Neuropixels

OneBox

Safety & Installation Manual

Neuropixels_OneBox_User_Safety_Manual_V1-0-1
December 2024
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ABOUT THIS MANUAL

This document describes the key features of the Neuropixels ONE_1000 and how to install it prior to use. The Neuropixels hardware consists of:

The Neuropixels probe. More information on installation and usage can found in the product manual. Even if you have read articles on the Neuropixels probes and feel that you are familiar with using the Neuropixels probes, we request and encourage you to carefully read the latest version of this *User Manual* to refresh your knowledge and remain up to date on possible changes that are relevant to the use of your probes.
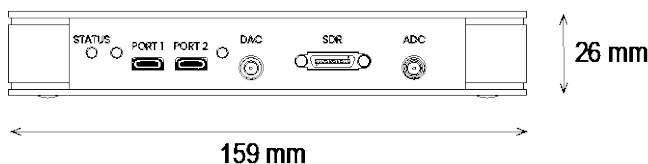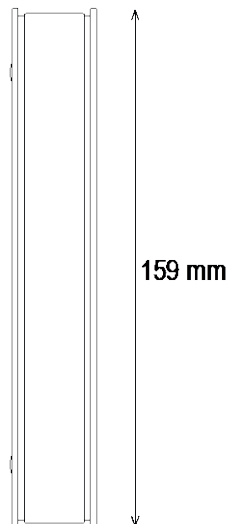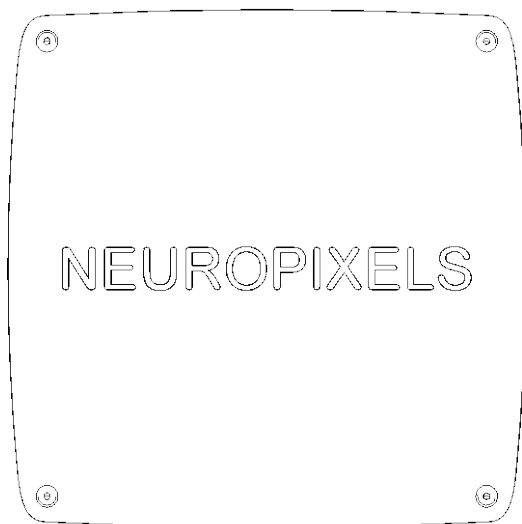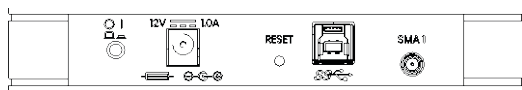
If you are unfamiliar with the Neuropixels probes, then it is <u>mandatory and imperative</u> that you carefully read the complete *Product Manual*.

The Neuropixels ONE_1000 contains:
A power adapter
A USB-3 interface cable
A standalone acquisition module (ONE_1000).

Although it might be straight forward setting up the control system It is highly recommended to carefully read the latest version of this *Safety & Installation Manual* and the *Product manual* to refresh your knowledge and remain up to date on possible changes.

Please check www.neuropixels.org or www.neuropixels.info for the latest version of all manuals.

RELATED DOCUMENTATION

The following documents and online resources contain information that you might find helpful as you read this manual:

Application Software:
- SpikeGLX:
    - http://billkarsh.github.io/SpikeGLX/.
    - https://billkarsh.github.io/SpikeGLX/Sgl_help/SpikeGLX_OneBox_Quickstart.html
- Open Ephys:
    - https://open-ephys.github.io/gui-docs/User-Manual/Plugins/Neuropixels-PXI.html
    - https://open-ephys.github.io/gui-docs/User-Manual/Plugins/OneBox

Brochures:
- Neuropixels probes (available on www.neuropixels.org or www.neuropixels.info).
- Control System (available on www.neuropixels.org or www.neuropixels.info).

Product Manuals (availabe on www.neuropixels.org/support)

Technical Datasheets (availabe on www.neuropixels.org/support)

Neuropixels Probe Datasheet.

System Datasheet.

Mechanical drawing of the aluminium metal cap (available on www.neuropixels.org or www.neuropixels.info).

EDITORIAL

About Neuropixels

The Neuropixels neural probes are advanced silicon CMOS digital integrated microsystems and tool for neuroscience research. It was developed through a collaboration funded by Howard Hughes Medical Institute (HHMI), Wellcome Trust, Gatsby Charitable Foundation and Allen Institute for Brain Science. Probes were designed, developed, and fabricated at imec, Leuven Belgium in collaboration with HHMI Janelia Research Campus, Allen Institute for Brain Science and University College London.

Limited Warranty and Limitation of Liability

All warranty and Limitation of Liability conditions are described in "IMEC GENERAL TERMS AND CONDITIONS OF SALE" added to the purchase order and are considered to be read and signed.

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The Neuropixels 1.0 probes are ONLY distributed to the Neuroscience Research Community under the "IMEC GENERAL TERMS AND CONDITIONS OF SALE OF NEUROPIXELS 1.0 PROBES".

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Important Information

THE NEUROPIXELS PROBES ARE ONLY INTENDED FOR RESEARCH USE ONLY ("RUO") IN NON-HUMAN SUBJECTS SUCH AS SMALL ANIMALS INCLUDING RODENTS AND NON-HUMAN PRIMATES. THESE NEUROPIXELS PROBES SHOULD NOT BE USED IN HUMANS AND ARE NOT MANUFACTURED OR APPROVED FOR HUMAN USE. THEY HAVE NO PROVEN HUMAN EFFICACY AND ARE NOT INDICATED FOR HUMAN USE OR ANY FORM OF CLINICAL USE.

Important safety information

This document contains information and warnings that must be followed by the user for safe operation and to keep the product in a safe condition.

NOTE. This document is a supplement to the Neuropixels OneBox Product Manual. Where there is conflict between the two, the information in this document supersedes the information in the manual.

General safety summary

Use the product only as specified. Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

Carefully read all instructions. Retain these instructions for future reference.

Comply with local and national safety codes.

For correct and safe operation of the product, it is essential that you follow generally accepted safety procedures in addition to the safety precautions specified in this manual.

The product is designed to be used by trained personnel only. Only qualified personnel who are aware of the hazards involved should remove the cover for repair, maintenance, or adjustment.

Before use, always check the product with a known source to be sure it is operating correctly.

This product is not intended for detection of hazardous voltages. When incorporating this equipment into a system, the safety of that system in combination with the OneBox is the responsibility of the assembler of the setup. Avoid improper or prolonged use of keyboards, pointers, and button pads. Improper or prolonged keyboard or pointer use may result in serious injury.

Be sure your work area meets applicable ergonomic standards. Consult with an ergonomics professional to avoid stress injuries.

Use care when lifting and carrying the product.

To Avoid Fire or Personal Injury

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings *information before making connections to the product*.

Do not exceed the Measurement Category (CAT) rating and voltage or current rating of the lowest rated individual component of a product, probe, or accessory.

Provide Proper Ventilation. Refer to the manual's installation instructions for *details on installing the product so it has proper ventilation*. No slots and openings are provided for ventilation, however the OneBox should never be covered or otherwise obstructed. Do not push objects into any of the openings.

Provide a safe working environment. Always place the product in a location convenient for viewing the indicators.

The ONE_1000 (OneBox Hardware Device) can be used as a desktop product. When two optional fixation parts are mounted to the bottom of the ONE_1000, the device can be used wall mounted. When On/Off button is out of operator range, the ONE_1000 becomes a disconnect able device by pulling the plug of the power supply.

Definitions of technical terms

Control System: System components required to enable control of and data streaming from Neuropixels probes. These entail the headstage, interface cable and ONE_1000.

Headstage: Miniature board that enables reliable power supply to the probe and is essential for bi-directional data communication from/to the probe.

Interface Cable: Thin and flexible cable for power and bidirectional data transmission between headstage and OneBox ONE_1000

OneBox ONE_1000: Standalone module with 1 FPGAs for probe configuration, data acquisition and transmission to PC via USB-3 interface.

Port: USB-C plug on the front panel of the OneBox ONE_1000. Each front panel contains 2 ports allowing connection of up to 2 interface cables.

