kernel Flow

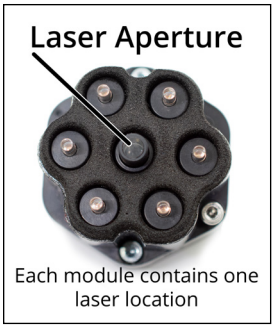
Quick Reference Guide

Flow 50 Version

LASER SAFETY

Kernel Flow complies with Federal Laser Product Performance Standards (FLPPS) 21CFR1040.10 as a Class 2 laser product. A Class 2 laser means any laser product that permits human access to levels of laser radiation in excess of Class 1 accessible emission limits (AEL) during normal operation. During normal operation the Kernel Flow emits invisible (850 nm) Class 1 laser radiation and visible (690 nm) Class 2 laser radiation. Kernel Flow utilizes 52 Class 1 diode lasers and 52 Class 2 diode lasers.

A Class 1 laser is considered to be incapable of producing damaging radiation levels during operation and exempt from any control measures.



Each module contains one laser location

A Class 2 laser system emits in the visible portion of the spectrum (400 nm to 700 nm) and eye protection is normally afforded by the aversion response. The aversion response is defined as closure of the eyelid, eye movement, pupillary constriction, or movement of the head to avoid an exposure to a noxious or bright light stimulant. The aversion response to an exposure from a bright, visible, laser source is assumed to limit the exposure of a specific retinal area to 0.25 s or less.

IMPORTANT Kernel Flow is designed to be positioned on the user prior to activation. Users should not intentionally stare into/or at the visible red beams.

CAUTION Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

DEVICE IS NOT USER-SERVICEABLE Do not open or attempt to service modules. Modules must be returned to manufacturer for service or repair.

IMPORTANT Kernel Flow has not been evaluated for clinical performance or use, accuracy, reliability, or effectiveness, and has not been validated for any particular use.

FOR RESEARCH USE ONLY Not intended for use in the diagnosis of disease or other conditions or in the cure, mitigation, treatment, or prevention of disease.

Kernel Flow 50 is a pre-production prototype that currently has not been tested for electrical safety, electromagnetic compatibility, or biocompatibility.

Any misuse or mishandling of the product, including failure to properly clean and store the product, will void the warranty.

This product complies with 21CFR1040.10 Federal Laser Product Performance Standards for light emitting products.

