
BrainAccess MIDI Electroencephalograph

Version 2.0

User's Manual
Version 2.0
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Introduction

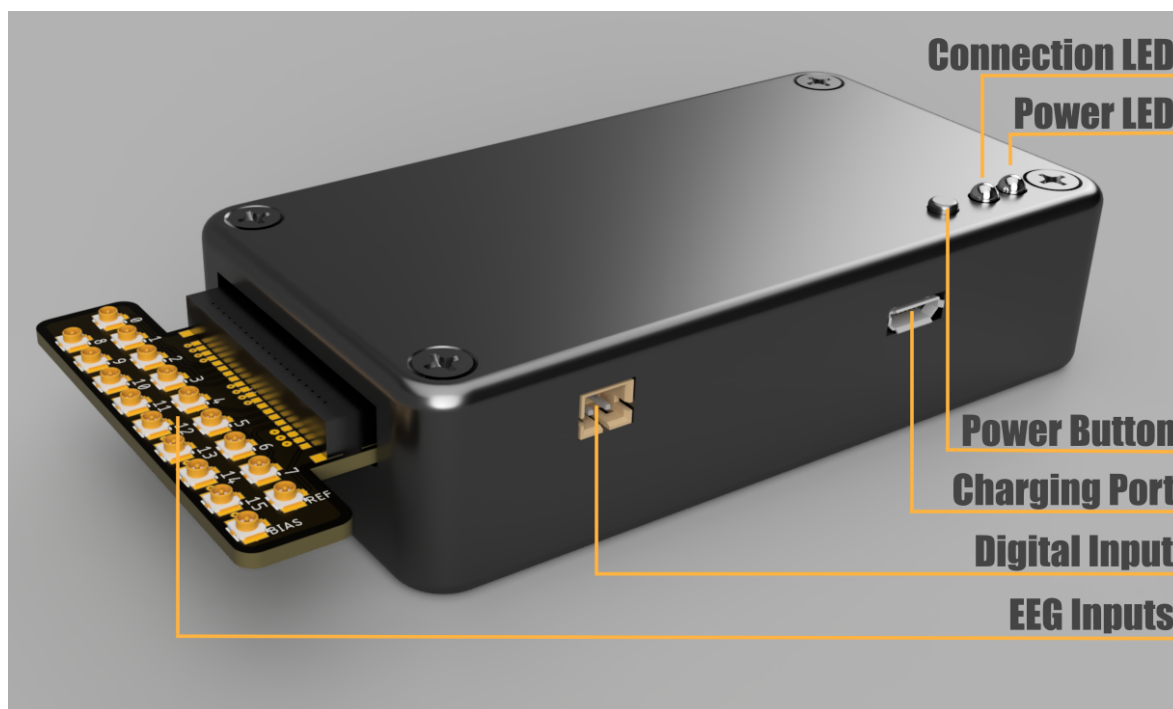
Welcome to the user's manual of BrainAccess MIDI electroencephalograph. It overviews the main features and specifications of the device and guides you through the set-up procedure. Should you have any further questions not covered in this guide please visit www.brainaccess.ai where you can find more information or contact us at brainaccess@neurotechnology.com.

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I Device Overview

The BrainAccess MIDI is a 16 channel electroencephalograph with a common reference channel. It offers high input channel density, Bluetooth connectivity and long battery life. Please, get acquainted with device's main components and connections before use.



USB Bluetooth adapter. In the package you will find a USB Bluetooth 4.2 adapter, which is used to communicate and stream data to computer from BrainAccess MIDI. If preferred, a different Bluetooth adapter such as an integrated Bluetooth adapter in a laptop may be used instead.

Power switch. Press and hold a push button for a couple of seconds to turn the device on/off. Power LED will be lit when powered on.

Power LED. It is a red-coloured LED that indicates when the device is powered on. If the power LED starts blinking, it indicates that battery level is below <10%.

Charging port. The device's battery can be charged via micro-USB port using standard 5V chargers such as mobile phone chargers with micro-USB plug. The charger should be capable of providing at least 800 mA of current. Do not use the device when charging with chargers powered from grid electricity due to safety reasons and potentially 50/60 Hz noise affecting the signals. The device can be used when charging from power bank though.

Connection LED. It is a blue-coloured LED that indicates when a Bluetooth connection is established between a computer and the device.

