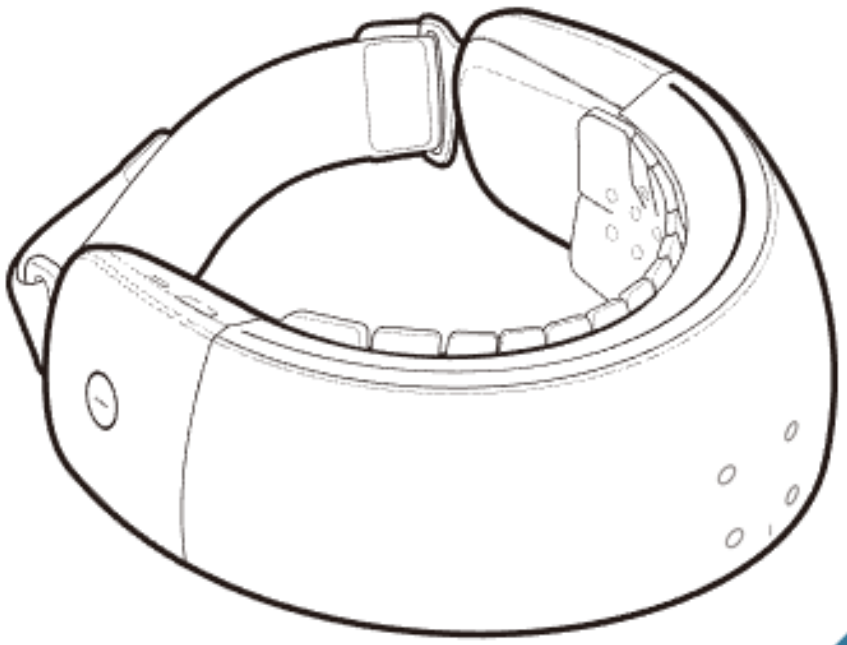
OBELAB



NIRSIT

NS1-H20B

User Manual

General Information

Thank you for purchasing NIRSIT, a near-infrared multi-channel device, made by OBELAB Inc. NIRSIT is a device designed to measure variations in cerebral blood oxygen saturation by radiating a near-infrared light beam, at two wavelengths of 780 nm and 850 nm, into the cerebral cortex. The device radiates a laser with a light output of 1 mW or less. It is harmless to the human body. The device comes with software used to monitor the distribution of cerebral oxygen saturation via multiple channels. NIRSIT is well suited for brain researchers.

This user manual contains important information regarding the use of the device. Please read this manual carefully before using the device. Keep this manual within easy reach for future reference.

Please contact us if you have questions about this manual or the product purchased.

- Manufacturer: OBELAB Inc.
- Address: 13F, 312 Teheran-Ro , Yeoksam-dong, Gangnam-gu, Seoul, Korea
- Tel: +82-2-6407-3889
- Fax: ++82-2-6407-4967
- Email: contact@obelab.com
- Website: http://www.obelab.com

Warranty and Liability

Warranty

OBELAB Inc. warrants the quality of this product as specified below.

Warranty Service

Free warranty service applies to repair services required for this device occurring as a result of failure during proper operation in the warranty period (1 year from the date of purchase).

Charged Service

A service fee will be applied in the following cases.

1 Out of warranty period

2 Within warranty period

a. repairs resulting from natural disasters (lightning, fire, earthquake, storm, flood, etc.)

b. repairs resulting from a device failure or damage caused by user mishandling (impact, dropping)

c. repairs resulting from old or worn out consumables (battery, cable, etc.) that need replacement

d. repairs resulting from a device failure due to unauthorized repair or modification

e. repairs resulting from the use of unauthorized components

f. repairs resulting from services performed by an unauthorized person or entity

Notice

For matters that are not specified in this document, the Act on Consumer Protection of Korea and relevant regulations on compensation for consumers shall apply. For other repairs and questions, please contact your dealer or the OBELAB Customer Support Center.

Request for service on a functioning device will result in service charges. Please read the User Manual.

This warranty is only effective in the Republic of Korea, and not to be re-issued. Please store the warranty in a safe place.

For any inconveniences related to service, please contact an authorized dealer or the OBELAB Customer Support Center.

Copyrights

This manual is the property of OBELAB Inc. and protected by copyright law. Unauthorized use or reproduction, in whole or part, is strictly forbidden.

Contents of this user manual are subject to change without notice, regarding changes to the performance or specifications of the device. For information on the device and user manual, please contact the OBELAB Customer Support Center.

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History of Revision

Version	Revised date	Details	Remarks
1.0	02/27/2023	Initial edition	

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1. Overview

1.1 Safety Instructions

Safety instructions are provided to ensure user safety and prevent property damage. Please read the following safety instructions and warnings before using the device.

- WARNING Symbol

WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Failure to comply with a warning could result in severe damage to the device.

- CAUTION Symbol

CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. Failure to comply with a caution may result in damage to the device.

- IMPORTANT Symbol

IMPORTANT	This symbol is used to indicate instructions that users must observe or refer to. All users must check and follow the instructions.

1.1.1 User Qualification

IMPORTANT	To use the device, the user must ▪ Read and understand this user manual. ▪ Understand the basic structure and features of the device. ▪ Be able to detect abnormal operation and take appropriate measures. ▪ Be at least 15 years old and have reading experience for at least five years. ▪ Be capable of understanding numbers and languages without difficulty, have knowledge of oxygen saturation measurement principles, and have experience using the device or previous training.

1.1.2 Electrical Safety Instructions

WARNING	▪ Always check the condition of the power supply, computer, tablet, and cable connections before using the device. ▪ Ensure that the battery is not replaced by an unauthorized user. There is risk of overheating, fire, and explosion. ▪ Do not disassemble the device for maintenance or repair when it is connected to a power supply.

CAUTION	Make sure to turn off the device when it is not in use.

1.1.3 General Safety Instructions

WARNING	▪ Do not use the device in a place where there is a risk of explosion. ▪ Keep the device away from inflammables. ▪ Do not stare directly into the sensor unit or laser. ▪ Do not operate the device with wet hands. ▪ Do not arbitrarily disassemble, repair, or modify the device. Inspection and repair must only be performed by certified professionals. For technical support, please contact the nearest Customer Support Center.

CAUTION	▪ Do not use the device on a patient who has a stab wound on the forehead or who is undergoing surgery. ▪ Keep the device away from water, humidity, and/or contaminants. ▪ To ensure safety, follow the instructions described in this user manual when using the device. ▪ Never let the device drop. Do not expose the device to excessive shock. ▪ Always keep the device in the storage case when not in use.

IMPORTANT	This device is intended for research purposes only and must be used by researchers or personnel that have been sufficiently trained in its use. ▪ Use the device with the dedicated software. ▪ Use the device under indoor lighting condition. ▪ Ensure that a fire extinguisher is within reach. ▪ Use the device at optimal temperature (15-35°C) to ensure safe operation. ▪ Store the device away from direct sunlight.

1.1.4 When cleaning the device

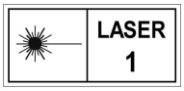
WARNING	Do not spray disinfectant on the device. Sprayed disinfectant can cause ignition.

CAUTION	Do not use wet or damp clothes or spray cleaners. There is risk of electric shock and damage to the device.

1.2 Symbols Used

A list of symbols found in this manual and on the label on the device is shown below. It is important to understand these indications, and to follow the safety instructions.

Table 1-1 Symbols Used

Symbol	Name	Description
WARNING	WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Failure to comply with a warning could result in severe damage to the device.
CAUTION	CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. Failure to comply with a caution may result in damage to the device.
IMPORTANT	IMPORTANT	This symbol is used to indicate instructions that users must observe or refer to. All users must check and follow the instructions.
NOTE	NOTE	Additional information that aids in device operation.
	LASER	Class 1 laser product.

1.3 Regulatory Compliance

FCC (Federal Communications Commission)

This equipment has been tested and found to comply with limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are residential installation.

This equipment generates, uses, and may radiate radio frequency energy. If not installed and used in accordance with the instructions, it may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet in a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/ TV technical for help.

This device complies with RF exposure requirement.

Changes or modifications not experssly approved bt the party responsible for compliance could void the user's authority to operate the equipment.

WARNING	This equipment may generate or use radio frequency energy. Changes or modifications to this equipment may cause harmful interference unless the modifications are expressly approved in the instruction manual. The user could lose the authority to operate this equipment if an unauthorized change or modification is made. This device complies with Part 15 of the FCC's Rules. Operation is subject to the following two Conditions: This device may not cause harmful interference, and This device must accept interference received, including interference that may cause undesirable operation.

Canadian Compliance

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device. Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p) is not more than that necessary for successful communication.

This device complies with Industry Canada license-exempt RSS standard(s).

Operation is subject to the following two conditions:

this device may not cause interference, and

this device must accept any interference, including interference that may cause undesired operation of the device.

This device complies with RF exposure requirement.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur)

approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes

l'appareil ne doit pas produire de brouillage, et

l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Cet appareil est conforme à l'exigence d'exposition RF.

1.4 Guideline for equipment disposal

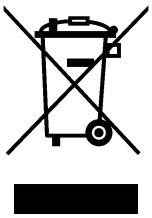


Figure 1-1 WEEE label (Directive 2002/96/EC)

Please dispose of the device according to your local regulations. The product contains components that can be recycled. Please recycle products to protect the environment. All of the product components, except for the battery, can be recycled. Plastic parts may be recycled, or burned in a controlled environment, depending on local laws.

NOTE	Please consult OBELAB, its resellers, or other disposal agencies for more information regarding disposal.

1.5 Notation

Notation is a series of special symbols or conventions used in this manual to denote different items.

This manual uses the following notation for users' better understanding of the device:

Table 1-2 Notation Used in the Manual

Notation	Description
" "	Used to denote a reference. Example: See "Chapter 1. Overview."
Bold	Used to denote GUI elements such as menus and buttons. Example: Click the **STOP** button.
>	Used to list several menus or buttons in sequence. Example: Click the **STOP** > **OPEN** buttons.
▪ ABC ▪ ABC ▪ ABC	Used to divide or list items of the same level in an organized way.
1 ABC **2** ABC **3** ABC	Used to describe a work procedure in order.
❶ ❷ ❸	Used to name or describe components of an image.

2. Using the NIRSIT system

2.1 Names and Locations of Components

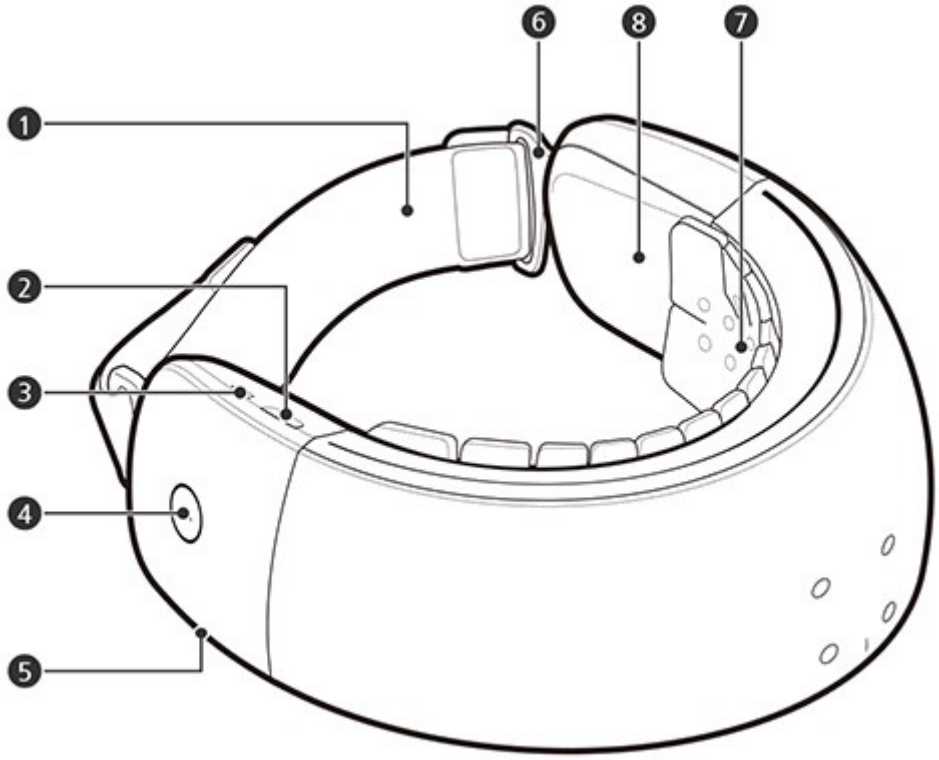


Figure 2-1 Components of the System

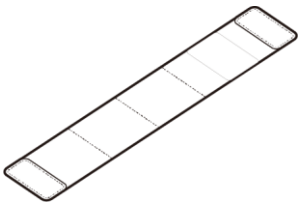
Table 2-1 Components and Their Functions

No.	Description
1	Strap
2	Mode select button (WiFi LED button)
3	Speaker
4	Power button and status indicator
5	5-pin micro connector
6	Strap holder
7	Sensors
8	Pad

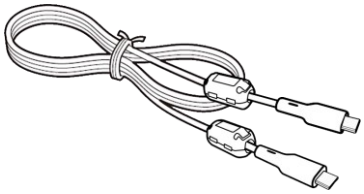
2.2 Basic Components

When opening the package, please make sure to check the components and inform the OBELAB Customer Support Center if there are any issues with the package.

