byonoy

Instructions for Use

# Luminescence 96 Automate

Valid for REF Number DE MAL 001


Instructions for Use
Luminescence 96 Automate
Version 1.0 (12/06/2024)


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**Dear customer,**

We are delighted that you have chosen Luminescence 96 Automate. To take full advantage of the reader's performance and to enjoy your reader for many years, please read these instructions for use carefully before installation and commissioning. Operate the reader in accordance with these instructions. The operating-safety and function of the reader 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.

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



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 reader 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.** |
| CE | **Certification mark that indicates conformity with health, safety, and environmental protection standards for products sold within the European Economic Area.** |
|  | **Disposal of used electrical and electronic equipment** |
|  | **Manufacturer** |
| SN | **Serial number** |
| REF | **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.

### 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.

Recycling of the product may also be carried out by the manufacturer. Please contact the service department.

### Working with biological and harmful material

Luminescence 96 Automate 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 reader 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 Automate

## 2.1 Scope of application

Luminescence 96 Automate is an optical laboratory instrument 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 Automate is an on-deck microplate reader module designed for easy integration into various liquid handling or robotic systems.

Luminescence 96 Automate 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 Automate 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 Automate System

### Luminescence 96 Automate Reader

Luminescence 96 Automate 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 Automate is a solid-state microplate reader and has 96 detection units, allowing for measurements without the need for a well-scanning mechanism.

The Luminescence 96 Automate is primarily designed to be integrated on-deck of various liquid handling systems and other robotic systems.

