

# VISO SYSTEMS LabFlicker

## User Manual

Revision: April 2021



*Congratulations on purchasing your new Viso Systems product. Before using this product, please read our Safety Information.*

*This manual contains all the feature operating information and troubleshooting necessary to install and operate your new Viso Systems product. Please review this manual thoroughly to ensure proper installation and operation.*

*For news, Q&A and support at Viso Systems, visit our website at [www.visosystems.com](http://www.visosystems.com)*

*Other manuals in this series, for which the latest versions can be downloaded from [www.visosystem.com](http://www.visosystem.com), include:*

- *LabSpion Assembly manual*
  - *Light Inspector User Guide (Software)*
  - *VISO Reference CALI-T50 User guide (calibration light source)*
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## Safety Information

*Warning! This product is not for household use.*

Read this manual before installing and operating the LabFlicker. Follow the safety warnings listed below and study all the cautions in the manual. If the device is in any way damaged, defective, wet, or show signs of overheating, disconnect from the PC and contact Viso Systems Service for assistance. Do not install or use the device outdoors. Do not spray with or immerse in water or any other liquid. Do not remove any covers or attempt to repair the controller or the power supply. Refer any service to Viso Systems.

## Disposing of this Product



Viso Systems products are supplied in compliance with Directive 2002/96/EC of the European Parliament and of the Council of the European Union on WEEE (Waste Electrical and Electronic Equipment), as amended by Directive 2003/108/EC, where applicable. Help preserve the environment! Ensure that this product is recycled at the end of its lifetime. Your supplier can give details of local arrangements for the disposal of Viso Systems products.

## Introduction

### About the LabFlicker

The LabFlicker expands the capability of the Viso Systems Goniometers series to measure the light modulations (Temporal Light artefacts) using the same Light Inspector software. The device is easily connected to the computer via USB and is automatically detected by the Light Inspector software. The LabFlicker can also be used as a stand-alone device for flicker measurements in the lab or on site.

### About this document

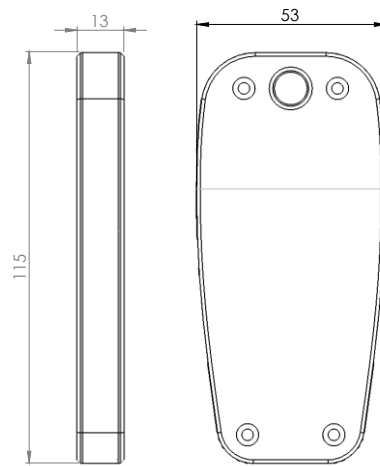
These guidelines describe the installation process of the LabFlicker and how to use it with any of Viso Systems' photogoniometers.

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## Product Dimensions



All dimensions in millimeter

## Packages and Weight

Shipping Packages	Shipping Dimensions	Shipping Volume	Weight
1. LabFlicker	210 x 150 x 50 mm	0,0016 m <sup>3</sup>	0,45 kg

Total shipping weight: 0,45 kg.

The shipment is done in a total of 1 package

## LabFlicker Package Content

- 1 LabFlicker Unit
- 5 m USB Cable
- Rubber coated magnet w/ ¼" thread
- Test Certificate



## Software Installation

Before you can start using the LabFlicker, the free “VISO LIGHT INSPECTOR” software must be installed on your PC. It is supported on all newer windows platforms. Use the following link to download the latest version:

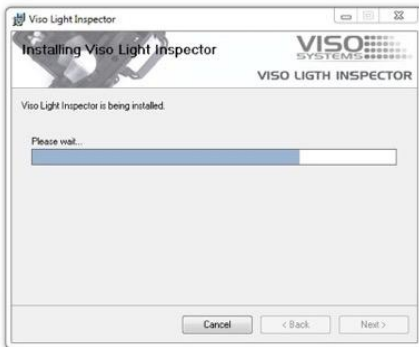
<http://www.visosystems.com/download-light-inspector/>

- Please make sure the LabFlicker is not connected to the computer during software installation
- Make sure to install version 5.28 or later for LabFlicker or the LabFlicker will not be supported by the Light Inspector
- Run the .msi file and follow the installation instructions
- USB drivers are automatically installed. Your measurements are not lost when updating to a newer version or uninstalling and reinstalling. All measurements will always remain in your document folder. If you want to remove all your measurements go to the ‘Light Inspector’ folder and delete them manually.