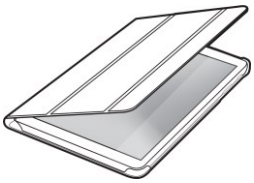
NIRSIT main unit



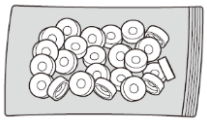
Replacement strap



USB-C to C cable



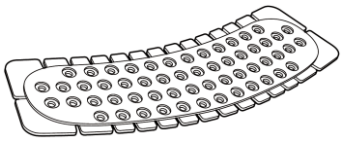
Tablet



Silicon caps in a box

Storage and carry-on box for NIRSIT

Accessories



Disposable patch

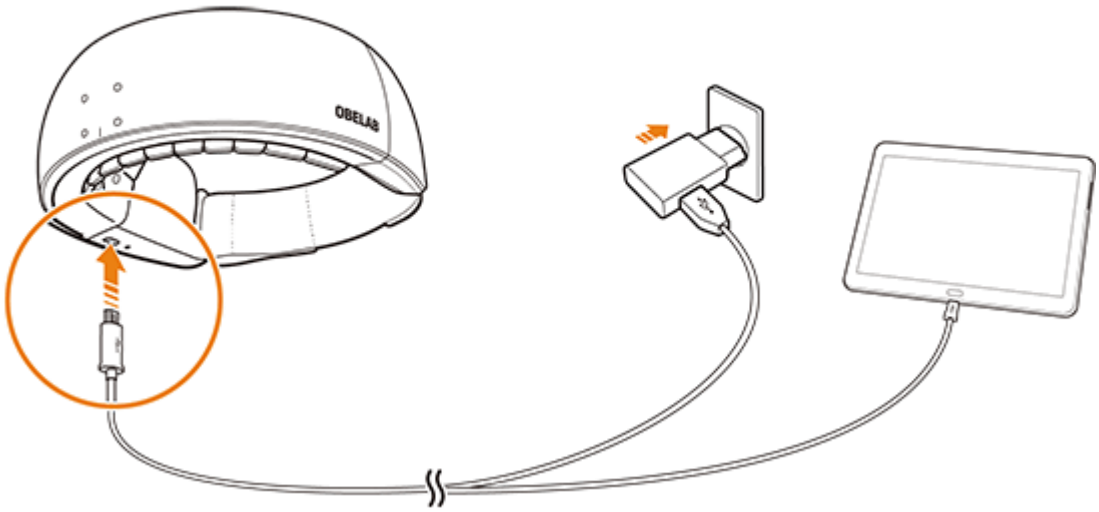
NOTE	To purchase accessories, please contact OBELAB or an authorized dealer. USB-C to C cable : 5A, PD 100W Fast charging, USB 2.0, 1.8 m Delta / GTMKOREA Inc. / Ferrite Core: EMI-5730 Tablet: Galaxy Tab S7 FE, LTE, Storage: 64GB or greater, Resolution: 2560 x 1600, RAM: 4GB or greater, OS: Android 인증정보 : R-C-SEC-SMT735

2.3 Battery

NIRSIT is powered by a lithium-ion polymer battery. For prolonged use, charge the battery at least 1 hour and 30 minutes before operating the device. Regularly check the remaining battery level to ensure availability.

2.3.1 Charging the Battery

Charge the battery by connecting the NIRSIT to a battery charging pack or tablet via a USB cable.



NOTE

- The device does not come with a battery charging pack. Recharge the device by using the battery charging pack that came with your smartphone or tablet.
- Charging adapter requirements
  - Rated input: AC 100-240V 50-60Hz 0.50A
  - Rated output: DC 9.0V 1.67A or DC 5.0V 2.0A

2.3.2 Checking Battery Level

Charging when the device is turned on

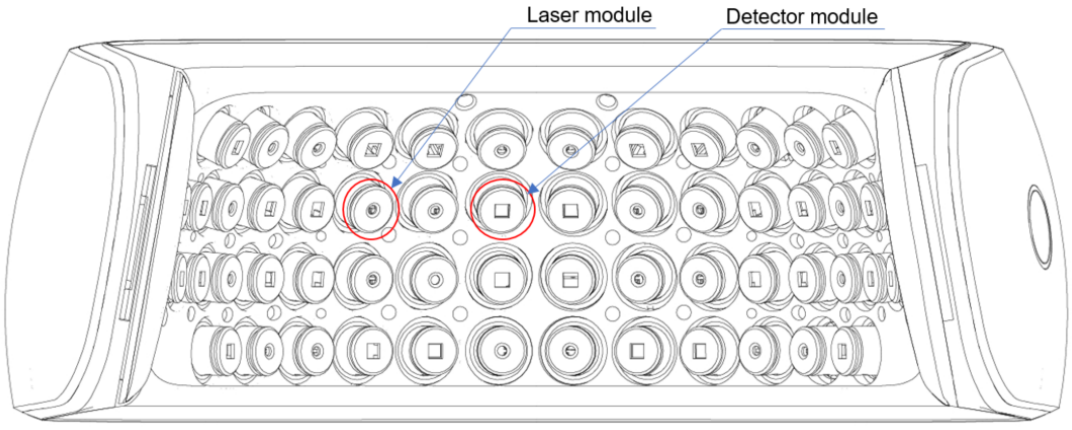
Battery level is 25% or lower | 25% charged | 50% charged | 75% charged | Fully charged

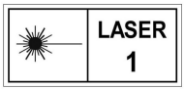
Charging when the device is turned off

Charging in progress | Fully charged

2.4 Sensor Module Position

The below picture shows the difference between laser modules and detector modules in terms of external appearance.





Optical Safety

The device uses VCSEL laser for source and is classified as Laser Class 1.

3. Before Using the NIRSIT Software

3.1 Preparing to wear NIRSIT

3.1.1 Attaching Silicon Caps

Attach all silicon caps to the sensors on the inner side of the NIRSIT device by pressing down on these caps.

3.1.2 Attaching a Disposable Patch (sold separately)

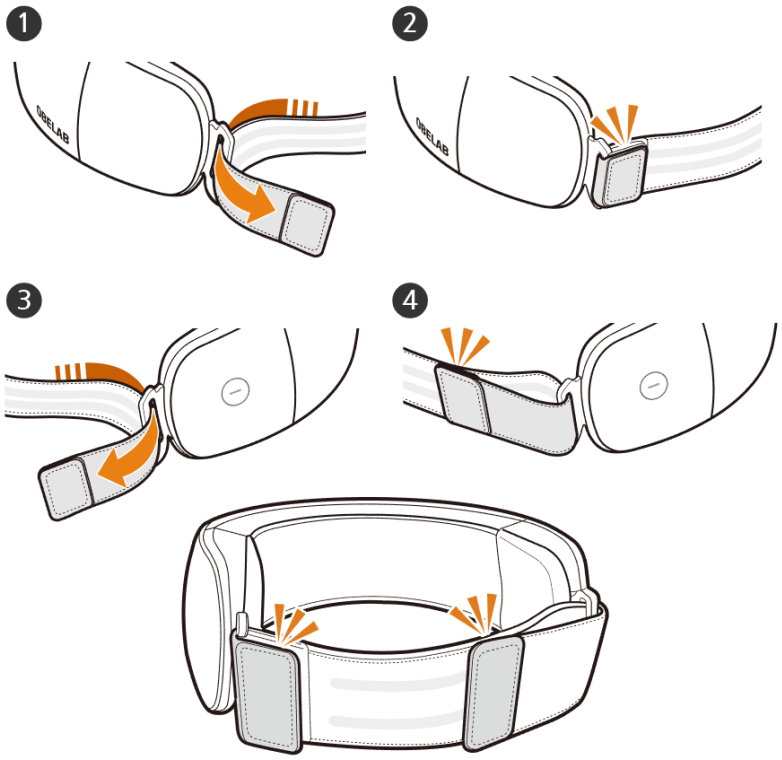
1 Align the holes on the disposable patch and the sensor modules on the inner side of the NIRSIT device.

2 Lightly press the disposable patch holes against each sensor on the NIRSIT device so that the patch attaches to the NIRSIT device tightly.

NOTE	To attach a disposable patch (sold separately), remove all the silicon caps first.

3.1.3 Installing the Strap Holder

Adjust the strap holder to fit the subject's head.



3.1.4 Checking Operation Status

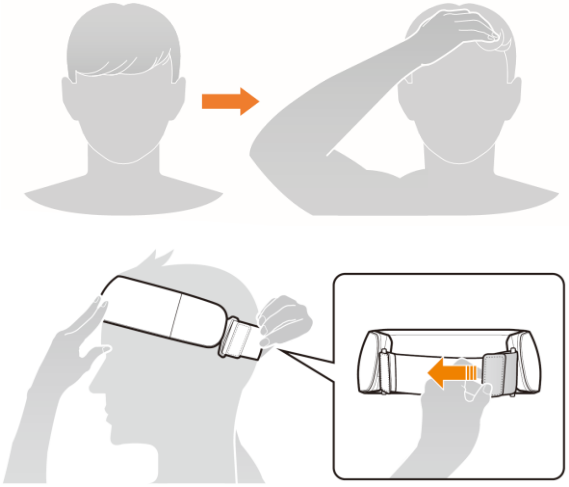
1 Press and hold the Power button for 3 seconds to turn on the device. Once powered on, the status indicator will illuminate in green, and a beep will be heard.

2 Press and hold the Power button for 3 seconds to turn off the device. Once powered off, the status indicator will turn off, and a beep will be heard.

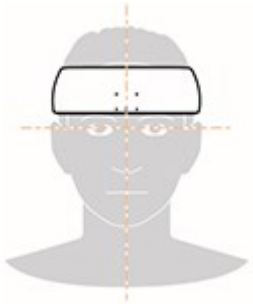
3.2 Putting on the NIRSIT device

1 Before putting on the device, make sure the strap tied to the strap holder is loose on one end so that there is ample room for the user's forehead to fit comfortably into the NIRSIT device.

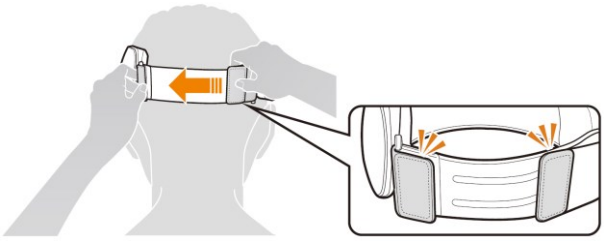
2 As shown below, remove all hair from the forehead region with one hand, and use the other hand to place the NIRSIT device on the forehead with no hair.



3 Take extra care to align the markers on the NIRSIT device with the user's eyes, nose, and the eyebrows, so that the NIRSIT device is placed adequately on the forehead.



4 The user can now pull and attach the strap to the Velcro to ensure the NIRSIT device adequately comes into contact with the forehead of the user.



3.3 Turning on the NIRSIT device

1 Turn on the NIRSIT device by pressing and holding the Power button for 3 seconds.

2 There should be a beep sound and the red LED light on the Mode Select button should blink twice.

3 Use the tablet to turn on the NIRSIT software.

3.4 Installing the NIRSIT Software

NIRSIT software is installed by our technician after you purchase it. If reinstallation or additional installation is needed, download the software from the OBELAB website after registering the NIRSIT device under www.obelab.com>JOIN US.

OBELAB website: www.obelab.com>SUPPORT>DOWNLOAD

3.5 Running the NIRSIT Software

On the tablet screen, select the **NIRSIT EYE** ( ) icon.

NIRSIT software will run automatically.

3.6 Connecting to the NIRSIT device

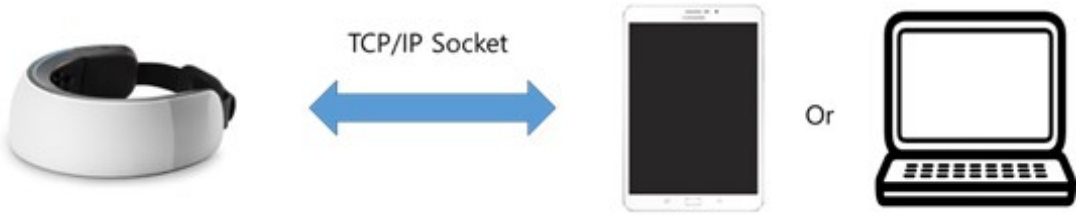
When you turn on the tablet, the NIRSIT device will connect to the NIRSIT application via WiFi network.

When the NIRSIT device is in the AP mode

The AP (Access Point) mode is the default setting. When the NIRSIT device is unpacked from the package and turned on for the first time, it is set to the AP mode. The LED on the Wi-Fi button (circled in the picture below) will blink twice when the NIRSIT device is turned on. The Wi-Fi LED will blink once again when the socket connection with NIRSIT application is complete. The Wi-Fi LED will remain turned off at all other times.

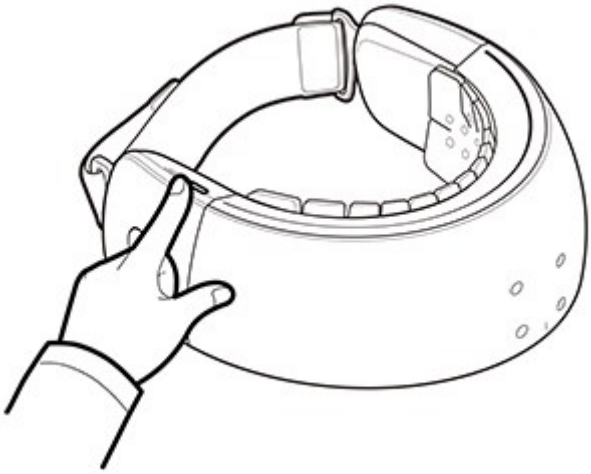
If the NIRSIT device is in the STA (Station) mode (please refer to "When the NIRSIT device is in the STA mode" explained below) and you would like to change the mode to the AP mode, please press the Wi-Fi LED button for 10 seconds until the LED light stops blinking. Do not press the Wi-Fi LED button after the LED light is turned off.