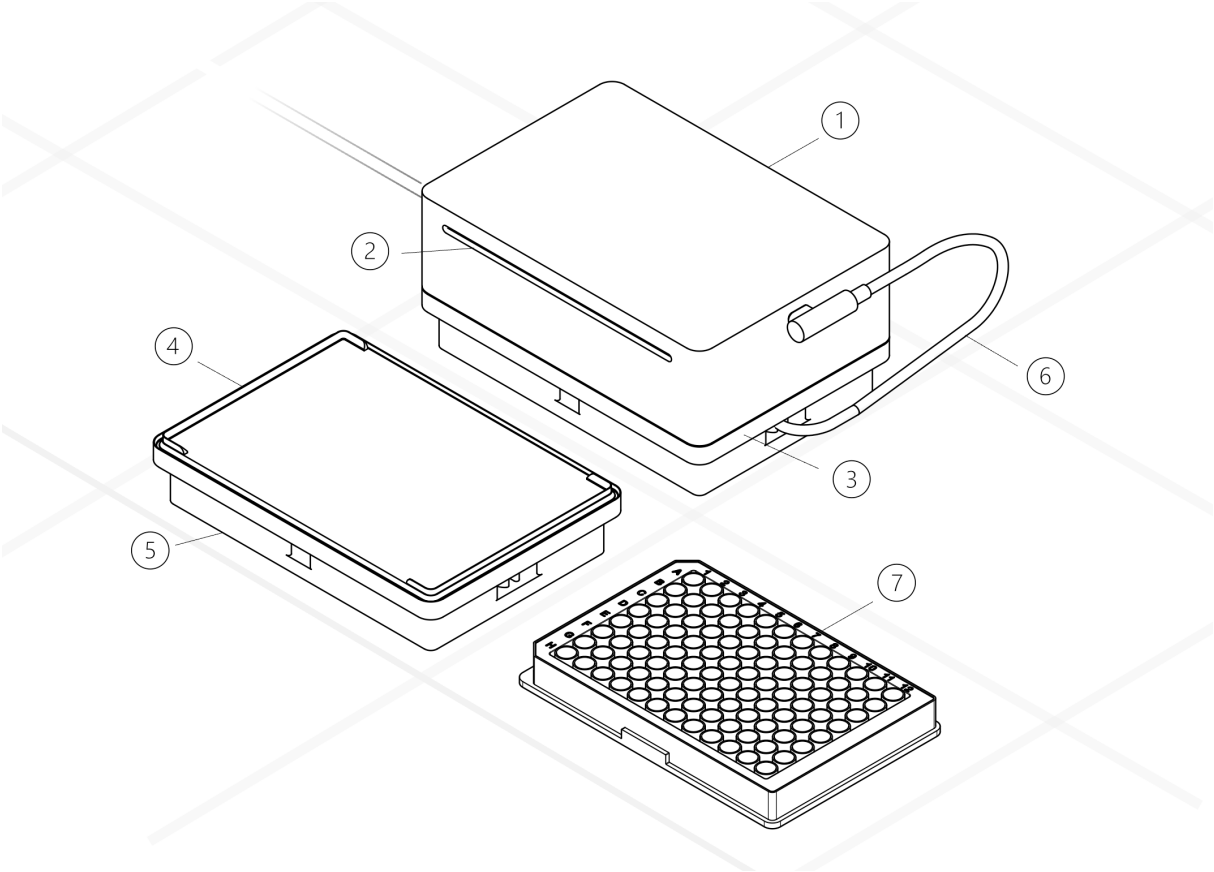


**Figure 1.** Visual representation of the product from the front, top. 1. Detection unit, 2. Groove for the gripper, 3. Reading position, 4. Parking position, 5. SBS adapter, 6. USB-C cable, 7. Microplate.

The solid-state design is achieved using Silicon Photomultipliers (SiPMs) instead of Photomultiplier Tubes (PMTs). Luminescence 96 series 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 detection unit 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.

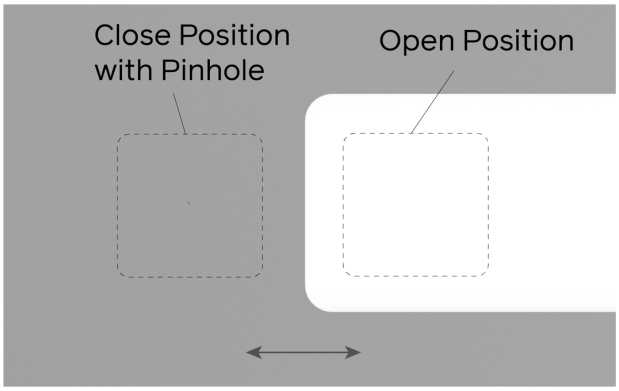


**Figure 2.** Two positions of the Pinhole shutter.

### 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.**

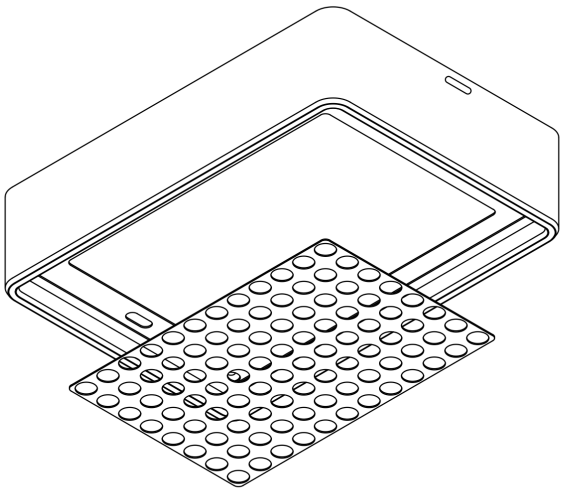

**Figure 3.** Visual representation of the cross-talk reduction array.

### Integration time

Integration time for Luminescence 96 Automate 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 Automate does not require gain adjustments to be made by the user for different measurements. To ensure a maximum dynamic range, Luminescence 96 Automate 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 Automate uses the appropriate mode depending on the level of light in each well.

## 2.4 Consumables

With Luminescence 96 Automate, ANSI/SBS Standard 96-well microtiter plates can be used. Only certain microtiter plate types can be used with Luminescence 96 Automate (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

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 reader 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.

## 3.2 Supplied materials

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

- Luminescence 96 Automate
  - Detection unit
  - Reading position (with SBS adapter)
  - Parking position (with SBS adapter)
- USB-C cable
- Hex key
- Information card with the download link
- Calibration certificate

## 3.3 Working environment

The Luminescence 96 Automate is designed to be integrated on-deck into liquid handling and other robotic systems.

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

**The ambient temperature and the humidity should be within the recommended range (see chapter 7).**

## 3.4 Installation

Before commissioning Luminescence 96 Automate, you should carefully read and understand the entire manual to familiarize yourself with the system.

Luminescence 96 Automate is controlled via the Luminescence 96 App, including the analysis of measurement data. The functions of the app are detailed in a separate user manual.

Commissioning Luminescence 96 Automate entails three integration steps:

1. Placement on-deck
2. Preparing the liquid handler
3. Integrating with the software

Each of these steps are explained below in further detail.

