

# iPronics SMARTLIGHT PRO

## v.1.0.0

### User Manual



1. User Manual.....	4
1.1 Introduction .....	4
1.2 General specifications.....	5
1.3 Guidelines before using the iPronics Smartlight PRO .....	5
1.3.0 Notes from the manufacturer .....	5
1.3.1 Disposal of electric and electronic devices.....	6
1.3.2 Warranty .....	6
1.3.3 Safety requirements .....	6
1.3.4 Electrical risk.....	7
1.3.5 Risk prevention.....	7
1.3.6 Main safety system .....	8
1.3.7 Mandatory PPE.....	8
1.3.8 Particular safety warnings .....	8
1.3.9 Handling of FC/APC connections .....	9
1.4 Operating with the iPronics Smartlight PRO .....	9
1.5 Installing the iPronics Smartlight PRO .....	10
1.6 Getting started with iPronics Software Development Kit .....	11
1.6.1 Software Requirements .....	11
1.6.2 Personal computer IP configuration for the first connection .....	11
1.6.3 Customizing the Network Configuration.....	14
1.6.4 Smartlight user and access credentials .....	16
1.6.5 Connecting to the iPronics Smartlight PRO SDK web user interface .....	16
1.6.6 SSH access to the iPronics Smartlight PRO .....	18
1.6.7 Troubleshooting during connection and software installation .....	18
1.7 Shutdown of the iPronics Smartlight PRO .....	20
1.8 Connection to additional optical systems .....	20
1.9 Maintenance and storage recommendations .....	20
1.9.1 Cleaning .....	20
1.9.2 Recommendations for a proper maintenance .....	20
1.9.3 Hardware maintenance .....	20
1.9.4 Optical connections and fibers maintenance .....	21
1.10 Regulatory Compliance.....	22
1.10.1 CE compliance.....	22
1.10.2 USA FCC compliance .....	23
1.10.3 Canada ISED compliance .....	25

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# 1. User Manual

## 1.1 Introduction



Read this manual and the safety recommendations included also in this manual before using or repairing the equipment. Although the information gathered in this manual represents the best criteria from the manufacturer, it does not assume any responsibility for its operation.

At iPronics we have made the power of photonics affordable and versatile. Our innovative programmable photonic processors allow high-speed radio frequency and light signals to be easily programmed onto the chip. This cost-effective solution can be adapted to a variety of applications, from data centers and communications to AI and sensing.

The iPronics Smartlight PRO is housed within a compact 2U enclosure. On the front panel, the layout is organized for user-friendly operation and efficient monitoring. Starting from the left and moving to the right, you'll find the ON-OFF switch paired with status indicator LEDs (1 in Fig. 1) for clear operational feedback. Adjacent to these are three MTP optical connectors, each capable of handling 24 channels (2 in Fig. 1). Directly below these optical connectors, you'll notice the optical output interface of the laser facilitated by an FC/APC optical connector (3 in Fig. 1). Continuing along the panel, there are two RF connectors physically linked to the RF photodetectors, and three additional RF connectors physically connected to the RF modulators (4 in Fig. 1). Positioned beneath the RF connectors, a ventilation grill is strategically located to ensure optimal cooling and performance (5 in Fig. 1).

The backpanel, from left to right, contains a Cat. 6 ethernet female connector (6 in Fig. 1), ventilation grills (7 in Fig. 1), and a power supply input connector (8 in Fig. 1).

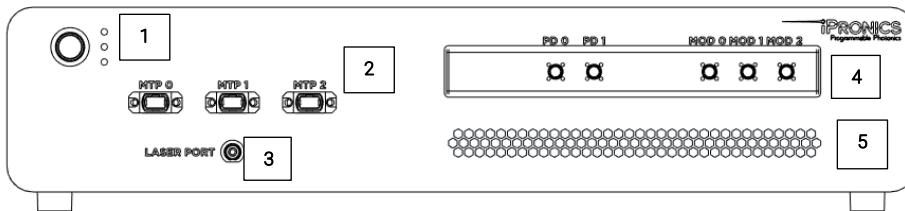
1. ON-OFF switch and status LEDs

2. Optical ports (3 MTP/MPO connectors, 72 optical ports. 24 ch. per connector)

3. Laser output (FC/APC)

4. RF Connectors

5. Ventilation grills



6. Ethernet communication port

7. Ventilation grills

8. Power supply input connector

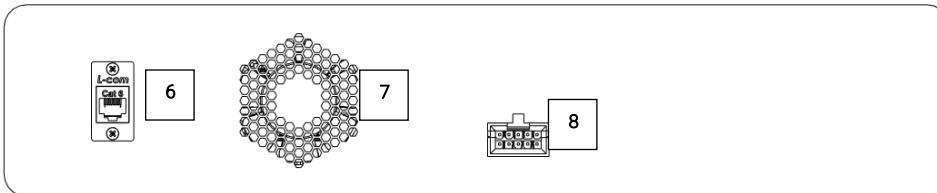


Fig. 1 Frontpanel and backpanel of the iPronics Smartlight PRO

## 1.2 General specifications

- **Brand Name:** iPronics Smartlight PRO
- **Model:** 72-2023
- **Hardware version:** 2.0
- **Software/firmware version:** 2.0.0
- **Radio services:** 2.4 GHz Wi-Fi; 5 GHz Wi-Fi
- **Frequency bands:** 2.4 GHz and 5.0 GHz IEEE 802.11b/g/n/ac wireless
- **Maximum transmission power per band:** 9.5 – 28.2 mW

## 1.3 Guidelines before using the iPronics Smartlight PRO

These guidelines are intended to the user. May you have any question, please contact the manufacturer. Do not allow unexperienced people to operate or maintain this equipment. Do not install or operate the equipment until all the guidelines have been read. If there exists any doubt while reading these instructions, contact the manufacturer for additional information. Make sure of understanding the safety measures before installing or operating this equipment.

...It is a responsibility for the user...

This equipment will work according to the description made in this manual, the labelling, and the given instructions.

- This equipment should be checked periodically.
- It should not be used under a wrong maintenance or operation. Broken, bent, missing, or deteriorated parts must be immediately replaced. If a repairment or replacement process is needed, the manufacturer recommends contacting the support team. This equipment or any of its parts must not be modified without previous written consent of the manufacturer.
- The user is the responsible for any malfunction resulting from the wrong operation, unproper maintenance, damages, reparments or invalid modifications made by any user, except for the manufacturer or any authorized distributor approved by the manufacturer.
- It is a recommendation for the user to carefully read this manual and following its recommendations.
- This document represents a necessary tool for the proper previous comprehension of the equipment that is to be operated.
- Its reading and understanding are mandatory before operating the equipment, correctly following the guidelines for operation, inspection, maintenance, and safety.
- The correct operation of the equipment will be determined by its proper start-up and employment.
- It is recommended to only employ replacement parts approved by the manufacturer. If any defect is detected in a part, please contact the manufacturer.
- Before operating the equipment, please verify that all its components are not damaged due to transportation. If so, the damaged parts must be replaced.
- It is necessary to verify the correct stability of the equipment on the surface to prevent any possible drop.
- Do not move or remove the warning and safety labels. In case they get damaged, it is mandatory to replace them.

*The manufacturer declines any responsibility in the damage or impairment caused due to not authorized modifications produced in the equipment.*



### 1.3.0 Notes from the manufacturer

The current user manual describes the recommended instructions from iPRONICS PROGRAMMABLE PHOTONICS S.L. with the goal of assuring the optimal performance of the equipment in safe conditions. Any improper form of manipulation, damages in the installation process and, in general, a wrong use not contemplated in this document, is out of the warranty coverage of the equipment.