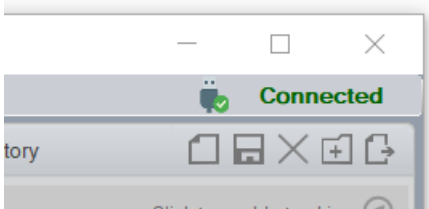
Per default, measurements are stored in

<C:\Users\'Username'\Documents\Viso Systems\Light Inspector>

If desired, the folder location can be altered in *Setup – Options – Basic – Folders*. Specify e.g. a shared server folder or a dropbox folder.



## Connecting the LabFlicker



Connect the LabFlicker to your Windows computer using the supplied USB cable, and start the Light Inspector software. When connected the text “Connected” will appear in green in the upper right-hand corner. The LabFlicker will wait for signal and, when it is ready, you will see ‘Click to Start’ in the display.



### Extending the USB Connection

If, for example, the LabFlicker is used with the LabSpion you may want to keep the LabFlicker around the LabSpion Base. By using an active USB hub, you can split the single USB cable to the LabSpion enabling both LabSpion and LabFlicker to be used on the same USB connection. A USB hub as pictured below can be acquired through Viso Systems.



## How to Use the LabFlicker

A 'Start/Pause' button is located on the front of LabFlicker. This is used for starting and stopping capturing 'basic' flicker (capture time less than 2 seconds). On the back you find the sensor at the top. Make sure not to cover any part of the sensor while measuring and place your hand like shown below.



To make a measurement, press the Start/Pause button and move the LabFlicker towards the lamp you want to measure with the sensor facing the lamp.

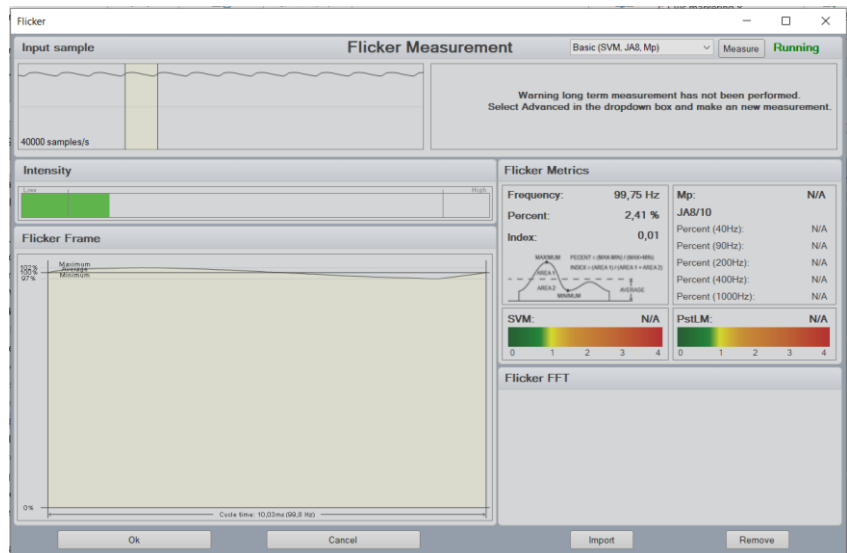




## Making a Measurement

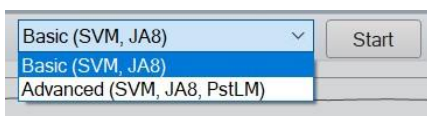
To make a flicker measurement, first choose the light measurement you want to add the flicker measurement to by selecting it in the library window in the Light Inspector software or choosing a new blank sheet if you just want clean flicker measurement.