### Placement on-deck

Prior to setting up the reader, the USB-C cable has to be routed as depicted in Figure 2. Remove the SBS adapter by loosening the pair of screws. Insert the USB-C cable and route it in the appropriate direction based on your deck's layout. Replace the screws to reaffix the SBS adapter. Now you can connect the USB-C cable to the detection unit.

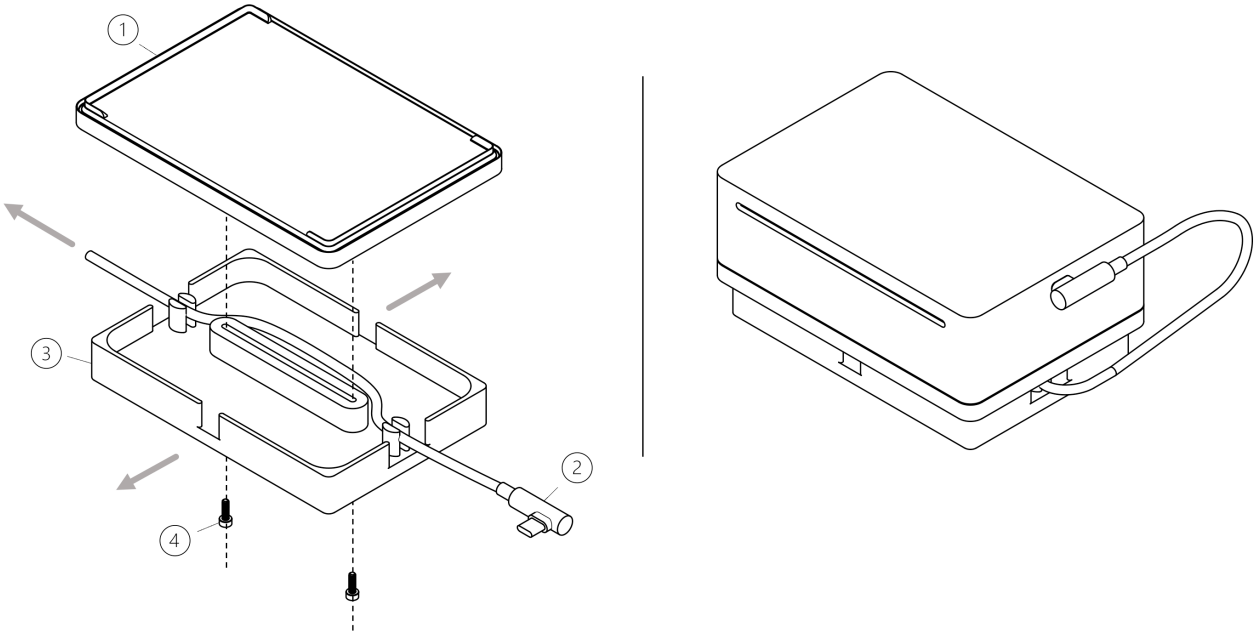


**Figure 4.** Installation of the USB-C cable. 1. Reading position, 2. USB-C cable, 3. SBS adapter, 4. Screws.

Position the detection unit with the reading position and the parking position next to each other on any available SBS deck position of the liquid handling system. Route the USB-C cable toward a computer or compatible device and connect it.

Provided that an SBS outlay is present, the detection unit may be simply placed on-deck: no further hardware is required to affix the reader.

ⓘ **Consult the specific requirements of your liquid handling system for instructions on affixing hardware on-deck**

### Preparing the liquid handling system

Once Luminescence 96 Automate has been installed on-deck, the gripper of the liquid handling system must be taught to interact with it.

ⓘ **Consult the manual of your liquid handling system for teaching instructions.**

ⓘ **Labware descriptions may already be available for your liquid handling system. Contact us for more information at service@byonoy.com.**

### Integrating with the software

The Luminescence 96 Automate is controlled via the Luminescence 96 App. The Luminescence 96 App can connect via SiLA2 to enable remote execution of commands including loading a protocol, performing a measurement, and exporting the results as a .csv file. Specific Instructions for Use for the SiLA2 interface can be downloaded from the following webpage: s.byonoy.com/abs96auto.

**System-specific drivers may already be available for your liquid handling system. Contact your liquid handling system provider for more information or contact us at service@byonoy.com.**

# 4 Operation

The functions of the Luminescence 96 Automate are controlled via the Luminescence 96 App, including the analysis of measurement data. The functions of the app are detailed in a separate user manual.

