Flicker Fusion
iOS User Instructions

Lafayette Instrument

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 Rel. 7.17.24

Table of Contents

Viewing Chamber Hardware

Flicker Fusion App

Description

The Lafayette Instrument Flicker Fusion system provides the user with a variety of versatile controls to perform accurate and timely measurements of CFF. Digital circuitry is used to provide extremely accurate frequency generation from 1.0 Hz to 100.0 Hz in 0.1 Hz steps. Unlike previous systems, this generation uses a Bluetooth® connection for maximum convenience. The tablet allows for exact and repeatable frequency settings, and a means for test result scoring and storage. The test options include five modes of operation to cover virtually any test requirement:

- **Simple Flicker:** Stimulus is decreased from steady to the point at which the light changes from steady to flicker.
- **Simple Fusion:** Stimulus is increased from flicker to the point at which the light changes from flicker to steady.
- **Automatic:** Automatically runs test using the Simple Fusion test to determine the fusion frequency and the Simple Flicker test to determine the flicker frequency.
- **Adaptive:** Displays fixed frequencies and allows the test subject to respond to the frequencies as "flicker" or "fusion". This test zeros in on the CFF and automatically ends when the value is determined.
- **Self-Control**: Allows the test subject to select whether to increase or decrease the frequency. This test is ended by the subject.

The viewing chamber has two lights, one for the left eye and one for the right eye. The light compartments are completely separated, allowing for four stimulus combinations to occur:

- **Left:** Left eye only
- **Right:** Right eye only
- **Coincident:** Left and right simultaneously
- **Alternate:** Left and right alternately

The viewing chamber is constructed to mitigate extraneous factors, which might distort CFF values. The white lamps produce even illumination over a 1" square LED. The stimuli are separated by 2 3/4" center to center with a stimulus to eye distance of 15" and a viewing angle of 1.9 degrees.

Overview

The Flicker Fusion is designed to test for the critical flicker fusion threshold (CFF). CFF can be used as an index of the temporal resolving power of the human visual system. The threshold of the flicker fusion is determined in the following manner: a light beam is interrupted intermittently by electronic means at a slow rate, causing it to flash or flicker. If the rate of the flicker exceeds a certain rate, the light will appear steady. The rate at which flicker ceases and the light appears steady is the threshold of fusion. The rate of flicker is then decreased from steady to the point at which the light changes from steady to flicker, the threshold flicker. The average of the threshold of fusion and the threshold of flicker is called the Critical Flicker Fusion threshold (CFF).

CFF is sensitive to a number of presentation and observer variables. Presentation variables include stimulus frequency, luminance, and size, color, and contrast, as well as light/dark ratio. Observer variables reported to affect results include body temperature, practice, general physiological state, age, sex, and genetics.

Photosensitivity Warning

A small percentage of individuals may experience symptoms of photosensitivity when exposed to flashing lights. These symptoms include feelings of nausea, dizziness, migraines, visual distortions, or photosensitivity induced seizures characterized by one or more of the following: light-headedness, altered vision, eye or face twitching, jerking or shaking of arms or legs, disorientation, confusion, loss of consciousness or convulsions that can lead to injury from falling or collision. Symptoms can occur in individuals with no history of seizures or epilepsy. Immediately stop using the Flicker Fusion if you experience any of the above symptoms. Consult a physician before using the Flicker Fusion if you or a relative have a history of seizures or epilepsy.

Specifications

- **Power Supply**
  - AC/DC Wall mount adapter 5V 5W w/ USB 1.1 Cable A Male to B Male 4.92' Shielded
  - Computer USB port
- **Frequency:** 1.0 to 100.0 Hz in 0.1 Hz increments with an error of 0.05%
- **Slide Holder:** 2" x 2" 35 mm holder for optional neutral density filters with 0.5% to 50% light transmission
- **Auto Mode Ramp Rates:** Options of 0.5, 1, 2, and 4 Hz per second
- **External Response:** SPDT normally open hand-held switch with 3.5 mm stereo plug
- **Typical Maximum Luminance:** 58 Cd/m_2
- **Viewing Angle:** 1.9 degrees
- **Light/Dark Ratio:** 1:1
- **Stimulus Color:** White
- **Viewing Chamber Color:** Black
- **Viewing Chamber Mask:** Hobart 770094 Welding Oxy-Acetylene
- **Viewing Chamber:**
  - **Dimensions:** 7" x 19" x 16" (L x W x H)
  - **Weight:** 6.3 lbs