When the LabFlicker is connected to the Light Inspector software and the 'Start/Pause' button is pressed, a window for the flicker measurement will appear.



The flicker window gives a live feedback of your flicker data.

## Basic Measurements



To make a basic measurement, you can use both the button on the LabFlicker and the button in the flicker window. The basic option is the default.

The basic measurement will measure for 1 second and will calculate:

- Flicker frequency
- Flicker percent
- Flicker index
- Mp
- JA8/10
- SVM.

Metrics are explained in more detail in section "Flicker Measurement Data" starting on page 12. Because of the very short measuring time, the measurement can be done while holding the LabFlicker in the hand.

The sensor needs to be operated within an illuminance level of 1,200 to 11,000 lux. A bar and text indicator on the LabFlicker display indicates whether this prerequisite is met ('OK') or whether illuminance on the sensor is 'too low' or 'too high'. Move the LabFlicker closer or further away from the lamp until you get a 'OK' in the display. When 'OK' is shown, press the Start/Pause button again to pause the measurement and capture the latest flicker values. If you want to redo the measurement, press the button again to do another measurement.



You will not see the flicker measurement on the home screen on Light Inspector, but it can be viewed under View-Flicker. You can choose to export the flicker measurement alone or the complete measurement as a Custom PDF report.

## Advanced Measurements

The advanced option creates a much longer measurement of 180 seconds and will calculate the same things as the basic plus PstLM:

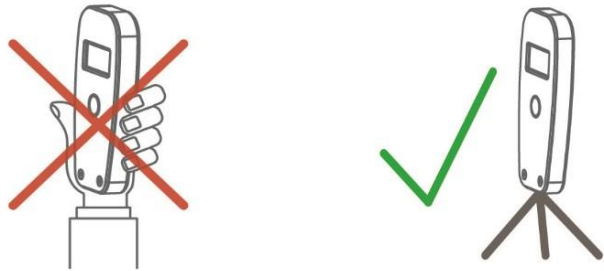
- Flicker frequency
- Flicker percent
- Flicker index
- Mp
- JA8/10
- PstLM
- SVM.

Metrics are explained in more detail in section “Flicker Measurement Data” starting on page 12. The advanced measurement can only be started from button in the flicker window. If an advanced measurement is started from the LabFlicker device, the measurement will be changed back to basic. This is due to the duration of the measurement and the assumption that no one can hold their hand still for 180 seconds.

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Attention

A PstLM measurement is done over a period of 3 minutes (180 sec). During this period the Lab Flicker has to be kept absolutely still, which isn't possible by hand. Please use a stand or place the device in front of or as shown below.



Make sure the intensity level is acceptable, otherwise move the device closer or further away from the lamp.

OK



Cancel Start

## Too Much/Little Light

If a measurement is done with too much or too little light, this is shown in the VISO LIGHT INSPECTOR software:

- Too little light is indicated with a **black bar and cross** in the Flicker Frame window



Flicker Measurement

Warning long term measurement has not been performed. Select Advanced in the dropdown box and make a new measurement.

Intensity: Not enough light, move sensor closer to the light source!

Flicker Frame: [Graph with a large black X over it]

Flicker Metrics:

