

Instructions for Use

Luminescence 96

Valid for REF Number DE MML 001



Instructions for Use

Luminescence 96

Version 1.0 (20/02/2024)

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www.byonoy.com

Dear customer,

We are delighted that you have chosen Luminescence 96. To take full advantage of the instrument's performance and to enjoy your instrument for many years, please read these instructions for use carefully before installing and commissioning the instrument. Operate the instrument in accordance with these instructions. The operating-safety and function of the instrument can only be guaranteed if both the general safety regulations and accident prevention regulations of the legislator, as well as the safety instructions in this manual, are observed. We accept no liability for any damage resulting from improper use or incorrect operation.



Ensure that the manual is always accessible and is read and understood by all persons operating the instrument.

This user manual may only be used according to its intended purpose. It may not be reproduced, changed, or translated in another language without the prior written consent of Byonoy GmbH.

This document is subject to technical changes and updates.

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1 General information

Important: Follow the instructions for use

Any commissioning or handling of the instrument requires precise knowledge and notice of this manual. The device is intended for the described use only.


In this manual and on the label of the reader, particularly important remarks are labeled as followed:


Symbol	Description
	Caution: Caution indicates a potentially hazardous situation, which, if not avoided, could result in minor or moderate injury.
	Information: This is a piece of information indicating certain properties that must be observed.
	Certification mark that indicates conformity with health, safety, and environmental protection standards for products sold within the European Economic Area.
	Certification mark employed on electronic products manufactured or sold in the United States.
	Certification mark used in Australia and New Zealand to show that electronic products meet specific regulatory standards for safety, electromagnetic compatibility, and telecommunications.
	Certification mark indicating that the product has been tested and certified by TÜV Rheinland, an organization recognized by the Occupational Safety and Health Administration (OSHA) in the United States.
	Disposal of used electrical and electronic equipment
	Device Manufacturer
	Serial number
	Catalogue number


Liability for function and damage

Liability for the function of the device shall, in any case, pass to the owner or operator if the device is improperly maintained, repaired, or modified by persons who do not belong to the authorized service personnel, or if it is handled in a way that does not comply with its intended use. The service and operation of the product must be in accordance with this manual. Byonoy shall not be liable for damages resulting from non-observance of the information above. Warranty and liability conditions of the terms of sale and delivery of Byonoy are not extended by the information above.

Information

-  **An incorrect operating environment can lead to a reduction in service life, damage to the device, or measurement errors.**

-  **To avoid measurement errors, it is essential to ensure that the instrument is connected properly and that the experiments are carried out correctly. Please note the explanations and warnings in chapter 3.**

-  **Incorrect cleaning of the instrument can reduce its service life and can cause damage to the instrument. Please note the explanations and warnings in chapter 6.2.**

Disposal of used electrical and electronic equipment.



The symbol on the product or its packaging indicates that this product is not to be treated as normal household waste. It must be disposed of at a collection point for the recycling of electrical and electronic equipment. By contributing to the correct disposal of this product, you protect the environment and the health of your fellow human beings. Recycling helps to reduce the consumption of raw materials. For further information on how to recycle this product, please contact your local authority or municipal waste disposal centres.

Working with biological and harmful material

Luminescence 96 is not to be used for the measurement of biohazardous substances.

Always observe the manufacturer's hazard information pertaining to the substances to be measured.

The instrument does not produce any toxic or harmful gases or substances. During the measurement, make sure that there are no toxic or harmful substances in the microtiter plate.

2 Overview of Luminescence 96

2.1 Scope of application

Luminescence 96 is a single-mode luminescence microplate reader for measuring the luminescence of biological or non-biological samples in ANSI/SBS-standard 96-well microtiter plates in accordance with the specifications described in the user manual. Luminescence 96 is intended for research and other non-in-vitro-diagnostic analyses only. It is to be operated by trained laboratory personnel and is intended for professional use.

2.2 Measurement method

Luminescence 96 is designed to carry out sensitive luminescence measurements. It measures the relative light intensity of samples, given in Relative Light Units (RLU).