### 1.3.1 Disposal of electric and electronic devices

How to dispose from electrical and electronic obsolete devices

	<ol style="list-style-type: none"> <li>1) If the crossed disposal bin symbol is present in the equipment, it means that the equipment follows the Directive 2021/19/UE.</li> <li>2) All electric and electronic devices must be disposed in a different way than the local disposal service, but through pick-up points designated by the Government or the local authorities.</li> <li>3) The proper pick-up and processing of non-working systems contributes to avoid potential risks to the environment and the public health.</li> <li>4) For more information about how to dispose obsolete devices, contact your city council, the waste disposal service, or the facilities where the equipment was acquired from.</li> </ol>
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### 1.3.2 Warranty

The manufacturer of the equipment guarantees to the original client the legal warranty period established in its destination country or purchase country. While in this period, the client or its authorized representatives will be responsible for the maintenance and for the replacement cost of any equipment when a problem caused for malfunctioning is found after an inspection at iPronics facilities

***WARNING: Scratches, shocks or falls and water or humidity affecting the equipment are not included in the warranty.***



The warranty does not include the following:

- Incidents caused by an unproper operation or mistreatment of the equipment for not following the instructions defined by the manufacturer.
- All equipment that was modified or whose maintenance was performed by unauthorized personnel not designated by the manufacturer.

It is required by the warranty service that the equipment is delivered to the manufacturer with the purchase documentation, a detailed description of the issue and the serial number of the unit.

This warranty does not include consumables. If the equipment uses unauthorized parts or its maintenance is performed by non-qualified personnel or authorized by the manufacturer, the warranty will not be valid. Furthermore, the employment of non-authorized materials or an unproper maintenance services could negatively affect the performance of the equipment and violate the electrical safety regulations. May you have any doubt regarding the equipment or the provider of the service, contact the manufacturer or the service representative.

### 1.3.3 Safety requirements

- The electrical network to which the equipment is connected must contain the necessary safety elements required by the regulations as, for example, overvoltage, circuit breaker, differential switch, etc.
- The equipment must not be operated by children
- The equipment must not be located in areas where children are likely to be present
- Do not open the equipment. If a repair is needed, deliver it to a qualified service technician.

- Make sure that the equipment is not near to any heat source. There is danger of fire.
- Do not drop or hit the equipment.
- Do not let liquids spill over any component of the equipment.
- The user must not modify the design or the settings of the equipment without consulting the manufacturer or an authorized representative.
- Verify that the electrical system is not exposed to water, dust or oil. It must be conveniently isolated.
- Verify the ground connection of the equipment.
- Electrical components may result damaged from corrosion, in this manner, this equipment should be operated far from corrosive environments.
- Whenever possible, please keep this equipment out of sun light. Room temperature and relative humidity must be regulated according to the kind of installation.

*The facilities where this equipment is installed must have the necessary protection.*



*The manufacturer will not be responsible of any of the modifications performed in the elements of the equipment when no authorization from the manufacturer was previously given.*



*Any modification, removal, or replacement of the settings of the equipment or to any of its security elements or structure, can cause different kinds of injuries.*



#### 1.3.4 Electrical risk



Contact with any electrical element and ground can cause severe damage. In this manner:

- Wires and conductive materials exposed or wrongly connected may expose the operator or other people to a fatal electrical shock.
- Use this unit if it's in safe conditions. Replace any broken or damaged wires or exposed conductive materials.
- Keep everything dry, the wires and the power supplies.

#### 1.3.5 Risk prevention

While operating the equipment, the following prevention risk measurements must be followed:

- CONNECTIONS ARE IN PERFECT SAFETY CONDITIONS
- ALWAYS READ THE MANUAL AND THE LABELLING

**ELECTRICAL RISK. DO NOT TOUCH OR MANIPULATE THE ELECTRICAL MATERIAL.**



### 1.3.6 Main safety system

All electrical equipment must be connected to ground, making mandatory to have this kind of connection inside the electrical network to which the equipment is connected. The electrical network where the equipment is connected must have this connection.

### 1.3.7 Mandatory PPE

It is shown here the mandatory PPE when performing any maintenance on this equipment:



It is mandatory the use of protective gloves while performing verification or maintenance duties

### 1.3.8 Particular safety warnings

#### Laser

The product contains a laser output properly indicated in the front panel (See section 1.2.). In addition, you might be using the system with light sources.



Risk of light radiation

- 1) If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- 2) Do not install or terminate fibers while a light source is active. Never look directly into a live fiber and ensure that your eyes are always protected.
- 3) The use of controls, adjustments and procedures, namely for operation and maintenance, other than those specified herein may result in hazardous radiation exposure or impair the protection provided by this unit.
- 4) Use only accessories designed for your unit and approved by iPronics. For a complete list of accessories available for your unit, refer to its technical specifications or contact iPronics.

#### Optical unit

The iPronics Smartlight PRO contains an optical unit that is highly sensitive to impacts and strong vibrations. Please, when moving the equipment verify that no wires are connected to the inputs/outputs of the different panels. Avoid any possible impacts to the outer frame when carrying or moving it. Also make sure that the equipment is correctly placed on a flat surface.

#### Laser and optical signals

This equipment incorporates an in-house laser that can be activated or deactivated by the user. When turning ON the equipment, all the peripherals including the laser, will remain in standby mode until the user decides to enable them. However, it is strongly recommended not to create direct eye contact with any optical input/output port located in the equipment at any time. Be sure to place the corresponding protective cap whenever an optical port is not being used.

#### Air flow and equipment ventilation

This equipment also includes a ventilation system based on air fans that will blow air to the front and back panel. Hot air can be exiting from the different ventilation grids included in the equipment. Verify that the equipment has enough space

to guarantee a proper air flow and that it is not close to any sensitive equipment/materials that could be damaged due to this.

## Operating environment

Do not install near any heat sources such as radiators, heat registers, stoves, or other equipment (including amplifiers) that produce heat. To reduce the risk of fire or electric shock, do not expose the unit to rain or moisture.

## Input and output connectors

When installing the equipment, several connections must be made, including electrical, optical and digital. Before their connection, verify that the connectors located in the different panels of the equipment are in good condition and clean of any dust or liquids. This also includes the connectors located in the different cables.

## ON/OFF switch

When connecting the power cord to the power supply input connector (8 in Fig. 1), verify that the external power supply switch is in OFF position for not causing an unintended turn ON of the equipment.

## Wiring

Please use caution when connecting the unit to the socket for power supply. Protect the power cord from being walked on or pinched particularly at the plugs, convenience receptacles, and the point where they exit from the unit. Connect the ground completely, as electric shock may occur if the ground is not connected correctly.

## Status LEDs

### 1.3.9 Handling of FC/APC connections

When a connection between an FC-APC fiber pigtail with an FC connector is needed, consider following these steps:

1. Inspect the FC fiber pigtail and FC connector for any visible damage. Ensure both are clean and free from dirt or dust.
2. Remove the protective caps from the FC pigtail and FC connector, if present.
3. Hold the FC fiber pigtail end facing the FC/APC port connector.
4. Align the keying mechanism (a small raised ridge or notch) on the FC connector with the corresponding slot on the fiber pigtail. This ensures proper alignment and prevents misconnection.
5. Gently push the fiber end into the FC connector until it is fully seated. Be careful not to exert excessive force or bend the fiber excessively.
6. Once the fiber is inserted, give it a gentle tug to ensure it is securely held in place by the connector.
7. Perform a visual inspection to ensure the fiber is properly seated and there are no visible gaps or misalignment.
8. Secure the connection by turning FC pigtail until it tightens.
9. Once the connection is made, you can use a fiber optic power meter or other appropriate equipment to verify the signal strength.

Remember to handle the fiber and connectors carefully and maintain cleanliness throughout the process. It's crucial to avoid touching the fiber ends and to keep them protected from dust and contaminants to ensure a reliable connection.

## 1.4 Operating with the iPronics Smartlight PRO

The iPronics Smartlight PRO is a plug and play general-purpose photonic processor capable of programming high-speed light signals on-chip with unprecedented flexibility. This is accomplished by the fine tuning of the Programmable Unit Cells (PUC) contained inside the chip through the Software Design Kit. The control unit executes these actions and aggregates the in-box optical laser, the thermal management, the driving unit and the monitoring units.

With the equipment, the following additional material will be included:

- 3x Fan-out modules. MTP to 24 FC/APC fibers.
- 1x Manual polarization controller with FC/APC fibers
- 1x FC/APC connector
- External power supply and power cable (destination dependent)
- Ethernet Cat6 cable

The next section illustrates the installation and how to get started with the Software Design Kit.

### 1.5 Installing the iPronics Smartlight PRO

The iPronics Smartlight PRO is a table top equipment.