Parts

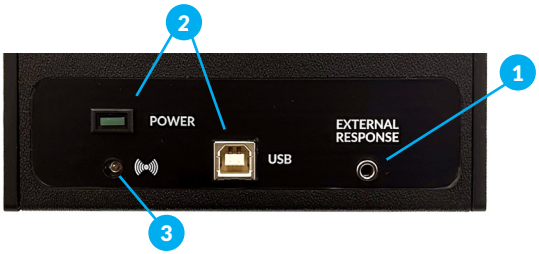
- Tablet
- Viewing Chamber
- AC adapter
- Hand-held response switch

Operating Instructions

1. Connect the black hand-held subject response switch to the external response connector on the rear of the viewing chamber.
2. The device receives power via USB port. POWER indicator on rear panel will light up when powered on.
3. Enable Bluetooth on tablet and open Flicker Fusion Application
4. Pair viewing chamber with tablet. When the chamber is successfully paired, the wireless connection indicator will light up.

   Note: For more specific details about the pairing process, see the "Pairing Flicker Fusion viewing chamber to app" section of this manual.

5. Follow app instructions to add users and begin testing.



Cleaning Instructions

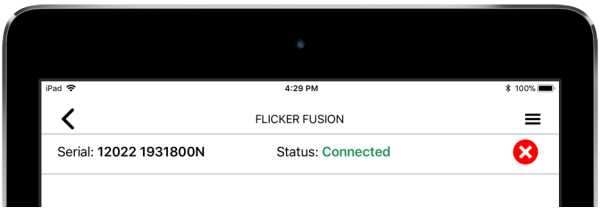
When necessary, the mask and viewing chamber can be wiped using a disinfecting cloth or wipe.

Flicker Fusion App

The Flicker Fusion is controlled by a tablet application. The app allows quick and simple setting up of tests, test scoring and storage of results.

Pairing Flicker Fusion viewing chamber to App

The first time the app is loaded or when a new viewing chamber is used, the chamber must be paired to the app. Tap the menu icon [☰] then "Select Device" to view the Select Device interface. Available in this section are a list of currently and previously paired devices as well as a search icon [🔍] to scan for a new viewing chamber.



Once a device has been paired, the serial number and status will be displayed below the title bar. A paired device can be disconnected by tapping the [⊗] icon.

> **Note:** After disconnecting, the most recently paired device serial number and status will remain in the title area. Quickly reconnect by tapping the [⊕] icon.

Actions

Manage Subjects

Upon opening the application, the user is given the opportunity to manage subjects. From the Manage Subjects interface, tapping the [+] icon displays the interface for adding a new subject. Tapping on a subject name will display the subject's details. Subject details include previous test and scores, as well as the ability to edit the subject's information and begin a new test. Tapping on the [⚙] icon displays the Task Setup interface.

> **Note:** The Manage Subjects interface can also be accessed through the main menu or by tapping the back button.

Add New Subject

From the Manage Subjects interface, tapping the [+] icon displays the interface for adding a new subject. A subject entry includes first and last name and an ID. Tapping on the [💾] icon saves the new subject

> **Note:** Tapping the [👁] icon will save the subject data and continue directly to the Run Test interface.

View and Edit Subjects

Subject names are displayed in the Manage Subjects interface. Tapping on an existing subject name displays the Subject Results interface. The Results table is filtered by result date and displays the task title, date, and result. Tapping on an existing test brings up the task result.

> **Note:** From the subject details, tapping on the [✎] icon displays the Edit User interface. Tapping on the [👁] icon displays the run test interface.