In the AP mode, either a tablet or a computer can associate directly to the SSID created by the NIRSIT device as shown in the picture below.

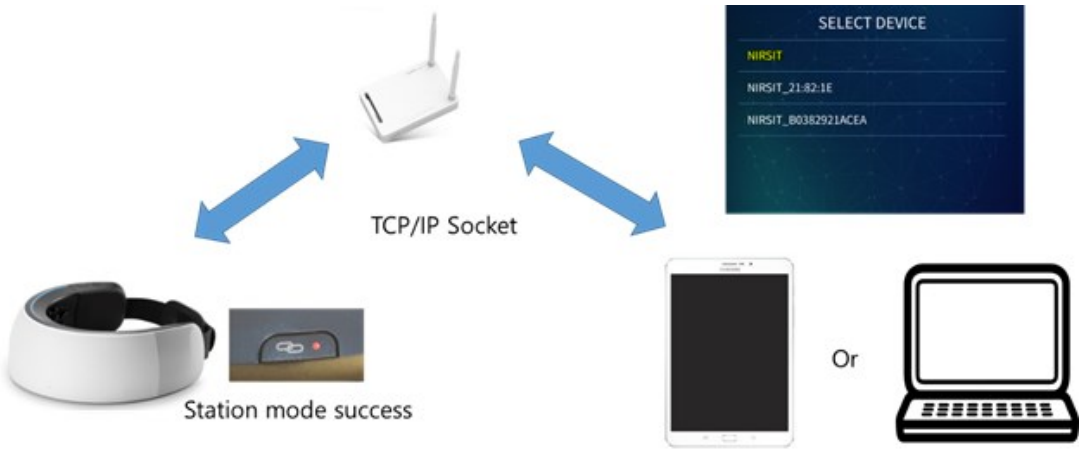


When the NIRSIT device is in the STA mode

To convert the AP mode to the STA mode, please press the Wi-Fi LED button for 10 seconds until the LED light stops blinking. Do not press the Wi-Fi LED button after the LED light is turned off.



In the STA mode, you will need additional access point or wireless router to connect the NIRSIT device and NIRSIT application in a tablet or PC software. The Wi-Fi LED light will turn on when NIRSIT device connection to the additional access point or wireless router is complete.

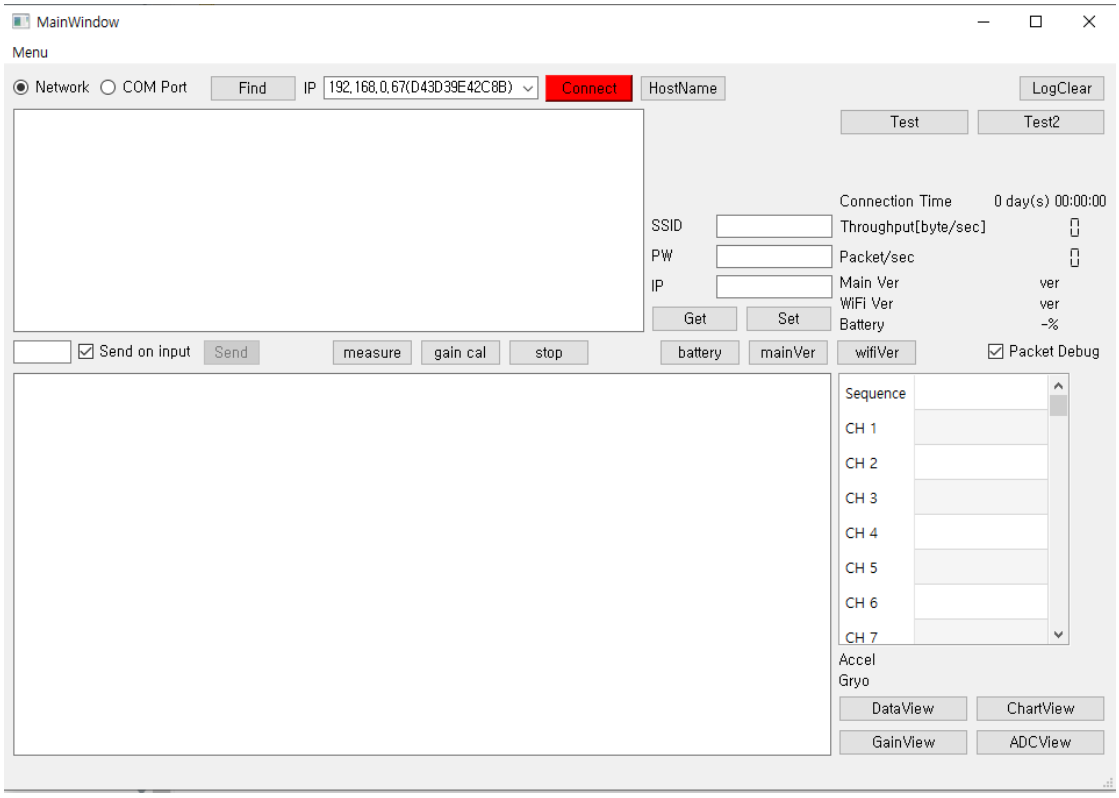


NOTE	The Wi-Fi LED light is turned on when the device is connected to the AP in the STA mode. The LED will not be turned on if the connection is unsuccessful.

Setting up the wireless router in the STA mode

Update SSID and password for the wireless router that will be used for STA mode.

1 Setting up the wireless and security



4. Using the NIRSIT Software

NIRSIT software is designed to view real-time variations in cerebral oxygen saturation according to the subject's cognitive status, measured via the NIRSIT device. NIRSIT software users are classified into Subject and Observer.

- Subject

  Wears the NIRSIT device and performs tasks provided in the NIRSIT software.

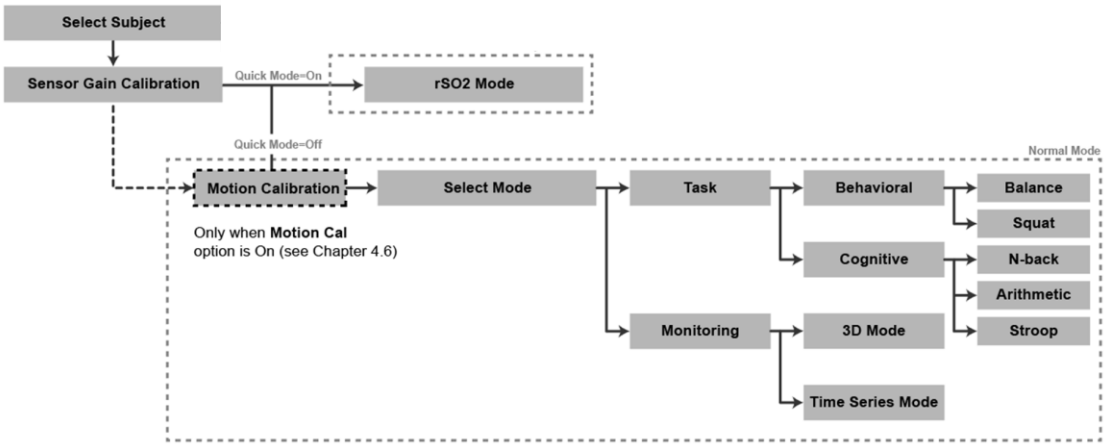
- Observer

  Uses the NIRSIT software to monitor, in real-time, the blood oxygen level of the subject's brain in **3D** mode or **TIME SERIES** mode.

4.1 NIRSIT Software Structure

Below chart briefly outlines the NIRSIT software structure for Android OS. The NIRSIT software runs in **Normal Mode** by default and **Quick Mode** is only running when it is set through the **SETTINGS** menu.

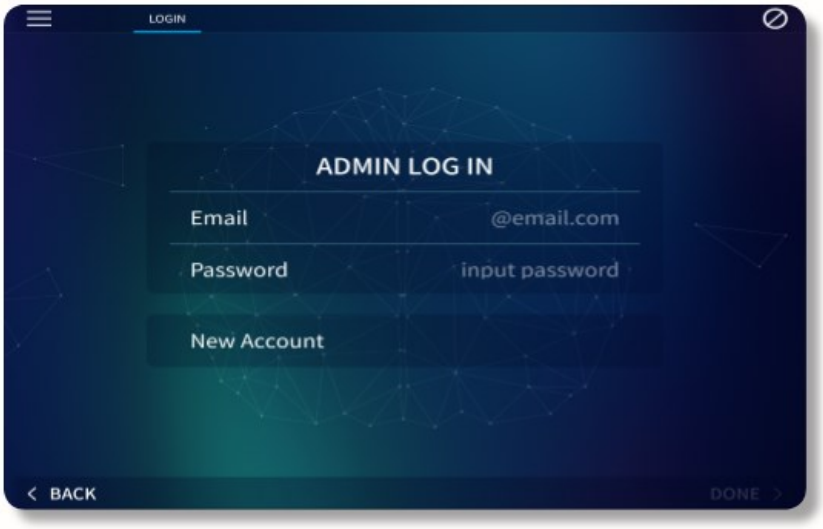
- **Normal Mode** means a state in which **Quick Mode** is set to **Off** in the **SETTINGS** menu.
- **Quick Mode** means a state in which **Quick Mode** is set to **On** in the **SETTINGS** menu.



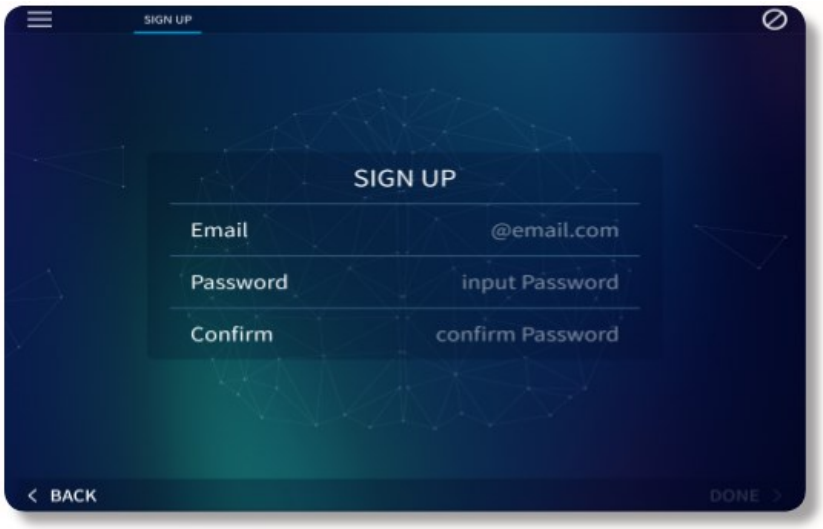
4.2 Administrator registration

4.2.1 Creating a New Account

1 If a new user, select on **New Account** on the **ADMIN LOG IN** screen.

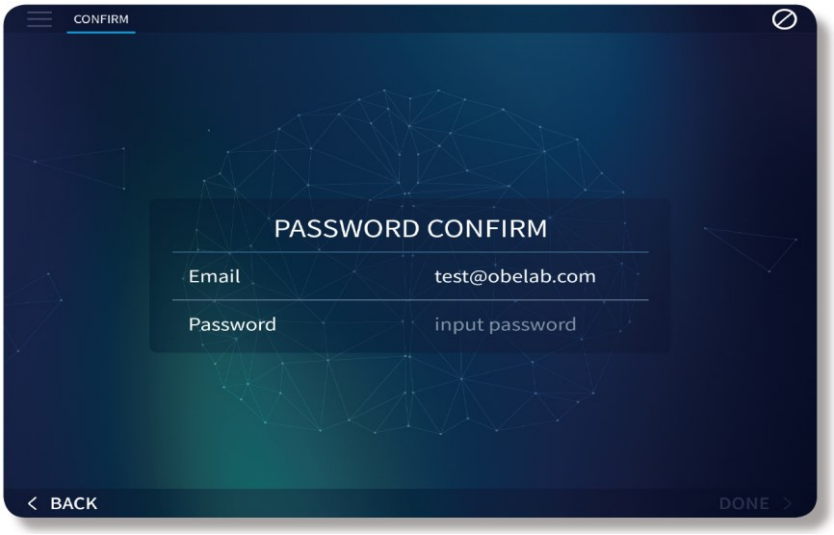


2 Enter the email address to be used as your observer account, enter a password on the **SIGN UP** screen, and then select **DONE** at the bottom of the screen. Your account is now created.