Driver: The software files that need to be installed on the host PC to enable communication with the Neuropixels control system and to develop custom application software.

List of abbreviations

API	Application Programming Interface.
ESD	Electro-Static Discharge.
FPC	Flexible Printed Circuit.
GND	Ground.
HS	Headstage.
I/O	Input and/or Output.
LED	Light-Emitting Diode.
PCB	Printed Circuit Board.
PC	Personal Computer.
REF	(External) Reference.
SMA	Sub-Miniature version A.
SMD	Surface-Mount Devices.
USB-C	Universal Serial Bus Type-C.

Table of Contents

List of Figures

List of Tables

1 General information

1.1 Intended use and functional description.

The intended use of the equipment is categorized as "Multimeter for scientific research and custom data acquisition system".

The Neuropixels ONE_1000 is to be used exclusively with Neuropixels probes. It provides the user readout functionality of neural data from up to 2 headstages towards a standard PC running Neuropixels API controlling the system. Additional peripherals are provided for local hardware synchronisation, triggering, configurable I/O and wave player functionality.

1.2 Unpacking and Handling

Regarding probe handling, it is mandatory to consult the *Product Manual* and carefully read the instructions. Upon receiving the Neuropixels ONE_1000 kit, immediately inspect the shipping boxes and content for damage. In case of damage, please carefully read the included warranty document and follow the instructions.

The ONE_1000 kit arrives in a protective cardboard box containing the ONE_1000 and peripheral accessories. All system components are also delivered in antistatic bags or boxes.

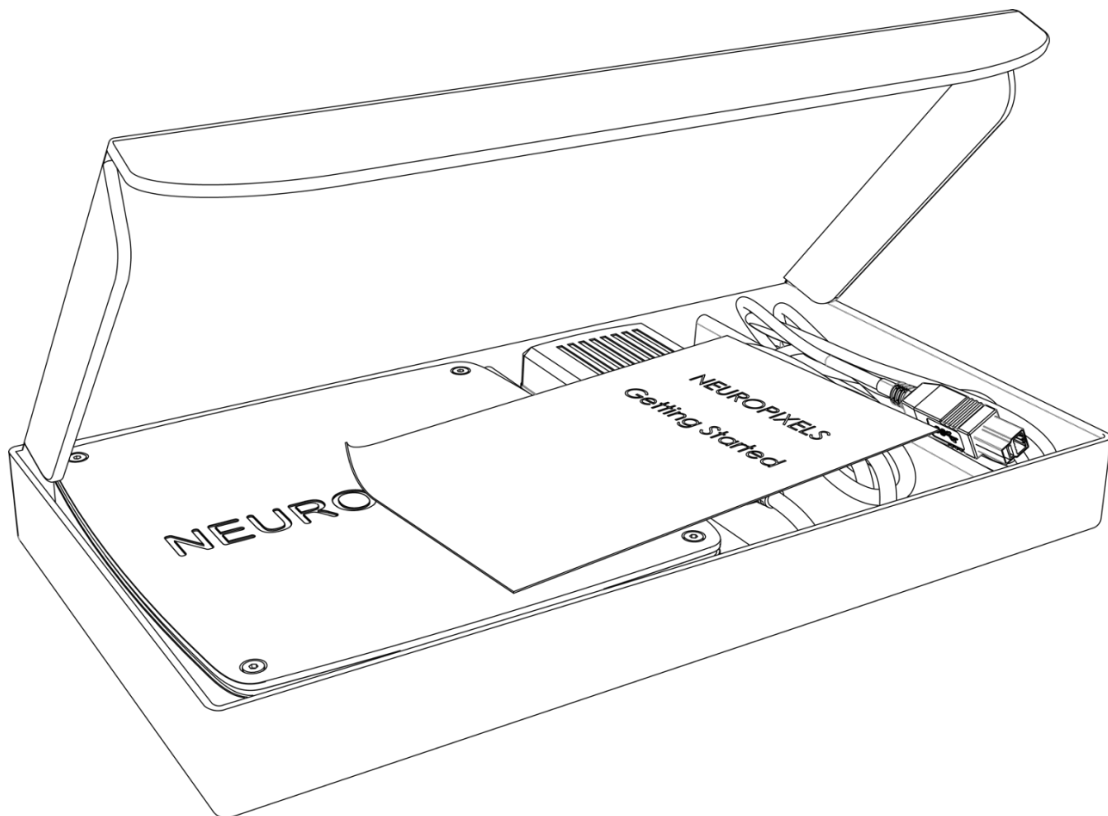Check all items on visual defect while unpacking. In case of defects please contact neuropixels.sales@imec.be .

Figure 1: Package Content

1.3 Packaging content

The Neuropixels ONE_1000 kit packaging box contains:

A power adapter: Phihong PSAA18U-120
A USB-3 interface cable: CNC Tech 103-1030-BL-F0200
A standalone acquisition module (ONE_1000):   ONE_1000
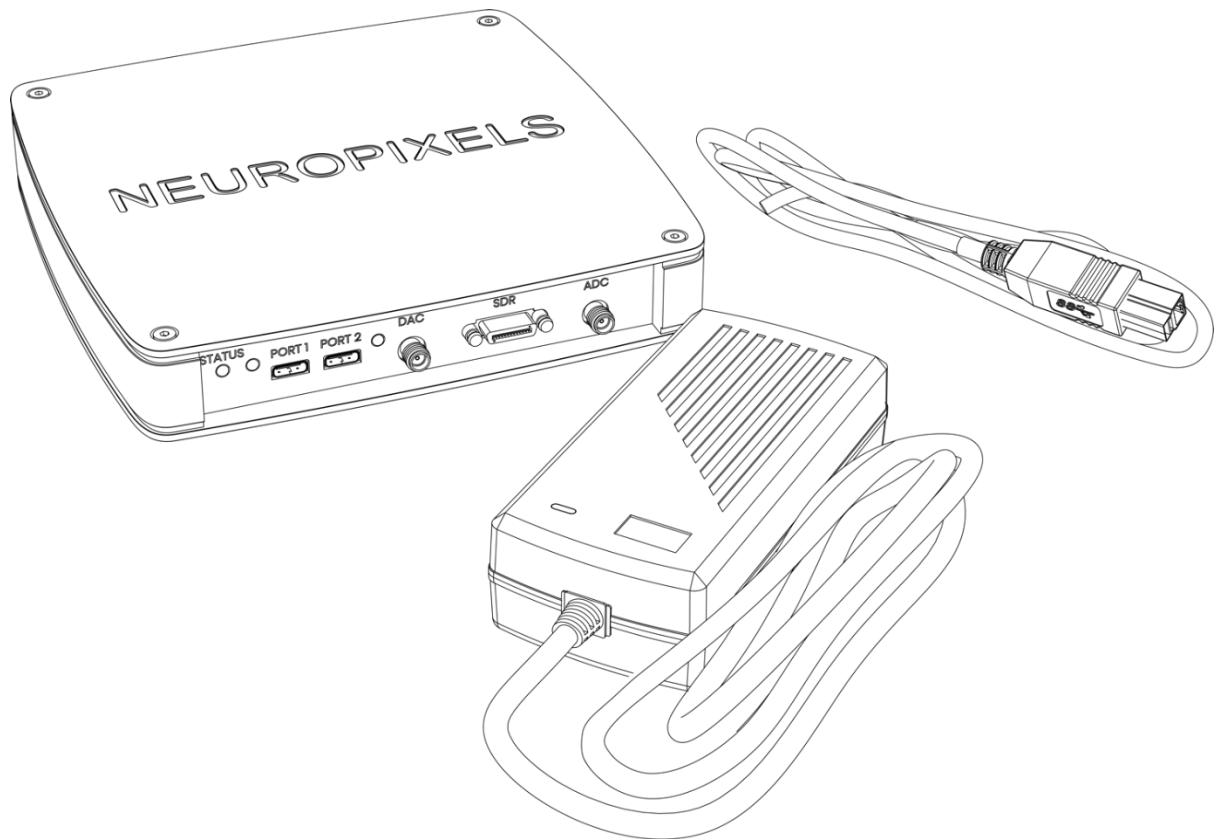Safety Instructions.