Once we make sure that all the security measurements are verified, we can proceed with the installation of the equipment.

Please follow the listed steps:

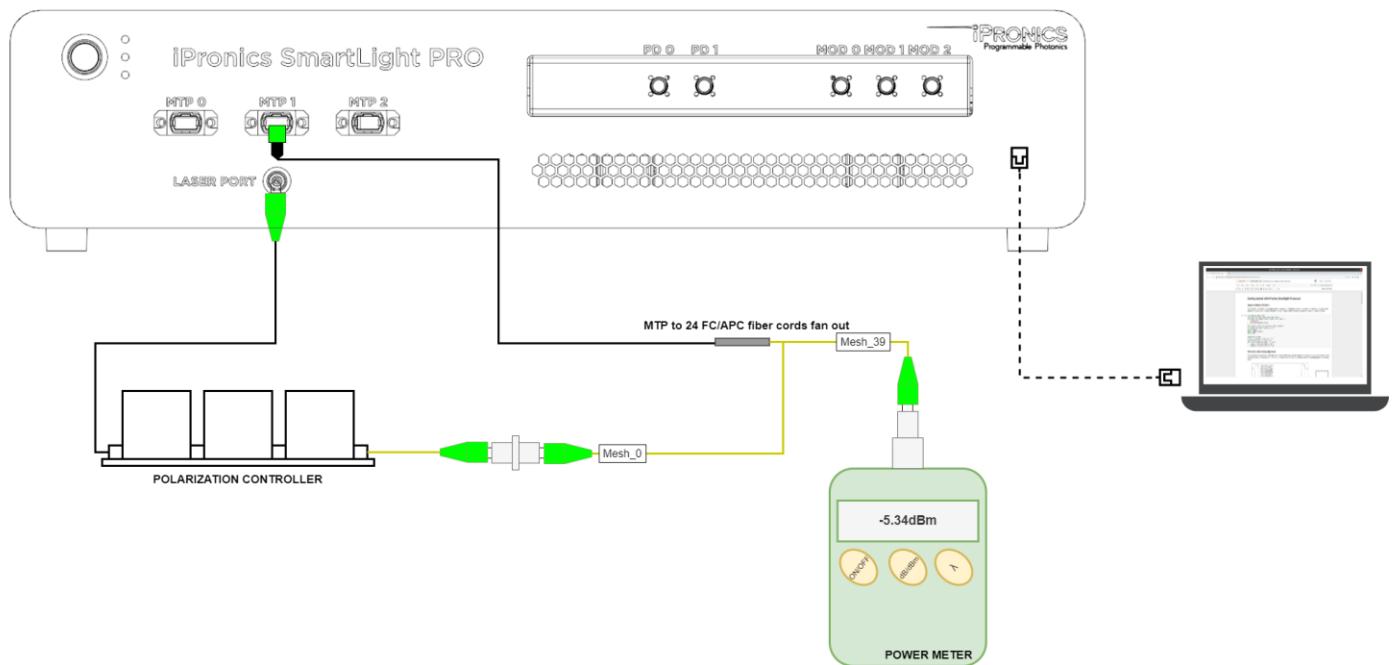


Fig. 2. Connection example of the iPronics Smartlight PRO (See **Annex 2** for absolute reference mapping)

1. Extract the system from the box and place it on a convenient table.
2. Remove the plastic cap in the front panel for the MTP 1 port and connect the MTP to 24 FC-APC fiber cords fan out to MTP 1 from the front panel. Keep the other protective caps ON whenever they are not used.
3. Connect the Cat.6 ethernet cord to the Cat.6 ethernet female connector from the back panel of the device and connect the other end to the Ethernet port of your personal computer.
4. Perform the connections as detailed in Fig. 2:
  - a. Connect laser port FC/APC from the front panel to polarization controller input. Likewise, connect polarization controller output to FC/APC connector (provided with the equipment).
  - b. Connect the MPT1 fiber cord corresponding to Mesh\_39 to power meter and fiber cord corresponding to Mesh\_0 (see Channel mapping distribution Annex) to the FC/APC connector.
5. Connect the power cord of the external power supply to the power supply input connector located in the back panel, ensure that the switch button of the external power supply is in the OFF position, and connect the power cord to the power supply network.
6. Put the switch button of the external power supply in the ON position.
7. Use the switch in the front panel to turn ON the equipment. The light inside the switch should turn red.
8. Wait 30 seconds for the system to get started.
9. Follow the next section (getting started with iPronics Software Development Kit) to initiate the iPronics Smartlight PRO functionalities.

## 1.6 Getting started with iPronics Software Development Kit

### 1.6.1 Software Requirements

To run the iPronics Smarlight Processor SDK, a web browser is required. The latest version of the following browsers has been tested compatible:

- Chrome
- Firefox
- Safari

The browser can be used from the following operating systems:

- Windows® 7 (32-bit, 64-bit)
- Windows® 10 (32-bit, 64-bit)
- Windows® 11 (32-bit, 64-bit)
- macOS Catalina, Big Sur, Monterey and newer versions
- Linux with GUI capable of running listed browsers (32-bit, 64-bit)

### 1.6.2 Personal computer IP configuration for the first connection

To connect to the iPronics Smartlight PRO for the first time the computer ethernet used must be configured with IP **10.42.0.1** and subnet mask **255.255.0.0**. Note that once the first connection is established, it will be possible to customize the network configuration of the iPronics Smartlight PRO to adapt it to your network requirements (see Customizing the Network Configuration section below).

The steps required for the most common operating systems are described below.

#### Windows:

1. Access to Control Panel\Network and Internet\Network and sharing center\Ethernet device\Properties\IPv4 properties\Properties
2. Select "Use the following IP address"
3. Fill in IP address with: **10.42.0.1**
4. Fill in Subnet mask with: **255.255.0.0**
5. Select "Use the following DNS server addresses"
6. Leave empty "Preferred DNS server" and "Alternate DNS server"
7. Click on the "Ok" button.

\* Ethernet device must match the ethernet interface used for connecting to the iPronics Smartlight PRO

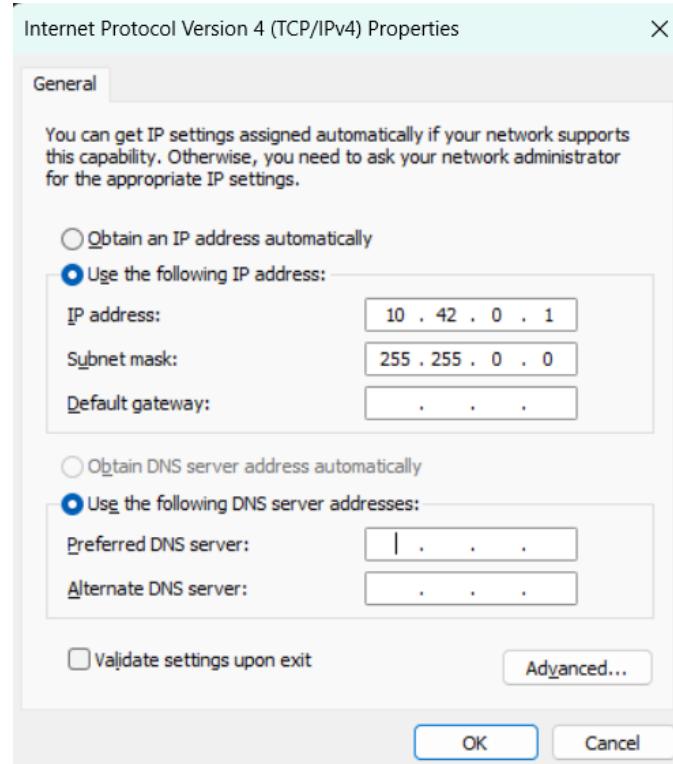


Fig. 3. IP configuration for first connection from Microsoft Windows

MacOS:

1. Choose Apple menu > System Preferences, then click Network
2. Select Ethernet from the network connection list.
3. Click the dropdown for Configure IPv4, and select "Manually".
4. Fill in IP address with: **10.42.0.1**
5. Fill in Subnet mask with: **255.255.0.0**
6. Click on the "Ok" button