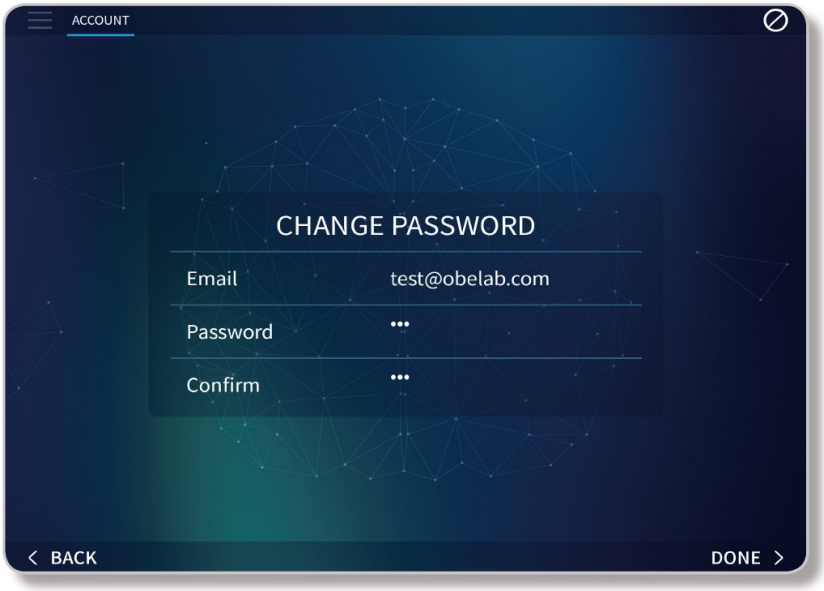
4.2.2 Changing the Admin Password

1 Select **MENU BAR** > **ACCOUNT**. To change the password, you need to confirm the password for the logged-in observer account.



2 Enter the password for the logged-in observer account and select **DONE**.

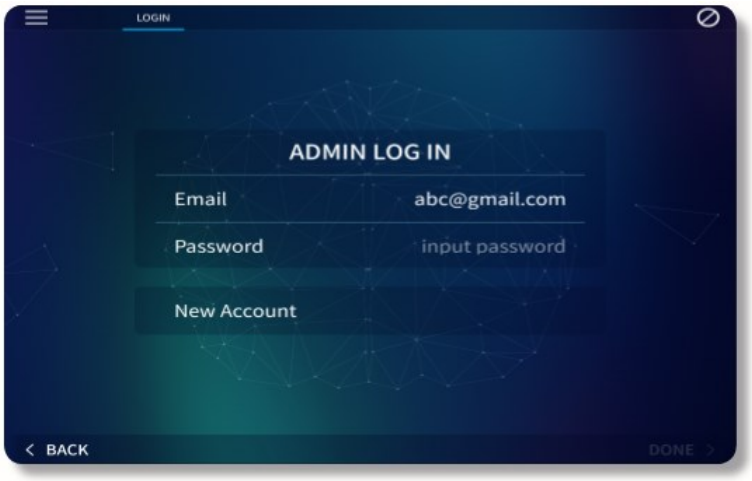
3 Enter a new password into Password and Confirm. And then select **DONE**. If the passwords entered in Password and Confirm match, "**Password is Changed**" appears at the bottom of the screen. Your password has now changed.



4.3 Selecting the NIRSIT Device

Before connecting to the NIRSIT, make sure that the device is turned on. The name of an NIRSIT is identified as NIRSIT(SSID)_MAC ID. In places where a wireless connection is unavailable or is unstable, use a USB cable.

1 On the **ADMIN LOG IN** screen, enter the email address for logging in as an observer, enter the password, and then select **DONE** at the bottom of the screen.

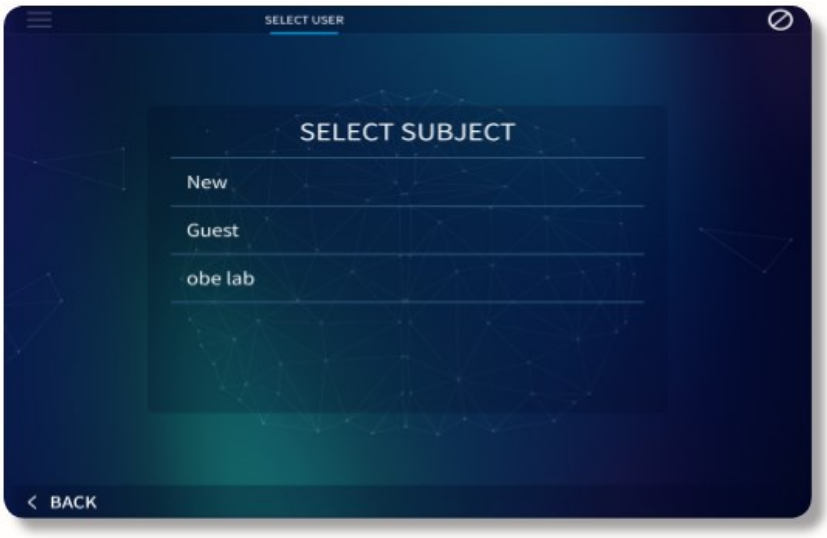


2 Select the NIRSIT name to connect from the displayed list, and then select **CONNECT** at the bottom of the screen.

4.4 Registering a Subject

1 On the **SELECT SUBJECT** screen, select **New**.

To measure without registration, select **Guest**.



2 Fill in all information requested on the screen and select the check box next to "**I agree with the above**." The **QUESTIONNAIRE** screen has a **DEFAULT VALUE** button used to fill in the input fields with default values automatically.

3 Select **DONE** at the bottom of the screen. The subject is now registered.

NOTE	This process is completed when all required input fields are filled in. A warning message will appear if the DONE button is selected with a required input field left empty.

4.5 Adjusting the NIRSIT Position on the Subject - PHOTOGRAMMETRY

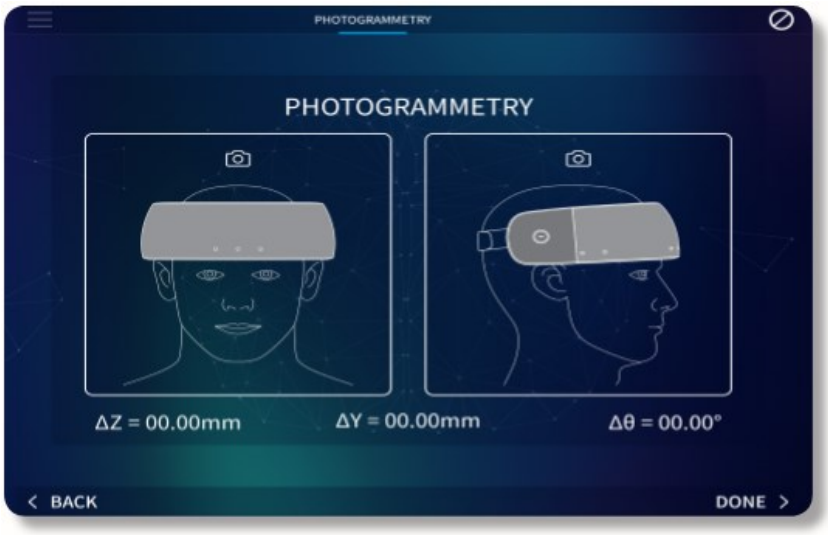
Measuring the position and location of the NIRSIT device on the subject's head helps create a more accurate localization value during the **CALIBRATION** process. NIRSIT position on the subject's head can be adjusted using **PHOTOGRAMMETRY** before starting the **CALIBRATION** process.

PHOTOGRAMMETRY is disabled when **Quick Mode** is on. To measure the NIRSIT position on the subject, select **MENU BAR** > **SETTINGS** and set **Quick Mode** to **Off**.

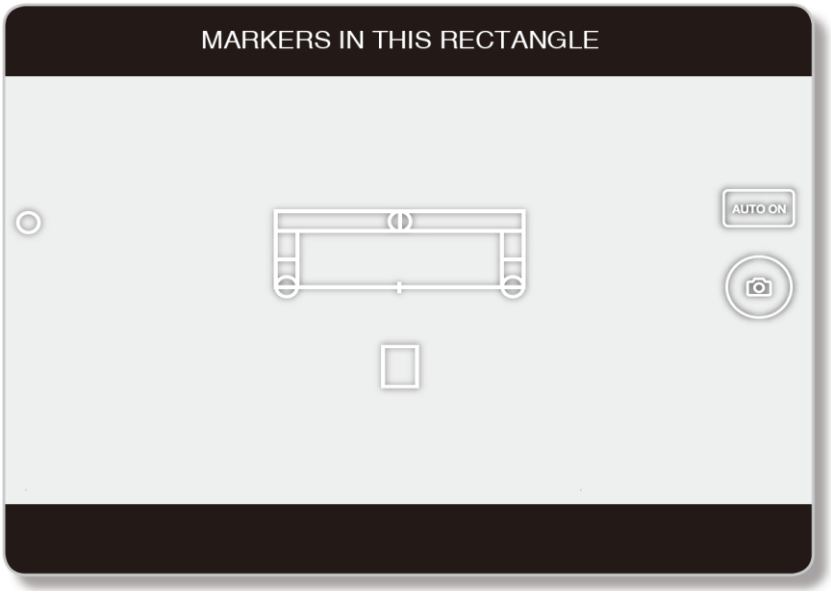
1 On the **SELECT SUBJECT** screen, select a registered subject.

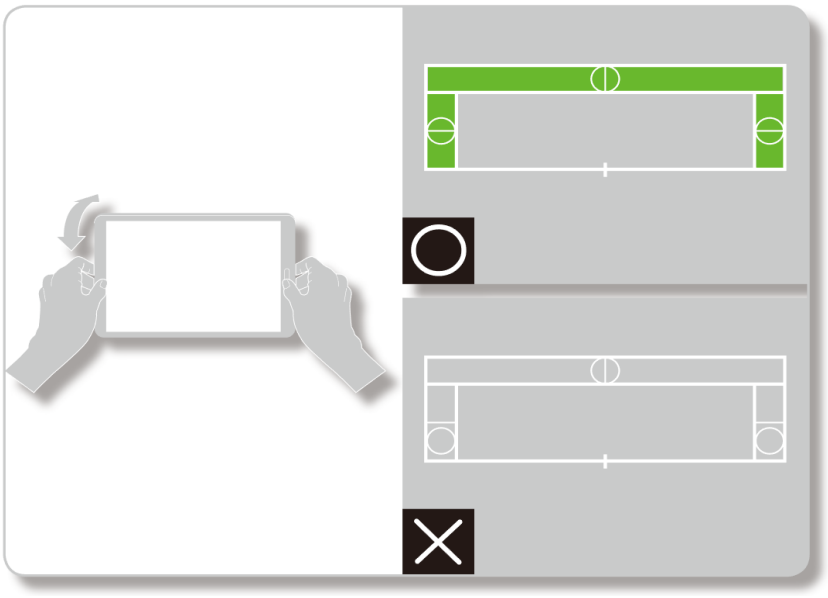
To measure without registration, select **Guest**.

2 Select the image located on the left side of the screen.

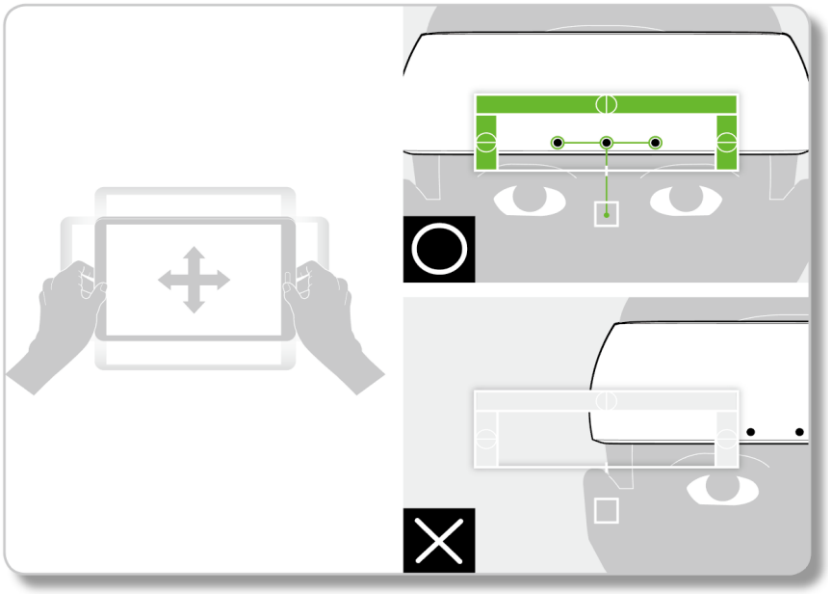


3 Activate the tablet camera by pressing **AUTO ON** icon and the camera image icon on the left-hand side of the screen. Hold the tablet with both hands and adjust it so that the circle at the edge of each rectangle box is aligned with the line in the middle of the rectangle box.