Figure 2: Packaging Box Content

Important Note:
The mains power cord is regionally bound and can be ordered separately. The recommended connector at the power adapter side is IEC60320 C13 with 250 VAC 10A ratings.

Figure 3: ONE_1000 standalone acquisition module (shown without accessories)

Important Remarks:

Please refer to paragraph 2.1 for connector description.

Please refer to the *Product Manual* for functional usage and configuration.

1.4 Product Label Description

The product label is located at the bottom of the ONE_1000 standalone acquisition module.
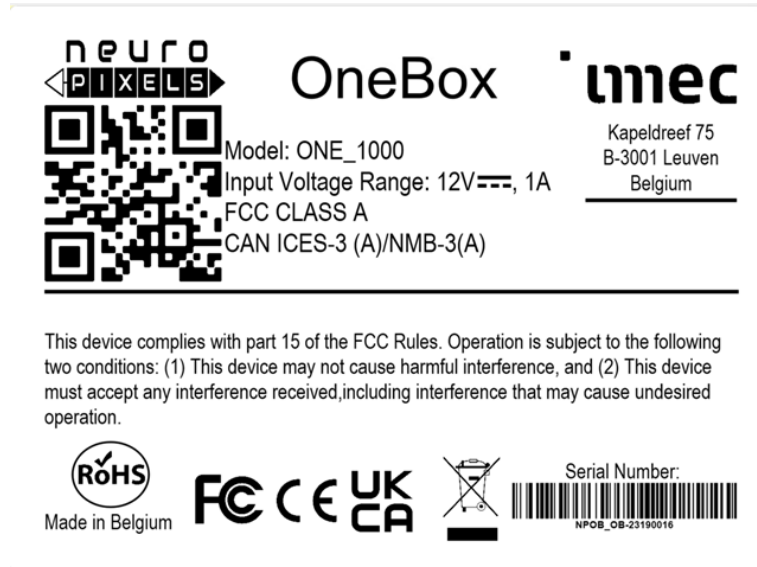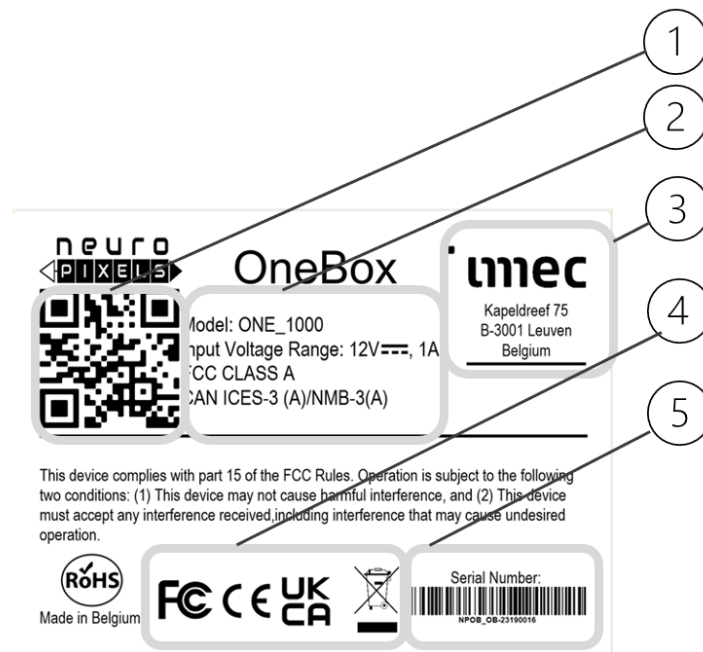

Figure 4: Product label

Figure 5: Product label content marking

Product label content description:
1: Qr-code referring to the www.neuropixels.org website.
2: Model description
3: Manufacturer address
4: Compliance pictograms
5: Product Serial number

SPECIFICATIONS

1.4.1 General

Operating temperature	+10˚C to +40˚C
Storage temperature	+5˚C to +60˚C
Relative Humidity	5 to 95%, non-condensing
Pollution Degree	2, Rated for indoor, dry location use only.
Operational altitude	< 2000m

Table 1: General Specifications

1.4.2 Mechanical

Dimensions	159mm x 159mm x 26mm
Weight	Approximately 0,610 kg (ONE_1000)
Usage	Desktop or Mountable (using fixation accessories)

Table 2: Mechanical Specifications

1.4.3 Power & I/O Signaling

Main DC input voltage	12V ⎓
DC input current	1.0 A
Internal input protection	Fused, Fast Acting 1A 63V Vishay MFU1206FF01000P100
USB Interface	3.0, no power transfer
SDR Interface: Power output (pin 1,26) LVDS I/O CAN I/O Analog I/O	12V at 0.5A max Vdiff = 340mVpp at 1.2VDC CM at +/- 12mA max per line LTC2875 Device specifications at 3,3V +/- 10 V DC at 30mA max per line
ADC Interface	+/- 10 V DC
DAC Interface	+/- 10 V DC
Clock output interface	+2.5Vpp at 1.25Vdc

Table 3: Power & I/O Signalling Specifications

1.4.4 Compliance Information

This section lists the safety standard(s) with which the instrument complies and other safety compliance information.

EU declaration of conformity:
Compliance was demonstrated to the following specification as listed in the Official Journal of the European Union:

Low Voltage Directive 2014/35/EU. Directive on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits.
According to the following standards:
EN 61010-1:2010 (edition 3.0): Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1: General requirements.
Electro-Magnetic Directive 2014/30/EU; Directive on the harmonization of the laws of the Member States relating to electromagnetic compatibility (recast)
According to the following standard:
EN 61326 – 1 (2013). Electrical equipment for measurement, control and laboratory use

US & Canada declaration of conformity:
FCC Part 15 Subpart B
ICES- 003 declaration of conformity

1.4.5 Safety class

The ONE_1000 is qualified as a CLASS III device, Overvoltage category II, Pollution degree 2.
The power supply is a Class I product with an IEC C14 type of input AC connector. The PE terminal of this connector is DC coupled connected to the functional ground of the DC output.

1.4.6 Certifications and precautions

This instrument is EN61010-1 certified. It may only be used to make measurements using Neuropixels certified types of neural probes. All inputs and outputs are protected against continuous overload conditions up to the limits of each function's stated protection (see specifications). Never exceed these limits or the ratings marked on the instrument itself. Always inspect your ONE_1000 module, probes and accessories for signs of damage or abnormality before every use. If an abnormal condition exists
(broken or damaged probes, cracked case, etc.), do not use. Never ground yourself when taking measurements. Do not touch exposed metal pipes, outlets, fixtures, etc., which might be at ground potential. Keep your body isolated from ground and never touch exposed wiring, connections, test probe tips, or any live circuit conductors. Do not operate instrument in an explosive atmosphere (flammable gases, fumes, vapor, dust.) Do not use this or any piece of test equipment without proper training.