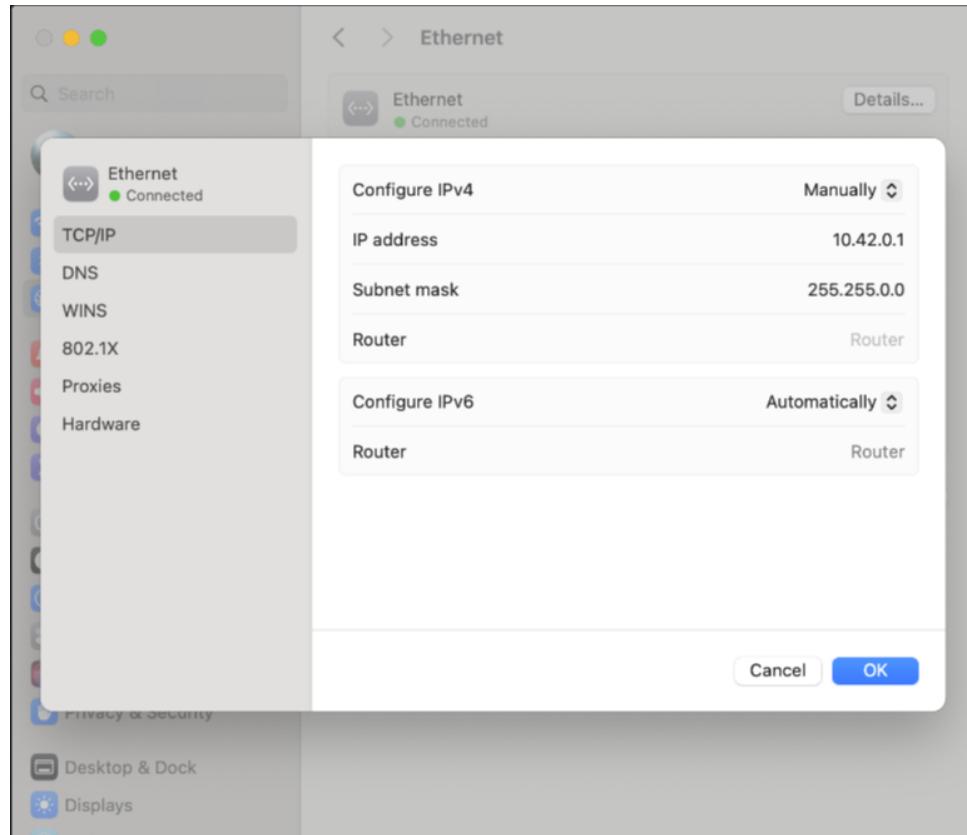


Fig. 4. IP configuration for first connection from MacOS

### Linux (Ubuntu / Gnome)

1. Access "Settings"
2. Click on "Network"
3. Click on Wired settings button
4. In "IPv4 method" select "Manual"
5. Fill in Address with: **10.42.0.1**
6. Fill in Netmask with: **255.255.0.0**
7. Click on the "Apply" button.

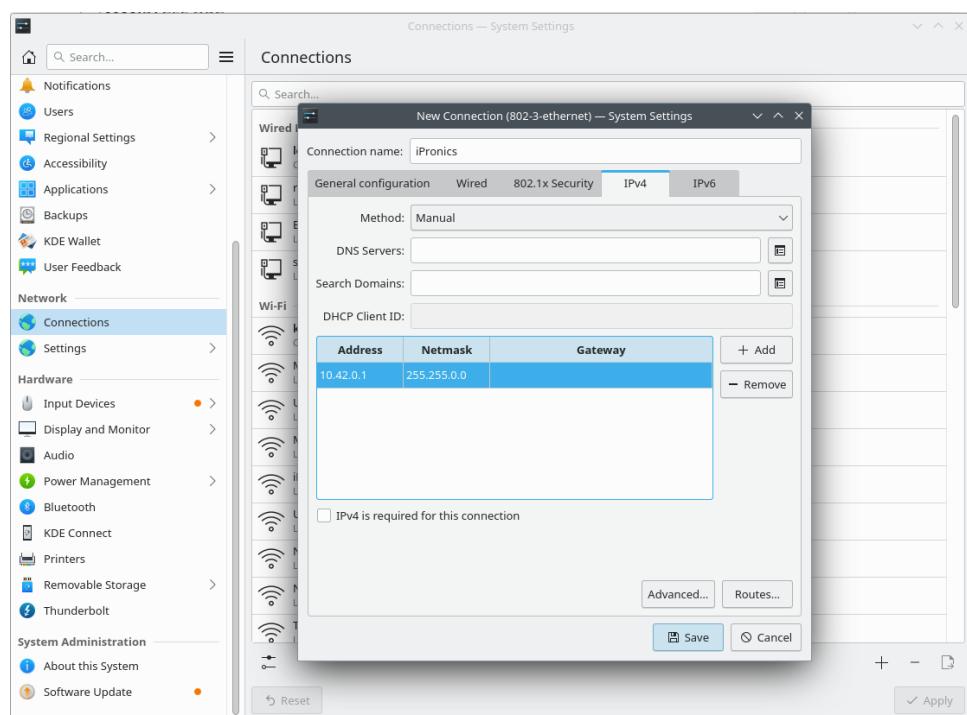


Fig. 5. IP configuration for first connection from Linux

### 1.6.3 Customizing the Network Configuration

The default IP configuration set up in the previous step enables communication with the iPronics Smartlight PRO *only from the computer directly attached to it*. If this default network configuration suits your needs, you can skip this section and jump directly to “Connecting to the iPronics Smartlight Processor SDK”. If you prefer to integrate the iPronics Smartlight PRO into your own network (e.g., to be able to access it from other computers), continue reading here.

The iPronics Smartlight PRO Logic Unit runs a GNU/Linux system with 2 network devices: **eth0** (for the ethernet port) and **wlan0** (for the wifi). Their configuration is managed by the NetworkManager suite. The configuration is done by adding / removing / editing / activating / deactivating “connections”. Each “connection” defines the configuration of a network device. You may have more than one “connection” for a device, but only one can be “active” (i.e. “applied”) on a device at a time (think of the inactive “connections” as ready-to use alternative configurations that can be applied at any moment).

The actual management of the connections can be done either with a command line utility called **nmcli** or with a less powerful but more user-friendly text user interface called **nmtui**. Both utilities should be invoked *from a Terminal* (also known as a Command Line Console) *running in the Logic Unit*. You can open a Terminal in the Logic Unit by any of the following two ways:

- a. Opening a Jupyter Terminal from the iPronics Smartlight PRO web interface (refer to section Connecting to the iPronics Smartlight PRO SDK web user interface below)
- b. Via SSH (refer to section SSH access to the iPronics Smartlight PRO below)

If you want to configure the wifi networking (wlan0 device), we recommend using the **nmtui** utility: just run the **nmtui** command in the iPronics Smartlight PRO Logic Unit Terminal.

For configuring the ethernet device, the iPronics Smartlight PRO Logic Unit is preconfigured with an active connection called “**eth0-custom**” that configures a static IP address for **eth0** in the range 10.42.X.Y (check the specific IP in the sticker attached to your iPronics Smartlight PRO).

The following table Provides a set of recommended commands for inspecting the **eth0-custom** connection and performing some common configuration changes on it. **Other configuration changes are possible using the nmcli and nmtui utilities but should only be attempted by network experts or under direct guidance of iPronics staff.**

## READ THIS BEFORE EFFECTING ANY CHANGE IN THE NETWORK CONFIGURATION:

- The iPronics Smartlight PRO can only be accessed via its network interfaces. Therefore, **if you apply a permanent configuration that cuts your connection and does not allow you to log back in to revert it, you would be locked out of the iPronics Smartlight PRO and you may need to return it to iPRONICS for servicing.**
- Always triple-check any configuration that you entered before applying it.
- We have thoroughly tested the proposed commands, but your local network architecture and security policies may be different from ours and may impose specific constraints. **Please read the nmcli manual and make sure that you fully understand each command before executing it, since there is risk of getting locked out of the unit permanently if you permanently apply the wrong configuration.** In case of doubt, request the help from an IT expert before changing any network parameter.
- It is strongly recommended to configure the wifi connection and test it (**including confirming that you can connect to the unit without cable after a reboot**) prior to customizing the ethernet connection. In this way you will have an alternative way to log in to the iPronics Smartlight PRO in case of issues during the customization. Once your ethernet customization is confirmed to work, you may disable the wifi again.

