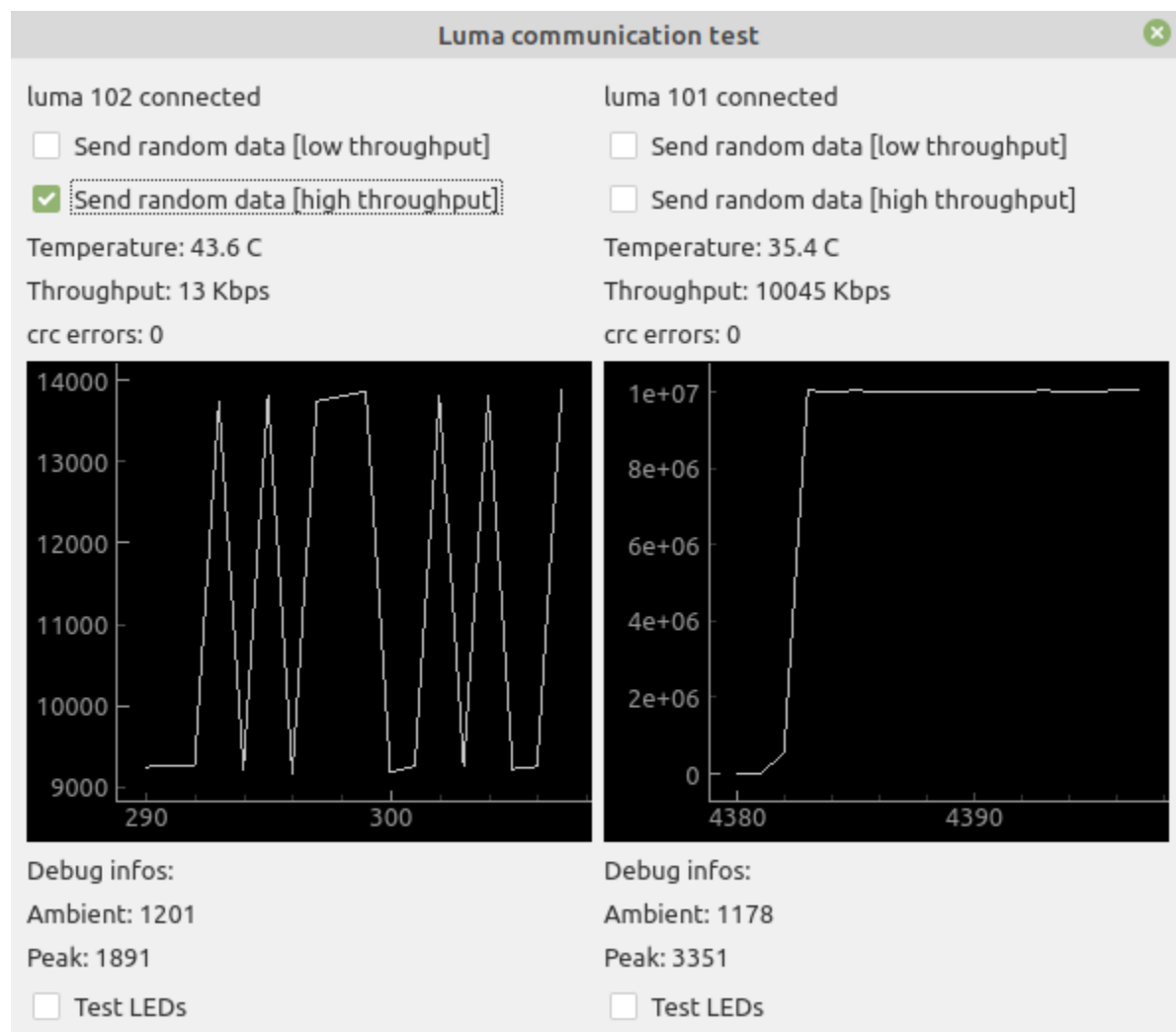

Figure 12 LumaConf's communication test utility with two modems connected and modem 102 transmitting random data at 10 Mbps, received by modem 101

4.4 Recording a log file

The *Debug report* button allows the user to run a self-check on the LUMA X and quantify the communication performance using two LUMA X.

Before you proceed with the test, two LUMA X should be connected to the same computer using Ethernet and they should be set into *config* mode.