1.4.1 Geographical Area

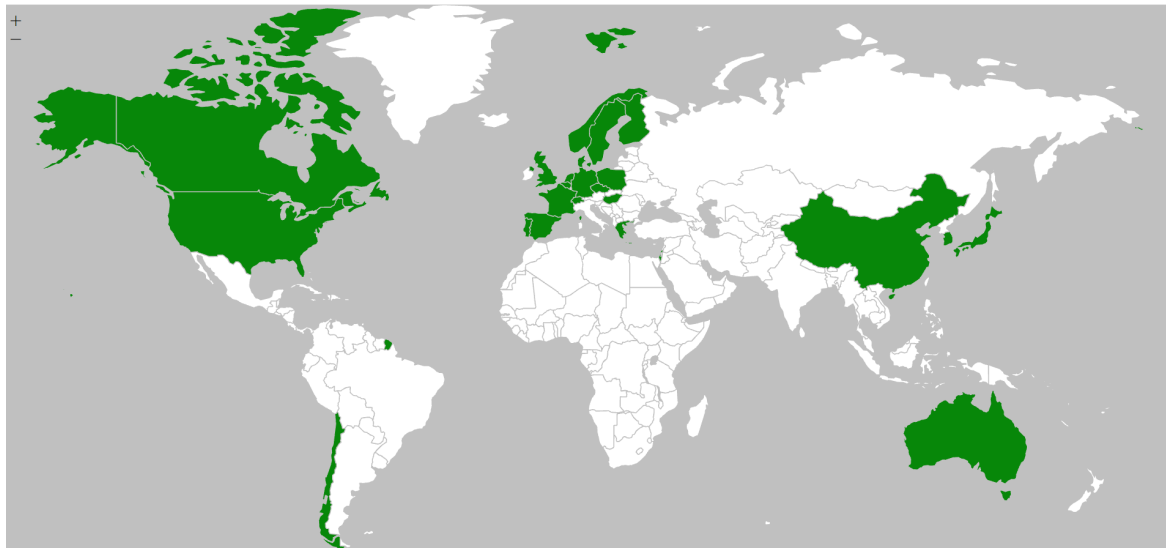This instrument is deployed in following geographical area:

Figure 6: Geographical Area

List of countries:
Australia
Belgium
Canada
Switzerland
Chile
China
Czech Republic
Germany
Denmark
Spain
Finland
France
United Kingdom
Greece
Hungary
Israel
Japan
Netherlands
Norway
Poland
Portugal
Sweden
Singapore
South Korea
US

2 Getting started

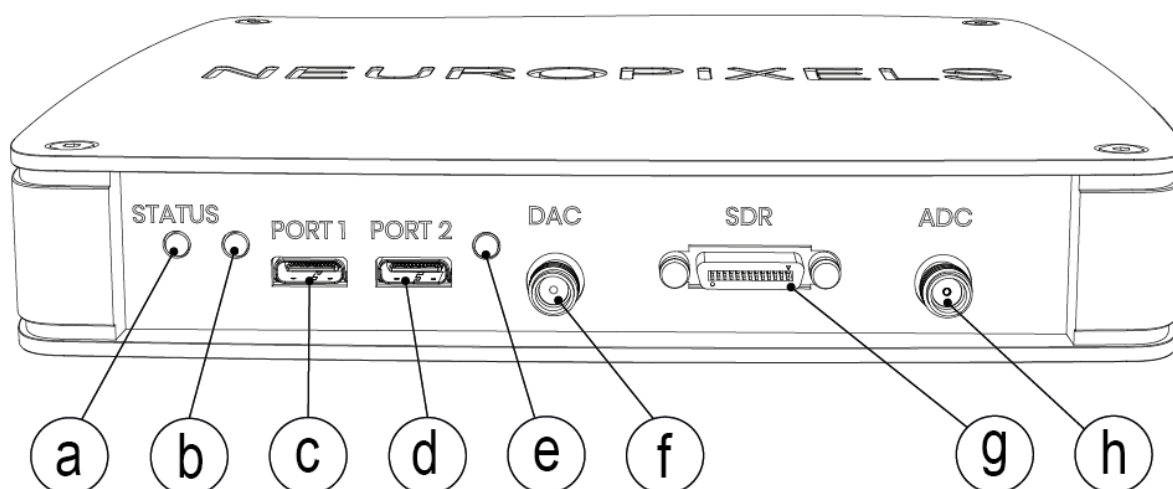## 2.1 Front and Back Plate Description

2.1.1 Front Plate

Figure 7: Front Plate Description

Front Plate Description (fltr)

Item	ID	Description
A	STATUS LED	General System Power & USB link status
B	PORT 1 LED	Port 1 LED indicator.
C	PORT 1	Probe 0 interface port (*)
D	PORT 2	Probe 1 interface port (*)
E	PORT 2 LED	Port 2 LED indicator.
F	DAC	Digital-to-Analog Converter Output Connector
G	SDR	Shrunk Delta Ribbon I/O connector
H	ADC	Analog-to-Digital Converter Input

(*)   *Warning: the mating USB-C type connector can only be used with the specific Neuropixels control system interface cable. Please refer to https://www.neuropixels.org/probes-and-probe-specific-accessories for different types. Connection of other devices might damage the ONE_1000 module.*
Back Plate Description (fltr)
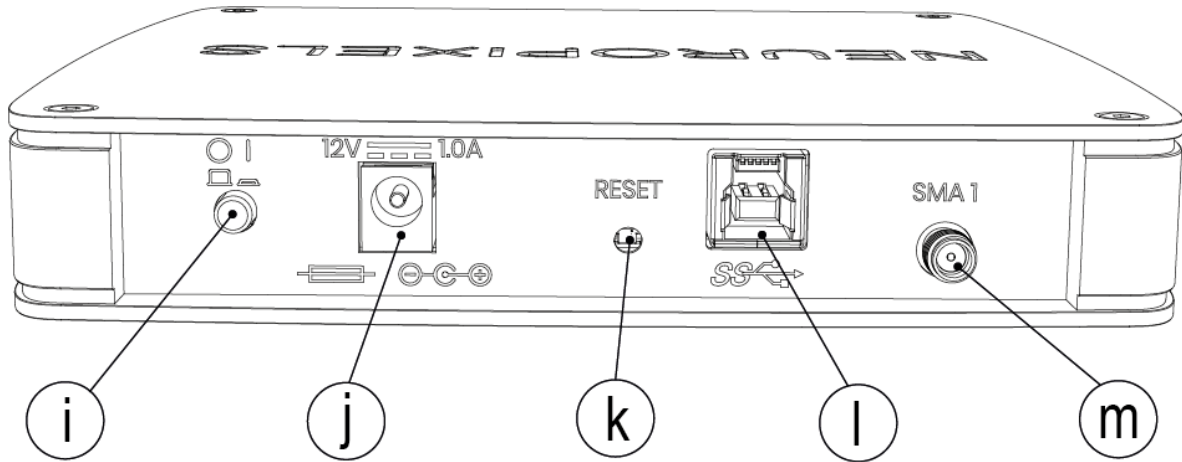
Table 4: Front Plate Description

2.1.2 Back Plate

Figure 8: *Back Plate Description*

Back Plate Description (fltr)

Item	ID	Description
i	PUSHBUTTON	Power ON/OFF Button
j	POWER JACK	Main Power Input.
k	RESET	System Reset button (*)
l	USB-3	USB-3 Interface port
m	SMA-1	Clock Synchronisation Output

(*) Please use an object of maximum 3mm diameter.

Table 5: Back Plate Description

Important remark:
More details on functional usage of interfaces, buttons and indicators are described in the *Product Manual.*

2.2 USB Driver Installation

The Neuropixels ONE_1000 acquisition module communication interface is a standard type USB 3.1. The interface requires a FTDI "D3XX" type of driver to communicate with the Neuropixels API. As the Neuropixels API is only supported in Windows 10, it is highly recommended to use the driver and API only in environment. Most Windows 10 installation packages contain this driver. In case manual driver installation is required, please refer to FTDI website for driver download and installation instructions at following location: D3XX Drivers - FTDI (ftdichip.com)

For instructions regarding API installation and usage, please consult the *Product Manual*.