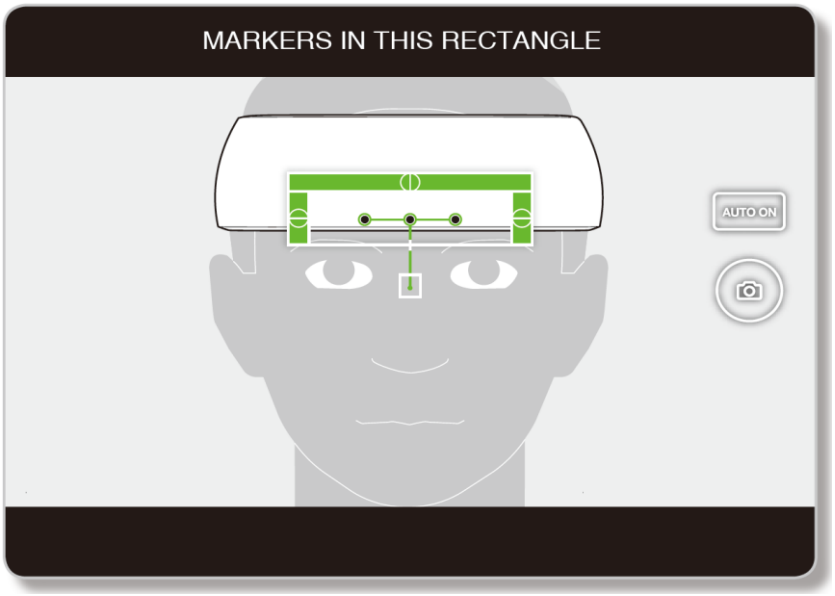




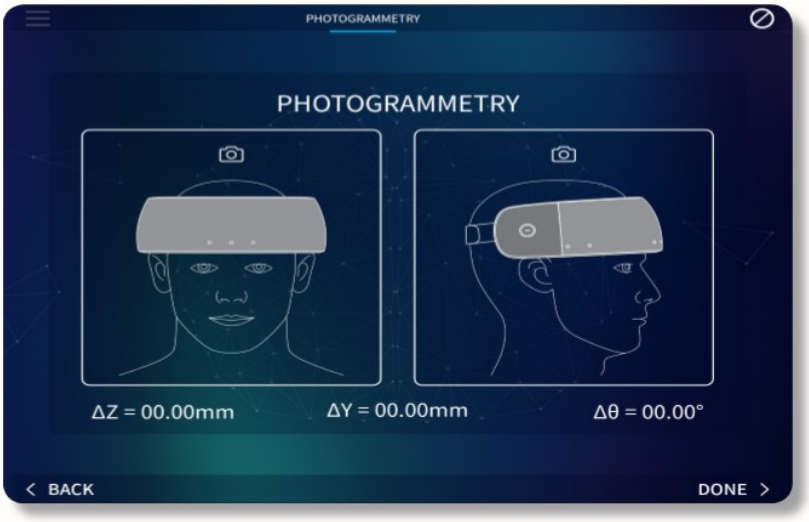
4 While the above alignment is intact, move and adjust the tablet so that the three circle markers in front of the NIRSIT device are shown inside the rectangle box and the circle markers are aligned with the nasion point (on the nose), as shown in the picture below.



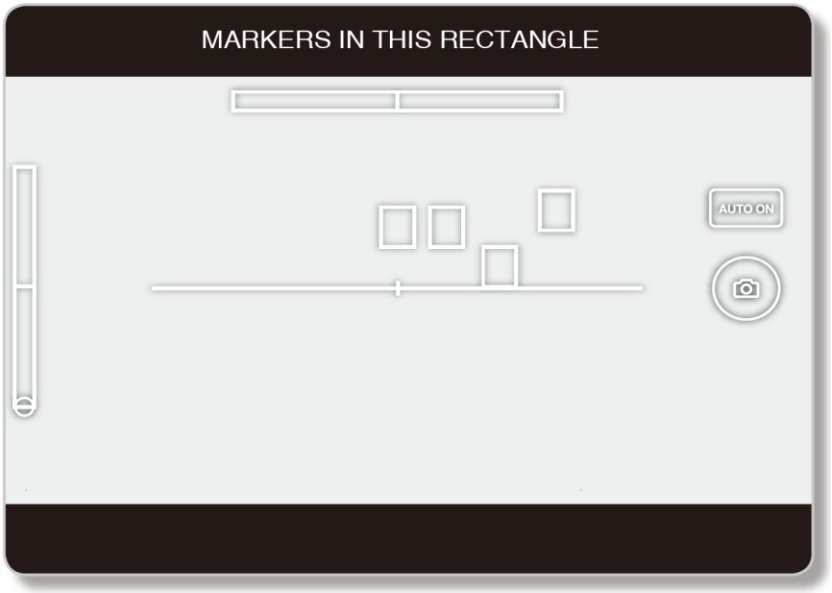
5 Once all conditions are met and the rectangle box edges turn green while the three circle markers are placed as shown below, a picture will be taken automatically by the tablet camera.

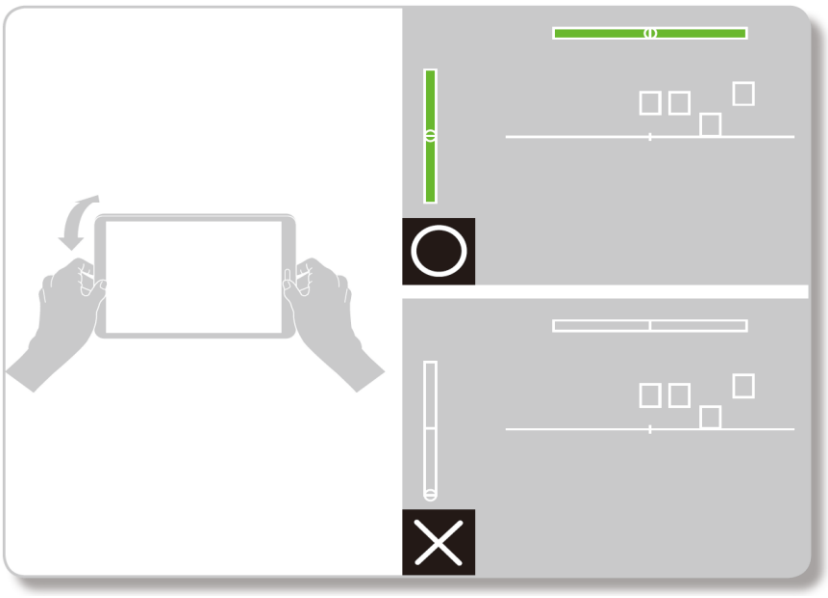


6 Select the side image located on the right side of the screen.

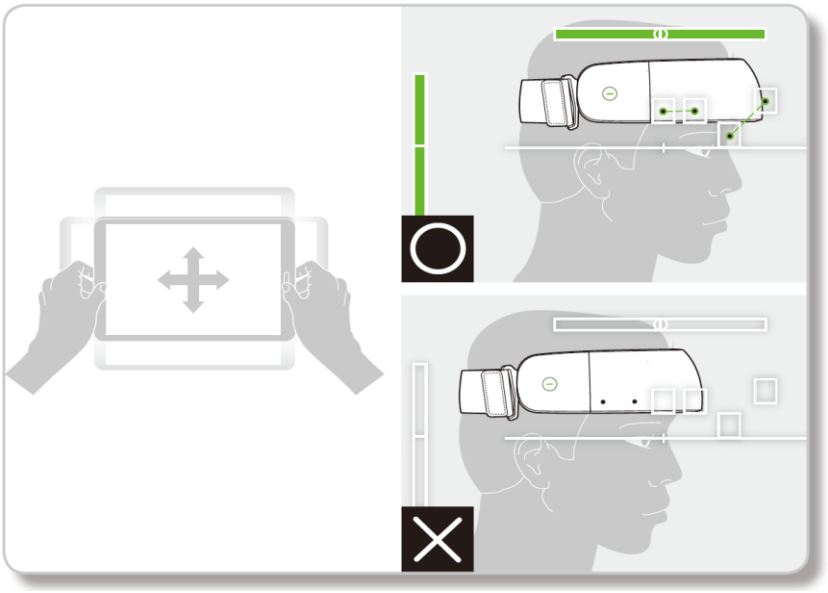


7 Activate the tablet camera by selecting the **AUTO ON** icon and camera image icon on the right-hand side of the screen. Hold the tablet with both hands and adjust it so that the circles in the rectangle boxes at the top and left edge of the screen are aligned with the lines in the center of the rectangle boxes.

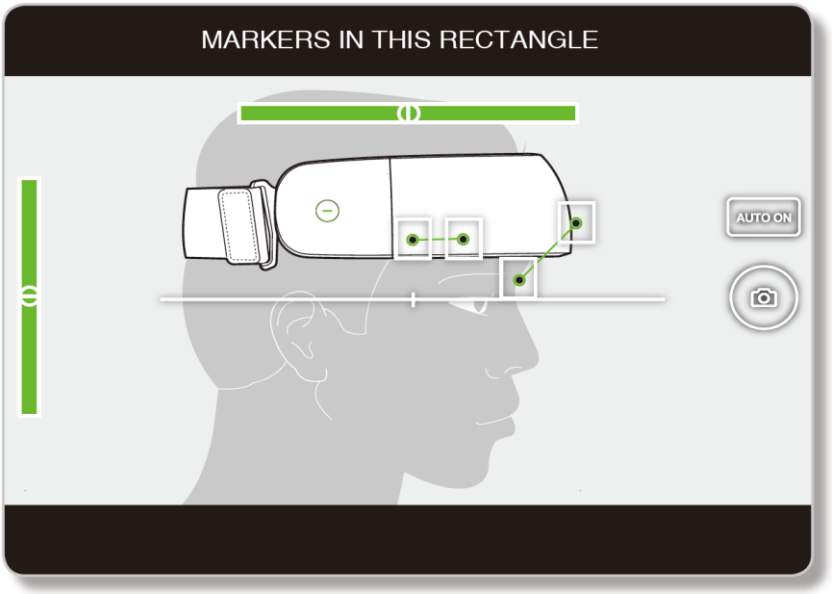




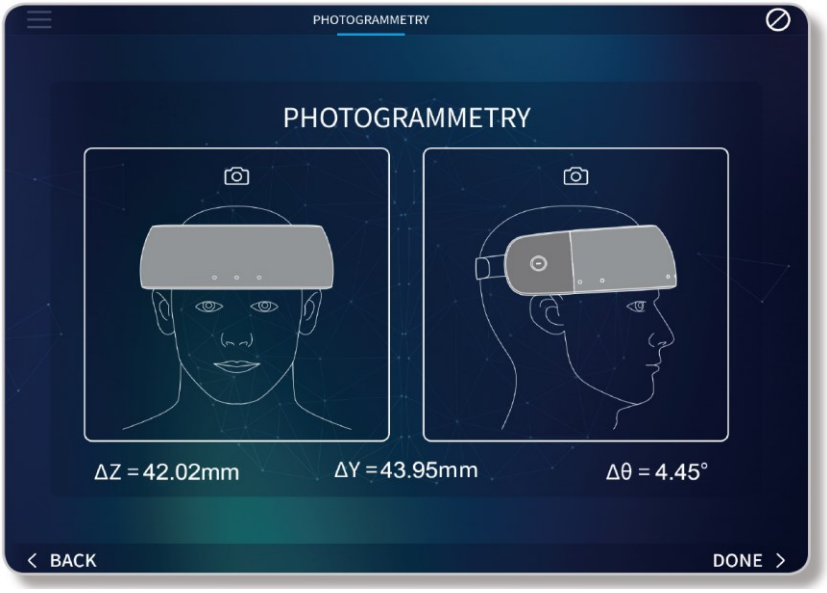
8 While the above alignment is intact, move and adjust the tablet so that the two side markers on the NIRSIT device are shown inside the rectangle box and the center point at the edge of NIRSIT device is aligned with the nasion point (on the nose), as shown in the picture below.



9 Once all conditions are met and the rectangle box edges turn green while the three circle markers are placed as shown below, a picture will be taken automatically by the tablet camera.



After this process, the front and side photos and corresponding °CZ, °CY and °C°C values will be shown on the **PHOTOGRAMMETRY** screen. This will allow the measured data from NIRSIT to correspond to MNI coordinates and achieve localization effect.

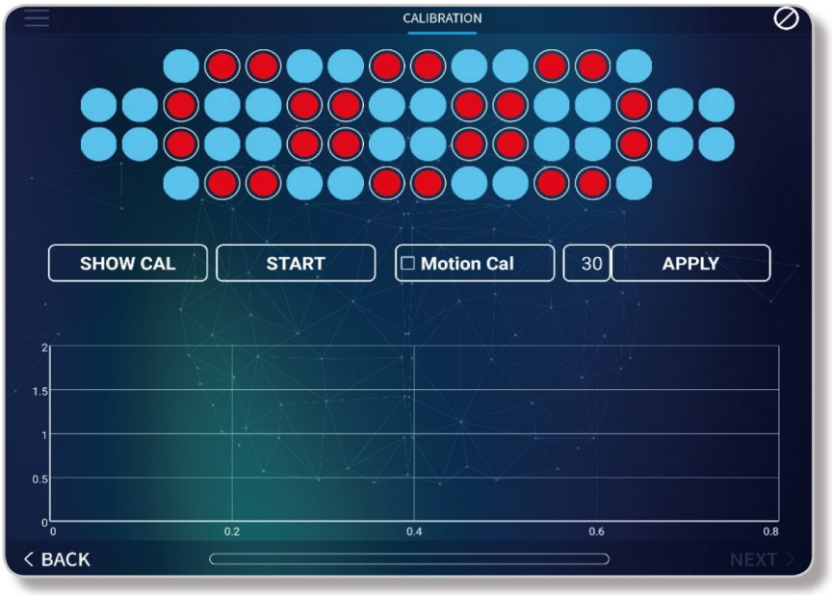


10 Select **DONE** at the bottom of the screen. Once the measurement is done, the **CALIBRATION** screen appears.

NOTE	If you wish to skip **PHOTOGRAMMETRY** process, simply select **DONE** instead of selecting on the face image on the screen. If you have already selected on the face image and the tablet camera is activated, simply press back button (⮌) on the tablet itself.