When opening the debug report window, multiple parameters can be selected for the communication performance test. These are the throughput, encoding, the number of transmitting LEDs and the number of active receivers. Selecting a higher number of parameters will require a longer testing time. Varying the number of transmitting LEDs helps determining if the receiver of the LUMA X is saturating for a short communication distance. Varying the throughput is useful to see if communication is possible at the selected speeds for a given range/turbidity/ambient light level.

When starting the test, a prompt asking for a log file name will appear.

The two LUMA X will then proceed doing the test automatically which will be composed of a few internal tests that each LUMA X will do individually as well as the communication tests which will use both LUMA X. During the communication tests, the two LUMA X will vary their receiver gain and report their perceived throughput at various gain values for each selected parameter. For optimal testing, the LUMA X should be placed in an area with constant ambient light and not be moved during the test. When the progress bar reaches 100% the test is completed and a log file will be written in the chosen folder. This log file can be sent to Hydromea for analysis

4.5 Visualizing a log file

A log file generated in 4.4 can also be converted into a readable PDF file using the *Create graph* button in the main window of *LumaConf*. Selecting *Create graph* opens a dialog where you can select the log file to create a PDF graph of. The PDF graph will show the perceived throughput of the two LUMA X over a range of gain values. This can be useful to evaluate the autogain performance and, in case it has trouble to automatically find an optimal gain value, determine a value to which to set the gain manually in a controlled environment.

5 Maintenance

Please wash the modem with warm water (only) to remove any built-up which could negatively affect its operation. Apply a thin film of silicone grease to the rubber part of the connector pins to protect the connector and to facilitate mating. For maintenance details regarding the connector follow SubConn's instructions.

6 API

Hydromea provides an API, based on REST, with which key operating parameters of the LUMA X can be changed or status parameters retrieved while the modem is running. The following tables provide a complete list of these parameters, followed by examples showing how to retrieve and change them (in case they are writable). The examples are written in Python

6.1 API parameters

status.json (read only)

Parameter	Description
amplitude	Current amplitude value of the Luma, selected by the auto gain
ambient	Ambient value read by the Luma sensor
temperature	Current temperature of the Luma
throughput_received	Data received successfully by the modem in bits per seconds
crc_errors	Number of CRC errors that happened in the last second in the Luma. A high number could indicate some noise or that the Luma is at the edge of the maximal range
pkt_recv	Number of packet received in the last second
pkt_loss	Number of packet lost in the last second. Note that the Luma can only detect packet loss after it has received a packet out of sequence
gain	Current gain value of the receiver
nb_additional_rcv	Number of extra receivers active
status_electronics	Status of the electronics, 0 indicates a internal problem
uptime	Time since start of the Luma firmware in miliseconds

general_info.json (read only)

Parameter	Description
hw_version	Hardware version of the Luma (16 bit value 8'MAJ, 8'MIN)
fw_version	firmware version of the Luma (16 bit value 8'MAJ, 8'MIN)
sha_version	Specific firmware variant of the Luma
api_version	Version of the API. (16 bit value 8'MAJ, 8'MIN)
proc_id_0	Unique identifier of the Luma (MSB 32bit)
proc_id_1	Unique identifier of the Luma (32bit)
proc_id_2	Unique identifier of the Luma (32bit)
proc_id_3	Unique identifier of the Luma (LSB 32bit)

parameters.json (read/write)

Parameter	Valid input	Description
start_state	0:config, 1:active	The state which the LUMA X will boot into. This is factory set to *config*, but for normal operation this should be set to *active*
optical_speed	{1, 4, 6, 8, 10}	Speed (in Mbits/s) of the optical Link. Note that higher transmit speeds mean less range.
nb_led	[1-5]	Number of active LED banks.
encoding	0:no encoding, 1:encoding	Enabling Encoding, improves the link quality at the cost of throughput
led_tx_pwr_normal	[0-100]	LED transmit power normal (%)
led_tx_pwr_cooldown	[0-100]	LED transmit power in cooldown (when the LUMA gets to 50C)
auto_gain_control	0:off, 1:on	The LUMA X will adapt to the parasitic light level by changing the receiver gain.
manual_gain	[0-4000]	Manual gain value for the receiver when auto gain is off
nb_receivers	[1-4]	If auto gain is on, this will be selected automatically by the LUMA X during active operation, otherwise it is a settable parameter
agc_amplitude_adjust	[0-4000]	Advanced parameter, in case of troubles with the autogain control, allows the system to aim for lower or higher target gain value.
keep_alive_pkt	0:off, 1:on	Luma will send small packets periodically, 10 times per second in case of a successful link. Can improve the autogain