3 Installation and mounting

This Chapter describes how to install the Neuropixels ONE_1000. Make sure you have the following hardware components available:

3.1 Neuropixels ONE_1000 components

As described in paragraph 1.3, the kit contains:
1x ONE_1000 acquisition module
1x Power adapter
1x USB 3.1 cable

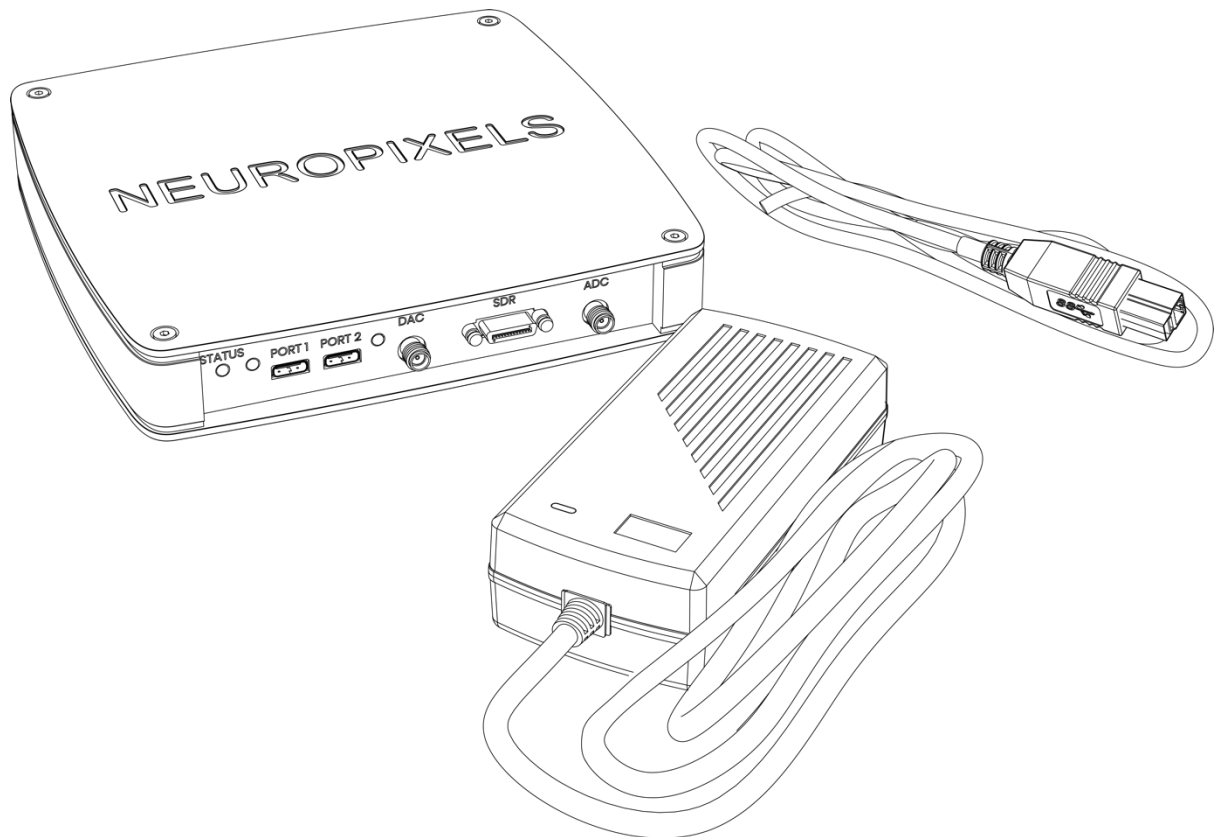*Figure 9: ONE_1000 kit components*

3.2 Neuropixels System Components

For more information about Neuropixels specific components such as Headstages, cables, Probes, and other system components, please refer to the OneBox *product manual.*

3.3 Connecting the ONE_1000 Components

3.3.1 USB-3 to ONE_1000 Module

Interconnection of the USB 3.1 cable to the ONE_1000 acquisition module is established at back plate "USB-3" interface, item "I" as referred in paragraph 2.1.2. This connection is "electrically hot-swappable" meaning that the ONE_1000 acquisition module does not require to be powered off when changing interconnection. However, it is possible that the software needs to be re-initiated. Please refer to the OneBox *product manual* for more details.
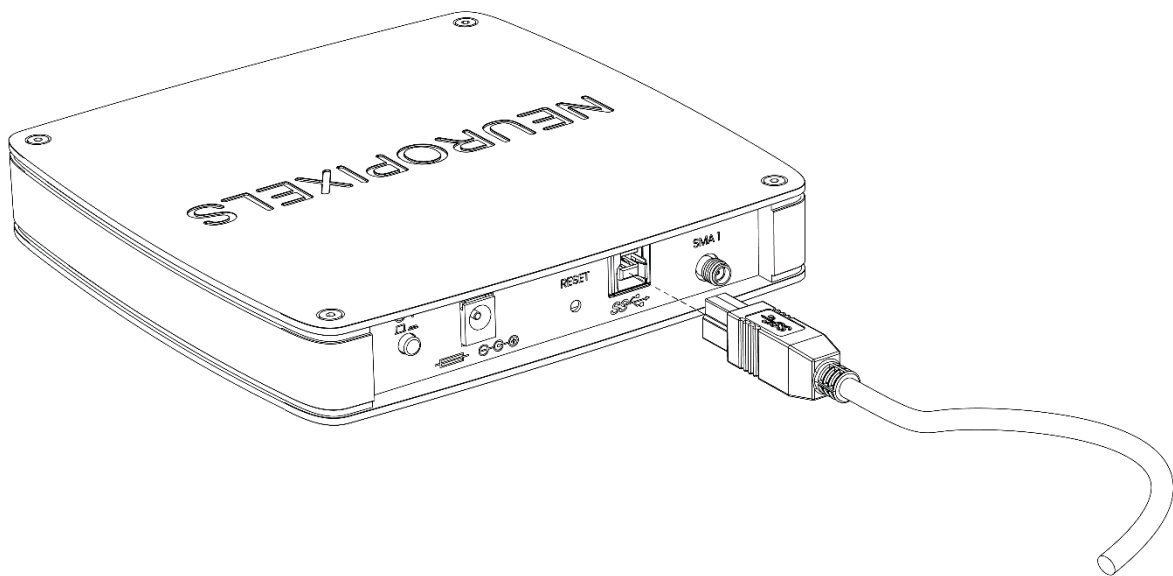

Figure 10: USB-3 connection

3.3.2 PSU to ONE_1000 Module

Interconnection of the power adapter to the mains voltage can only be established by using a regionally safety approved power cord with a IEC320 C14 plug according to rating recommendations as described in paragraph 1.3.
Please refer to regional installation and power cord safety approvals before use to avoid damage or injury.
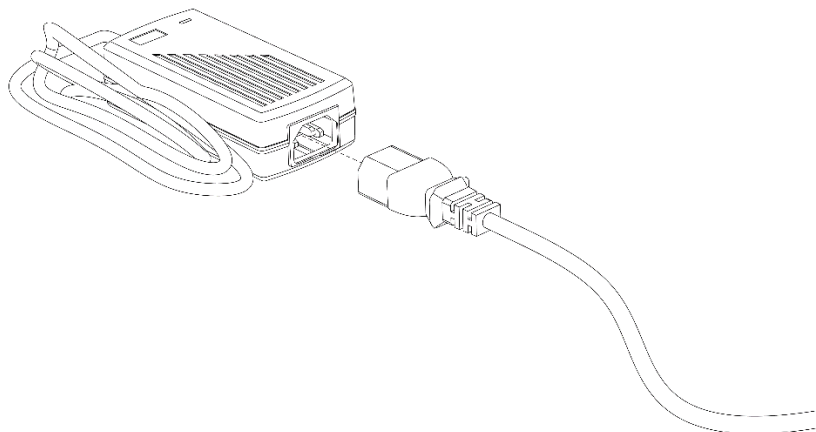