## 4.1 App installation procedure and updates

The Luminescence 96 App is compatible with Windows and MacOS operating systems (see chapter 7).

To install the Luminescence 96 App, visit the following webpage: s.byonoy.com/lum96auto. 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 Automate requires a connection to the computer for power supply, reader control, and data transfer. Luminescence 96 Automate starts 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 reader 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 Automate is switched on, the signal light on the right side of the reader lights up. Each time the reader is switched on, an internal self-test is performed to ensure there are no malfunctions.

## 4.3 Workflow

### Microtiter plate loading

Luminescence 96 Automate is operated using the gripper of the liquid handling or robotic system. To load a microtiter plate into the reader the gripper performs three steps, which are illustrated in Figure 5.

1. Moving the detection unit to the parking position.

2. Moving the microtiter plate to the reading position.
3. Moving the detection unit back to the reading position.

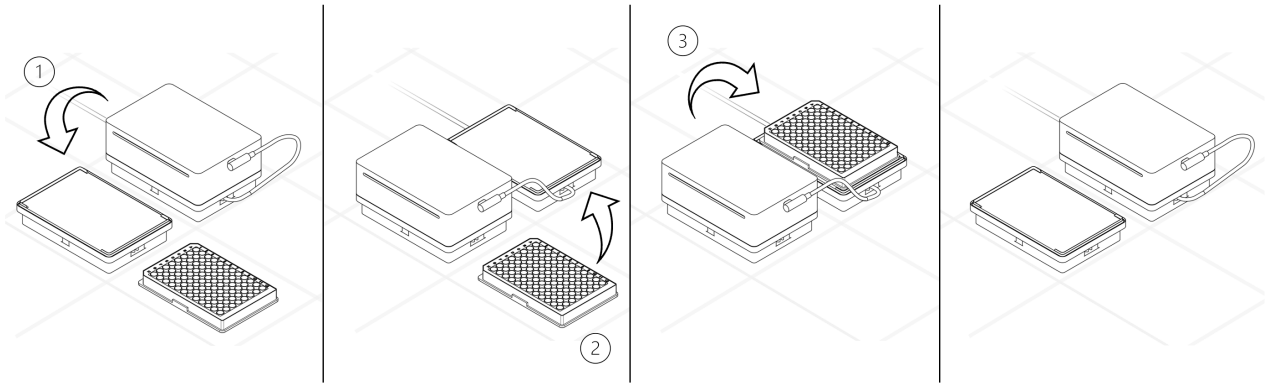


**Figure 5.** Three steps to load the microplate into the reader utilizing the gripper.

### Assay readout

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

To guarantee a correct measurement result, pay attention to the indications in the Luminescence 96 App and heed the following information:

ⓘ **Shocks to Luminescence 96 Automate or the microtiter plate can cause an unwanted signal. Therefore, neither Luminescence 96 Automate nor the microtiter plate should be touched during measurement.**

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 Automate after the readout. To do this, reverse the steps for the loading procedure.

ⓘ **Make sure not to store a microtiter plate filled with reagents in the device, as evaporating gases can damage the device and especially the filters.**