Luminescence

Luminescence generally describes the emission of light from an excited species, a process not induced by high temperature. This broad term encompasses various non-thermal emissions like fluorescence, phosphorescence, bioluminescence, and chemiluminescence. At Byonoy, however, luminescence specifically denotes those emissions that occur without any form of external excitation, i.e. bioluminescence and chemiluminescence.

Relative Light Units

The amount of light detected by the reader can vary between different device models and manufacturers and is dependent of the optical design and the type of detector used. To account for this fact, the intensity of the light produced by the sample is measured in units relative to the instrument and not in absolute terms. These units are called relative light units and are abbreviated as RLU.

2.3 Luminescence 96 System

2.3.1. Technology description

Luminescence 96 is a luminescence-based measuring device, i. e. a measuring instrument, with which the luminescence intensities of samples in a 96-well microtiter plate can be read, recorded and provided for further processing. Luminescence 96 is a solid-state microplate reader and has 96 detection units, allowing for measurements without the need for a well-scanning mechanism.

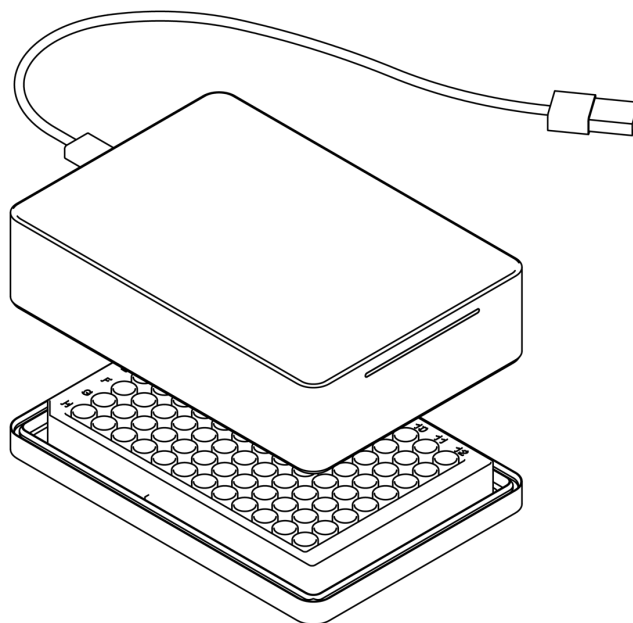


Figure 1. Visual representation of the product from the front.

The solid-state design is achieved using Silicon Photomultipliers (SiPMs) instead of Photomultiplier Tubes (PMTs). Luminescence 96 is the first microplate reader to implement them on this scale to bring to market a 96-well luminometer based solely on this technology.

The upper part of the housing, as the device is shown in figure 1, contains the entire electronic assembly of the device, where there are 96 SiPMs which serve as the detectors for the device. In addition to the detector core of the instrument, a series of technological innovations have been implemented in order to process the signal provided by the SiPMs and provide reliable measurement results. These technological innovations are important to reduce cross-talk, improve sensitivity, and increase linear dynamic range.

Shutter

The shutter is opened and closed multiple times during the process of a normal measurement. This is done in order to monitor the background signal created by instrument and account for it in the measurement. In addition, a micro-sized pinhole is used to reduce the amount of light reaching the detector at high intensities, preventing the detectors from saturating, thereby increasing the linear dynamic range of the instrument.

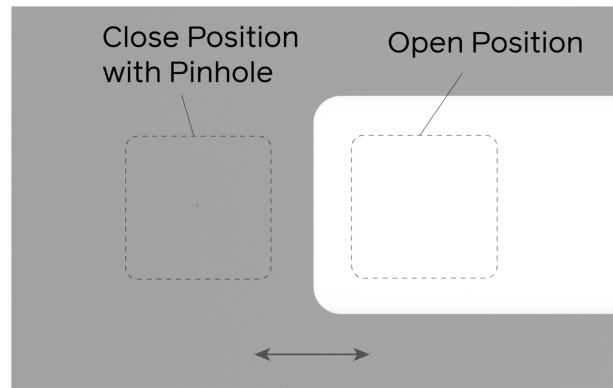


Figure 2. Two positions of the Pinhole shutter.