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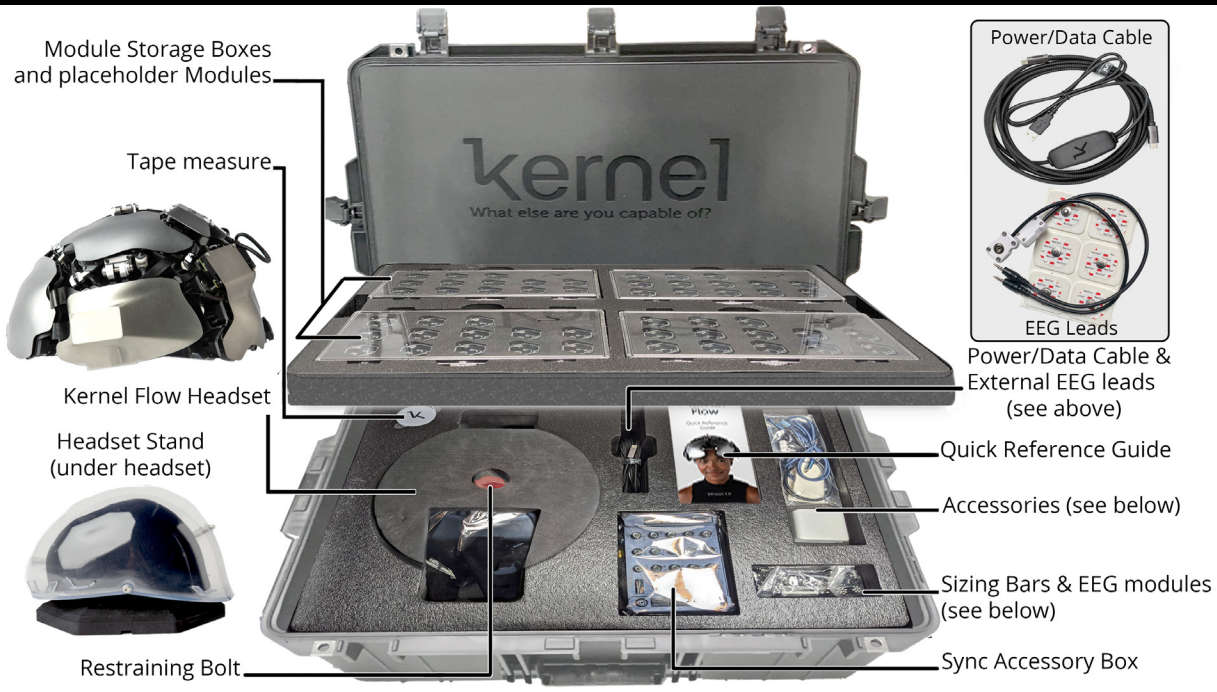
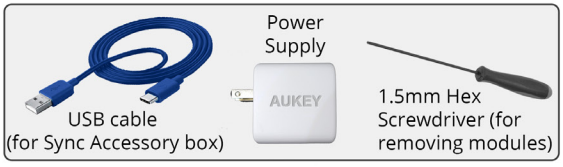
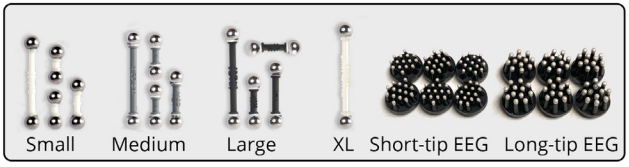
WHAT'S IN THE BOX



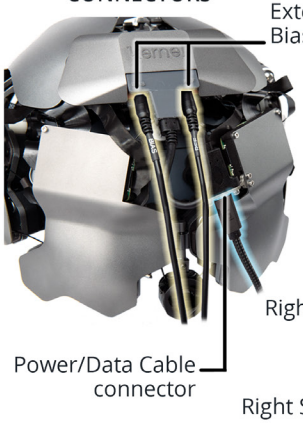
ACCESSORIES



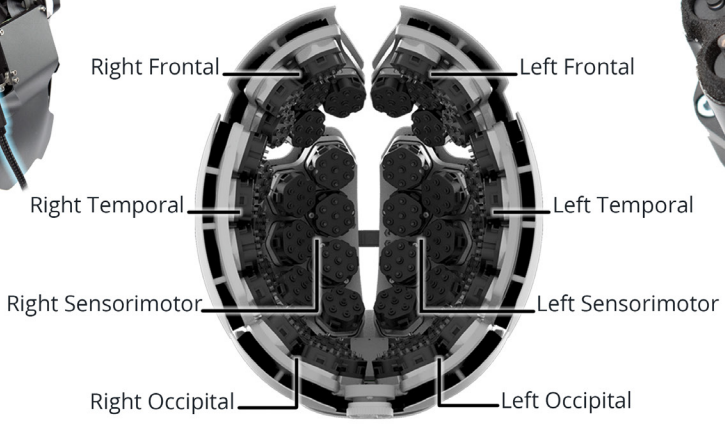
SIZING BARS & EEG MODULES



CONNECTORS



HEADSET PLATES



MODULE PARTS

BEFORE YOU BEGIN

Before using Kernel Flow for the first time, you must set up your organization using the Researcher Portal:

portal.kernel.com

Refer to your purchase confirmation email to confirm your primary user account login information. Use this web-based portal to perform the following tasks:

- Add researchers to your team
- Create studies
- Create participant IDs
- Generate participant invitation codes
- Create task names
- Upload surveys for study participants
- View, analyze, and download study data

NOTE: *Before beginning the steps in this guide, you must, at a minimum, create a study and one participant ID, and the intended participant must accept the invite code (in the Kernel App on iOS or Android) granting permission for their data to be viewed.*

Detailed instructions for all these tasks are available at:

docs.kernel.com

Once you're ready to begin, follow the steps in this guide to connect, prepare, and configure your Flow headset and to record your first session.