Ip_address.json (read/write)

Parameter	Valid input	Description
Ip_addr1	[0-255]	First byte of the ip address (0-255)
Ip_addr2	[0-255]	Second byte of the ip address (0-255)
Ip_addr3	[0-255]	Third byte of the ip address (0-255)
Ip_addr4	[0-255]	Fourth byte of the ip address (0-255)

control.json (write)

Parameter	Description
save_parameters	Saves all current parameters into ROM to be persistent between restart
save_ip_address	Saves the IP address that was entered in ip_address.json
read_parameters_from_rom	Gets all parameters from ROM and replace the recent changes
reset_parameters	Resets all parameters back to default
reboot	Restart the Luma, makes it go into bootloader

6.2 Usage examples

Example of using the API using python requests library

```
import requests
requests.post('http://192.168.102.101/api/parameters.json', json =
{'optical_speed':6, 'nb_led':3, 'auto_gain_control':1})
```

The above example is putting the luma 101 to **6Mhz**, **3 banks of LEDs** and with **autogain** active.
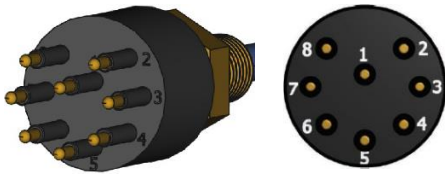
Reading the API is similar:

```
response = requests.get("http://192.168.102.101/api/status.json")
print(response.json())
```

and gives the following result:

```
{'amplitude': 3864, 'ambient': 3742, 'temperature': 40.3125,
'throughput_received': 0, 'crc_errors': 0, 'pkt_recv': 0, 'pkt_loss': 0,
'gain': 990, 'nb_additional_rcv': 0, 'status_electronics': 1}
```

7 Electrical and software Characteristics

(*)