Cross-talk reduction array

The cross-talk reduction array is a magnetic strip that is present on interior optical surface of the instrument. This array is designed to form a seal around the wells of the microplate, preventing light from bleeding into neighbouring wells.

- ⓘ For cleaning, use tweezers or a similar tool to remove the cross-talk reduction array.

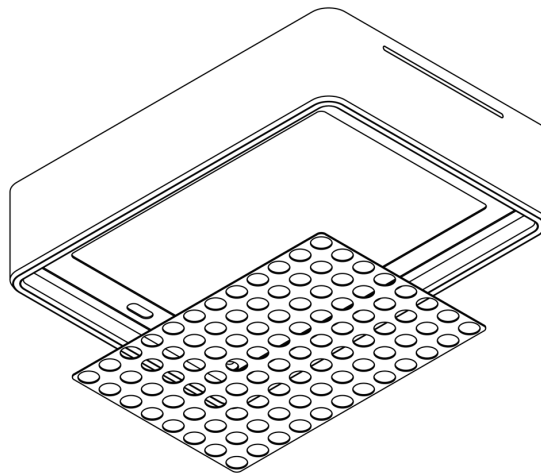


Figure 3. Visual representation of the cross-talk reduction array.

Integration time

Integration time for Luminescence 96 is defined as the total measurement time per well within a 16-well quadrant. All quadrants are measured in parallel, while wells within the quadrants are measured sequentially. Approximately half of the total measurement time per well is exposure time or shutter-open time.

In the Luminescence 96 App, it is possible to choose between three pre-set integration modes: Rapid, Sensitive, and Ultra-Sensitive (these modes correspond to integration times of 0.1, 2, and 20 seconds respectively), or select a custom integration time.

Hybrid dynamic range

Unlike other luminometers, Luminescence 96 does not require gain adjustments to be made by the user for different measurements. To ensure a maximum dynamic range, Luminescence 96 can operate in three different modes across a constant gain setting: photon counting mode, Integration mode, and a micro-Integration mode. In photon counting mode, each individual photon triggers an electrical pulse, which is counted by the electronics. In Integration mode, these pulses are integrated across a defined time, which allows for detecting overlapping pulses and increases the dynamic range. In micro-Integration mode, the shutter is used to attenuate the signal and allows for an even higher dynamic range. The Luminescence 96 uses the appropriate mode depending on the level of light in each well.

2.3.2. Physical characteristics and interface

Luminescence 96 is designed for manual handling, i.e. it requires the manual, physical input of the user in order to function properly. The device is split into two parts: the Detection Unit and the Sealing Unit. The Detection Unit contains all of the electronic components, including the detectors. The Sealing Unit serves to close and darken the chamber, preventing the entry of stray light into the system.

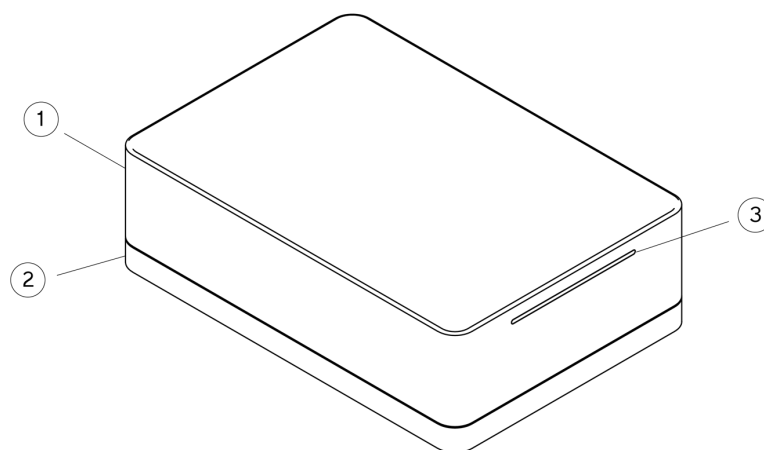


Figure 4. Visual representation of the product from the front, top. 1. Detection Unit 2. Sealing Unit 3. LED Status Bar.