Unpacking Kernel Flow

IMPORTANT: *Before proceeding, review the safety warnings on the first page of this booklet.*

Kernel Flow is shipped with specialized protective packaging. Upon unpacking, **be sure to preserve and save these materials** so the device can be safely moved or shipped in the future.

1. Remove the foam tray containing the Module Storage Boxes and set it aside.
2. Remove the Instapak foam insert covering the headset. Do not discard this.
3. Take the Flow headset out of the case. This wrapped package contains the headset as well as the headset stand.
4. Remove the anti-static bag covering the headset.
5. Unscrew and remove the red Restraining Bolt that holds the headset to the stand.

Handling the Headset

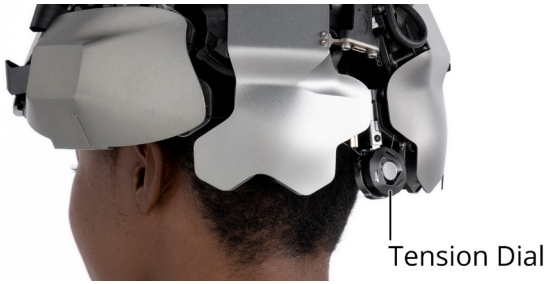
- When you remove the headset from the case, remove the Headset Stand with it.
- Whenever possible, use the headset stand.
- Always use the flat Support Tabs (under the Temporal plates) to lift or carry the device.

- Never lift or hold the headset by the hinges on the top or by a single plate.

The headset should always be kept tightly tensioned.

Loosening should only be done temporarily to get the device on and off the stand or a participant's head.

Even while moving the headset from one support element to another, tightening keeps the plates from excessive movement which can damage the device.



- To tighten, turn the Tension Dial clockwise until it is snug.
- To loosen, turn the Tension Dial a half-turn counterclockwise to release the tension, then gently pull the plates apart as needed to fit the device on or off of a support element.

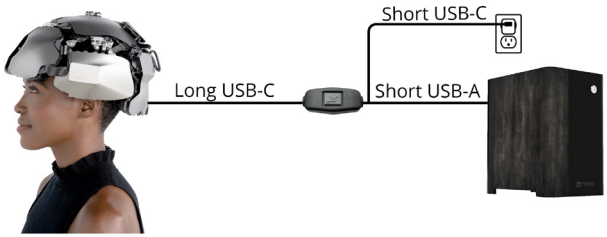
Using EEG

This guide does not include instructions for using the EEG modules.

To learn about installing and using the provided EEG modules, visit **docs.kernel.com/docs/eeg.**

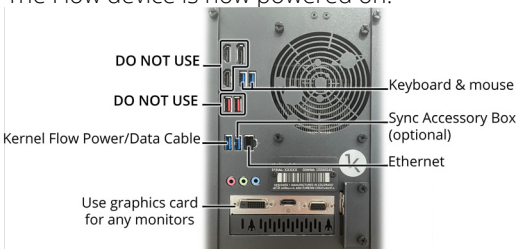
STEP 1: CONNECT THE HEADSET TO THE PC

Kernel Flow must be connected to the provided PC to be configured and controlled. Follow the following steps and diagrams to ensure successful operation.



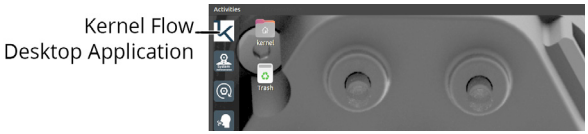
1. Plug the long USB-C end of the Power/Data Cable into the USB-C connector on the back of the headset.
2. Plug the shorter USB-C end of the Power/Data Cable into the Kernel Flow Power Supply.
3. Plug the Power Supply into the **same outlet or power strip** as the Kernel Flow Configuration PC.
4. Plug the USB-A end of the Power/Data Cable into the PC (**Do not use the red USB ports**).