Task Setup

Task setup includes a number of options. These options include task type (Simple flicker, simple fusion, automatic, adaptive, and self-control), stimulus (left, right, coincident, and alternate), luminance (1-100), sweep rate (depends on task type), starting frequency for flicker and fusion (depends on task type and subject), and delay (0-5 seconds). Tapping on the [] icon saves the new task setup. Tapping the [] icon will run a preview of the chosen task setup. Do not perform testing in preview mode.

> **Note:** For further instructions on testing methods, read the appropriate sections of this manual.

Run Test

Navigating to the Run Test interface displays the test type, subject name, and various details about how the test will be run. Tapping the [] icon begins a new test. Tapping the [] icon displays the Task Setup interface.

> **Note:** Tapping the [] icon when a test is running will abort the active test. Aborted tests are not scored and cannot be saved.

Once the test has been completed, the examiner can choose to save the test by tapping the [] icon or continue without saving by tapping the [] icon.

View Task Results

The View Results interface displays the task title, subject name, date, result, and any chosen test parameters. Tapping on the [] icon will delete the chosen test record. Return to the Subject Results interface by tapping the back button.

Run Test Interface

Regardless of chosen method, all options continue to the Run Test interface. Before the test, only the Run Test [] and Test Settings [] buttons are enabled while the Abort Test button [] is disabled. The example at right is shown during an Automatic test.

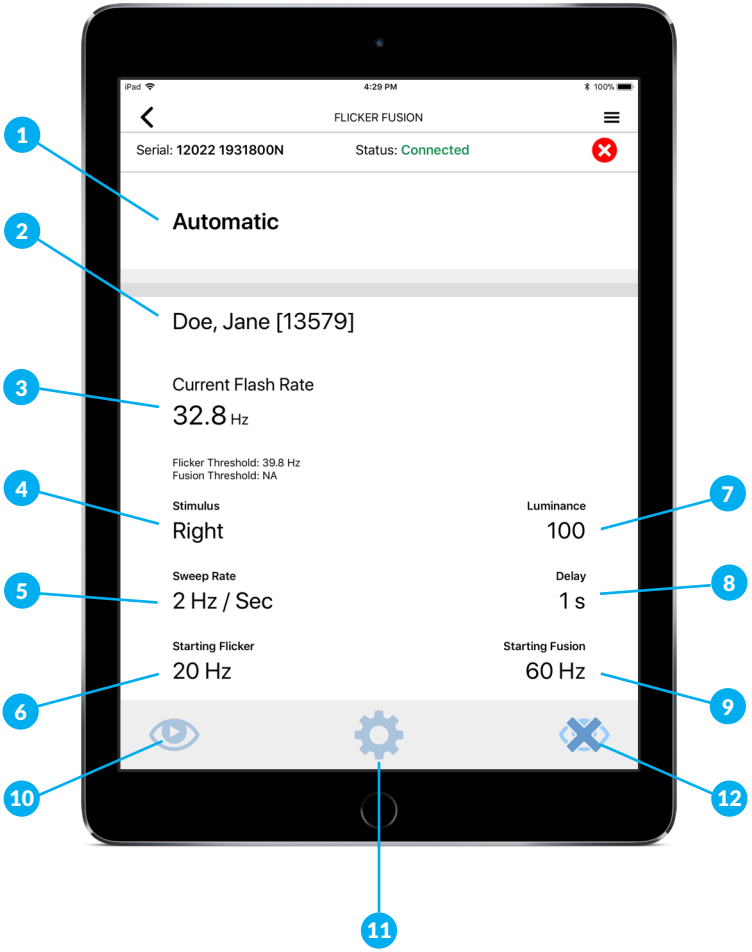
1. Display selected test type: Simple Flicker, Simple Fusion, Automatic, Adaptive, or Self Control

   Note: For further instructions on testing methods, read the appropriate sections of this manual.

2. Display selected subject (and ID number)
3. Display of current flash rate

   Note: Displayed values 4-9 can be edited via the Test Settings interface prior to active testing.