Reference input. An input that should be connected to a common reference electrode. In BrainAccess Kit setups it is typically an electrode placed at Fp1 location. The connection is denoted as 'R' on the device.

Bias input. An input that should be connected to a bias electrode. In BrainAccess Kit setups it is typically an electrode placed at Fp2 location. The connection is denoted as 'B' on the device. It is a driven bias which reduces the common mode noise such as noise coming from the grid electricity.

The bias signal is derived from any of the EEG inputs which can be chosen in software. They are denoted as ‘bias feedback channels’ in software. Use only channels/electrodes that have good quality signals for bias feedback.

Inputs. These inputs should be connected to electrodes that measure EEG activity with respect to the reference electrode.

Input connector-converter. An input connector-converter has input connections for all the cables coming from each electrode on one end and a single socket connection to the MIDI on the other end. This allows, for example, disconnecting MIDI quickly from an EEG cap and connecting to another EEG cap with a different setup.

Digital input. The device has an additional digital input that is sampled at the same rate as EEG signals and is treated as an additional input channel in software. It can be used for connecting external sensors or for synchronizing multiple BrainAccess MIDI devices, read more on this in Section 5.

Accelerometer. The device has also an integrated 3-axis accelerometer. It can be used for example to record any body/head movements when it is attached to the EEG cap.

Velcro tape attachment. A velcro tape can be found at the bottom of the device, that can be used to attach it to the BrainAccess CAP.

2 Specifications

Main specifications of BrainAccess MIDI electroencephalograph are given in the table 2.

Connectivity	
type	Bluetooth 4.2
range	up to 10m (using the provided Bluetooth adapter)

EEG Input Channels	
number of channels	16 + common reference channel
sampling frequency	250Hz
input resolution	24 bits
analog gain values	1, 2, 4, 6, 12, 24
input voltage range	4500 mV / gain value (w.r.t. reference channel)
input connector	Ultra-mini RF coaxial connector

Digital Input Channel	
type	internally pulled-up, driven low by closing the input contacts
sampling frequency	250Hz
connector	JST right-angle, 2 mm pitch

Accelerometer	
number of axis	3
sampling frequency	50Hz (resampled to 250Hz in software)
range	$\pm 2g$
resolution	10 bits

Battery	
type	Li-Po
capacity	2200 mAh
operating time	up to 9 hours (continuous streaming, all channels turned on)
charging time	3 hours
charger input	5V 800 mA min (charger not included)
charger connector	micro-usb

Mechanical	
mass	85g
dimensions	92x50x23 mm

Table 1: Specifications of BrainAccess MIDI electroencephalograph.

3 Set-up

- If not connected, connect the electrodes to the BrainAccess MIDI EEG inputs.
- Press the power pushbutton and hold for a couple of seconds, the power LED should be lit-up indicating the BrainAccess MIDI has turned on. If not, the battery might be empty – charge it first.

For Microsoft Windows users:

- Plug in the provided Bluetooth adapter to your computer, the drivers should install automatically. Skip this step if using an integrated or some other installed Bluetooth adapter.
- Find BrainAccess MIDI on the list of available Bluetooth devices and connect to it.
- Go to “Bluetooth & other devices” settings, under “Related settings” section click on “More Bluetooth options”. A new window will pop-up, select “COM Ports” tab and look for a port with “outgoing” direction. Note down this COM port as you will need it when connecting to the BrainAccess MIDI.
- Use BrainAccess Core library or BrainAccess Viewer to interface with BrainAccess MIDI. See section 4 for more details.

For linux users:

- Plug-in the provided bluetooth adapter. Skip this step using an integrated bluetooth adapter. Connect to the device via bluetooth. If using Ubuntu/GNOME, this can be done through the GNOME Control Center, or using the bluetoothctl or bluez tools.
- Install the bluez-utils package (Ubuntu/Debian: `sudo apt install bluez-utils`)
- Enter the following command: `sudo rfcomm bind <DEVICE> <MAC_ADDRESS>`, where:

<DEVICE> is the port you will enter into the application to connect to the device (/dev/<DEVICE>). By default, you should use `rfcomm0`.