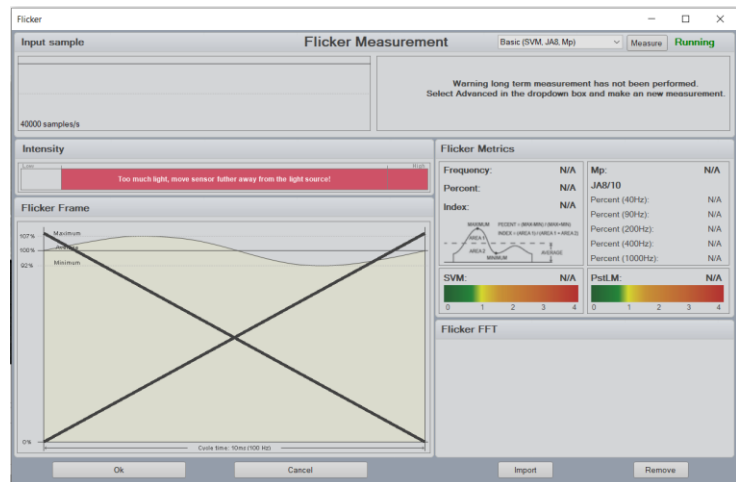
Frequency:	100 Hz	Mp:	N/A
Percent:	3,74 %	JAB/10	N/A
Index:	0,01	Percent (40Hz):	N/A
		Percent (50Hz):	N/A
		Percent (60Hz):	N/A
		Percent (1000Hz):	N/A

SVM: N/A PstLM: N/A

Flicker FFT

Ok Cancel Input Remove

- Too much light is indicated with a **red** bar and a black cross in the Flicker Frame window



This cross will also be shown on the LabFlicker device and a new measurement will be required. Simply press the 'Start/Pause' button again. If it is not possible to do a measurement within the 'OK' range of the LabFlicker and the cross is shown both in the display and on top of the result (in Light Inspector), the result can still be saved, but the accuracy of this measurement cannot be guaranteed.

You can choose to save this measurement or export it to PDF, but the accuracy of the result cannot be guaranteed. In the PDF report, the black/red cross will not be shown.

Remember to save the measurement after the Flicker Window is closed.

## Flicker Measurement Data

Flickering light is a problem at low frequencies and can trigger headaches, fatigue and migraine attacks at higher frequencies - even if the effect is not visible. There are huge differences in how much people are affected by flickering light.

Flicker and stroboscopic effects are only found to a negligible degree in incandescent bulbs, as the filament does not get cold between each 50 Hz pulse from the power supply. Many LED solutions, however, are unsatisfactory in this regard - not because of the LEDs, but because of poor drivers/power supply electronics. Particularly dimmed LED luminaires and some screw-base LED light sources can be very flickering.

CIE Technical note CIE TN 012:2021 ("Guidance on the Measurement of Temporal Light Modulation of Light Sources and Lighting Systems") provides a lot of valuable information on the topic and is free to download.

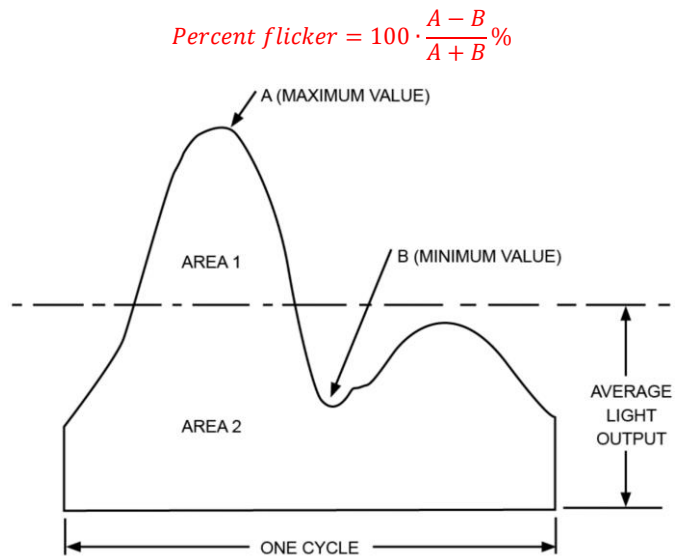
### Flicker Frequency

Flicker Frequency is the flicker frequency of lamp typically caused by the driver and supplied AC current.

### Flicker Percentage (PF) $\approx$ Modulation Depth (MD)

Flicker percent is a relative measure of the cyclic variation in the output of a light source (i.e. percent modulation). Sometimes this is also referred to as the

“modulation index” (as a fraction between 0 and 1, not percent). From the figure<sup>1</sup> below:



### Flicker Index (FI)

According to CIE S 017:2020, 17-22-094 (CIE 2020) the flicker index (symbol  $I_f$ ) is the quotient of the above-average luminous energy to the total luminous energy over a period of time.