On the back of Luminescence 96 there is a USB-C port for connecting the instrument to a computer via the included USB-C cable.

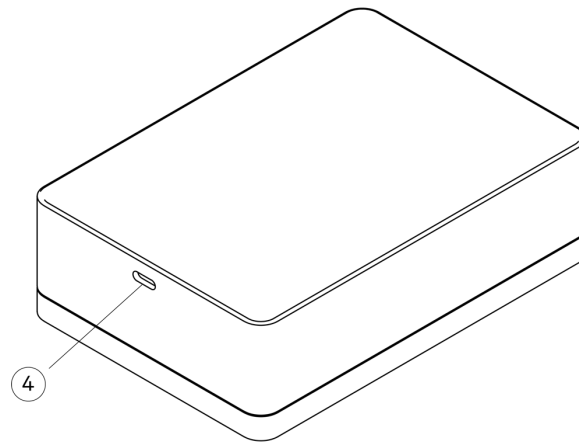


Figure 5. Visual representation of the product from behind, top. 4. USB-C port.

To perform a measurement, the microplate must be placed inside the measurement chamber. This is achieved by separating the Detection Unit from the Sealing Unit, placing the microplate into the device, and recombining the Detection Unit with the Sealing Unit.

Power consumption

Luminescence 96 is an analytical instrument with very low power consumption. It is operated by a USB-C cable and the total power consumption is generally less than 2.5 watts.

Luminescence 96 App

The reader is controlled via the Luminescence 96 App. The operation of the app is described in-detail in a separate user manual.

2.4 Consumables

With the Luminescence 96, ANSI/SBS Standard 96-well microtiter plates can be used. Only certain microplate types can be used with the Luminescence 96 (see chapter 7).

When using microtiter plates, always check the specifications of the microtiter plate manufacturer. Not all microtiter plates of a particular manufacturer are the same in design, materials, or configuration. The temperature stability within the microtiter plate can depend on the type of microtiter plate used.

3 Preparing the product for use



3.1 Unpacking, storage, and transport

Unpacking

Remove the packaging material and carefully place the device on a firm and level surface. Check the device for external damage and check the materials supplied (see chapter 3.2).

The device is packed in a specially designed cardboard box. Keep the packaging material. If the device must be returned for repair, the original packaging material must be used.

Storage and protection during the intervals of normal use

-  **Protect the device from moisture and dust during prolonged storage.**
-  **Do not store the device next to heat sources and protect it from direct sunlight.**

The temperature for storage should be within the recommended temperature range (see chapter 7).

Transportation

Before transportation, unplug the instrument and ensure there is no microtiter plate inside the device. Depending on the transport distance, use the original packaging material. Make sure that the new location meets the requirements described in chapter 7.



To avoid spillage and contamination, make sure that there is no microtiter plate inside the instrument before transport.

-  **Always transport the product well-packaged to avoid damage in transit.**

3.2 Supplied materials

When unpacking the device, please check that the following components are present:

- Luminescence 96
- USB-C cable
- Quick-start guide with download link
- Calibration certificate

3.3 Working environment

Due to its small size, Luminescence 96 can be operated very well in various working environments.

However, the following warnings must be observed. Ignoring them may lead to measurement errors and a reduction in the expected lifetime or damage to the device:


- ① The device should stand on a level surface, free from dust and vibrations.
- ① Do not operate the device near heat sources or under direct sunlight.
- ① The ambient temperature and the humidity should be within the recommended range (see chapter 7).
- ① Place the instrument in a horizontal position secured against falling.

4 Operation

The Luminescence 96 is controlled via the Luminescence 96 App, including the analysis of measurement data.

4.1 App installation procedure and updates

To install the Luminescence 96 App, visit the following webpage: s.byonoy.com/lum96. Download the latest version of the App for your operating system and follow the steps in the Setup Wizard to complete the installation.


