

# SILENTSYS

ultralow noise systems

## USER GUIDE



ULTRALOW NOISE BALANCED PHOTODETECTOR

# ULN-PDB



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## I. INTRODUCTION

The ULN-PDB module is a plug and play Ultralow Noise Balanced Photodetector in a compact and user-friendly package. It is a product developed by SILENTSYS SAS to offer the best performances in terms of signal-to-noise ratio. ULN-PDB is proposed with InGaAs, Si or GaAs photodiodes and offers a bandwidth of 100 MHz with a high gain of 39 kV/A in a DC-coupled configuration.

The electronic architecture was made to reach ultralow noise while keeping a high efficiency. The electronic circuit is integrated in a modern designed aluminum enclosure with standard connectors for an easy use.

The ULN-PDB module works with the provided AC/DC switching power supply of 6 VDC and disposes of a 4 mm grounding hole for a banana connector if needed.

**IMPORTANT:** Read the operating instructions carefully and especially observe the safety information. If you do not follow the safety instructions and information on proper handling in this manual, we assume no liability for any resulting personal injury or damage to property. Such cases will invalidate the warranty/guarantee.

## II. DELIVERY CONTENT

The ULN-PDB is delivered with a case for easy transportation and protection. Inside the case, you will find:

- ULN-PDB photodetector module
- AC/DC switching power supply – Triad Magnetics WSX060-4000
- User Guide (this document)
- Data Report

**IMPORTANT:** For up-to-date Operating Instructions, please contact us directly (see contact information at the end of this document).



## III. SAFETY INSTRUCTIONS

- Consult an expert when in doubt about operation, safety or connection of the device.
- Maintenance, modifications and repairs are to be performed exclusively by SILENTSYS SAS.
- If you are not sure about the correct connection or use, or if questions arise which are not covered by these operating instructions, please do not hesitate to contact our technical support or another qualified specialist.
- The device is not a toy. Keep it out of the reach of children and pets.
- Protect the product from extreme temperatures, direct sunlight, strong jolts, high humidity, moisture, flammable gases, vapors and solvents.
- Do not place the product under any mechanical stress.
- If it is no longer possible to operate the product safely, take it out of operation and protect it from any accidental use. Safe operation can no longer be guaranteed if the product:
  - is visibly damaged,
  - is no longer working properly,
  - has been stored for extended periods in poor ambient conditions or
  - has been subjected to any serious transport-related stresses.
- Also observe the safety and operating instructions of any other devices which are connected to the product.
- Never open the device or insert objects into it through its holes. Such cases will void the warranty/guarantee.
- Always lay the cables so that nobody can trip over or become entangled in them. This poses a risk of injury.
- Check the product for damage(s) each time before use. If you discover any damages, do not use the product.
- Do not operate the product in interior places or rooms with unfavorable ambient conditions. This can damage the sensitive electronics found inside the product and can potentially pose life-threatening risks. Poor ambient conditions are:
  - High humidity (>80 % relative, condensation)
  - Humidity, dust, flammable gases, solvent vapors, benzine
  - Electromagnetic fields (motors, transformers, audio systems for model building etc.) or electrostatic fields
- The maximum altitude allowed is 2'000 m (6'561 ft) above sea level.
- This device is powered down by removing the mains plug, which must remain accessible.

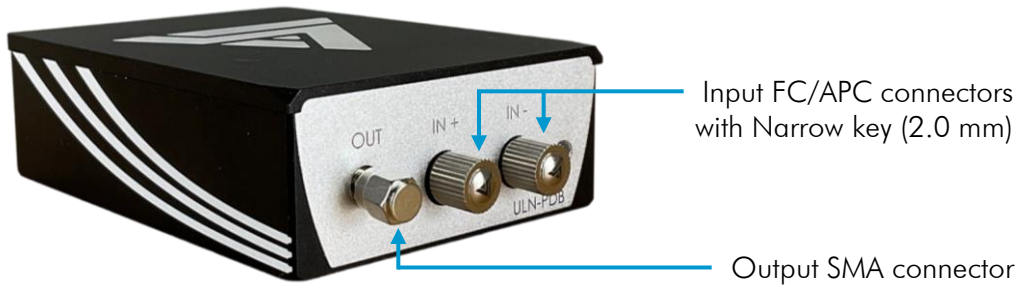
## IV. DISPOSAL



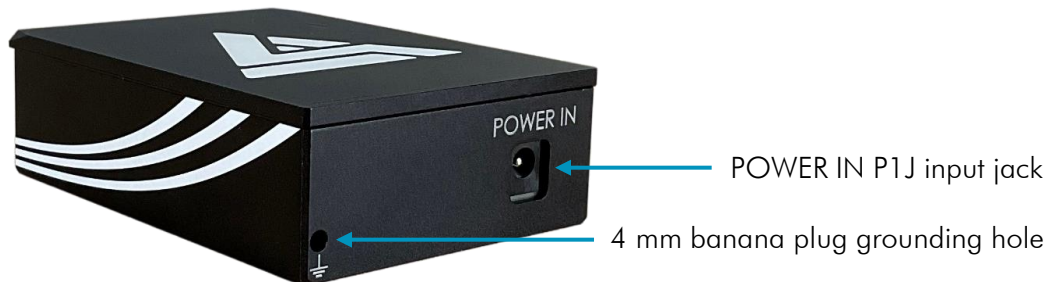
Electronic devices are recyclable waste and must not be disposed of in the household waste. At the end of its service life, dispose of the product according to the relevant statutory regulations. You thus fulfill your statutory obligations and contribute to the protection of the environment.