## Show summary of configuration for all managed devices

nmcli

## List all existing connections

nmcli conn

## Show full info on the eth0-custom connection

nmcli connection show eth0-custom

Add an IP address (including network mask) to the connection.<sup>(1)</sup>

nmcli connection mod eth0-custom +ipv4.addresses 192.168.2.2/24

Note that previously configured IPv4 addresses are **not** overwritten by this command since we just are adding a new one (it is possible to configure more than one IP address on the same interface).

**This is the recommended approach for configuring a new static IP to avoid getting locked out of the iPronics Smartlight PRO:** we can test the new configuration to confirm that we can access the Logic Unit with the new IP. If it fails, we still have the old IP ready.

Remove an IP address from a connection.<sup>(1)</sup>

nmcli connection mod eth0-custom -ipv4.addresses 192.168.2.2/24

Only remove the IP address if you really need it (e.g. to avoid a IP address conflict with another device) and you have other addresses or a working DHCP configuration. **Otherwise you would end up with a non-working configuration and probably locked out of the iPronics Smartlight PRO**

Set the gateway manually (to allow the unit connecting to other networks or the Internet)<sup>(1)</sup>

nmcli connection mod eth0-custom ipv4.gateway 192.168.2.1

**Note that if the gateway was previously configured, this command would overwrite it.**

Activate DHCP on the eth0-custom connection<sup>(1)</sup>

nmcli connection mod eth0-custom ipv4.method auto

In some situations, when no DHCP server exists in your network, enabling this may cause long initialization times and unstable connections **with risk of getting locked out of the iPronics Smartlight PRO.** So only enable DHCP if the iPronics Smartlight PRO is connected to a network with DHCP.

Return to static-only configuration (deactivate DHCP)<sup>(1)</sup>

nmcli connection mod eth0-custom ipv4.method manual

Do not switch from **auto** to **manual** method unless you have at least one working static address configured in the **ipv4.addresses** setting, or you would end up with a non-working configuration and probably **locked out of the iPronics Smartlight PRO.**

## NOTES:

1. the **nmcli connection mod** commands only modify the connection, but they do not "apply" the changes immediately. To apply them, either reboot or run **nmcli conn up eth0-custom**

#### 1.6.4 Smartlight user and access credentials

In order to connect to some of the various software services of the iPronics Smartlight PRO, a user and a password may be required

- User name: **smartlight**
- Password: *[Printed on a sticker in the backpanel of your iPronics Smartlight PRO and on the right of Fig. 6]*

Each iPronics Smartlight PRO is configured with a **unique default password** which consists of a 32 character-long sequence.

**Tip for advanced users:** should you wish to change the default password, you can do it by logging into the web UI (as explained at the beginning of this section), then opening there a new Terminal and issuing the “**passwd**” command.

**IMPORTANT:** make sure to store the new password in a safe place. **In case of lockdown**, iPronics would only be able to reset the user password if the unit is connected to the internet with its port 22 accessible on a public IP.

#### 1.6.5 Connecting to the iPronics Smartlight PRO SDK web user interface

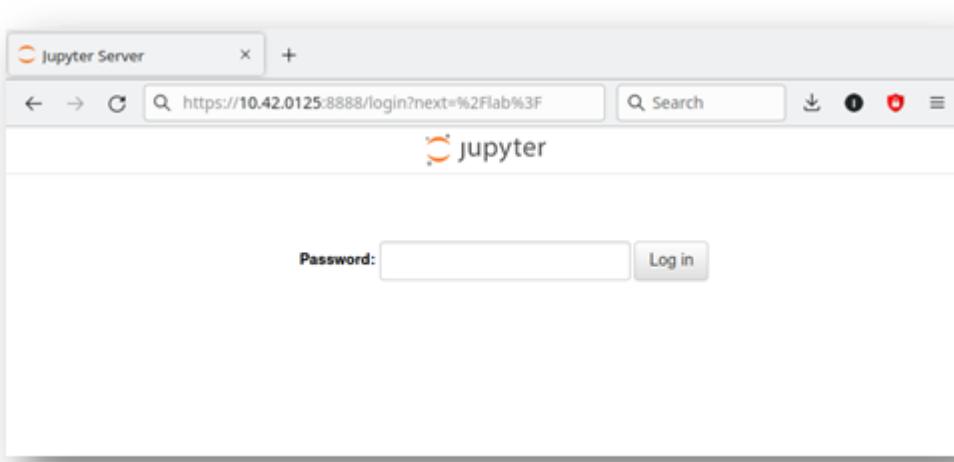
iPronics Smartlight PRO includes a proprietary SDK for users to exploit the maximum capacity of reprogrammable photonics. This SDK can be accessed through a web interface that enables control and monitoring of all the peripherals included in the equipment.

At this point, you should either be connected with an ethernet cable directly from your computer to the iPronics Smartlight PRO and using its default IP 10.42.X.Y (check the specific IP in the sticker attached to your iPronics Smartlight PRO) or you customized the network configuration and can access the iPronics Smartlight PRO via your custom URL. In the following examples, we will assume that the URL is <https://10.42.0.125> Just replace 10.42.0.125 with your own IP (or hostname if you configured name resolution).

To access the SDK, point a browser to the iPronics Smartlight PRO URL using port 8888:

<https://10.42.0.125:8888> (or your equivalent custom URL)

The following login dialog will show up.



>Password  
alphanumeric sticker

Password QR sticker

Fig. 6. Log in window to JupyterLab we UI for the iPronics Smartlight PRO.

Type the password and click on the “Log in” button to access the JupyterLab web user interface.

**Note:** If an error is shown when trying to access the URL or while logging in, please follow the recommendations in the Troubleshooting during connection and software installation section.

Once inside the JupyterLab web user interface, you have full access to the iPronics Smartlight PRO SDK: you can create python scripts, execute existing code, browse documentation, open a system terminal, etc.

As a first step, locate the “*Setup\_Installation*” notebook and double-click on it to open it:

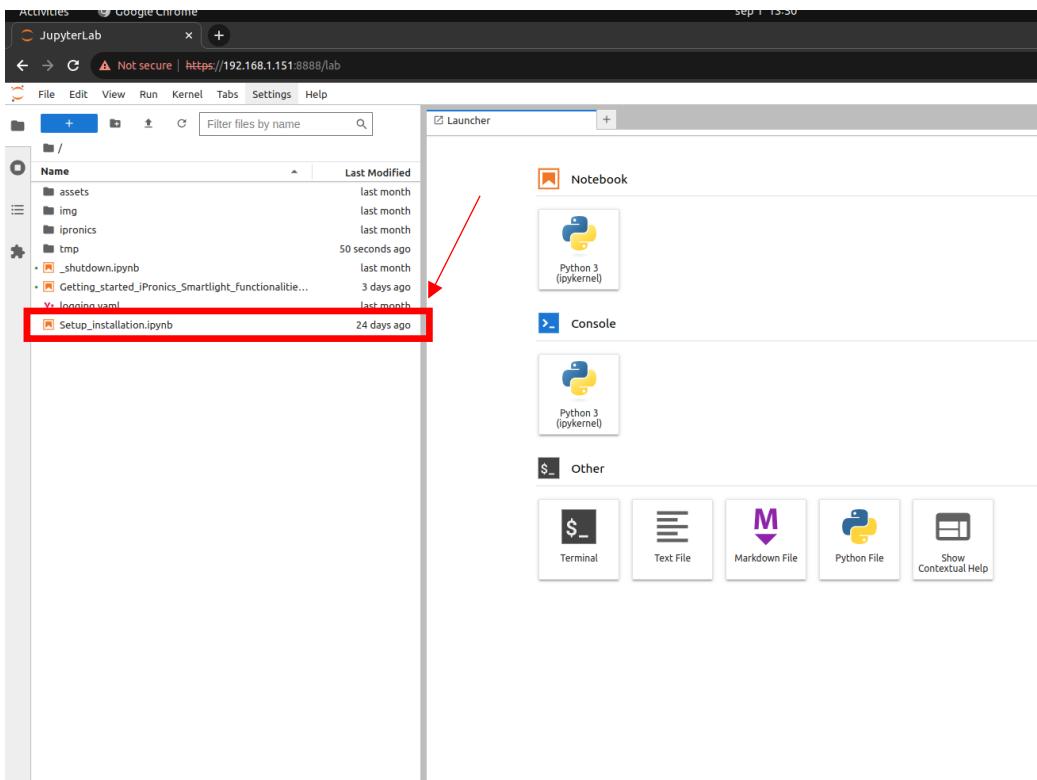


Fig. 7. Start window on JupyterLab.