# 5 Signals and troubleshooting

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

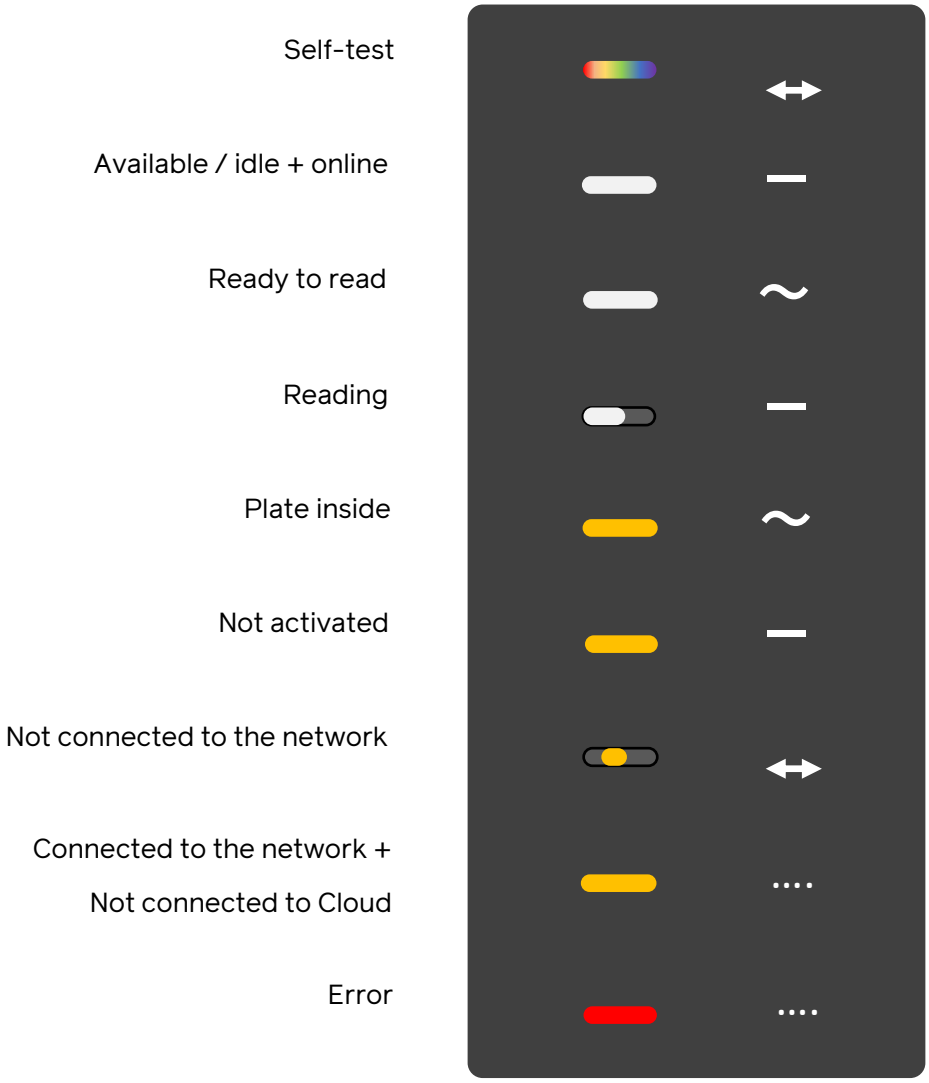


**Figure 7.** Overview of various states indicated by the status LED

# 6 Maintenance and cleaning

## 6.1 Maintenance

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

There are no parts within Luminescence 96 Automate 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 Automate, 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 Automate. 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 Automate, 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 Automate |
| 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 x $10^{-6}$ RLU |
| Plate Uniformity | >95% |
| Connection to computer | USB 2/USB 3 with 5 VDC and max. 3 A |
| Dimensions reader | 95.5 x 137.8 x 47.7 mm (W x L x H) |
| Dimensions SBS adapter | 85.5 x 127.8 x 17 mm (W x L x H) |
| Power supply | USB Connection 5 V |
| Nominal value/Characteristic of the fuse | 1 A/very fast-acting |
| Power input | 2.5 W |
| Weight | Detection unit 515 g, Reading position 395 g |
| System requirements (App) | Microsoft Windows: Windows 7 or above<br>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

# 8 Guarantee

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

The reader 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.

CE

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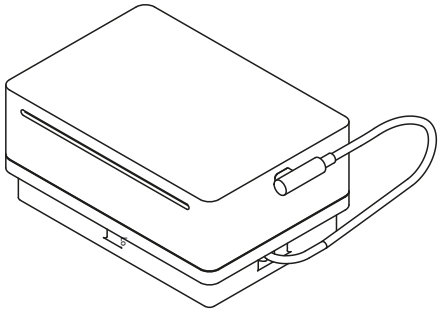
# EU Declaration of Conformity



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 Automate

Reference Number
DE MAL 001

Serial Number Range
BYOMALXXXXX [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) |
| **2014/35/EU** | Low Voltage (LV) |

Relevant EU standards

| | |
|---|---|
| **EN IEC 61326-1:2021** | Electromagnetic Compatibility for Electrical equipment for measurement, control and laboratory use |
| **ETSI EN 301 489-1 V2.2.3**<br>**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 |
| **EN 50419:2022** | Marking of electrical and electronic equipment (EEE) in respect to separate collection of waste EEE (WEEE) |
| **EN IEC 63000:2018** | Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances |

Hamburg, 13.06.2024

Yousef Nazirizadeh
CEO