## V. CONNECTION INTERFACES

### FRONT VIEW



### REAR VIEW



## VI. QUICK START

- 1) Plug the provided power supply into an electrical socket.
- 2) Plug the adaptor of the provided power supply to the "POWER IN" input connector of the ULN-PDB on the rear face.
- 3) The ULN-PDB is ready to be used. You can now connect the ULN-PDB to your devices.
- 4) To turn OFF the ULN-PDB, unplug connector on the rear face of the ULN-PDB and/or unplug the provided power supply from the electrical socket. Socket must be accessible.

**IMPORTANT:** Place the ULN-PDB unit on a stable, level and robust surface.

## VII. TECHNICAL DATA

### Specifications

- Number of optical inputs: 2
- Number of electrical outputs: 1
- Optical input connectors: FC/APC with Narrow key (2.0 mm)
- Electrical output connector: SMA
- Max optical power input: typ. 5 mW (depends on the photodiodes used)
- Photodiode types:
  - InGaAs (1000-1650 nm)
  - GaAs (400-700 nm)
  - Si (400-1100 nm)
- Output voltage range:  $\pm 3$  V
- Output impedance: 50  $\Omega$
- Bandwidth:
  - DC coupled version: 0 Hz – 100 MHz
  - AC coupled version: 160 Hz – 100 MHz
- Trans-impedance gain: 39 kV/A
- Power supply input voltage: 5 to 9 VDC
- Power supply plug: P1J
- Provided power supply : 6 VDC / Triad Magnetics WSX060-4000

### Mechanicals characteristics

- Product dimensions: 108 mm x 79 mm x 33 mm
- Product weight: approx. 400 g
- Aluminum case
- Temperature: 0 to 40°C

## VIII. APPLICATION

### LASER RELATIVE INTENSITY NOISE (RIN) CHARACTERIZATION

The RIN of a laser corresponds to the intensity fluctuations divided by the average intensity. The calculation of the RIN from the photodetector measurement is shown below.

$$RIN = \frac{\text{Signal PSD}}{G^2 \times P_{in}^2} = \frac{\text{dBc}}{\text{Hz}}$$

PSD of signal output ( $\frac{\text{dB V}^2}{\text{Hz}}$ )

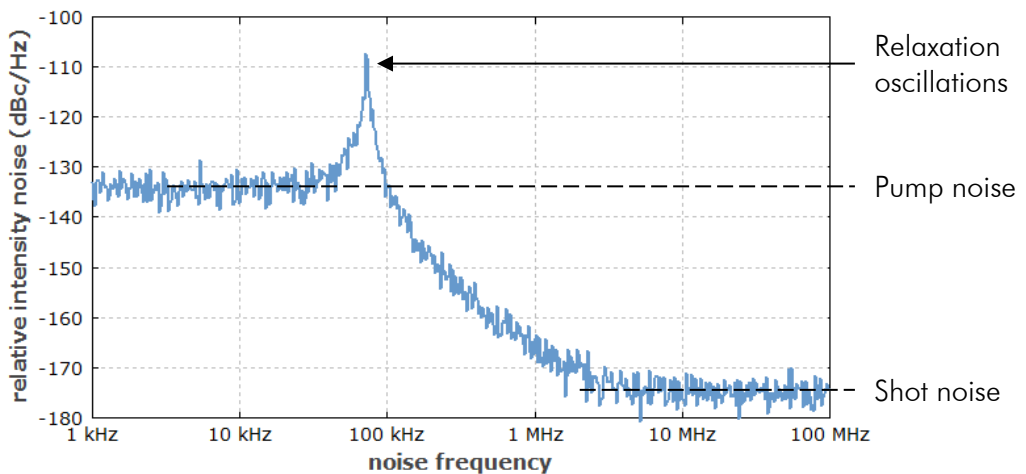
Output gain:

$$G = \text{TransImpedance Gain} \times \text{Photodiode Responsivity}$$

$$= 39000 \frac{\text{V}}{\text{A}} \times 0.9 \frac{\text{A}}{\text{W}_{opt}}$$

$$= 35100 \frac{\text{V}}{\text{W}_{opt}}$$

Input optical power ( $\text{W}_{opt}$ )



Simulated RIN of a 1064-nm Nd:YAG laser with 100 mW average output power.

Source: [https://www.rp-photonics.com/relative\\_intensity\\_noise.html](https://www.rp-photonics.com/relative_intensity_noise.html)

## ABOUT SILENTSYS

SILENTSYS SAS is a French company that develops, produces and commercializes innovative ultralow noise systems covering photonics, microwave/THz and electronic modules. Thanks to our well-established know-how and our patented designs, SILENTSYS offers high-performance systems that are compact, easy to use and affordable.

Our goal is to provide systems that are highly compatible with the needs of emerging industrial and laboratory applications such as those related to quantum technologies (Communications, Cryptography, Computing, Metrology, Sensing...).

## CONTACT

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## LOCATION



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