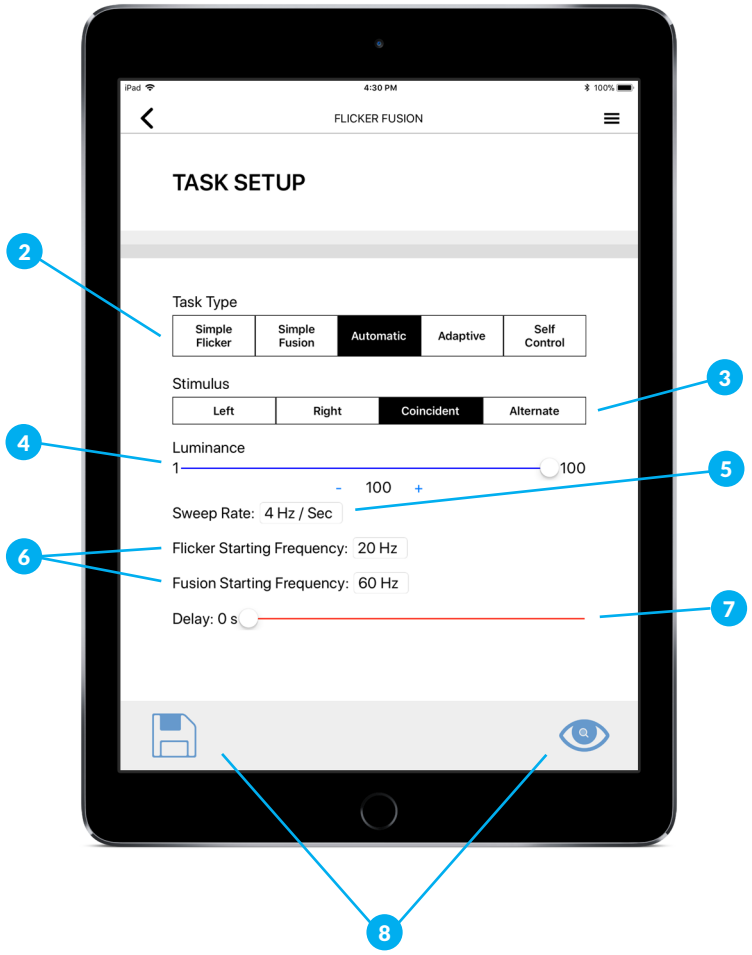
4. Selected Stimulus: Left eye only, right eye only, coincident, or alternate
5. Selected Luminance: Brightness of stimulus
6. Selected Sweep Rate: The rate at which the frequencies will change during the test - shown in Hz/second
7. Selected Delay: Delay between tests
8. Selected Starting Flicker
9. Selected Starting Fusion
10. Run Test button: Begins test - currently disabled due to active test
11. Test Settings button: Displays test settings interface - currently disabled due to active test
12. Abort Test button: Aborts currently active test (enabled due to active test)


iPad
4:29 PM
100%
FLICKER FUSION
Serial: 12022 1931800N
Status: Connected
Automatic
Doe, Jane [13579]
Current Flash Rate
32.8 Hz
Flicker Threshold: 39.8 Hz
Fusion Threshold: NA
Stimulus
Right
Luminance
100
Sweep Rate
2 Hz / Sec
Delay
1 s
Starting Flicker
20 Hz
Starting Fusion
60 Hz
1
2
3
4
5
6
7
8
9
10
11
12

Automatic Method

In Automatic Method, the test is automatically run using the Simple Fusion test to determine the fusion frequency and the Simple Flicker test to determine the flicker frequency. The results of these two tests are averaged to obtain the CFF value. In this method, the subject responds by pressing either side of the hand-held subject response switch.

1. From the manage subjects interface, tap the [⚙] icon to display the Task Setup interface.
2. Select Automatic Method task from the panel
3. Select the Stimulus (left eye only, right eye only, coincident, or alternate) from the panel. Coincident is selected in the example on the next page.
4. Using the slider, select the desired brightness by adjusting the Luminance (%) setting.
5. The Sweep Rate is the rate at which the frequencies will change during the test in Hz/sec. Select the desired Rate from the appropriate drop down.
6. Select the desired Flicker and Fusion starting frequency by selecting the frequencies from the drop downs. In the example on the next page, the Flicker Starting Frequency is set to 20 Hz and the Fusion Starting Frequency is set to 60 Hz.
7. Using the slider, select the between test Delay Time. Delay Times are measured in seconds within a range of 0 to 5 seconds.
8. Once the appropriate selections have been made, tap the save icon [💾] to save and return to the previous screen OR tap the preview icon [👁] to see a preview of the test using the selected parameters.