Hence, the Flicker Index is a “relative measure of the cyclic variation in the output of various sources at a given power frequency. It takes into account the waveform of the light output as well as its amplitude”<sup>1</sup>. The flicker index assumes values from 0 to 1.0, with 0 for steady light output. Higher values indicate an increased possibility of noticeable lamp flicker, as well as stroboscopic effect. Again, from the figure above:

$$Flicker\ Index = \frac{Area\ 1}{Area\ 1 + Area\ 2}$$

<b>Mp:</b>	<b>0,04</b>
<b>JA8/10</b>	
Percent (40Hz):	0,18 %
Percent (90Hz):	0,57 %
Percent (200Hz):	2,7 %
Percent (400Hz):	2,45 %
Percent (1000Hz):	2,39 %

### Assist Mp

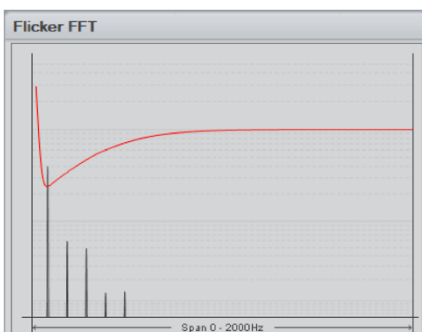
ASSIST (Alliance for Solid-State Illumination Systems and Technologies, US) recommends the  $M_p$  metric, which is a flicker perception metric designed to predict human flicker perception for lamps. It mainly deals with signals below 80Hz and which do not interact with moving objects or observers (stroboscopic or phantom array effect).

### JA8

JA8/JA10 is the test method described by California energy commission in title 24. This method uses the fluctuation of light from the lighting system and processes the signal to quantify the flicker percent below a given cut-off frequency. Signal processing is used to remove high frequency components above the cut-off frequency.

### Flicker FFT and new flicker metrics

Flicker Index and Flicker Percent are not suitable to describe the effect of light modulations of human perception. E.g. 100% flicker at 1,000 Hz flicker frequency will



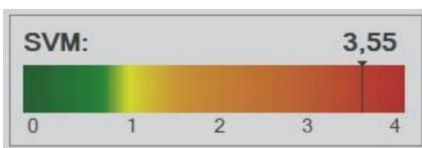
<sup>1</sup> The IESNA Lighting Handbook, 9th Edition, Mark S. Rea, 2000

result in a very high flicker index but at 1,000 Hz humans will generally not be affected by flicker, so 'Percent Flicker' and 'Flicker Index' will not describe human perception of stroboscopic effects. The latest research in what is collectively referred to as 'Temporal Light Artifacts' distinguishes three different effects: **flicker** (static light sources), **stroboscopic effects** (moving light sources) and **phantom array effects** (eyes moving relative to the light source). For the first two, good metrics for the effect on people has been established: the two indices  $P_{st}^{LM}$  and SVM.

The flicker FFT graph shows the different flickering frequencies represented in the light produced by the AC supply combined with the used light source and driver. The SVM threshold curve can be seen in the Flicker FFT graph above and what is below the red SVM is not visible to the human eye.

### SVM - 'Stroboscopic visibility measure'

Invisible flicker / stroboscopic effects typically occur in the frequency range from 80 Hz to 2,000 Hz and are measured by the SVM measurement method (the abbreviation stands for "Stroboscopic Visibility Measure"). SVM quantifies the strobe effect that may occur in connection with moving objects and a light modulation. Above 2000 Hz there is usually no risk of strobe effects. SVM is based on several parameters like: Intensity, flicker Index, frequency etc.