Figure 11: Power cord connection

Interconnection of the DC power plug type of the PSU to the power jack ONE_1000 module is established at back plate "Power Jack", item "j" Interface as referred in paragraph 2.1.2. It is recommended to switch off the ONE_1000 acquisition module power by setting "PUSHBUTTON, item "i" as referred in paragraph 2.1.2 to OFF.
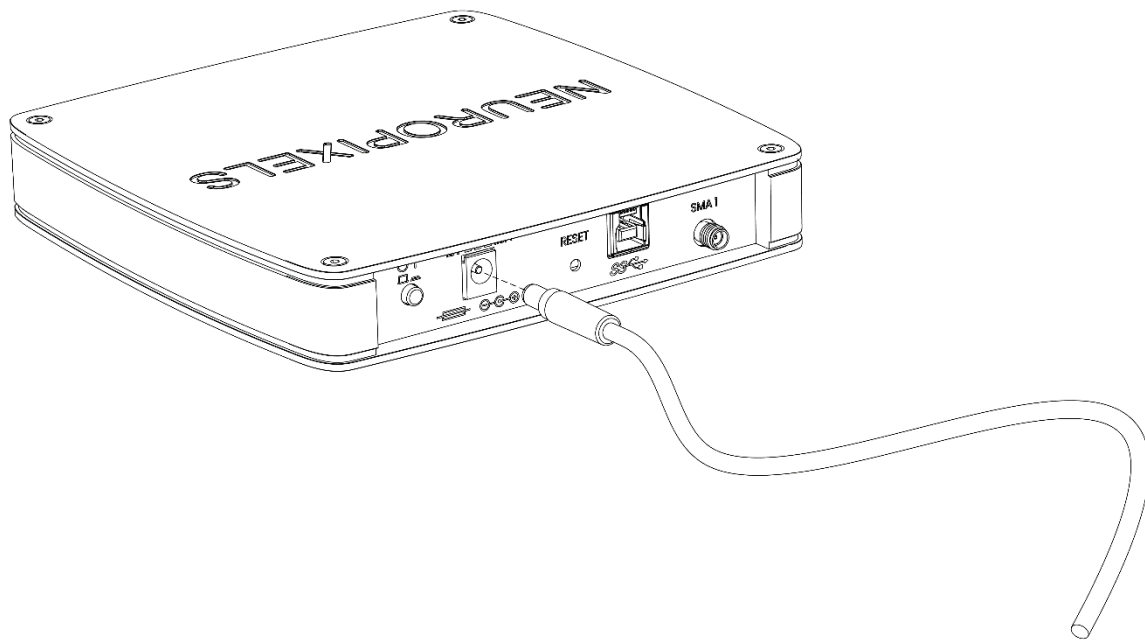

Figure 12: DC power plug connection

3.4 Installation of the ONE_1000

The ONE_1000 acquisition module can be used either in a desktop setup or wall mounted. For proper usage of the equipment, it is advised to follow the recommendations in this paragraph.

3.4.1 Desktop placement

Setting up the ONE_1000 components in a desktop configuration requires some available free space for and around the device for mounting and positioning components and cables, easy access to connectors and indicator LEDs.
Always place the acquisition module with the Neuropixels logo at the upside. Do not cover the acquisition module or power adapter. The acquisition module has rubber feet mounted at its bottom cover plate to avoid easy sliding on a desktop.
Position the power adapter and USB cables free and in such a manner that connectors are strain relieved. Excessive stress on connectors due negligent cable positioning can damage component connectors. Make sure that cable positioning cannot result in component damage or injury of the user.
Although not mandatory for functional operation it is recommended to follow workplace ergonomic recommendations and instructions when using the setup.
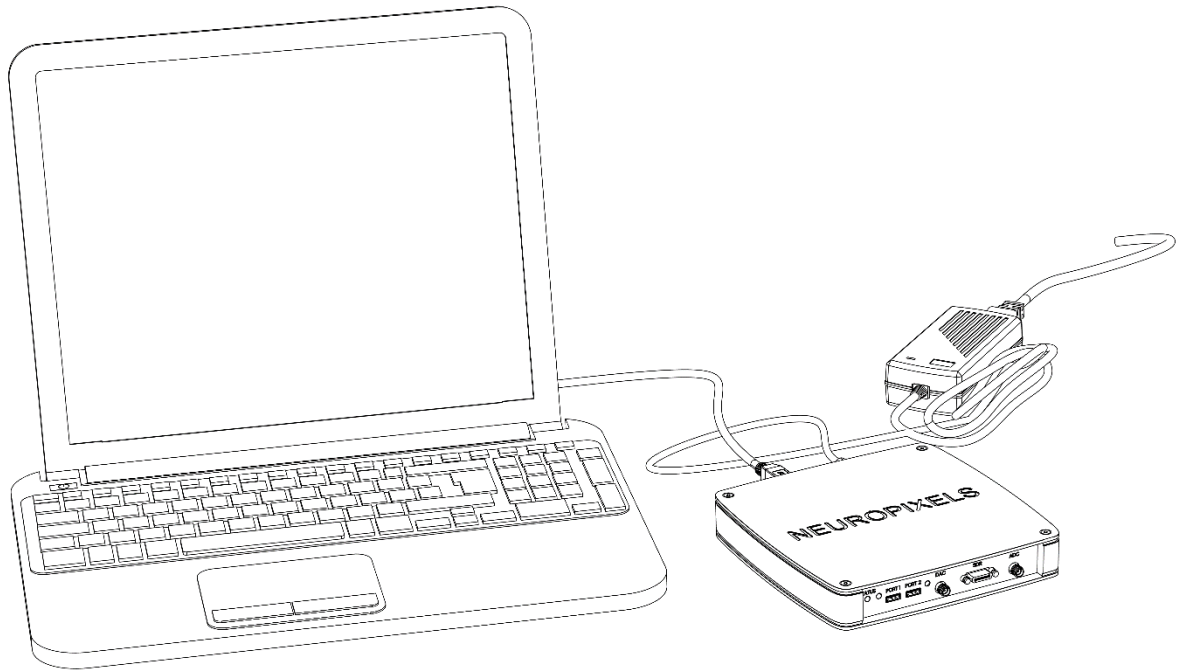An example of a desktop setup is shown in Figure 10.

Figure 13: Desktop placement example

3.4.2 Wall mounting

Always take local safety rules and guidelines into account as described by the working environment of the user before starting wall mounting activities on any of ONE_1000 components.
Setting up the ONE_1000 components in a wall mounted configuration requires some extra handling and installation steps:

Step 1:
Mount the fixation plates to the acquisition module using the recessed M3 screws in the mounting plate kit.
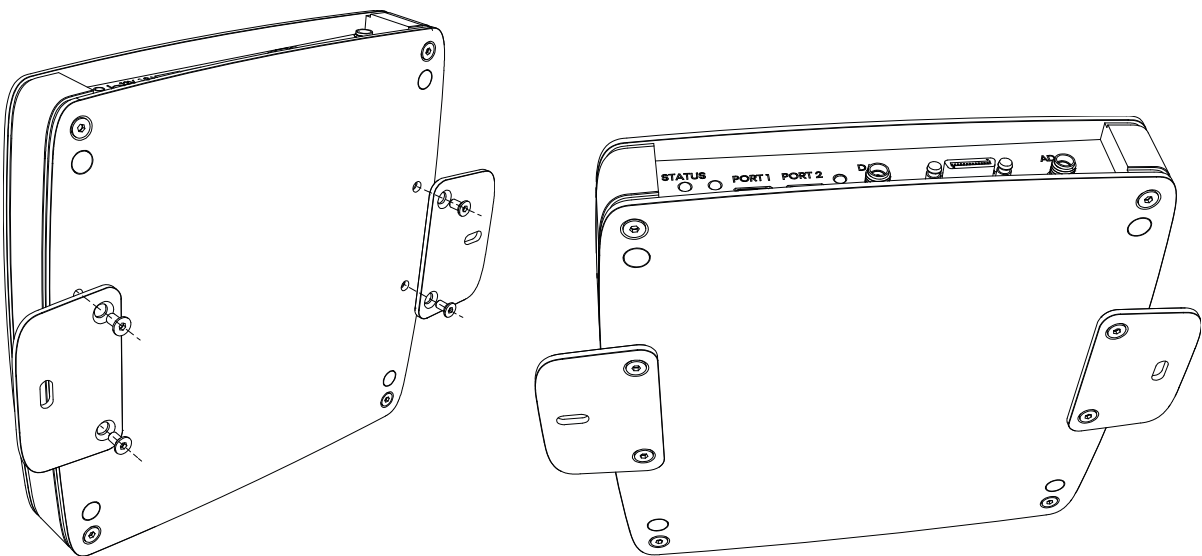

Figure 14: Fixation plate mounting.