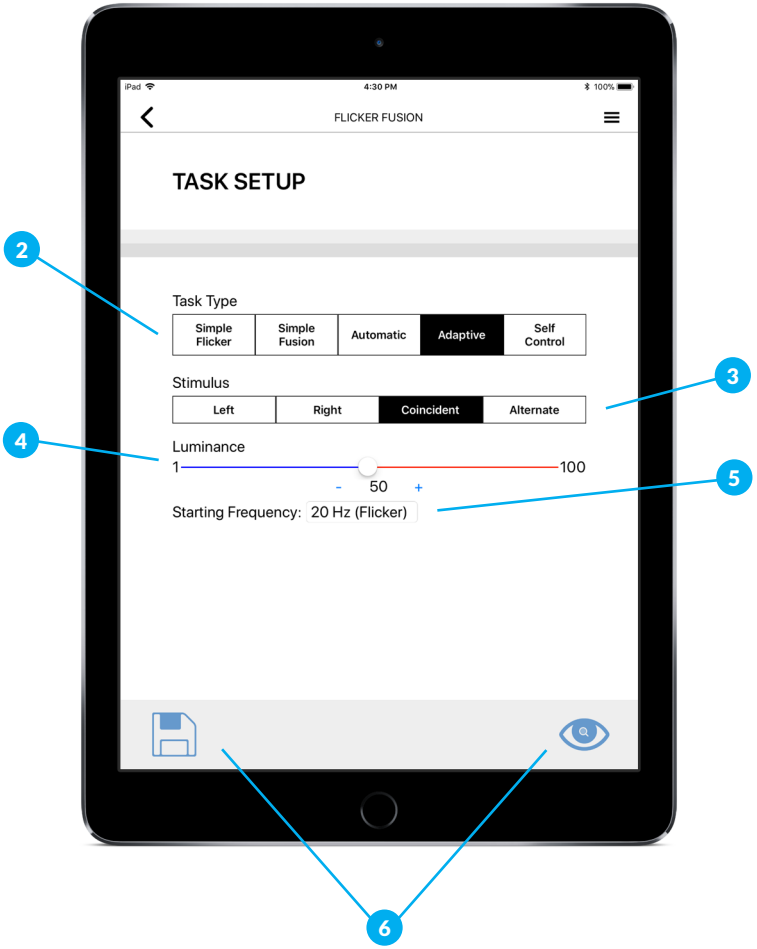

iPad
4:30 PM
100%
FLICKER FUSION
TASK SETUP
Task Type
Simple Flicker
Simple Fusion
Automatic
Adaptive
Self Control
Stimulus
Left
Right
Coincident
Alternate
Luminance
1
100
-
100
+
Sweep Rate: 4 Hz / Sec
Flicker Starting Frequency: 20 Hz
Fusion Starting Frequency: 60 Hz
Delay: 0 s
2
3
4
5
6
7
8

Adaptive Method

In Adaptive Method, the test displays fixed frequencies. Using the hand-held response switch the subject responds to the frequencies as “flicker” or “fusion.” This test zeros in on the CFF and automatically ends when the value is determined.

> **Note:** The half-circle shape with dotted lines extending out on the response switch symbolizes a response of “flicker” while the half-circle shape with solid lines extending out symbolizes a response of “fusion”.

1. From the manage subjects interface, tap the [⚙] icon to display the Task Setup interface.
2. Select Adaptive Method task from the panel
3. Select the Stimulus (left eye only, right eye only, coincident, or alternate) from the panel. Coincident is selected in the example on the next page.
4. Using the slider, select the desired brightness by adjusting the Luminance (%) setting.
5. Select the Flicker starting frequency from the drop down. In the example on the next page, the Flicker Starting Frequency is set to 20 Hz.
6. Once the appropriate selections have been made, tap the save icon [💾] to save and return to the previous screen OR tap the preview icon [👁] to see a preview of the test using the selected parameters.