   The Flow device is now powered on.



NOTE: *Even though a blue light illuminates on the headset, all lasers remain off until they are enabled using the Kernel Flow Desktop Application.*

5. Turn on the PC and launch the Kernel Flow Desktop Application (the first icon in the Taskbar as illustrated in the picture below).



NOTE: *Your PC has been pre-configured by the Kernel team prior to shipment so it is ready to operate the Flow headset immediately. No login or setup is required to run the Kernel Flow Application.*

STEP 2: INITIALIZE THE HEADSET

1. Be sure the headset is seated and tightened on the Headset Stand.
2. In the main window of the Kernel Flow desktop application, click **Initialize**.
3. A confirmation dialog appears. Click **Initialize** to proceed.

   Initialization performs a series of tests and procedures to ensure all modules are synchronized and receiving adequate signal.

TIP: *You may disregard the color of the modules onscreen because the headset is not recording brain activity at this stage in the setup process.*

4. When Initialization is complete, click **Close** to exit the Initialization window.

IMPORTANT: *Initialization must be performed every time the headset is powered on.*

NOTE: *Kernel Flow's lasers benefit from a warm up period prior to recording a study. Often the process of tuning and prepping a participant (while lasers are enabled) provides sufficient warm-up time, but you may consider enabling the lasers for 5-10 minutes while the headset is sitting on the Headset Stand after Initialization. Just be sure to disable the lasers prior to removing the Headset after this step.*

STEP 3: MEASURE PARTICIPANT'S HEAD

1. Wrap the supplied tape measure around the participant's head as illustrated below.

2. Ensure the tape measure is snug and free of kinks or twists and note the number of centimeters.

STEP 4: INSTALL THE SIZING BARS

1. Using the table below, select the size of Sizing Bars best suited for the current participant.

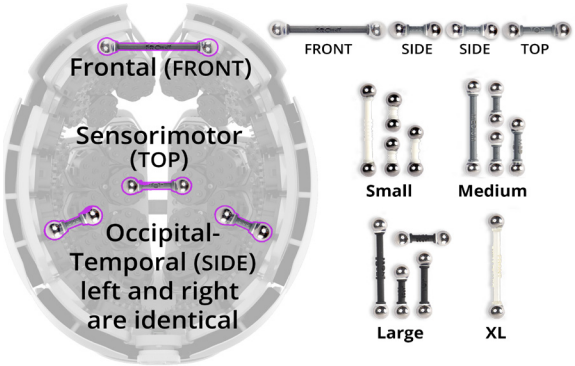
Sizing Bar Measurement Chart

Circumference	52-54cm	55-57cm	58-60cm
Sizing Bars	S (White)	M (Gray)	L (Black)

TIP: *Sizing Bars may be mixed to find the best possible fit. Notate the bars selected and use the same set every time that participant is recorded.*

2. Turn the headset upside down and place it onto the inverted protective foam insert from the shipping case, tightening and loosening as described in the *Handling the Headset* section above.

3. Insert the four Sizing Bars, using the magnets to snap the bars into the proper position as illustrated in the diagram below.

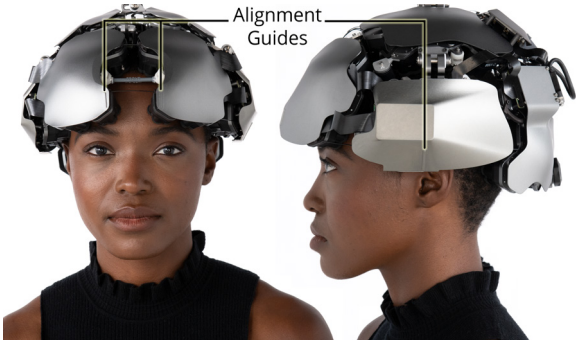


TIP: *You may need to loosen the Tension Dial in order to install the Top Sizing Bar.*

STEP 5: PLACE THE HEADSET

1. Loosen the Tension Dial, then, holding the device by the Support Tabs, gently set the headset on the participant's head.