-  **To install the proper software on the computer, the user must have administrator rights or obtain such permissions.**


4.2 Computer connection

Luminescence 96 requires a connection to the computer for power supply, starting the experiment, and data transfer. Insert the USB-C cable into the Luminescence 96 and the USB port of the computer. The Luminescence 96 powers up automatically when connected to a computer via the USB-C cable and the software automatically establishes a connection.



Always use the included USB-C cable for the connection to your computer.

-  **Connect the instrument directly to your computer and do not use an external USB hub.**

-  **The device may only be operated at a USB port USB 2/USB 3 with 5 VDC and a maximum of 3 A of a certificated computer (with certification mark of an approved testing laboratory). Use an adapter cable on USB 3.1 with type C plug connection, which ensures the profile 1: 5 V@2.0 A.**

When Luminescence 96 is powered on, the LED status bar on the top of the instrument will illuminate. Each time the instrument is switched on, an internal self-test is performed to ensure there are no malfunctions.

4.3 Assay

Placing the microtiter plate into the instrument



Place the plate into the instrument cautiously and slowly to avoid spills.


-  **Pay attention to the correct plate orientation.**

Plate orientation and positioning

Luminescence 96 can perform both top and bottom readouts. While most luminescence assays are read from above using opaque, white microplates, it is possible to use plates with a clear bottom to read the signal at the bottom of the well instead of from above. To enable bottom readout, simply invert the reader, placing the Detection Unit on the bottom and the Sealing Unit on the top, as shown in figure 6.

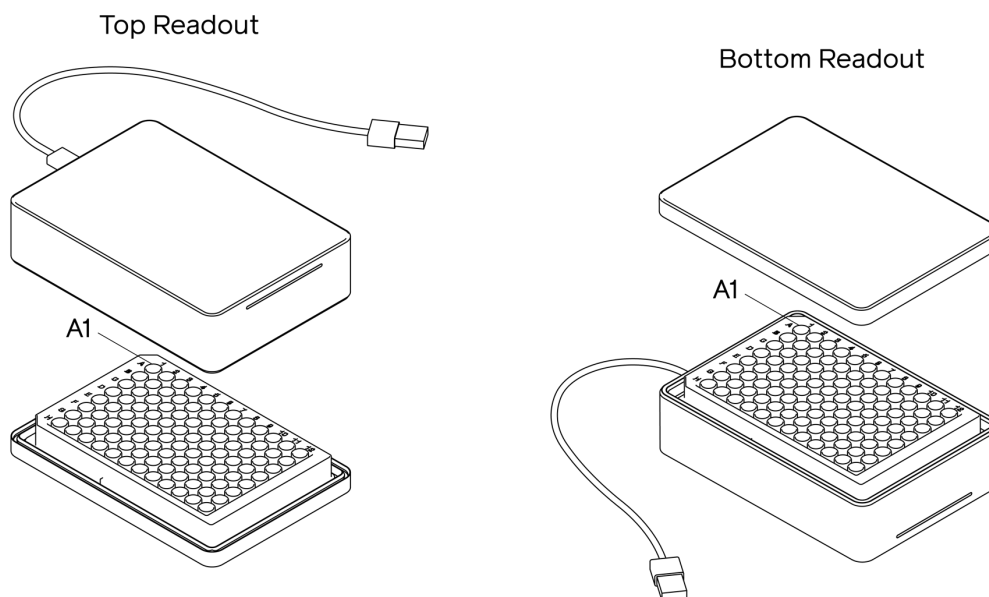




Figure 6. Visual representation of the two readout orientations.

When placing the microplate into the device, ensure that the A1 well is in the correct position, as shown in figure 6. For bottom readout, A1 will be in the reverse position.

Once all settings have been completed, the measurement can be started. The app will automatically guide the user through the readout process.