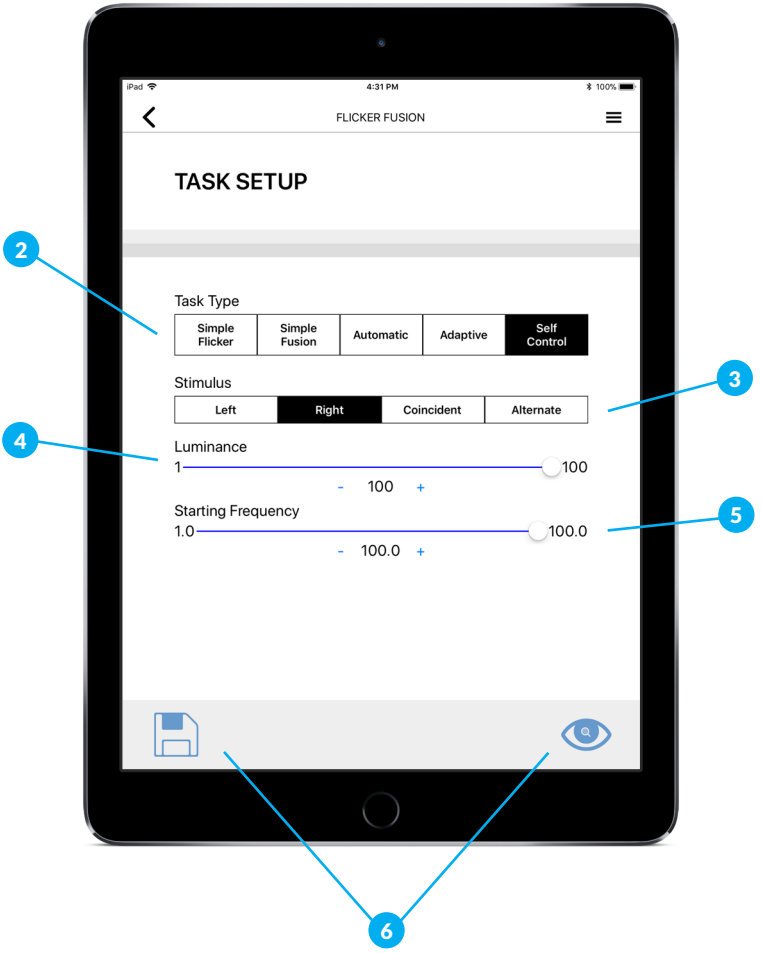

iPad
4:30 PM
100%
FLICKER FUSION
TASK SETUP
Task Type
Simple Flicker
Simple Fusion
Automatic
Adaptive
Self Control
Stimulus
Left
Right
Coincident
Alternate
Luminance
1
100
- 50 +
Starting Frequency: 20 Hz (Flicker)
2
3
4
5
6

Self-Control Method

In Self-Control Method, a test allows the test subject to select whether to increase or decrease the frequency. The test is complete when the subject cannot discern whether the frequency is a flicker or a constant. The amount of the increase or decrease becomes smaller as the subject "zeros in" on the CFF. This test is ended by the subject.

> **Note:** The "+" symbolizes a response to increase the frequency while the "-" symbolizes a response to decrease the frequency.

1. From the manage subjects interface, tap the [⚙] icon to display the Task Setup interface.
2. Select Self-Control Method task from the panel
3. Select the Stimulus (left eye only, right eye only, coincident, or alternate) from the panel. Right is selected in the example on the next page.
4. Using the slider, select the desired brightness by adjusting the Luminance (%) setting.
5. Using the slider, select the Flicker starting frequency. In the example on the next page, the Flicker Starting Frequency is set to 100.
6. Once the appropriate selections have been made, tap the save icon [💾] to save and return to the previous screen OR tap the preview icon [👁] to see a preview of the test using the selected parameters.