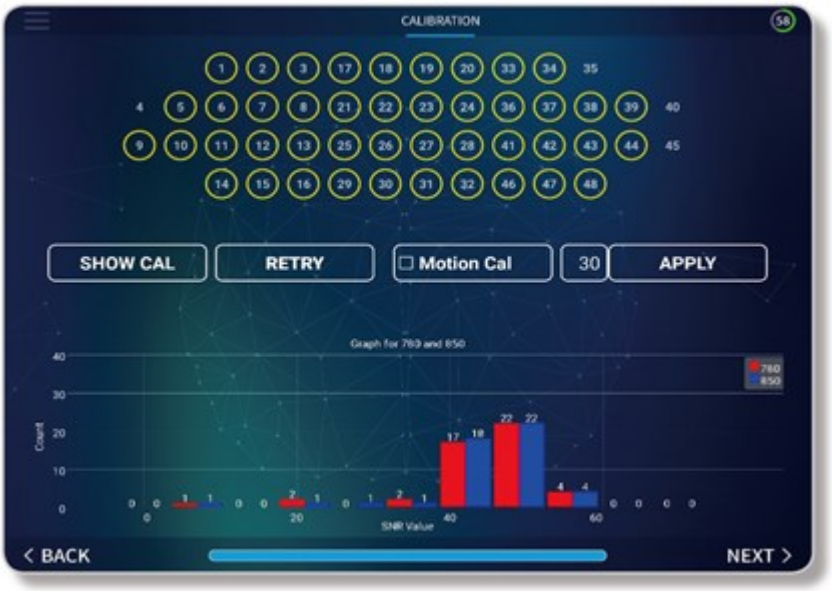
4.6 Calibrating NIRSIT

1 Select **START**. Sensor Gain calibration of NIRSIT lasers and detectors allows the NIRSIT device to measure optimal signals from the subject. The subject will need to stay calm with minimal physical movement during the **CALIBRATION** process to avoid possible artifacts.

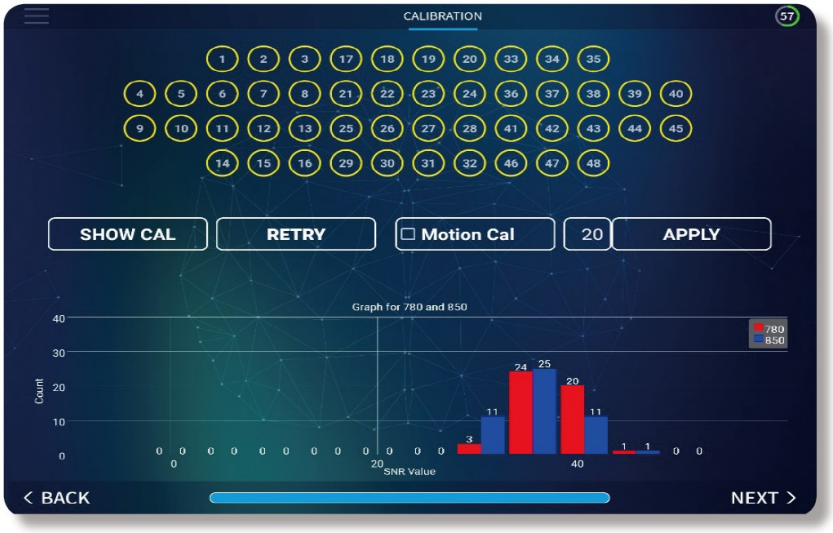


2 Once calibration is complete and the time bar at the bottom turns blue, active channels will be shown with yellow circles. In addition, signal to SNR (Signal Noise Ratio) will be shown as a graph.

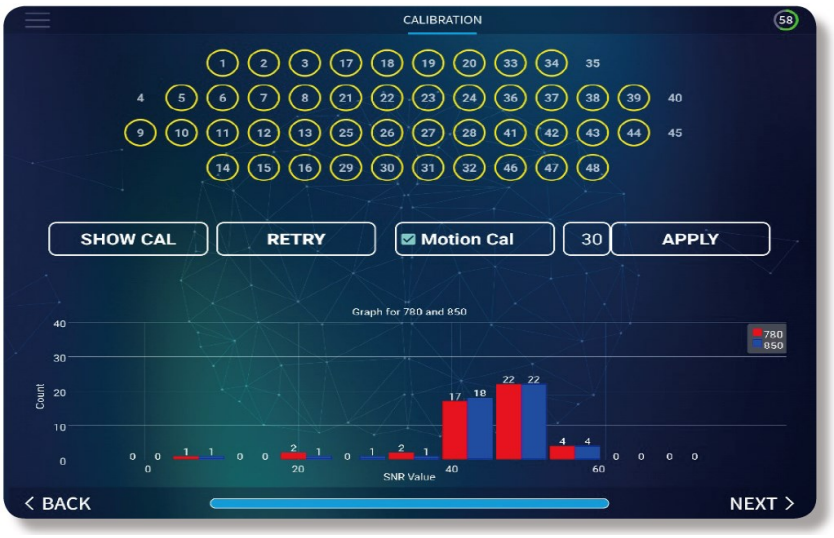
3 If certain channels are shown without a yellow circle (as non-active), adjust NIRSIT on the subject's head to ensure all hair is removed from the sensors' area and measure again. To measure again, select **RETRY**.



a. If certain channels still remain un-circled, you may lower the signal to noise ratio (SNR) value to less than 30 by changing the default SNR value number 30 shown next to **APPLY** button. Please note that changing the default SNR value of 30 to less than the default SNR value may result in noise increase in the measured signal.



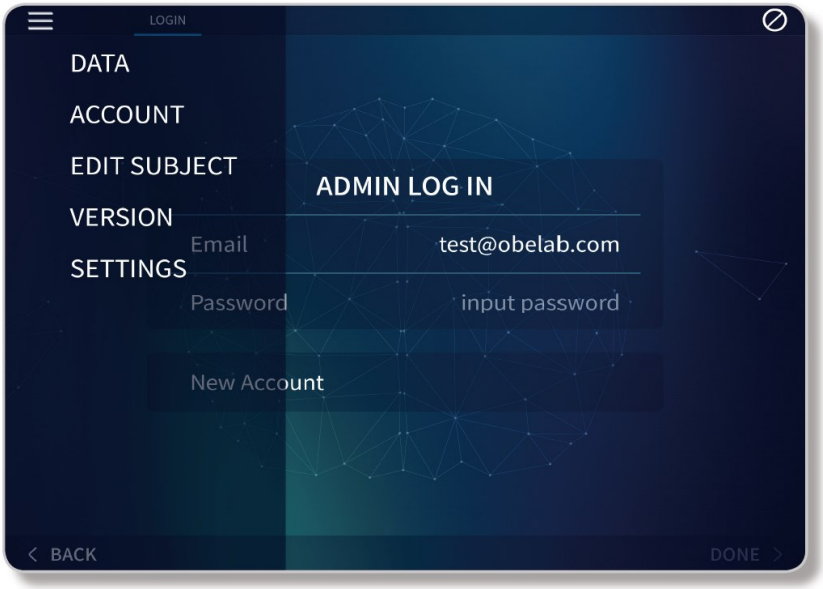
b. If performance of a task involves significant head movement (e.g., bending head down), check the box next to **Motion Cal**. This will activate the motion calibration feature and the signals received from the NIRSIT device will be compensated to improve accuracy. If little head movement is involved, do not select the **Motion Cal** check box. The motion calibration process will be skipped.



4 After calibration is completed, select the **NEXT** button at the bottom to proceed to the **SELECT MODE** stage.

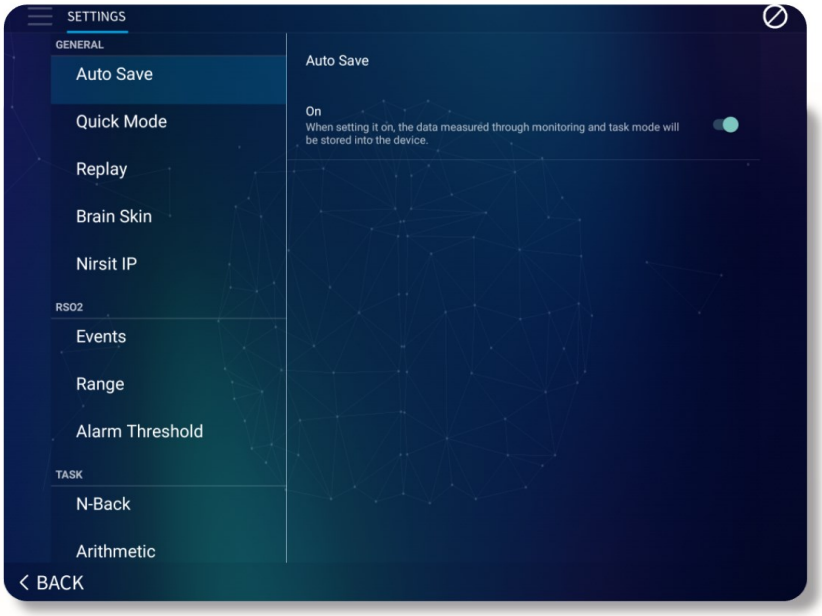
4.7 Configuring Initial NIRSIT Settings

1 Select (MENU BAR) > **SETTINGS**.



2 Enter the password for the logged-in observer account, and then select **DONE** at the bottom of the screen.

3 Select features from the left of the screen, and set each of the features to **On** or **Off**.



Feature	Description
Auto Save	When setting it on, the data measured through **MONITORING** and **TASK** mode will be stored into the device.
Quick Mode	When setting it on, both the **PHOTOGRAMETRY** and **SELECT MODE** steps will be skipped. See "4.9 Using the Software in Quick Mode" and

Feature	Description
	"4.8 Using the Software in Normal Mode" for details.
Replay	**On**: Shows raw data with button history. **Off**: Shows raw data without button history.
Brain Skin	Set the color of the brain image displayed in 3D mode to either **Normal** (peach color) or **Dark** (grayscale).
Nirsit IP	Change the default IP address of the NIRSIT device to connect the additional NIRSIT device. This will mainly be used when there is more than one NIRSIT device used simultaneously in STA mode.
RSO2-Events	Configure **Events**. Checked **Events** will appear on the **Quick Mode** screen. (see 4.9.2. Quick Mode Screen Overview)
RSO2-Range	Set the maximum and minimum rSO2 display range. Default value for minimum is 15% and maximum is 95%.
RSO2-Alarm Threshold	Configure alarm conditions based on reference values (see "4.9.2 Quick Mode Screen Overview" for details). Default value for Alarm Threshold is 20, which means alarm will sound when rSO2 value of either Right side rSO2 or Left side rSO2 increases or decreases by more than 20% as compared to the Baseline.
TASK- N-back, Arithmetic, Stroop	Configure task settings, such as number of task iteration, duration time, rest time, and question count.

4.8 Using the Software in Normal Mode

In **Normal Mode**, NIRSIT can monitor the subject's cerebral oxygen saturation level in either **TASK** or **MONITORING** mode.

To use NIRSIT in **Normal Mode**, select **MENU BAR** > **SETTINGS** and set **Quick Mode** to **Off**.

In case Motion Cal was checked to initiate Motion Calibration process

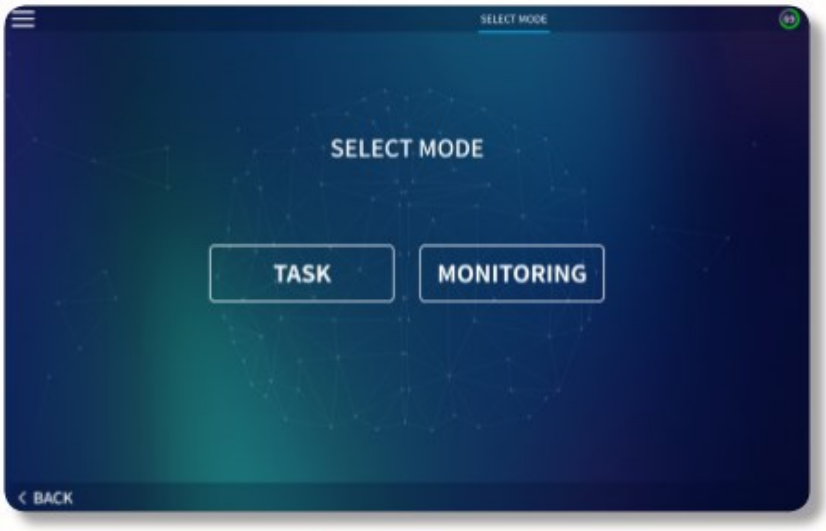
Perform baseline measurement, following the on-screen instructions. This will take about a minute. You need to stay as still as possible while baseline measurement is in progress.

4.8.1 Performing Tasks (TASK Mode)

Monitor the level and distribution of the subject's cerebral oxygen saturation while they perform tasks.

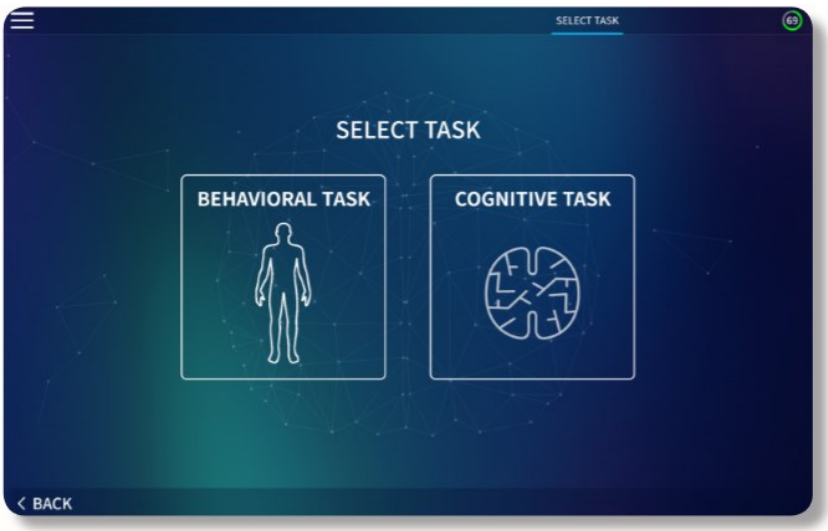
NOTE	On the **CALIBRATION** screen, perform sensor gain calibration and then select **NEXT** to display the **SELECT MODE** screen.