The provided notebooks, when opened, display documentation and code snippets that can be interactively edited and executed within the notebook itself. This makes them ideal for demonstrating the capabilities of the iPronics Smartlight tool.

Once you have finished with all the steps of the Setup Installation notebook, click on "Getting started.ipynb" notebook to follow a guide for first steps with the equipment.

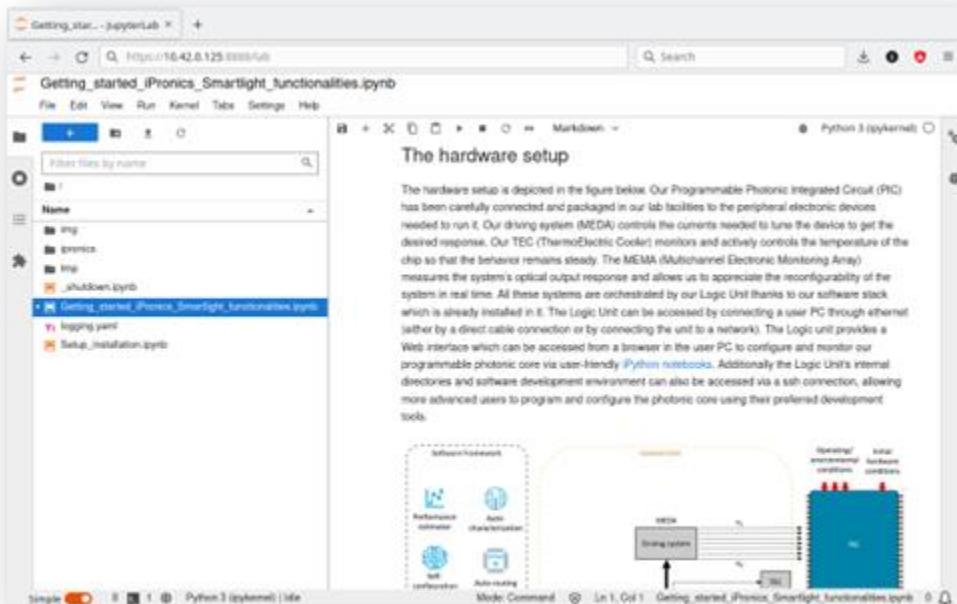


Fig. 8. Getting started notebook in JupyterLab.

The notebook can be navigated with the scroll bar and the **UP** and **DOWN** arrow keys, and the cells can be run by pressing **CTRL+ENTER** or clicking on the “play” button. After running a sequence, this symbol **[\*]** will let you know that the code snippet is being executed turning into a **[number]** when it finishes.

*Important:* The execution of the cells must be done sequentially from top to bottom.

### 1.6.6 SSH access to the iPronics Smartlight PRO

Apart from the JupyterLab-based web user interface, the iPronics Smartlight PRO can also be accessed via the secure shell protocol (SSH).

The credentials are the same as for the web UI (see the Smartlight user and access credentials section) and the SSH server listens on the default port (22) of the iPronics Smartlight PRO address (See the Personal computer IP configuration for the first connection and the Customizing the Network Configuration sections above).

This enables several advanced usages of the iPronics Smartlight PRO, such as:

- Opening a terminal to execute system commands on the iPronics Smartlight PRO Logic Unit (e.g., using the *PutTY* program on windows, or the `ssh` command on GNU/Linux and MacOS)
- Transferring files between a local computer and the iPronics Smartlight PRO (e.g., using graphical user interfaces such as *WinSCP* on windows, or *FileZilla* on any OS, or directly via the `scp` and `sftp` commands on GNU/Linux and MacOS)
- Using a local IDE to develop, execute and debug code remotely on the iPronics Smartlight PRO as, for example:
  - *VSCodium* with the *open-remote-ssh* extension (full Free/Open-Source license)
  - *VSCode* with the *remote-ssh* (“*gratis*” proprietary license)
  - *PyCharm-pro* with *JetBrains Gateway* (paid proprietary license)

### 1.6.7 Troubleshooting during connection and software installation

#### Problem: Web access not available

When accessing the web interface, the error “This site can’t be reached. 10.42.0.125 took too long to respond.” appears.

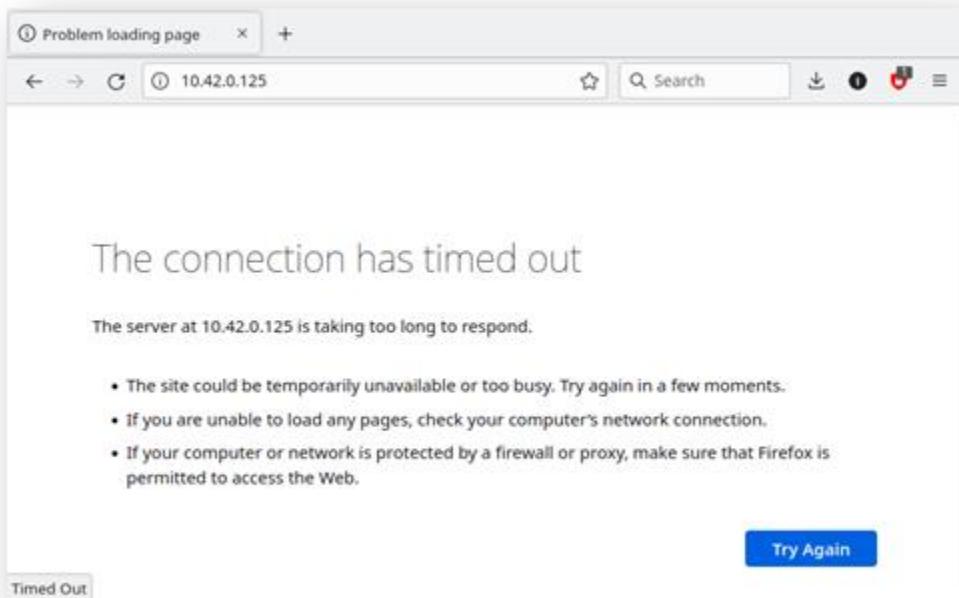


Fig. 9. Window error: This site can't be reached. 10.42.0.125 took too long to respond.

Solution:

1. Check that the URL is correct. Note that you must use "http**s**://" and the "**:8888**" port.
2. Check that the ethernet cable is plugged in.
3. Check that the system firewall or similar software is not blocking outgoing connections from the ethernet.
4. Allow time for the device to complete the boot operation after being switched on (up to 30 seconds).
5. Review the host device ethernet network configuration. See the Personal computer IP configuration for the first connection section.

**Problem: "Invalid credentials"**

When trying to log into web user interface I get the following error: *Invalid username or password*

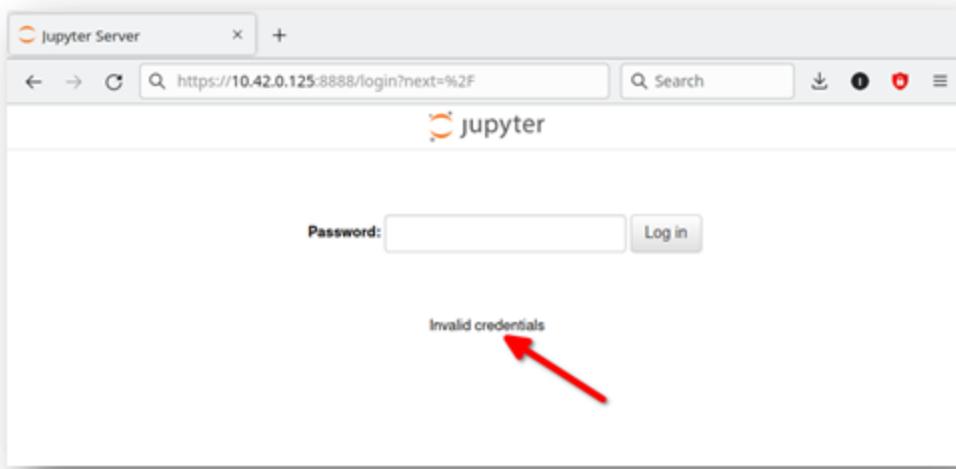


Fig. 10. Invalid credentials error.