The SVM value can be read as:

- SVM < 1                      Not Visible
- SVM = 1                      Just Visible
- SVM > 1                      Visible

### $P_{st}^{LM}$

Visible flicker typically occurs when the frequency is from 0.3-80 Hz. In this area the metric  $P_{st}^{LM}$  is used (the abbreviation comes from "short term light modulation"). The details are described in IEC / TR 61547-1 and IEC 61000-4-15.

The  $P_{st}^{LM}$  values in general can be read as:

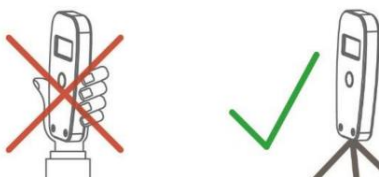
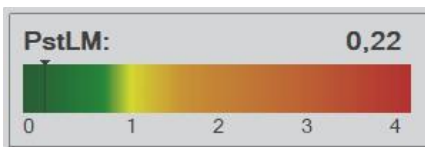
- $P_{st}^{LM} \leq 1$                       Good
- $P_{st}^{LM} > 1$                       Bad

$P_{st}^{LM}$  is measured over a period of 180 seconds or 3 minutes. It is important that the flicker device is held still during this period. Consequently, the LabFlicker should be placed on a table or stand in front of the lamp being tested. Generally, it is always recommended to have the LabFlicker in a static position during all types of flicker measurements.

To hold the LabFlicker a special rubber-coated magnet is enclosed in the LabFlicker package:

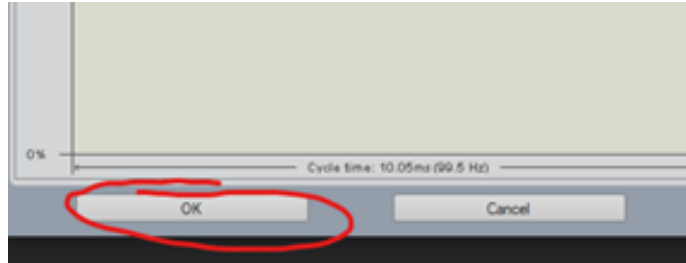


The magnet has a 1/4" female thread that fits all standard camera stands. With the magnet the LabFlicker hand be held safely on a camera stand or on any steel surface.



## Saving Flicker Measurements Separately

1. Make the desired flicker measurement, and click OK when done (the Flicker window closes)

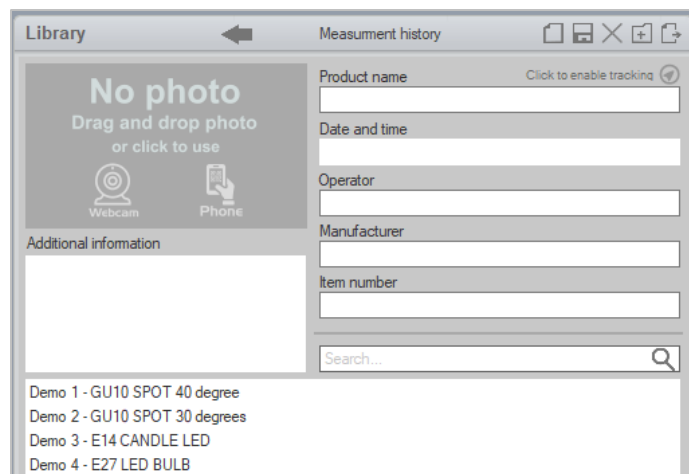


2. Save the flicker measurement. Type Ctrl+S, click the Save icon or click File -> Save as and follow instructions

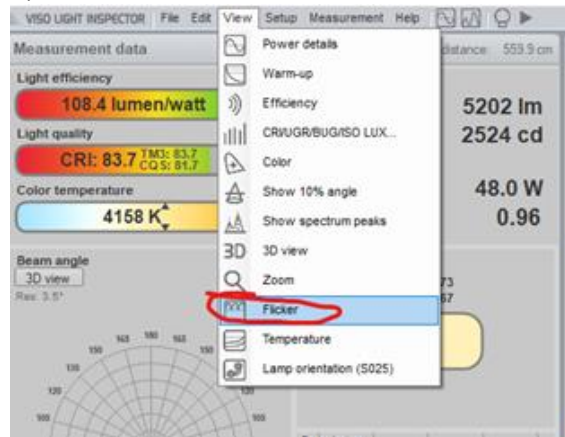
## Saving Flicker Measurements with Light Measurements