Step 2:
Fasten the OneBox acquisition module to the wall (or frame) by means of two screws. The weight of the OneBox is approximately 650g. The screws should support this to avoid possible damage or injury.
Tip: It is recommended to position the OneBox in such a way that indicator LEDs at the front panel or visible to the user.
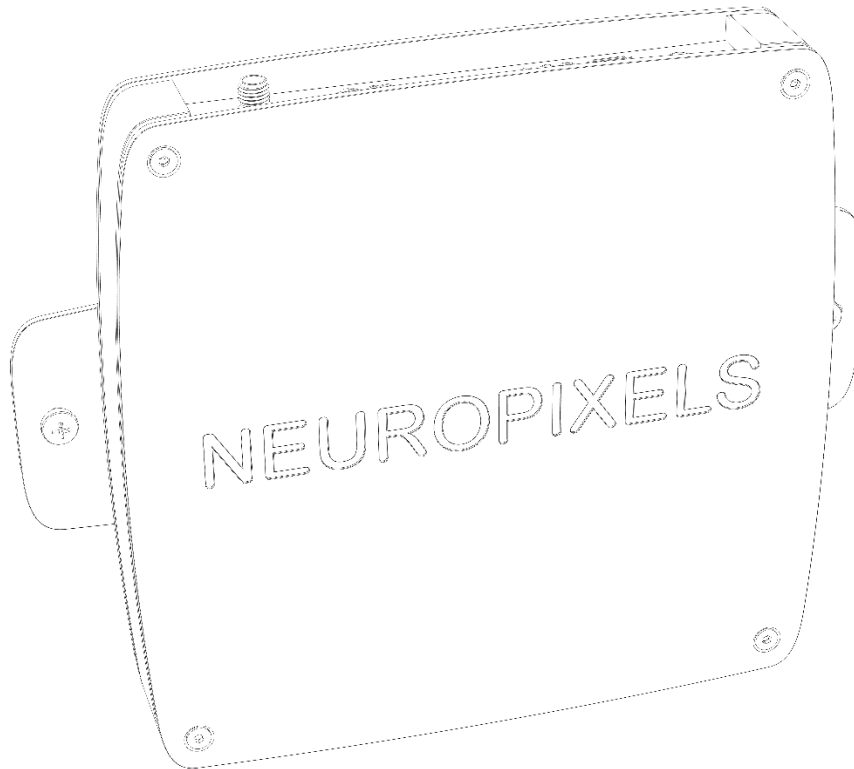

Figure 15: Wall or Frame mounting.

Step 3:
Connect power adapter and cables to the acquisition module. Extra care should be taken to mount the power adapter and strain relief all cables to avoid damage to connectors or possible injury.
It is advised to install a safety switch to obtain that the module power can be switched ON and OFF by in case the ON/OFF button is difficult or not reachable. This safety switch ratings should meet module power and safety installation regulations.

4 ESD Safety

To avoid ESD damage when handling the electronic hardware (probe, HS, ONE_1000), the operator must be grounded via ESD protective equipment, such as a wrist wrap. General ESD guidelines can be found at: http://www.esda.org/about-esd/esd-fundamentals/part-3-basic-esd-control-procedures-and-materials/.

When the probe is implanted in an animal, special precautions are required; To protect the probe from ESD damage, potential static charge build-up on the animal must be discharged via a low-current path. ESD-compliant material must be used because the cables and connectors have an integrated 1M-10M resistor, which limits the current and thus induces a slow discharge rather than a spike.

Preventing static charge build-up on an animal can be challenging, especially when the animal is transported between locations (e.g., vivarium cage, transport cage, lab cage, operation table). Static charge build-up can be prevented by continuously keeping the animal on an ESD-compliant mat which is connected to earth ground via an ESD-compliant cable.

If continuous grounding of the animal is not feasible, the following guidelines should be followed:

- Grounding of the operator via ESD-compliant protective equipment when touching the animal.
- Grounding of the animal via ESD-compliant protective equipment prior to connecting the probe flex to the HS. This can be done, for example, by placing the animal on an ESD-compliant mat. Alternatively, if the external reference wire of the probe flex is connected to the animal's skull, the grounding can be done through this connection. This connection should be maintained throughout the experiment.
- Grounding of the probe flex ground pin or wire via ESD-compliant protective equipment prior to connecting the probe flex to the HS. This connection can be removed when the probe flex is plugged into the HS.
- Grounding of the ONE_1000 module to earth ground prior to connecting the probe flex to the HS. This is normally already achieved using a mains cable with PE into the mains supply IEC C14 connector.

NOTE: A connection from the probe to the ONE_1000 module ground does not provide an ESD-safe discharge path, because it does not contain a current-limiting resistor.

Addendum A: General Technical Information
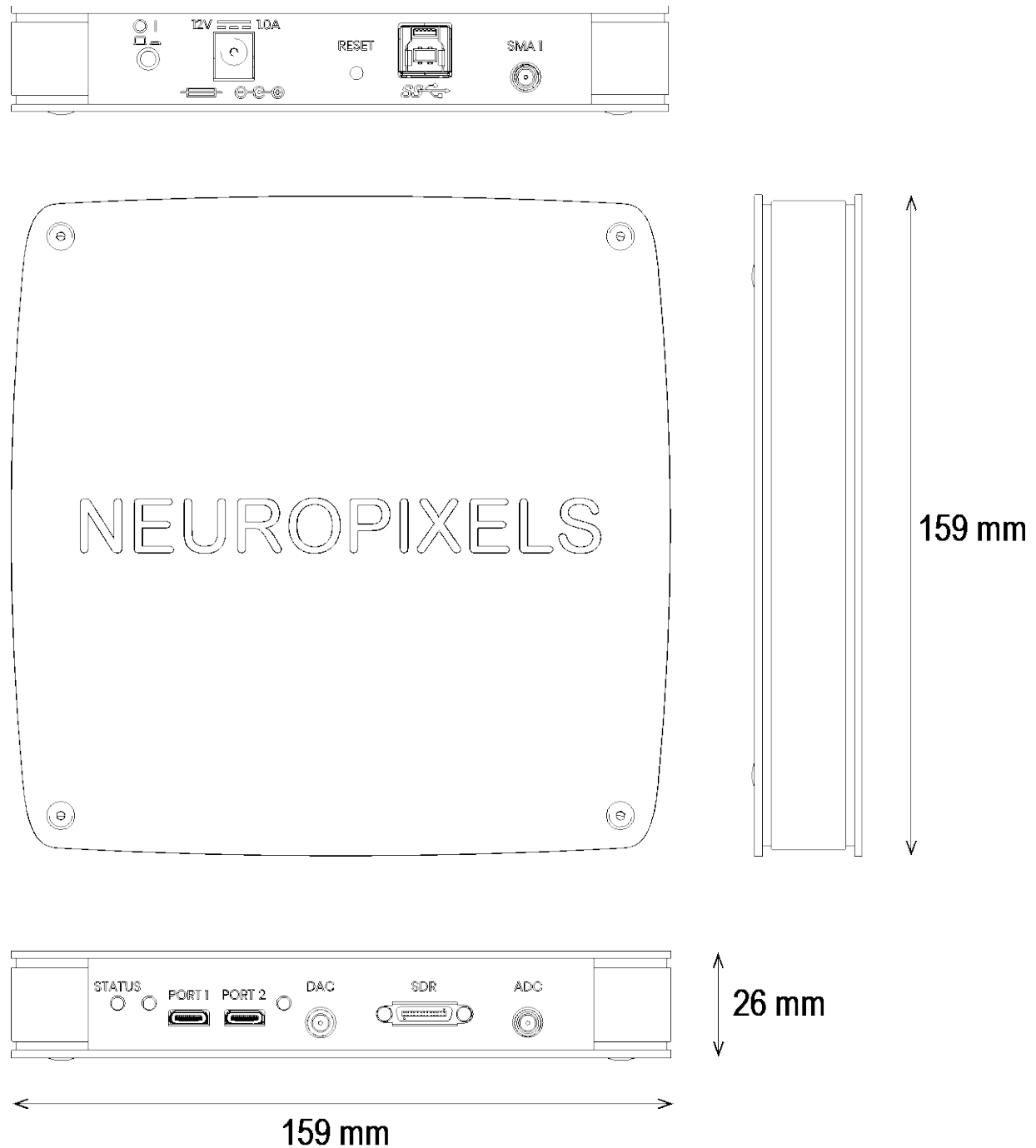
1. MECHANICAL DIMENSIONS