Solution:

1. Check that you are using the correct password (see Smartlight user and access credentials section above).
2. Check that the "Caps lock" is not enabled
3. If the problem persists, please contact with [support@ipronics.com](mailto:support@ipronics.com)

**Problem: Errors shown when running the notebook.**

When executing the code provided in the example notebooks errors are displayed in red messages.

Solution:

1. Check that you are running the notebook cells sequentially from top to bottom.
2. If you have edited the cell, please review the last part of the error message. It will show the origin of the problem.
3. If you have not edited any cell, please go to the last part of the notebook and execute the following snippet: `smart.disconnect()`
4. Close the notebook
5. Open the notebook and start running it from the top until the cell that was showing the error.
6. Check that the cell works correctly.
7. If the problem persists, please contact [support@ipronics.com](mailto:support@ipronics.com) and attach a screenshot of the problem.

## 1.7 Shutdown of the iPronics Smartlight PRO



To shut down the iPronics Smartlight PRO, please, refer to the Notebook shutdown.ipynb included with the equipment to turn off the unit correctly.

## 1.8 Connection to additional optical systems

The iPronics Smartlight PRO can be connected to any optical passive device. In addition, optical actives (lasers, and amplifiers) can also be connected if, and only if, the user warrants that optical power beyond 17 dBm is not reached at any point on the circuit (13 dBm is the recommended value). This is especially serious for the on-chip optical couplers.

## 1.9 Maintenance and storage recommendations

	Repair, cleaning or any intervention on the equipment must be done when THE EQUIPMENT IS COMPLETELY DISCONNECTED FROM ITS POWER SUPPLY
--	---

Defective or not well-preserved equipment may cause damage. In this manner:

- Do not execute any electrical related task unless you are qualified to do this work.
- Disconnect the power supply from the electrical network.
- Keep wiring, ground wiring, connections in safe conditions. Do not operate with any defective component.
- Keep the equipment far from heat sources such as ovens, also humid places like water puddles, oil or grease, corrosive environments, and rough weather conditions.
- Use the equipment only for the intention it was designed and fabricated for.

### 1.9.1 Cleaning

For cleaning duties, it is not necessary to use special cleaning tools. Do not use aggressive or toxic cleaning products. The user must follow the following recommendations when performing any cleaning task:

- It is recommended to clean the equipment periodically, attending to its location to avoid dust and, therefore, defective performance.
- It is not recommended the use of any chemical equipment.
- Once a cleaning or maintenance task is performed, verify that all components are in good condition.

### 1.9.2 Recommendations for a proper maintenance

The inspection of the equipment will regard the following aspects:

- Possible deformations, mainly in the areas where components are connected or in contact.
- Safe condition of the wiring and connections.
- Status of the security elements included.

Any anomaly must be reviewed and amended.

Periodically, check the fixation elements. Replace any indicative label that may be deteriorated or misplaced.

### 1.9.3 Hardware maintenance

To help ensure long, trouble-free operation the system should be operated and maintained following these recommendations:

- Keep the unit free from dust.
- Clean the unit casing and front panel with a cloth slightly dampened with water.
- Store the unit at room temperature in a clean and dry area. Keep the unit out of direct sunlight.
- Avoid high humidity or significant temperature fluctuations.
- Avoid unnecessary shocks and vibrations.
- If any liquids are spilled on or into the unit, turn off the power immediately at the front panel switch, disconnect from any external power source, and let the unit dry completely.

#### 1.9.4 Optical connections and fibers maintenance

- Optical connections and fibers maintenance:
  - Regular cleaning of detectors will help maintain transmission accuracy and loss reduction.
  - Following the safety guidelines, always inspect fiber-optic connectors before using them and clean them if necessary. To do so, employ specialized fibre-optic cleaning pens for single fiber-connectors and for multi-port fiber connectors.
  - If the connector is dusty, use compressed air to clean it.
  - For the single-mode fibers, please employ single-use cleaning tips with optical-grade liquid cleaner. Applying light pressure, gently rotate the cleaning tip on the fiber head. Repeat again with a dry-cleaning tip or blow dry with compressed air. Discard the cleaning tips after one use.



The use of controls, adjustments and procedures, namely for operation and maintenance, other than those specified herein may result in hazardous radiation exposure or impair the protection provided by this unit.

## 1.10 Regulatory Compliance

### 1.10.1 CE compliance



The undersigned, on behalf of the manufacturer:



**IPRONICS PROGRAMMABLE PHOTONICS S.L.**

Avenida Blasco Ibáñez, 25, Entresuelo  
CP 46010, Valencia, España

☎ +34 960 195 435

✉ info@ipronics.com

<https://ipronics.com/>

Declares that the design and construction of the PRODUCT/ **PRODUCT: iPronics SMARTLIGHT PROCESSOR**

Declara que el diseño y fabricación del PRODUCTO/ **MODEL: 78-2022**

Déclare que le dessin et construction du produit:

**This declaration of conformity is issued the sole responsibility of the manufacturer.**

Complies with the relevant Union harmonisation legislation / **2014/30/UE - Electromagnetic**

Cumple con la legislación de armonización de la Unión **Compatibility**

pertinente/ **2011/65/UE - ROHS amended by**

Conforme à la législation d'harmonisation de l'Union **2015/863/UE**  
applicable:

References to the relevant harmonised standards used or **EN IEC 62368-1:2020**

references to the other technical specifications / Referencias a **EN 55032:2015+A11:2020**

las normas armonizadas pertinentes utilizadas o referencias a **EN 55035:2017+A11:2020**

otras especificaciones técnicas / Références aux normes **EN IEC 61000-3-2**

harmonisées pertinentes utilisées ou références aux autres **EN IEC 61000-3-2**

spécifications techniques **EN IEC 63000:2018**

Date of issue of this declaration of conformity:

**December 2022**

**SIGNATURE (Name and position of the signatory)**

Eladio Crego Gil  
CEO

### 1.10.2 USA FCC compliance

#### FCC REGULATORY INFORMATION



##### FCC ID: 2BCTZ72-2023

"Note 1: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense."

"Note 2: This equipment contains FCC ID: 2ABCB-RPI4B"

**ATTENTION:** Do not modify this unit! Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment." The undersigned, on behalf of the manufacturer:

This device complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.  
The device contains an integral antenna hence, the device must be installed to so that a separation distance of at least 20cm from all persons.



## Supplier's Declaration of Conformity

This Declaration of Conformity is hereby issued according to Chapter 1, Subpart A, Part 2 of Title 47 of the Code of Federal Regulations by:

iPronics Programmable Photonics S.L.  
Avenida Blasco Ibanez, 25, entresuelo  
46010 Valencia – SPAIN

iPronics Smartlight Processor, Model 78-2022 complies with the applicable requirements of FCC Rule Part 15.

RESPONSIBLE PARTY located in the United States:

Testing Partners LLC  
18200 SR 306  
Chagrin Falls, OH 44023  
info@testingpartners.com

The responsible party warrants that each unit of equipment marketed under this Declaration of Conformity will be identical to the unit tested and found acceptable with the standards and that the records maintained by the responsible party continue to reflect the equipment being produced under such Supplier's Declaration of Conformity continue to comply within the variation that can be expected due to quantity production and testing on a statistical basis.

(signed)  
By: ELADIO CREGO GIL  
CFO  
  
Date: 30/11/2022



iPRONICS PROGRAMMABLE PHOTONICS S.L. AVENIDA BLASCO IBAÑEZ N°25 46010 – VALENCIA, SPAIN VAT: ESB40630733

### 1.10.3 Canada ISED compliance

CAN ICES-003 (A) / NMB-003 (A)

**“ATTENTION:** Do not modify this unit! Changes or modifications not expressly approved by the party responsible for compliance could avoid the user’s authority to operate the equipment.”