2. Using two hands, carefully adjust the headset so the Alignment Guides on each side of the device align to matching positions on each side of the head.



3. Adjust the headset so the Alignment Guides on the front of the device are positioned symmetrically above the eyes.

TIP: *You may need to rotate the headset forward towards the brow for proper alignment.*

4. Tighten the Tension Dial so the headset is as snug as possible while still remaining comfortable for the participant.

STEP 6: TUNE THE LASERS

Once the headset is seated on the participant's head, you must tune the lasers. This operation turns on the lasers and configures the strength of each laser to ensure every detector is receiving an adequately strong signal.

NOTE: *The Tune Lasers tool must be re-run each time the headset is placed on a participant's head.*

1. In the Kernel Flow application, at the top of the main window, click the **Tune Lasers** button.

2. Click **Tune Lasers** in the window that appears.

   A progress bar appears to indicate the duration of the operation.

3. Once the operation is complete, click **Close** to close the Tune Lasers window.

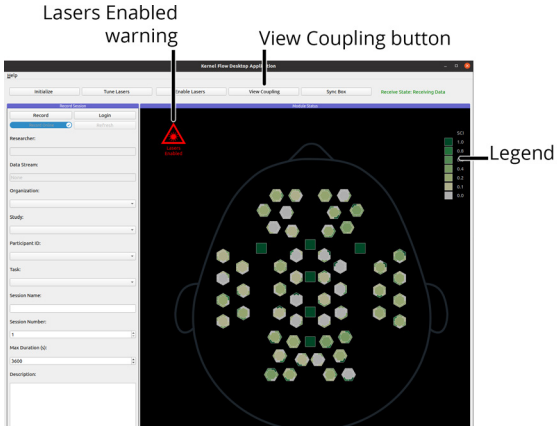
NOTE: *When the Tune Lasers command is complete the lasers remain enabled.*

SAFETY WARNING: *Never remove headset from the participant's head while lasers are enabled.*

STEP 7: CHECK THE SCALP COUPLING

The Module Status View displays the quality of signal received by each detector, and in aggregate by each module.

The legend indicates the signal quality that each color represents; darker green means a better signal.



By default, the Module Status View uses the total count of photons received to determine the quality of the data for each detector.

At any point you can click **View Coupling** to switch the view to display in SCI (scalp coupling index) values rather than total counts. There will be a five-second delay before the view updates.

Click **View Total Counts** to switch back.

If the Module Status View indicates modules with insufficient signal, first switch to Total Counts, then try the actions below to improve the connection:

- Verify that you have the most appropriately sized Sizing Bars installed, and that the Tension Dial is properly tightened.
- Attempt to move thick locks of hair out of the way of the affected module(s).
- Gently manipulate or wiggle the headset.
- Re-run the Tune Lasers command.
- For additional troubleshooting instructions, visit **docs.kernel.com**.

STEP 8: RECORD A SESSION

NOTE: *Remember that participants must explicitly provide consent by accepting a participant Invitation Code before their session data may be viewed, downloaded, or analyzed.*

1. In the Kernel Flow Desktop Application, click the **Login** button (if you haven't already).
2. Enter your Kernel Cloud ID (email address) and password and click Login or press Enter.

   Once logged in, your organization and available Studies are loaded into the software.

TIP: *Kernel Flow can be operated offline (without an Internet connection). Instructions are available at **docs.kernel.com**.*

3. Choose a Study, Participant ID and optionally enter other metadata (such as a Task name, Session name, which Sizing Bars are used, or other notes) to save with the session.
4. Optionally change the value in the Maximum Duration field. Enter in seconds (for example: 10 minutes = 600).
5. Click **Record**.
6. Confirm that the participant wearing the headset is correctly associated with the Participant ID displayed onscreen, and click **Continue**.