iPad
4:31 PM
100%
FLICKER FUSION
TASK SETUP
Task Type
Simple Flicker
Simple Fusion
Automatic
Adaptive
Self Control
Stimulus
Left
Right
Coincident
Alternate
Luminance
1
100
- 100 +
Starting Frequency
1.0
100.0
- 100.0 +
2
3
4
5
6

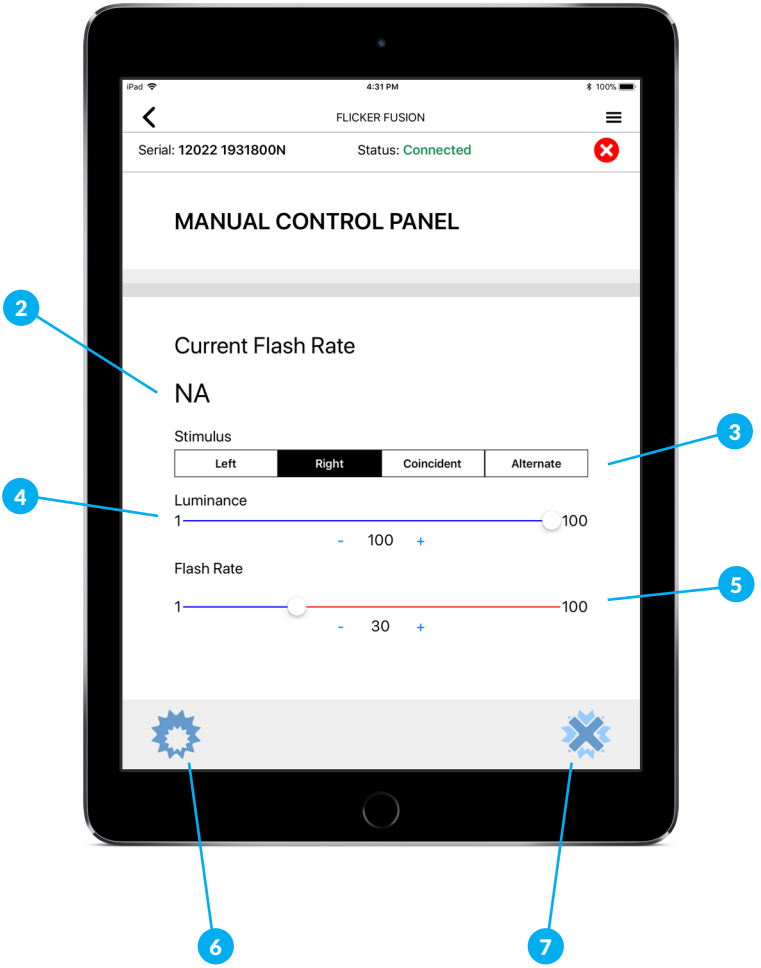
Manual Control Panel

This interface is used for testing stimulus values by allowing the user to view and select parameters for stimulus, luminance, and flash rate.

1. Tap the menu icon [☰] then "Manual Control Panel" to view the Manual Control Panel interface.
2. Displays Current Flash Rate
3. Select the Stimulus (left eye only, right eye only, coincident, or alternate) from the panel. Right is selected in the example on the next page.
4. Using the slider, select the desired brightness by adjusting the Luminance (%) setting.
5. Using the slider, select the desired starting Flash Rate setting.
6. Once the appropriate selections have been made, tap the Flash icon [ ] to begin.

> **Note:** Any changes made on this interface will be immediately reflected by the viewing chamber.