**Annex 1: Correspondence of current specifications to Free- Spectral Range of structures programmed within the optical core.**

Note that the group index employed is measured to be 4.2. Small deviations can cause the filter to have  $\pm 0.2$  GHz FSR deviations from those covered in the following tables. BUL accounts for Basic Unit Length.

*Annex Table 1: Free-spectral ranges (FSR) for infinite impulse response structures or cavities within the optical core.*

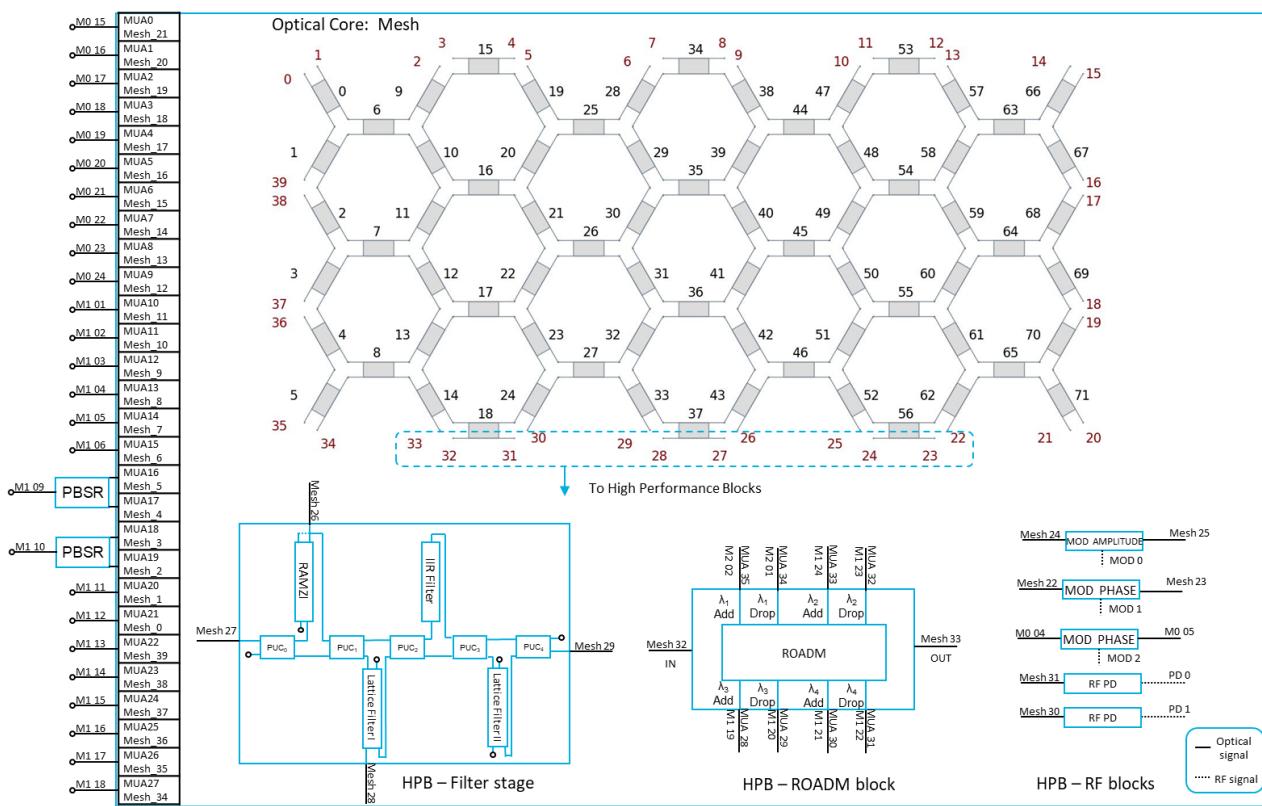
Cavity Length (BUL)	Cavity Length (mm)	FSR (nm)	FSR (GHz)
6	4.60	0.1243	15.51
10	7.67	0.0746	9.31
12	9.20	0.0621	7.76
14	10.74	0.0533	6.65
16	12.27	0.0466	5.82
18	13.81	0.0414	5.17
(...)			

*Annex Table 2: Free-spectral ranges (FSR) for finite impulse response structures within the optical core.*

Arm length difference (BUL)	Arm length difference (mm)	FSR (nm)	FSR (GHz)
2	1.53	0.3729	46.53
4	3.07	0.1864	23.27
6	4.60	0.1243	15.51
8	6.14	0.0932	11.63
10	7.67	0.0746	9.31
12	9.20	0.0621	7.76
(...)			

**Annex 2: Channel mapping distribution**

MTP	Fan-out code	Purpose/	Fan-out code / Description	MTP	Fan-out code	Purpose	Fan-out code / Description	MTP	Fan-out code	Purpose	Fan-out code / Description
0	1	Internal	Loop 1	1	1	Enabled	MUA10 Mesh_11	2	1	Enabled	MUA34 ROADM 8
0	2	Internal	Loop 1	1	2	Enabled	MUA11 Mesh_10	2	2	Enabled	MUA35 ROADM 7
0	3	Internal	Loop 2	1	3	Enabled	MUA12 Mesh_9	2	3	Internal	Loop 5
0	4	Enabled	MOD 2 PHASE_IN	1	4	Enabled	MUA13 Mesh_8	2	4	Internal	Loop 5
0	5	Enabled	MOD 2 PHASE_OUT	1	5	Enabled	MUA14 Mesh_7	2	5	Internal	Internal Use
0	6	Internal	Internal Use	1	6	Enabled	MUA15 Mesh_6	2	6	Internal	Internal Use
0	7	Internal	Internal Use	1	7	Internal	Loop 4	2	7	Internal	Internal Use
0	8	Enabled	MUA0_OUTPUT	1	8	Internal	Loop 4	2	8	Internal	Internal Use
0	9	Internal	Internal Use	1	9	Enabled	MUA16 Mesh_5 MUA17 Mesh_4	2	9	Internal	Internal Use
0	10	Enabled	Internal Use	1	10	Enabled	MUA18 Mesh_3 MUA19 Mesh_2	2	10	Enabled	Internal Use
0	11	Internal	Internal Use	1	11	Enabled	MUA20 Mesh_1	2	11	Enabled	Internal Use
0	12	Internal	Internal Use	1	12	Enabled	MUA21 Mesh_0	2	12	Enabled	Internal Use
0	13	Internal	Loop 3	1	13	Enabled	MUA22 Mesh_39	2	13	Enabled	Internal Use
0	14	Internal	Loop 3	1	14	Enabled	MUA23 Mesh_38	2	14	Internal	Loop 2
0	15	Enabled	MUA0 Mesh_21	1	15	Internal	MUA24 Mesh_37	2	15	Internal	Loop 6
0	16	Enabled	MUA1 Mesh_20	1	16	Enabled	MUA25 Mesh_36	2	16	Internal	Loop 6
0	17	Enabled	MUA2 Mesh_19	1	17	Enabled	MUA26 Mesh_35	2	17	Internal	No Connected
0	18	Enabled	MUA3 Mesh_18	1	18	Enabled	MUA27 Mesh_34	2	18	Internal	No Connected
0	19	Enabled	MUA4 Mesh_17	1	19	Enabled	MUA28 ROADM 1	2	19	Internal	No Connected
0	20	Enabled	MUA5 Mesh_16	1	20	Enabled	MUA29 ROADM 2	2	20	Internal	No Connected
0	21	Enabled	MUA6 Mesh_15	1	21	Enabled	MUA30 ROADM 3	2	21	Internal	No Connected
0	22	Enabled	MUA7 Mesh_14	1	22	Enabled	MUA31 ROADM 4	2	22	Internal	No Connected
0	23	Enabled	MUA8 Mesh_13	1	23	Enabled	MUA32 ROADM 6	2	23	Internal	No Connected
0	24	Enabled	MUA9 Mesh_12	1	24	Enabled	MUA33 ROADM 5	2	24	Internal	No Connected



## Log

Date	Version of the doc	Information
2023-10-23	1.0.0	Start the document.