In order to guarantee a correct measurement result, please pay attention to the indications in the Luminescence 96 App and heed the following warnings:

-  **Shocks to Luminescence 96 can cause an unwanted signal. Therefore, Luminescence 96 should not be touched during measurement.**
-  **Note that the system depends on a clean and dust-free environment. Therefore, do not wear powdered safety gloves.**

After a successful measurement, the results section will open automatically in the app.

Removing microtiter plate

The microtiter plate must be removed from the Luminescence 96 after the readout. To do this, separate the two parts of the instrument and remove the plate.



Do not leave a microtiter plate filled with reagents in the device for prolonged periods of time, as evaporating gases can damage the device.

5 Signals and troubleshooting

5.1 LED Status Bar

Luminescence 96 has a LED status bar that indicates the various states of the device.

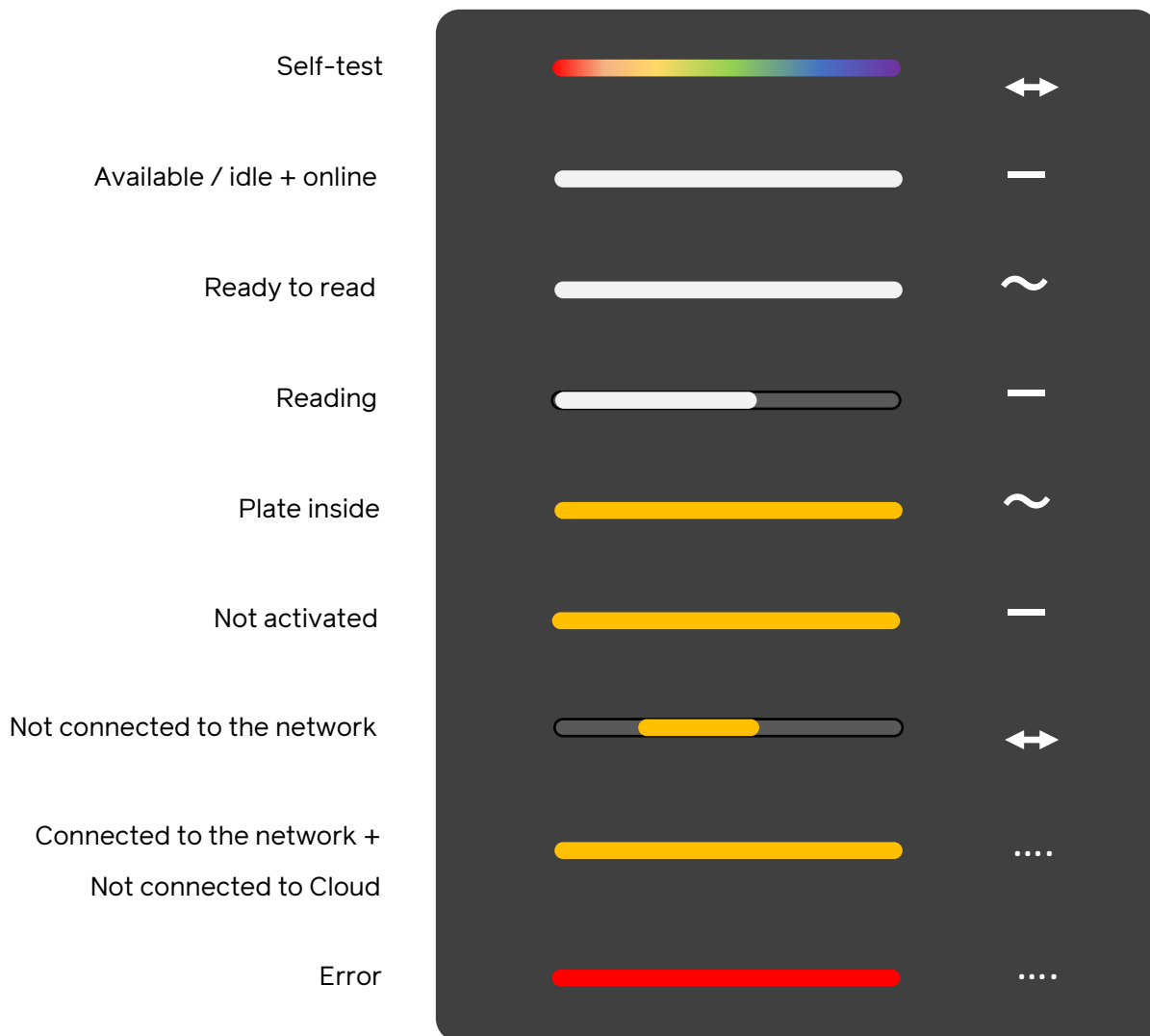


Figure 7. Overview of various states indicated by the LED status bar

6 Maintenance and cleaning

6.1 Maintenance

Luminescence 96 is maintenance-free. Each time the instrument is switched on, an internal self-test is carried out to ensure there are no malfunctions.

There are no parts within the Luminescence 96 that can be serviced by the customer. It is only necessary to ensure that the device is kept clean.

If required, a yearly verification procedure can be implemented to ensure that the device is still measuring within the specifications. Please consult Byonoy's [Care Packages](#).

6.2 Cleaning

Remove the USB-C cable from the instrument before cleaning.



Make sure before cleaning, that there is no microtiter plate in the instrument.

Cleaning the housing

The surfaces of the housing should be cleaned regularly. For this purpose, you can use e. g. a cloth, or a sponge lightly wetted in water. For heavier soiling, clean the surface of the housing with a mild soap solution diluted with water or glass cleaner and then wipe with a lightly moistened cloth or sponge to remove any residue. Do not use scouring agents.

Cleaning the interior

To clean inside of Luminescence 96, simply separate the two parts of the instrument to access the interior chamber. Remove the cross-talk reduction array using a tweezer or a similar tool and wipe it with a clean, damp cloth. If necessary, the interior surface underneath the cross-talk reduction array may be cleaned with a damp cloth with, for example, 70% ethanol.






Do not loosen any screws, as this can lead to a malfunction and may void the instrument's warranty.

Do not allow water or other liquids to get inside the instrument. If this happens, return the device to the manufacturer for inspection.