7. Tap the Stop Flash icon [ ] to end.


iPad
4:31 PM
100%
FLICKER FUSION
Serial: 12022 1931800N
Status: Connected
MANUAL CONTROL PANEL
Current Flash Rate
NA
Stimulus
Left
Right
Coincident
Alternate
Luminance
1
100
- 100 +
Flash Rate
1
100
- 30 +
2
3
4
5
6
7

Terms and Conditions

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Placing an Order
All orders need to be accompanied by a copy of your purchase order. All orders must include the following information:

- Quantity
- Part Number
- Description
- Purchase order number or method of pre-payment
- Tax status (include tax-exempt numbers)
- Shipping address for this order
- Billing address for the invoice we'll mail when this order is shipped
- Telephone number
- Email address
- Signature and typed name of person authorized to order these products

Exchanges and Refunds
No item may be returned without prior authorization from Lafayette Instrument Company and a Return Materials Authorization (RMA#) number which must be affixed to the shipping label of the returned goods. The merchandise should be packed well and insured for the full value. Unopened merchandise may be returned prepaid within thirty (30) days after receipt of the item and in the original shipping carton. Collect shipments will not be accepted. Product must be returned in saleable condition, and credit is subject to inspection of the merchandise.

Repairs
Instrumentation may not be returned without first receiving a Return Materials Authorization Number (RMA). When returning instrumentation for service, please contact Lafayette Instrument to receive an RMA number. Your RMA number will be good for 30 days. Address the shipment to:

Lafayette Instrument Company
RMA# XXXX
3700 Sagamore Parkway North
Lafayette, IN 47904, USA.

Shipments cannot be received at the PO Box. All items should be packed well and insured for full value. An estimate of repair will be given prior to completion. We must receive a copy of your purchase order via email before non-warranty repair work can commence.

Damaged Goods
Damaged instrumentation should not be returned to Lafayette Instrument prior to a thorough inspection. If a shipment arrives damaged, note damage on delivery bill and have the driver sign it to acknowledge the damage. Contact the delivery service, and they will file an insurance claim. If damage is not detected at the time of delivery, contact the carrier/shipper and request an inspection within 10 days of the original delivery. Please contact the Lafayette Instrument Customer Service Department for repair or replacement of the damaged merchandise.

Limited Warranty
Lafayette Instrument Company warrants equipment to be free of defects in material and workmanship for a period of one year from the date of shipment, except as provided hereinafter. This assumes normal usage under commonly accepted operating parameters and excludes consumable products.

Warranty period for repairs or used instrumentation purchased from Lafayette Instrument is 90 days. Lafayette Instrument Company agrees either to repair or replace, at its sole option and free of part charges to the customer, instrumentation which, under proper and normal conditions of use, proves to be defective within the warranty period. Warranty for any parts of such repaired or replaced instrumentation shall be covered under the same limited warranty and shall have a warranty period of 90 days from the date of shipment or the remainder of the original warranty period whichever is greater. This warranty and remedy are given expressly and in lieu of all other warranties, expressed or implied, of merchantability or fitness for a particular purpose and constitutes the only warranty made by Lafayette Instrument Company.

Lafayette Instrument Company neither assumes nor authorizes any person to assume for it any other liability in connection with the sale, installation, service or use of its instrumentation. Lafayette Instrument Company shall have no liability whatsoever for special, consequential, or punitive damages of any kind from any cause arising out of the sale, installation, service or use of its instrumentation.

All products manufactured by Lafayette Instrument Company are tested and inspected prior to shipment. Upon prompt notification by the Customer, Lafayette Instrument Company will correct any defect in warranted equipment of its manufacture either, at its option, by return of the item to the factory, or shipment of a repaired or replacement part. Lafayette Instrument Company will not be obliged, however, to replace or repair any piece of equipment, which has been abused, improperly installed, altered, damaged, or repaired by others. Defects in equipment do not include decomposition, wear, or damage by chemical action or corrosion, or damage incurred during shipment.

Limited Obligations Covered by this Warranty

1. Shipping charges under warranty are covered only in one direction. The customer is responsible for shipping charges to the factory if return of the part is required.
2. This warranty does not cover damage to components due to improper installation by the customer.
3. Consumable and or expendable items, including but not limited to electrodes, lights, batteries, fuses, O-rings, gaskets, and tubing, are excluded from warranty.
4. Failure by the customer to perform normal and reasonable maintenance on instruments will void warranty claims.
5. If the original invoice for the instrument is issued to a company that is not the company of the end user, and not an authorized Lafayette Instrument Company distributor, then all requests for warranty must be processed through the company that sold the product to the end user, and not directly to Lafayette Instrument Company.

Lafayette Instrument