   The system begins recording.

STEP 9: PERFORM A TASK

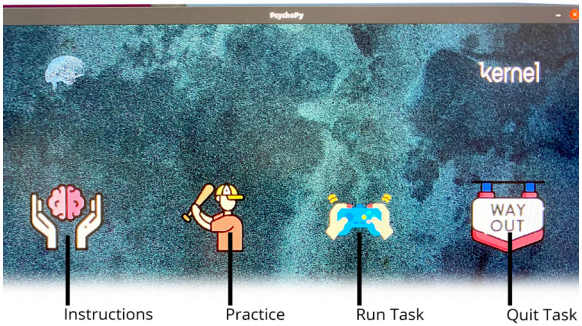
Kernel provides a collection of standardized tasks to aid in your data collection. These tasks are pre-installed on the Kernel Flow PC. Each task is represented by an icon in the Taskbar.

For a description of each task, go to **docs.kernel.com**.

1. Click an icon in the Taskbar to open a Task. The Task Parameters dialog opens.

TIP: *For a simple, short example that should generate a robust response, choose* **Breath Hold.**

2. Optionally customize the settings, then click **OK**.



Each task includes a Home screen with buttons to display instructions, run in practice mode, run the actual task, and to exit the task.

NOTE: *Some tasks do not include a practice mode.*

TIP: *While running the task, be sure to move the pointer away from the onscreen stimuli. Also, be careful not to click outside the Task window while a task is running, or keyboard inputs won't be logged.*

NOTE: *Your Kernel Flow system includes a Sync Accessory Box for connecting external stimuli or external data-recording devices. Instructions for the Sync Accessory Box can be found at* **docs.kernel.com.**

STEP 10: END THE SESSION

A session ends when the maximum duration elapses, or the researcher clicks the **Stop Recording** button. All captured data is automatically uploaded to Kernel Cloud for processing and analysis.

- If you want to immediately begin another session with the same participant, repeat step 9 above.
- If you are done recording sessions, there are important steps to follow:

  1. If necessary, click the **Stop Recording** button.
  2. Click **Disable Lasers**.

SAFETY WARNING: *Never remove the headset from a participant while the lasers are enabled.*

3. Loosen the Tension Dial and gently spread the plates apart, then, lifting from the Support Tabs, carefully remove the headset from the participant. Avoid lifting by the top hinge.

NOTE: *The exterior of the headset may be hot after recording.*

4. Tighten the Tension Dial again and cradling the headset upside-down in your lap, remove and stow the Sizing Bars.
5. Loosen the Tension Dial, and place the headset back on the Headset Stand, then tighten the Tension Dial again.
6. Disconnect and stow the Power/Data Cable.

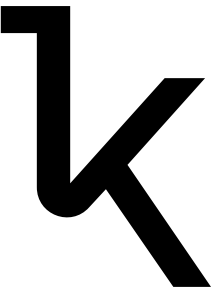
Full instructions for storage and cleaning of the headset can be found at **docs.kernel.com.**

STEP 11: VIEW OR DOWNLOAD YOUR DATA

1. When you're ready to view or download the data captured during your session, login to the Kernel Cloud Researcher Portal at **portal.kernel.com.**
2. Click the study you selected in Step 8 above.
3. Click **Datasets** and you'll see a list of sessions (or *datasets*).
4. Click the dataset from the list to open the detail page for the recording you just made.
5. Click **Pipelines** to access a Quality Control (QC) file describing the data, or you can generate and download a SNIRF or NIfTI file containing the data.

NOTE: *The Kernel Flow system includes many additional tools and features not covered in this guide. Also, this guide may be updated. Please check the website (link below) for the latest version of this document, as well as for the full user guide.*

docs.kernel.com



kernel
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Model: **Kernel Flow**
Manufactured:_____

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