1 On the **SELECT MODE** screen, select **TASK**.



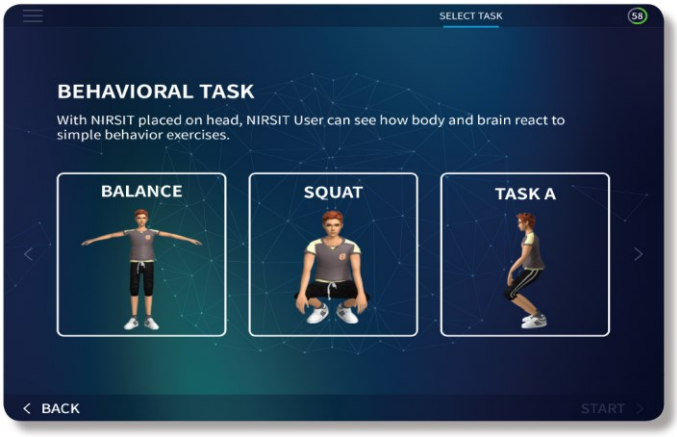
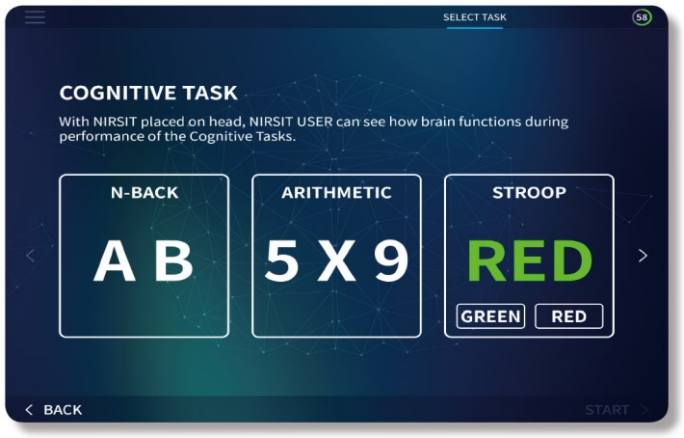
2 On the **SELECT TASK** screen, select the desired **TASK** mode.

TASK mode comes with two sub-modes.

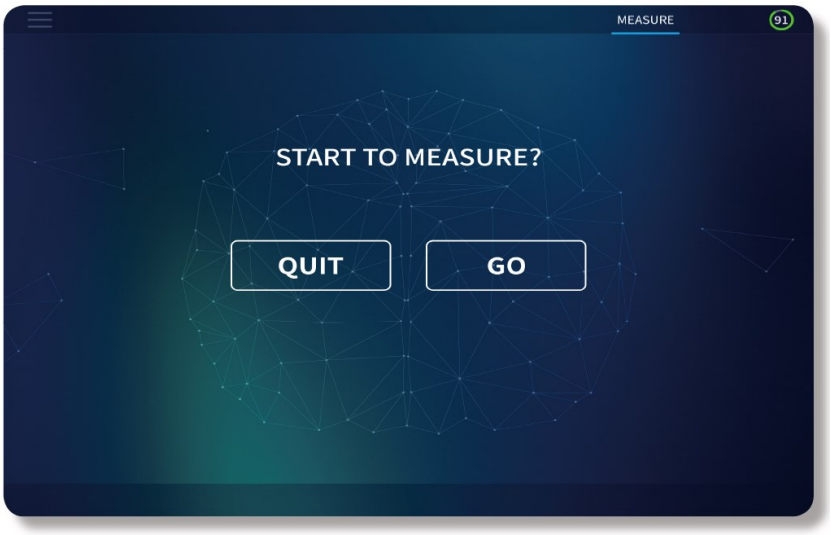


TASK Mode	Description
BEHAVIORAL TASK	Monitor the subject's cerebral oxygen saturation level while behavioral tasks are performed as instructed on the screen.
COGNITIVE TASK	Monitor the subject's cerebral oxygen saturation level while cognitive tasks are performed as instructed on the screen.

3 On the active **TASK** mode screen, select the task to be tested and select **START**. The following tests can be performed in each TASK mode:

TASK Mode	Available tests
BEHAVIORAL TASK	**BALANCE / SQUAT / TASK A** 
COGNITIVE TASK	**N-BACK / ARITHMETIC / STROOP** 

4 On the **START TO MEASURE** screen, select **GO**.



5 Move according to the instructions on the screen. If you select the brain image, a task time bar appears at the bottom of the screen. The measured data as well as the markers indicating the start and end of the task will be saved automatically after the task completion.

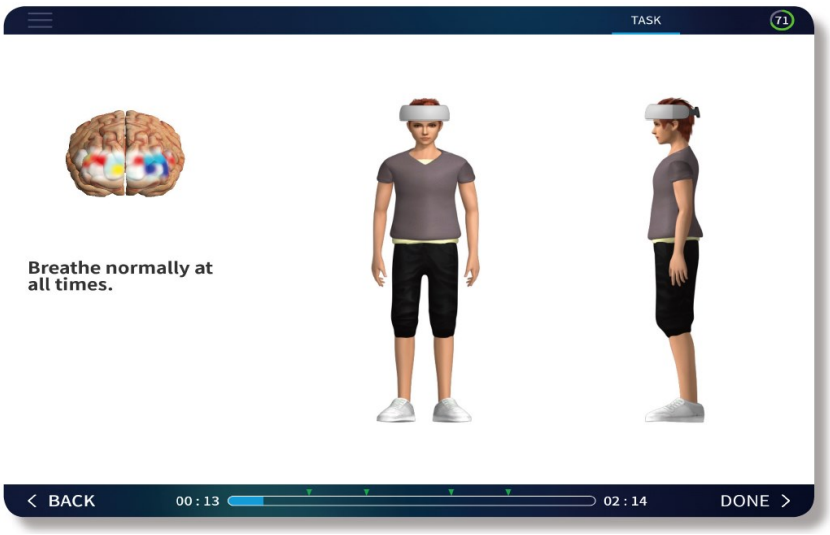


Figure 4-1 BEHAVIORAL TASK

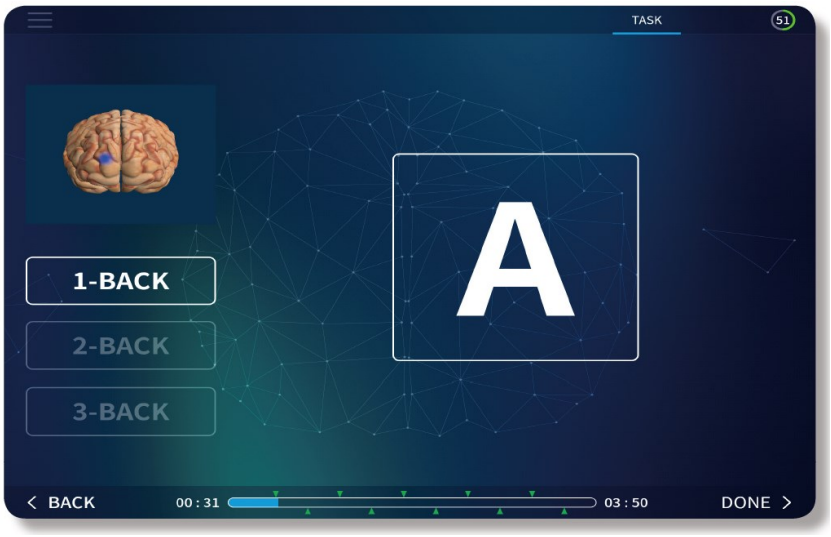
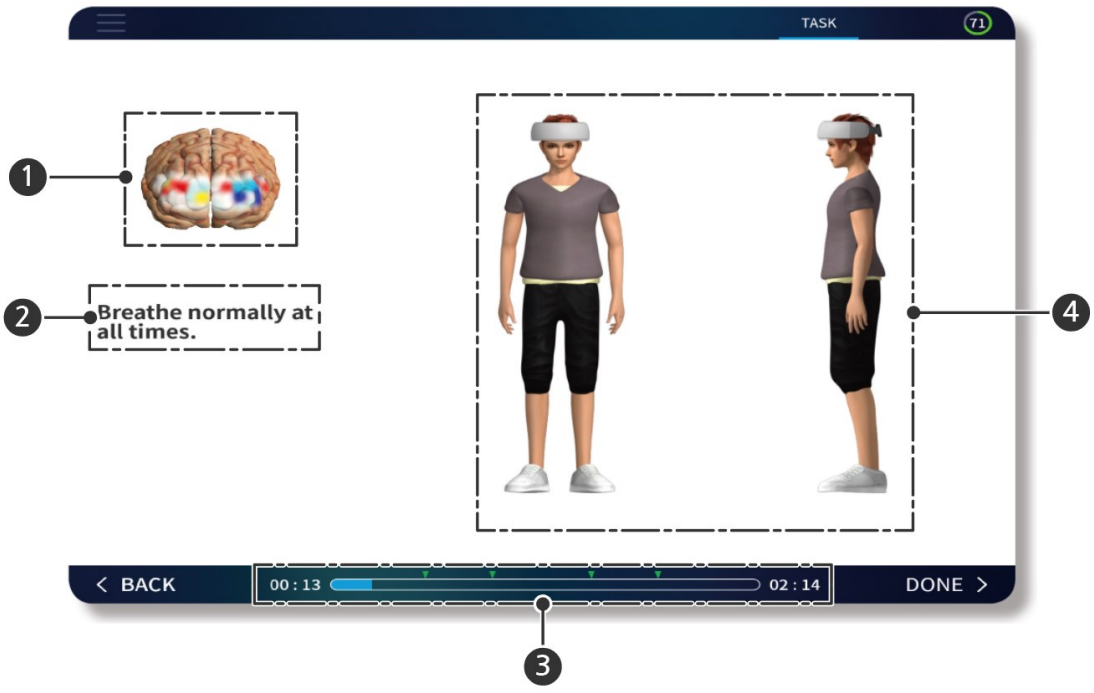


Figure 4-2 COGNITIVE TASK

4.8.2 BEHAVIORAL TASK Mode Screen Overview

In this mode, the user can just follow the motion described in the tutorial and the markers indicating the start and end of the selected task will automatically be embedded in the dB file.



No.	Description
1	Brain monitoring window
2	Tutorial window

No.	Description
3	Task time bar. Green markers denote the behavioral tutorial.
4	Task window

NOTE	View the brain image of the subject via the Brain monitoring window while tasks are performed. The Brain monitoring window is deactivated by default, but you may activate Brain monitoring window by selected on the brain image. If you select the brain image, a task time bar appears at the bottom of the screen.

4.8.3 COGNITIVE TASK Mode Screen Overview

In this mode, the user can just follow the instruction on the Task window and the markers indicating the start and end of the selected task will automatically be embedded in the dB file.

No.	Description
1	Brain monitoring window
2	Level adjustment window
3	Task time bar. Green markers denote start and finish of a task. You can configure task settings, such as number of task iteration, duration time, rest time, and question count under MENU > SETTINGS > TASK. (see 5.5.6 Configuring Initial NIRSIT Settings)
4	Task window

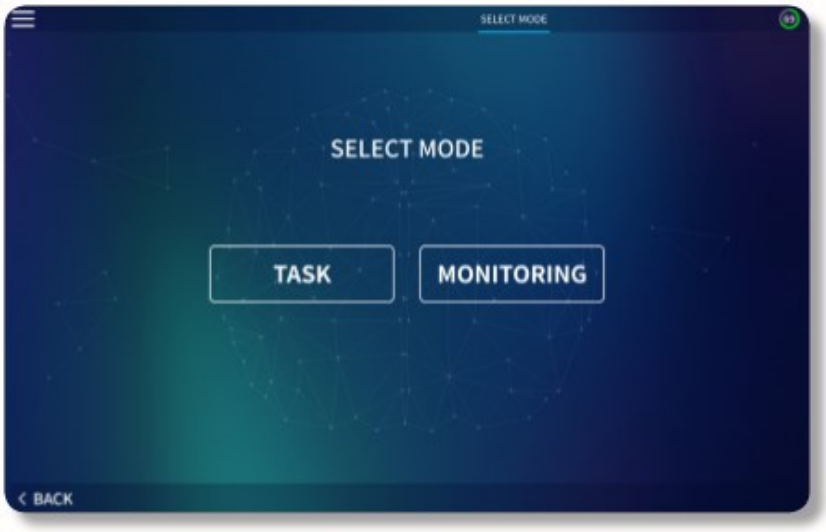
NOTE	View the brain image of the subject via the Brain monitoring window while tasks are performed. The Brain monitoring window is deactivated by default, but you may activate Brain monitoring window by selected on the brain image. If you select the brain image, a task time bar appears at the bottom of the screen.