Warnings for cleaning

When cleaning, pay attention to the following warnings. Failure to observe these warnings may result in damage to the instrument. This can lead to a reduction of the service life or in measurement errors:

-  **Always avoid spraying liquid directly onto the surfaces of Luminescence 96. This is especially important for the inside of the device, where there are optical elements that are very sensitive and essential for the functioning of the instrument.**
-  **Never clean the interior of the device with sharp or abrasive scourges, and do not use aggressive solvents or corrosive agents.**
-  **Biological hazard: Always wear gloves during cleaning operations that may involve contact with biological or generally hazardous materials or liquids.**

6.3 Technical support

In case of problems with the instrument, please contact the manufacturer's service department at service@byonoy.com or your local representative.

-  **Biological hazard: It is your responsibility to decontaminate the instrument and all accessories before servicing and before returning the instrument or accessories to the manufacturer.**

For decontamination of Luminescence 96, follow the government guidelines for inactivation of organisms used in biological laboratories.

6.4 Repairs

Repairs on the device may only be carried out by the manufacturer. Please contact the service department at service@byonoy.com, or your local representative. The product warranty is voided if the device is modified by unauthorized persons, or different parts are installed.

7 Technical specifications

Table 1. Performance and technical data

Parameter	Value
Type of product	Luminescence microplate reader
Product name	Luminescence 96
Operating Software	Luminescence 96 App
Service life	10 years at an average use of 4h/day
Housing material	Aluminium
Place for use	Laboratory
Degree of contamination	2
Temperature for storage/measurement	5–40 °C*
Temperature (Transport)	-10–50 °C
Relative tolerated humidity (storage/measurement)	Max. 70 %
Measurement mode	Luminescence
Measuring method	Endpoint and Kinetic
Measurement type	Glow, Flash**
Microplate types	96-well, flat bottom, white or black
Detection	96 Silicon Photomultipliers
Linear Dynamic Range	8 decades
Sensitivity	100 fmol ATP/well (in 96-well plate) ***
Cross-Talk	0.7×10^{-6} RLU
Plate Uniformity	>95%
Connection to computer	USB 2/USB 3 with 5 VDC and max. 3 A
Dimensions	98 x 140 x 42 mm
Power supply	USB Connection 5 V
Nominal value/Characteristic of the fuse	1 A/very fast-acting
Power input	2.5 W
Weight	570 g
System requirements (App)	Microsoft Windows: Windows 7 or above Mac OS: High Sierra 10.13 or above
Altitude	<5100 m