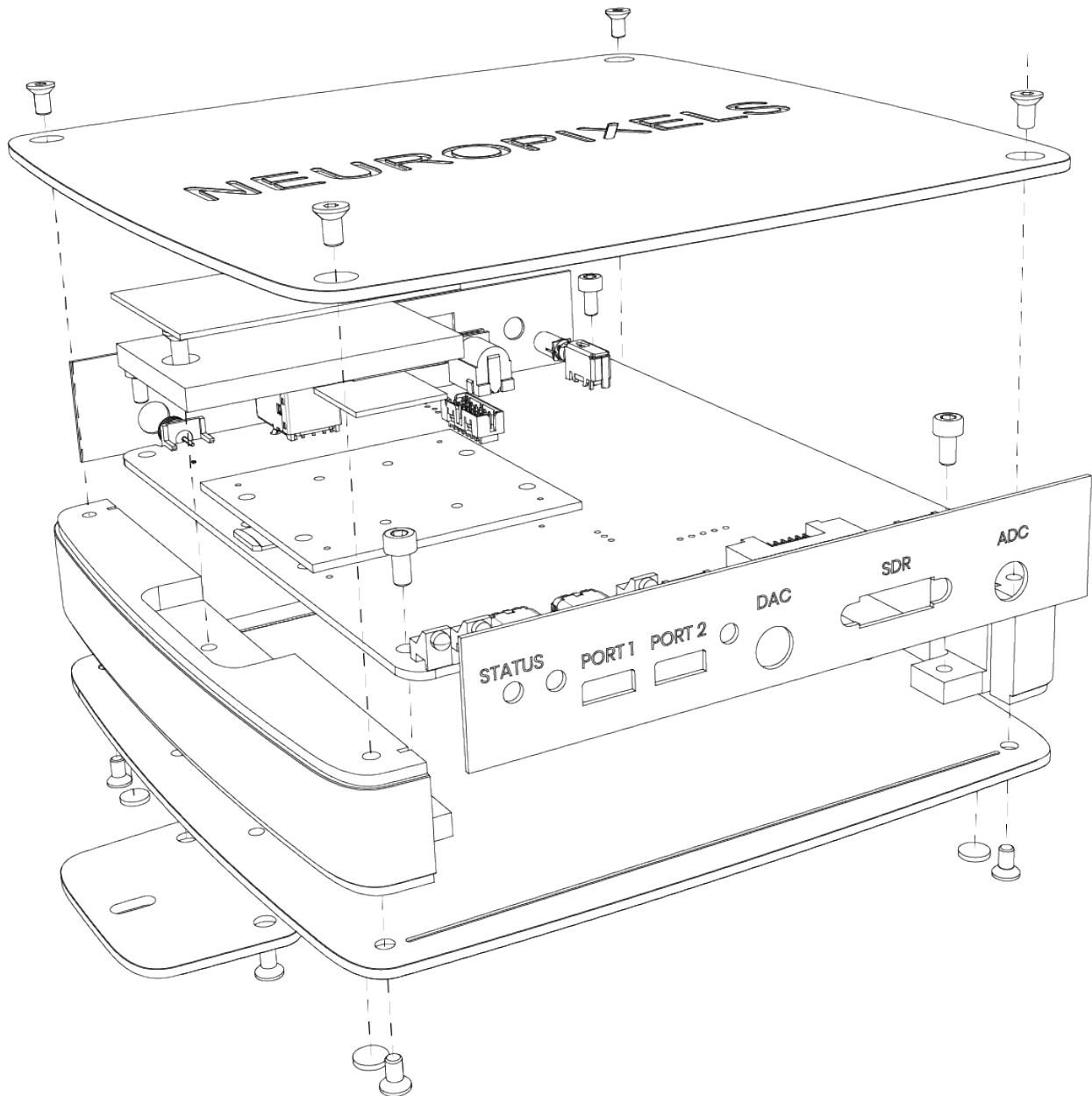*Figure 16: Mechanical Dimensions.*

2. ASSEMBLY ILLUSTRATION

Figure 17: Assembly Illustration.
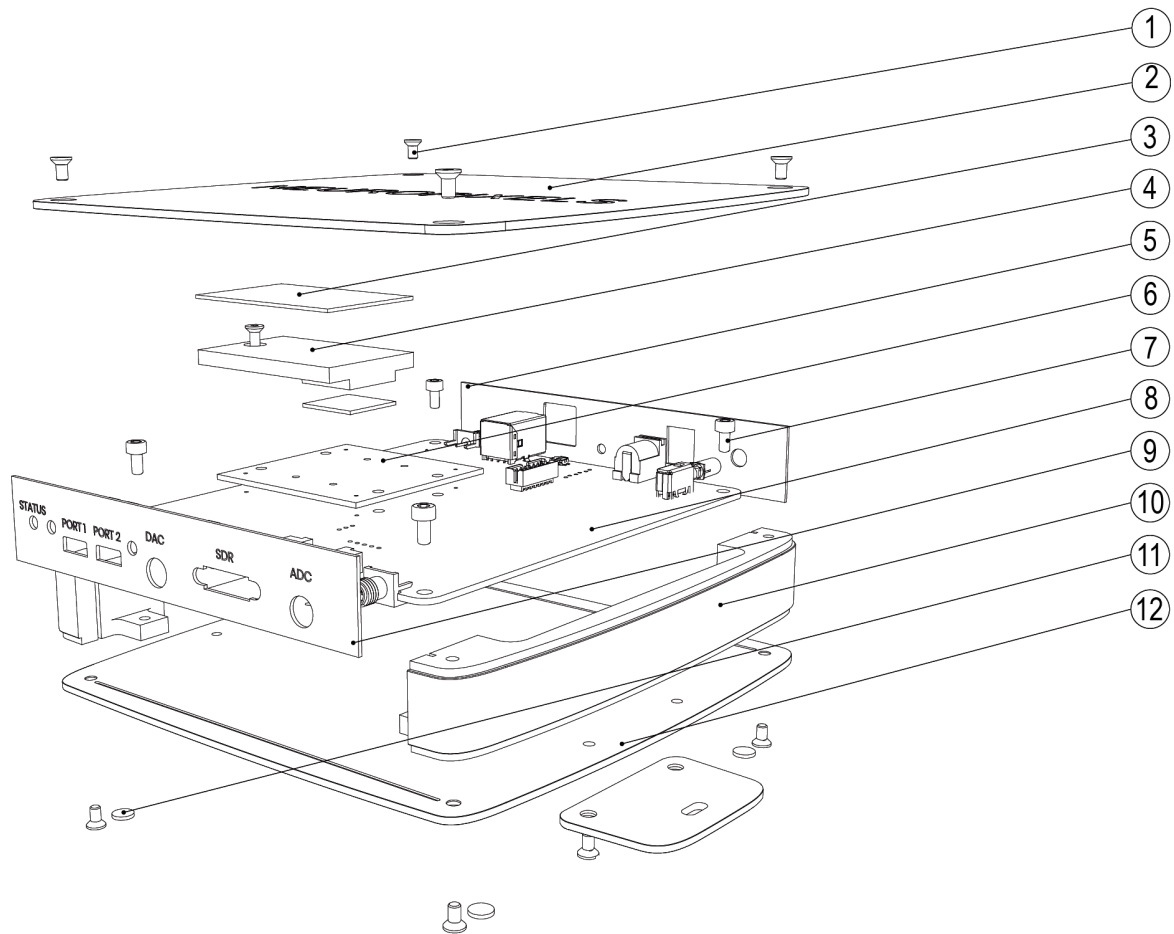
3. ASSEMBLY PART DESCRIPTION

Figure 18: Assembly Part Description.

Item #	Description
1	Screws M3x6 (8x, countersunk)
2	Top Cover Lid (w Neuropixels Embedded logo)
3	Thermal adhesive
4	Heat Sink + screw M3x6 (1x, countersunk)
5	Back Plate
6	Enclustra ZX-5 module
7	Screws M3x6 (non countersunk)
8	Acquisition Board
9	Front Plate
10	Mounting side plates (2x)
11	Module legs
12	Bottom Cover Lid

Notes:

END OF DOCUMENT