Your flicker measurement can be saved with your light measurement – or with several light measurements:

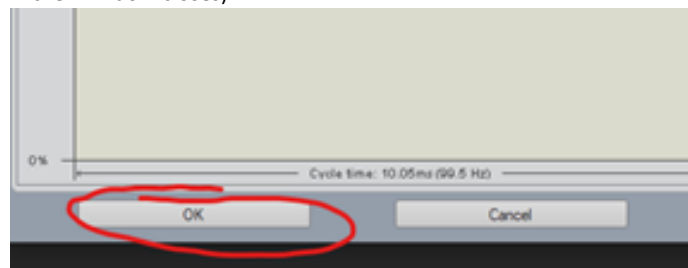
3. Choose an existing (or new) measurement in your file browser



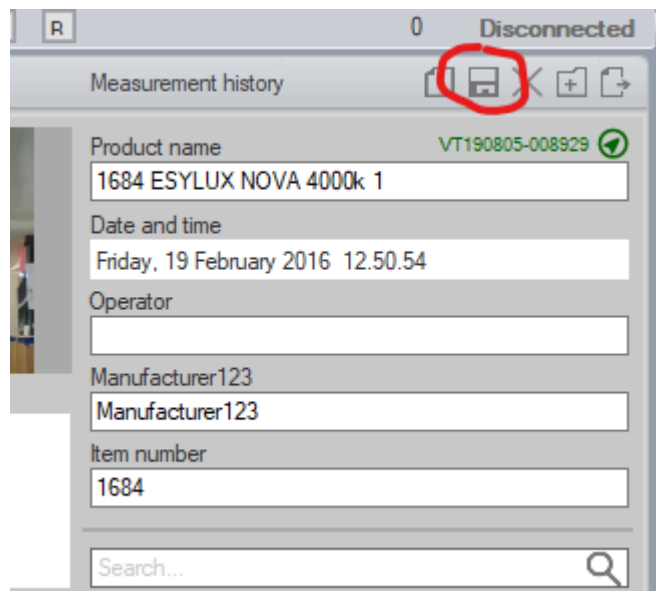
4. Open the Flicker window



5. Make the desired flicker measurement, and click OK when done (the Flicker window closes)



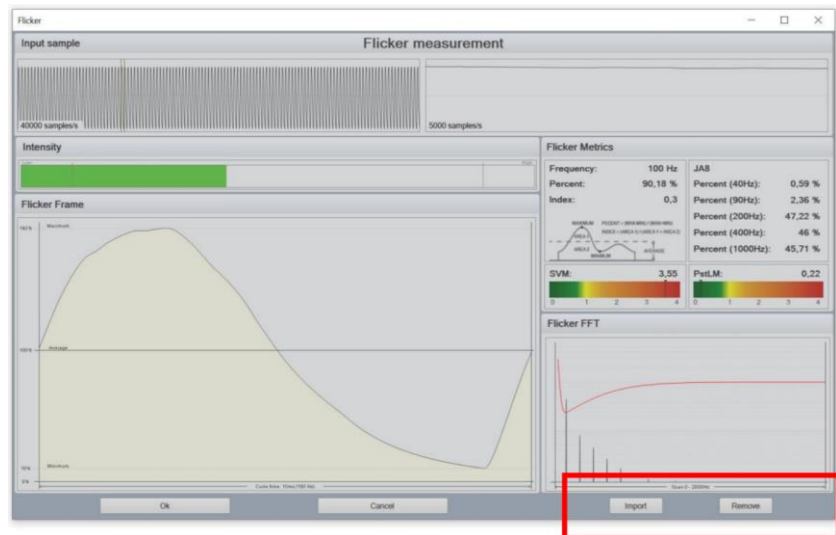
6. Save the whole light measurement. Type Ctrl+S, click the Save icon or click File -> Save as and follow instructions