<MAC_ADDRESS> is the bluetooth address of the device (example: B8:F0:09:AA:28:6A)

Example command: `sudo rfcomm bind rfcomm0 B8:F0:09:AA:28:6A` (replace this address with your device address)

This step has to be repeated every time the PC is restarted.

- Once finished, you can do `sudo rfcomm unbind <DEVICE>` to remove the port and free it for usage by another EEG device.
- Use BrainAccess Core library or BrainAccess Viewer to interface with BrainAccess MIDI. See section 4 for more details.

4 Software

This section overviews the main components of BrainAccess software. More detailed information on software installation and set up can be found at www.brainaccess.ai/resources/software. The software can be downloaded from the download centre at <https://www.brainaccess.ai/resources/download>, which becomes available after the purchase.

For Windows Users. All the BrainAccess software is provided within a single installer and can be installed on computers running Microsoft Windows 10 or newer.

For Linux Users. All the BrainAccess software is provided as a debian package and should work for most debian-based linux versions and amd64 architecture.

BrainAccess Core. BrainAccess core library provides an interface with BrainAccess electroencephalographs. It enables control of the device, configuration of acquisition parameters and streaming of EEG data to computer.

BrainAccess Processor. BrainAccess Processor library has functions for EEG signal preprocessing such as detrending, filtering, FFT and other typical utilities.

BrainAccess Viewer. BrainAccess Viewer is a Python application which essentially provides a GUI for some functionality of BrainAccess Core library. Python API package has to be installed beforehand for it to work.

BrainAccess BCI Connect. BrainAccess BCI Connect library provides various BCI algorithms such as P300, SSVEP, motor imagery and other classifiers.

C/C++ and Python API BrainAccess libraries can be accessed via C/C++ API or Python API. Python API is provided as a Python package.

5 Digital Input

BrainAccess MIDI features a digital input which can be used for connecting external sensors or other devices. The digital input is internally-pulled high and is driven low when input contacts are closed. An external switch or open-collector/open-drain circuits can be used to close the digital input contacts and drive the digital signal low. The device comes with preassembled plug for the digital input that can be incorporated in the external circuitry used to drive this digital input. The sampling of the digital input coincides with the sampling of the EEG channels.

Multiple Device Synchronization. Multiple BrainAccess electroencephalographs can be synchronized using this digital input. When purchasing multiple MIDI devices or other BrainAccess electroencephalographs, a cable will be included that has multiple plugs so that multiple devices can be connected together. The BrainAccess software allows for driving the digital input to low. Hence, one device can be used to generate a short low pulse that the other devices would record. This signal can when be used to align EEG recordings from different devices. After providing the synchronization signal the cable can be disconnected and devices used as usual. If the stream is restarted the synchronization has to be repeated.

6 Safety Notice

BrainAccess MIDI electroencephalograph will be referred as 'the device' in this safety notice.

- Do not use the device outside in rainy/snowy conditions.
- Do not use the device near the water or in extremely damp conditions.
- Do not use the device in an explosive atmosphere.
- Use the inputs of the device only for their designated purpose. Do not connect any electrical power sources to the device's inputs.
- Do not connect the device to a person via electrodes when charging it with a charger powered from grid electricity. The device can be used when charging with power bank though.
- Do not use the device with suspected failures. In cases such as, but not limited to, the device does not operate as expected, physical damage is visible on the casing, the device was dropped into the water/snow, the device was dropped from substantial height, other objects has been dropped on

the device, liquid has been spilled on the device, have the device inspected by qualified personnel before further operation.

- The device should be serviced by authorized personnel only.

7 Warranty

Neurotechnology ltd. warrants this product (BrainAccess MIDI electroencephalograph) against defects in materials and workmanship for one (1) year from purchase date under normal consumer use conditions. If the product fails during normal and proper use within the warranty period, Neurotechnology will repair or replace the product. The liability of Neurotechnology does not include any incidental or consequential damages.

This warranty does not include failure caused by improper set-up, operation, maintenance, accident, damage, misuse, modifications not approved by Neurotechnology, normal wear and tear, any event or act outside Neurotechnology's control.

This warranty does not apply if serial number of the product has been altered or removed, the casing of the product has been opened or the product has been tampered or repaired by unauthorized personnel.

8 Support

Please contact Neurotechnology if you have any problems using any of the BrainAccess products.

Neurotechnology ltd.

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