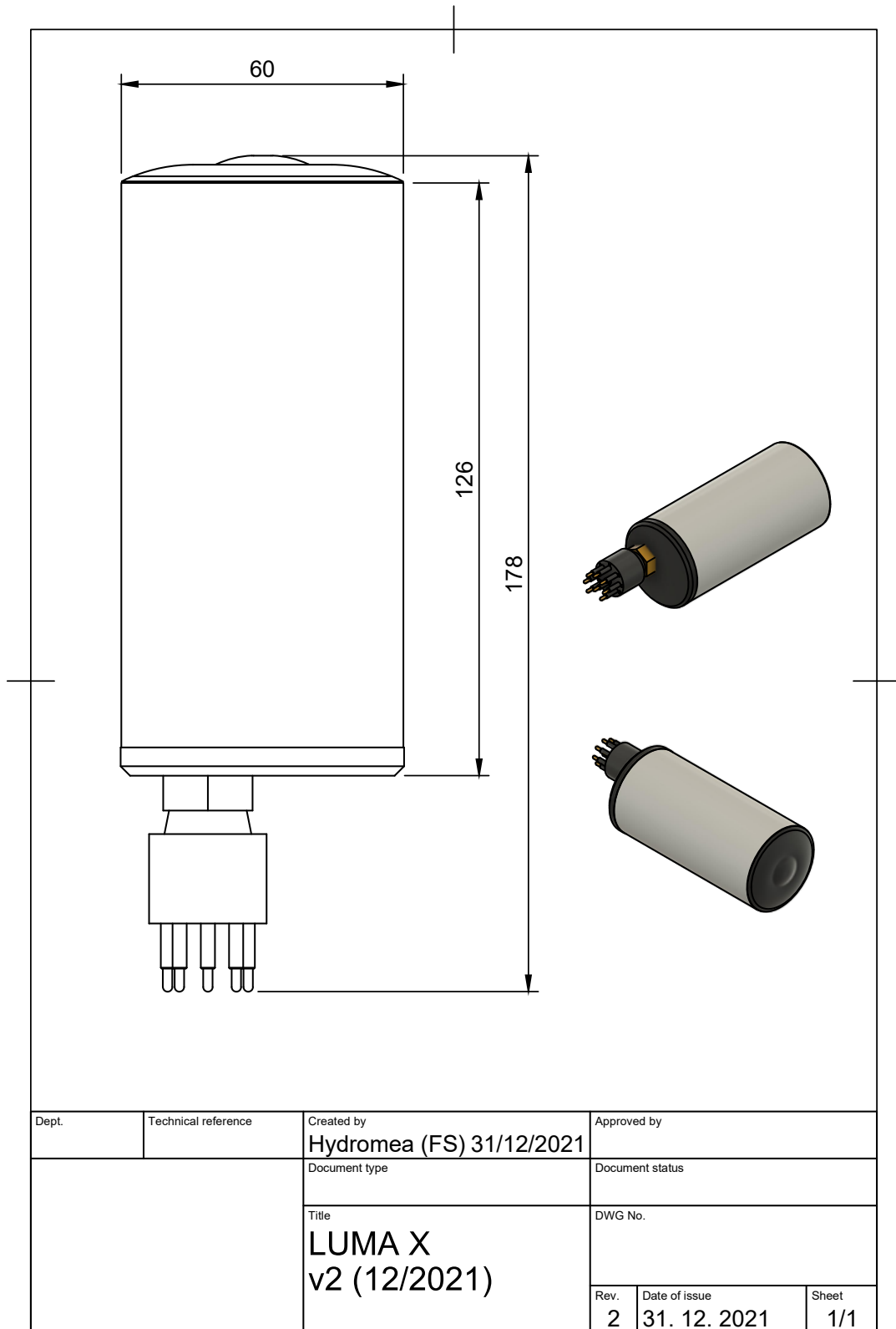|	
Supply voltage (Vs)	12 – 36 V
Power consumption	2 W (active mode, receiving) 2 – 17 W (active mode, transmitting)
Range	> 50m (164 ft) (depending on turbidity, ambient light) (LUMA X) > 30m (100 ft) (LUMA X-UV)
Data rate (optical)	1 Mbit/s – 10 Mbit/s
Data rate (Ethernet)	10/100 Mbit/s
Data rate (serial)	Software selectable: 9600, 19200, 38400, 57600, 115200, 204800, 227556, 256000, 512000
Transmission power	Software selectable: 1, 2, 3, 4 or 5 banks with 3 LEDs each
Interface	Software selectable: Ethernet RS232 RS485
Emission wavelength	480 nm (LUMA X) 395 nm (LUMA X-UV)
Beam pattern	120-degree cone (LUMA X) 60-degree cone (LUMA X-UV)
Connector pinout	1: Vcc 2: GND 3: RS232 RX / RS485 D+ 4: RS232 TX / RS485 D- 5: Ethernet RX- 6: Ethernet RX+ 7: Ethernet TX- 8: Ethernet TX+

(*) subject to change without notice

8 Mechanical Characteristics

(*)

Length x Diameter (Housing)	126 x 60 mm (5" x 2.4") total length with connector: 178 mm (7")
Weight in air	475 g (1 lb 7 oz)
Weight in water	125 g (10.5 oz)
Connector	SubConn Ethernet Circular 8 – DBH8M
Depth rating	6000 m (19000 ft)

(*) subject to change without notice

Dept.	Technical reference	Created by Hydromea (FS) 31/12/2021		Approved by		
		Document type		Document status		
		Title LUMA X v2 (12/2021)		DWG No.		
				Rev. 2	Date of issue 31. 12. 2021	Sheet 1/1

9 Errata

Version	Release date	Errata
1.0	6.5.2021	Original version
1.1	25.5.2021	- swapped Vcc and GND in connector pinout in table in chapter 5 - added chapters 4.4 and 4.5 - updated table in chapter 4.1 - added version number to front page
1.2	7.6.2021	- added Windows 10 IP address configuration - added firewall exception configuration
1.3	22.12.2021	- update to web interface configuration - updated dimensional drawing to reflect v2 dimensions (units sold from Dec. 2021 are 20mm longer)
1.3.1	11.1.2022	updated mechanical dimension in table 8
1.3.2	16.2.2022	- added note about *LumaConf* not being certified - added note about firmware file selection - deleted a broken reference - minor typo edits
1.4	31.3.2022	Added chapter 6
1.5	4.7.2022	Added extra info for range and wavelength
1.6	7.11.2022	Modified front page to reflect that the manual is for LUMA X and LUMA X-UV
1.7	16.1.2023	- Added differentiation between beam patterns of LUMA X and LUMA X-UV - Renamed document to reflect that it is for LUMA X as well as LUMA X-UV