* Reduced sensitivity at higher temperatures

** Development times > 5 seconds, manual addition of reagents required

*** Preliminary result

8 Guarantee

The regular warranty period of Luminescence 96 is 24 months. If a defect manifests itself in your device during the warranty period, please contact the service department directly at service@byonoy.com.

The instrument may only be operated in technically perfect condition. In the event of defects that could endanger employees or third parties, the device may only be used again after it has been repaired by the manufacturer.

This warranty does not cover damage caused by improper use or external mechanical influences, transport damage, or unauthorized intervention in the device by unauthorized persons.

9 Compliance

9.1 FCC

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device contains a WiFi-Transmitter-Unit with the FCC-ID: 2AC7Z-ESPS3WROOM1

Responsible Party – U.S. Contact Information:

Americas Compliance Consulting LLC dba iCertifi

2445 NE Division Street, Suite 202

Bend, Oregon 97703 USA

FCC_sDoC@icertifi.com

icertifi.com

9.2 ISED

This product meets the applicable Innovation, Science and Economic Development Canada technical specifications.

Le présent produit est conforme aux spécifications techniques applicables d'Innovation, Sciences et Développement économique Canada.

This device needs to be at least at 20cm distance of user at normal operation.

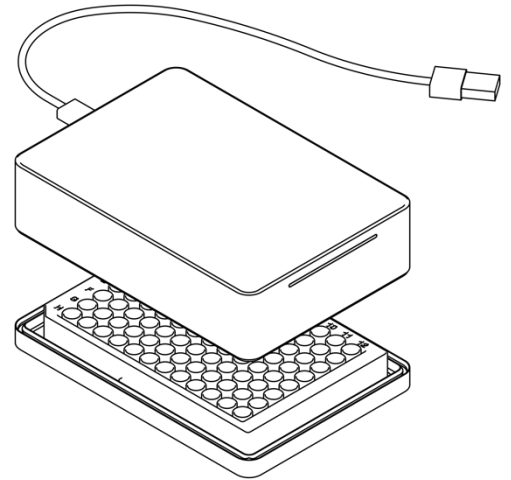
Contains IC: 21098-ESPS3WROOM1



EU Declaration of Conformity

Byonoy GmbH
Schützenstraße 21
22761 Hamburg
GERMANY

The Product named below fulfills the relevant fundamental requirements of the EU directives and standards listed. This declaration of conformity is issued under the sole responsibility of the manufacturer.



Product Type
Luminescence microplate reader

Product name
Luminescence 96

Reference Number
DE MML 001

Serial Number Range
BYOMMLXXXXX [XXXXX = 00001 – 99999]

Relevant EU directives

2014/53/EU	Radio Equipment Directive (RED)
2012/19/EU	Waste Electrical and Electronic Equipment (WEEE)
2011/65/EU	Restriction of Hazardous Substances (RoHS II)

Relevant EU standards

DIN EN IEC 61326-1:2021	Electromagnetic Compatibility for Electrical equipment for measurement, control and laboratory use
ETSI EN 301 489-1 V2.2.3 ETSI EN 301 489-17 V3.2.5	Electromagnetic Compatibility for radio equipment and services
EN IEC 62311:2020	Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields
IEC 61010-1:2010 EN 50419:2022	Safety requirements for electrical equipment for measurement, control, and laboratory use Marking of electrical and electronic equipment (EEE) in respect to separate collection of waste EEE (WEEE)
BS EN IEC 63000:2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Hamburg, 24.04.2024

Yousef Nazirizadeh
CEO