4.8.4 Real-time Monitoring (MONITORING Mode)

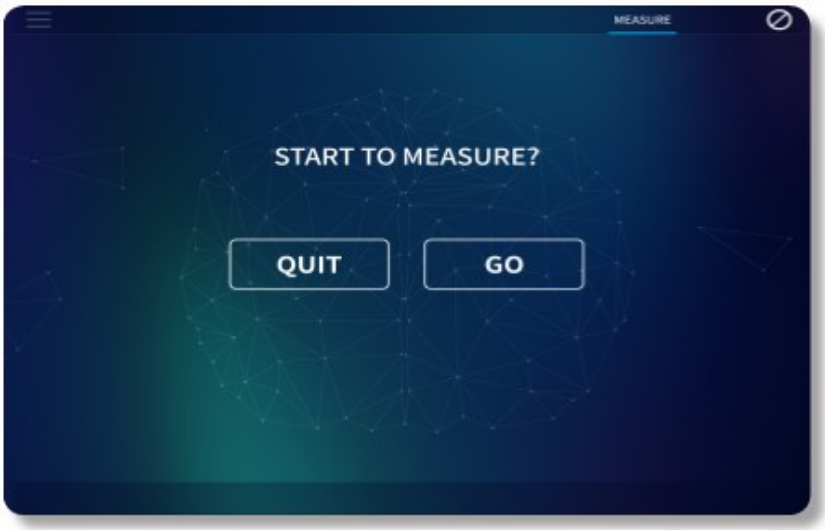
In MONITORING mode, two different modes are available for real time monitoring, both of which display the change in the cerebral oxygen saturation level of the subject.

1 On the **SELECT MODE** screen, select **MONITORING**.

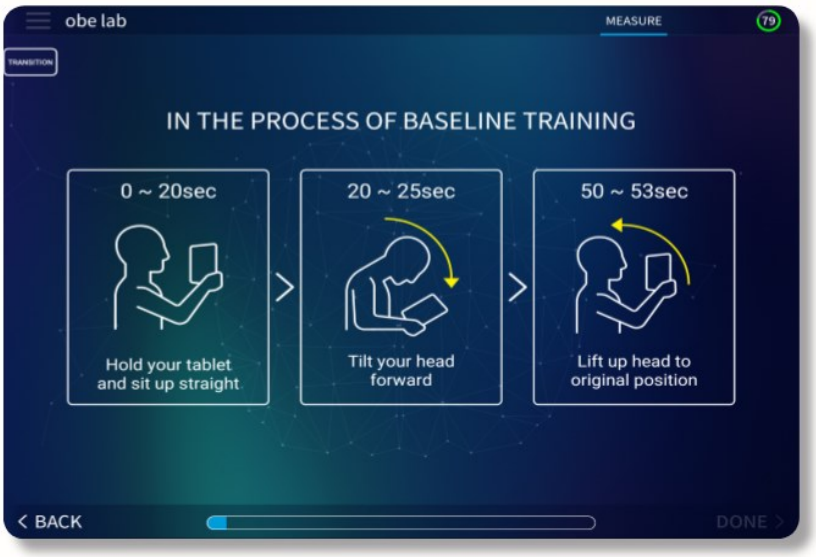
On the **CALIBRATION** screen, perform sensor gain calibration and then select **NEXT** to display the **SELECT MODE** screen.



2 On the **START TO MEASURE** screen, select **GO**.



3 If the **Motion Cal** check box was selected to initiate motion calibration process, perform baseline measurement, following the on-screen instructions. This will take about a minute. You need to stay as still as possible while baseline measurement is in progress.



Once the measurement is done, real-time data of the subject can be monitored in the desired mode. MONITORING mode comes with two sub-modes.

MONITORING Mode	Description
3D mode	**3D** mode visualizes the changes in the hemoglobin level in real-time on a 3D brain model. Depending on the intended use, the user can choose to monitor among HbO2, HbR, or HbT changes.
Time Series mode	**Time Series** mode shows HbO2 and HbR changes in a graph format in real-time on a channel by channel basis.

4.8.5 MONITORING Mode Screen Overview

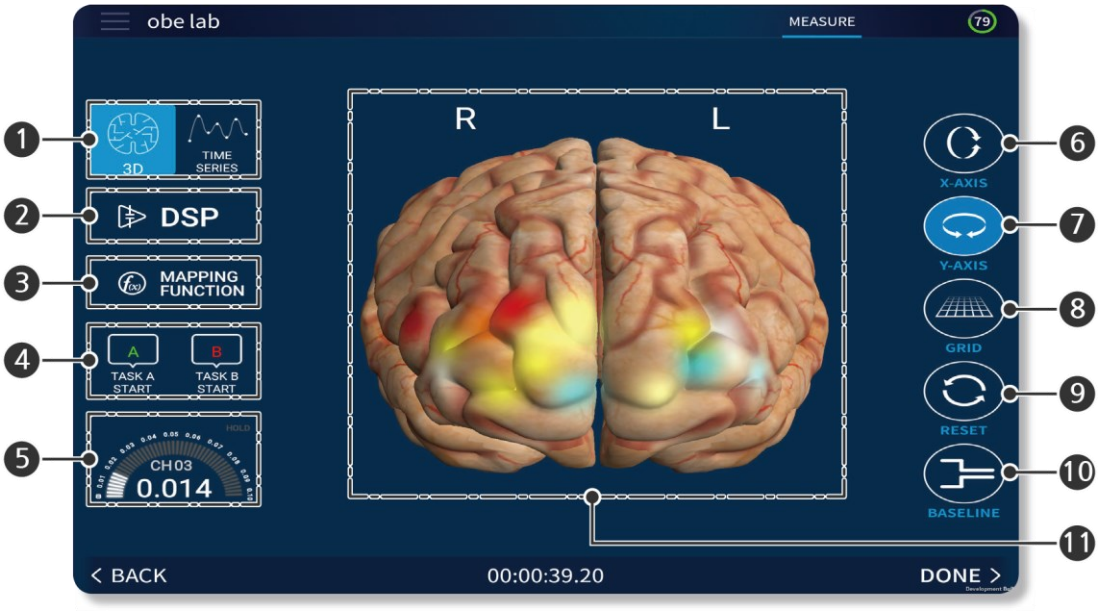


Figure 4-3 3D mode

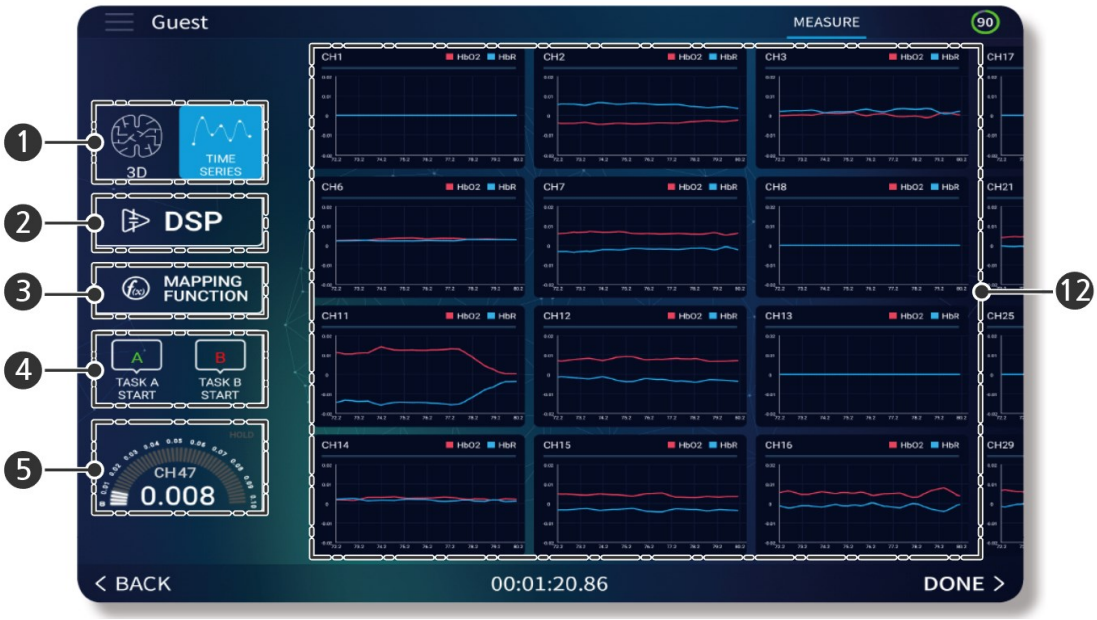
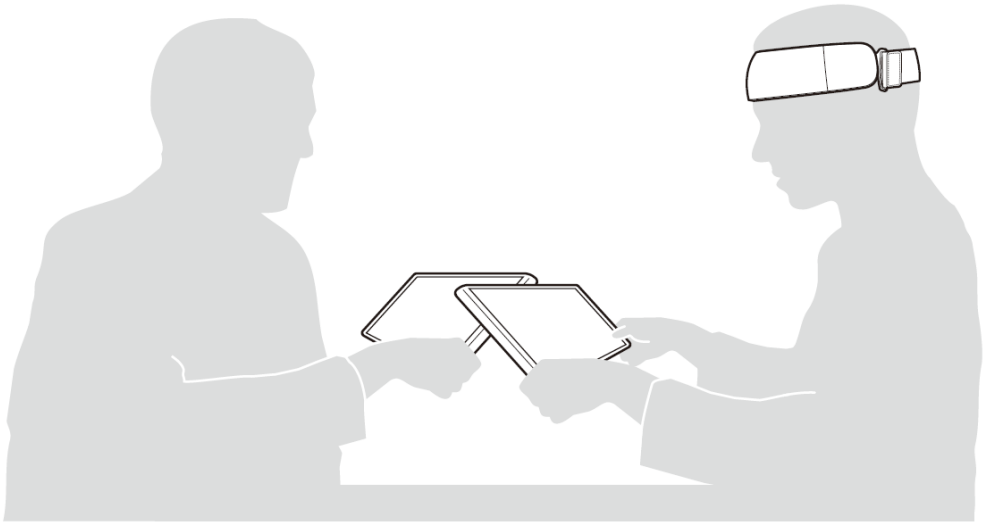


Figure 4-4 TIME SERIES mode

No.	Description
1	Select a monitoring mode: ▪ **3D** mode (current mode) ▪ **TIME SERIES** mode
2	Display on-screen filtering menu items as follows: ▪ LPF: Use a low-pass filter to remove high frequency noise. ▪ MBLL: View changes in HbO2 and HbR levels calculated with the Modified Beer-

<table>
<tr><th>No.</th><th colspan="2">Description</th></tr>
<tr><td></td><td colspan="2">Lambert Law.
▪ MOTION COMPENSATION: Remove motion artifacts caused by head movement of the subject.</td></tr>
<tr><td></td><td>NOTE</td><td>To use MOTION COMPENSATION feature, first check the Motion Calibration checkbox during GAIN CALIBRATION section to activate Baseline Training process and complete motion data measurement.</td></tr>
<tr><td></td><td colspan="2">▪ N/A CHANNEL REJECTION: Delete channels that do not meet the default/set SNR value.
▪ HEART BEAT: Remove heart beat effect.
▪ BASELINE REMOVAL: This feature is yet to be implemented.</td></tr>
<tr><td>3</td><td colspan="2">Display on-screen function menu items as follows:
▪ BILINEAR INTERPOLATION (MBLL): Color-map channels using bilinear interpolation
▪ SIMULTANEOUS DOT: Color-map at pixel level using simultaneous diffuse optical tomography
▪ ITERATIVE DOT: Color-map at pixel level using repeatable diffuse optical tomography
▪ Display Data:
• HbO2: Color-map changes in HbO2 level
• HbR: Color-map changes in HbR level
• HbT: Color-map changes in the sum of HbO2 and HbR levels
▪ ACTIVATION MODE: Display only positive changes
▪ AVERAGE MODE: Color-map the average of left and right cerebral hemispheres
▪ LINEAR MAPPING: Linearly color-map RGB and data values
▪ COMPRESSION MAPPING: Color-map compressed RGB and data values</td></tr>
<tr><td>4</td><td colspan="2">Save the task start point by selecting the TASK A START button. Save the task end point by selecting the TASK A END button. The same applies to the Task B START and END button.</td></tr>
<tr><td></td><td>NOTE</td><td>You can manually save the task start point and end point in the NIRSIT database. It is possible to record two tasks (tasks A and B) simultaneously.</td></tr>
<tr><td>5</td><td colspan="2">Display the channel number that has the highest HbO2 level and its value.</td></tr>
<tr><td>6</td><td colspan="2">Rotate the 3D image along the X axis.</td></tr>
<tr><td>7</td><td colspan="2">Rotate the 3D image along the Y axis.</td></tr>
<tr><td>8</td><td colspan="2">Display all of the channel numbers for the sensor unit.</td></tr>
<tr><td>9</td><td colspan="2">Reset the position of the 3D brain image.</td></tr>
<tr><td>10</td><td colspan="2">Set the baseline of initial MBLL value to the current value.</td></tr>
<tr><td>11</td><td colspan="2">3D brain image
▪ R denotes Right Hemisphere.
▪ L denotes Left Hemisphere.</td></tr>
</table>

No.	Description	
	▪ Measured signal is shown in mM, ranging from -0.010mM to 0.010mM.	
	NOTE	Measured signals are represented in multiple colors on 3D brain image, and each color indicates different states: ▪ White: Initial state of the brain (Baseline) ▪ Red > Yellow > White: Increase in HbO2 level ▪ White > Light Blue > Blue: Decrease in HbO2 level
12	Time series image ▪ Time Series Mode shows HbO2 and HbR changes in a graph format in real-time on a channel by channel basis.	

4.8.6 Monitoring + Task Mode

Allows both Monitoring and Task modes to be run by connecting two tablets to a single NIRSIT unit.