## Import/Remove Flicker Measurements

If you want the flicker data from one measurement added to another, you first select the measurement you want the flicker data to be imported to and then open the Flicker Window. Go to: View – Flicker – Import and choose the measurement you want to import the flicker data from, close the window and save the measurement again.



In the Flicker Window at the right bottom, it is also possible to remove the flicker data from a measurement.

## Laboratory measurements

The LabFlicker is convenient to use under laboratory conditions. To make reliable measurements, please create laboratory conditions as described in Viso manual [Guidelines – Building a Lighting Laboratory](#).

## Field measurements

A field measurement is considered to be any measurement that is not done under controlled laboratory conditions, e.g. a measurement in an office or outdoors.

Field measurements can be considerably different from laboratory measurements. If conditions are not as well controlled, the measurement can be used to determine the performance of the DUT (Device Under test) under 'less controlled' conditions or in a specific application. A measurement done under mainly uncontrolled conditions is only suited for determining the TLM or TLA aspect of that specific environment, and not of a specific device.

Laboratory measurement results and field measurement results should not be compared directly. Nor should laboratory measurements be assumed to be directly applicable in field conditions.

When field measurements are reported (or results discussed), the conditions under which the measurements were performed should be listed, as far as possible similar

to how laboratory measurements are reported. In particular a statement that the measurements were performed as a 'field measurement' should be noted.

For any field measurements as much detail as is known should be listed in a measurement report. Even a simple statement can suffice (e.g., "connected to mains", or "daylight present"). If no information is available, this should be mentioned as well. The following list describes factors that can significantly influence field measurements:

- Power supply characteristics, e.g., AC voltage waveform
- Settings of lighting controls (dimmer, pulse-width modulation (PWM) settings, color setting for tunable lights)
- Ambient temperature of the DUT
- Static background illumination from other sources, including daylight and other sources
- Non-static background illumination from other TLM sources
- Mechanical vibrations strong enough to influence the measurement.

#### **Reducing influence from ambient light in field measurements**

Simple measures can be taken to reduce influence of ambient light in field measurement situations:

- Place the LabFlicker as close as possible to the DUT (without overshooting intensity)
  - Place the LabFlicker in a black bucket and hold the bucket as close to the DUT as possible.
-

## Specifications

### Physical dimensions

Dimensions (L x W x H)	115 x 53 x 13 mm
Weight	155 g
Shipping Dimensions (L x W x H)	170 x 130 x 70 mm
Shipping weight	500 g

### Sampling

Sensor Analog to Digital converter resolution	12 bit
Sensor Analog to Digital sample rate	640,000 sample/s
Software working sample rate (Down-sampled to ensure performance: Basic to 20,000 samples/s, and PstLM to 10,00 samples/s)	40,000 samples/s
Automatic pre-ADC gain levels (Ensuring maximum dynamic use of ADC)	3 levels
Bandwidth	0 Hz to 5,000 Hz

### Photometric

Sensor lux range	1,200 to 11,000 lux
Sensor candela range (at distance from lamp from 0.1 m to 10 m)	12 cd @ 0.1 m to 1,100,000 cd @ 10 m

### Electric

Connection	micro USB
Power	Connection via USB only 5V / 200mA / 1W

### Warranty

Warranty period	2 years from delivery date
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### Ordering information

LabFlicker	P/N LABFLCK01
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At Viso Systems, we design, develop and manufacture OEM- and customer-specific goniophotometer solutions. Our mission is to support customers with powerful, yet easy-to-use control and measurement solutions. Products are developed and manufactured in Copenhagen, Denmark.



**Light measurement made easy**

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