

Pro Spectrum
Product Description

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1 Introduction

Tobii Pro Spectrum is an advanced, high-frequency eye tracking platform, intended for extensive studies into human behavior and the mechanics of eye movements. The design allows the subject to move naturally during recording while still maintaining high accuracy and precision. This means that eye movements such as saccades and short fixations can be studied without using a chinrest. Pro Spectrum delivers superior eye tracking through high-quality hardware components as well as fine-tuned algorithms that work in a variety of conditions (dark or bright environments, during head movements) resulting in excellent eye tracking quality over the entire screen. This eye tracker can be used in various setups, either with an attached monitor or in standalone form to perform eye tracking with physical objects

1.1 Application areas

Tobii Pro Spectrum is suitable for use in areas such as:

- Neuroscience studies - for example those combining eye tracking and EEG data;
- Ophthalmology studies - for example those where a large freedom of head movement is needed;
- Reading studies - for example those where large freedom of movement is important;
- Psychology research - for instance in developmental psychology and psycho-linguistics;
- Tests requiring a latency of less than 5 ms - for instance in gaze-contingency studies.

1.2 Product versions

Tobii Pro Spectrum is available in four product versions: 1200 Hz, 600 Hz, 300 Hz and 150 Hz. The values denote the eye tracker's maximum sampling frequency, but it can be used at lower settings as well. The 600 Hz, 300 Hz and 150 Hz versions can be upgraded to a faster version. For more information, contact your sales representative or visit tobiipro.com.

1.3 Tobii Pro Eye Tracker Manager

Tobii Pro Eye Tracker Manager is free software available on [Tobii Pro Connect](#).

Pro Eye Tracker Manager helps you manage your Tobii Pro eye tracker. It lets you see which eye tracker firmware and software versions you are running and also facilitates updates (where applicable). It provides:

- Drivers and Firmware installation or updates
- Display setup
- Positioning guide
- User calibration
- Gaze visualization*

*Gaze visualization in Pro Eye Tracker Manager lets you quickly evaluate the quality of the eye tracking data. The Gaze visualization overlaps data only on the Pro Eye Tracker Manager screen while Pro Eye Tracker Manager is open.



References in product documentation to Tobii Pro Eye Tracker Manager refer to the latest version available on Tobii Pro's website.

1.4 Additional software options

<p>Pro Lab tobii.com/product-listing/tobii-pro-lab/</p>	<p>Pro Lab is a comprehensive research software platform for eye tracking designed to meet the highest demands on different research scenarios with exact timing accuracy. This software offers an efficient workflow, making it easy to design experiments, record data, analyze and visualize eye tracking data, and to sync this data with other biometric data streams.</p>
<p>Pro SDK tobii.com/product-listing/tobii-pro-sdk/</p>	<p>Pro SDK offers a broad set of tools that makes it simple to develop a variety of niche applications or scripts across multiple platforms, using a wide range of programming languages. This SDK gives the researcher access to the full set of relevant gaze data streams, such as 3D eye coordinates, raw data, pupil data, etc.</p>
<p>Third-party software</p>	<p>This term refers to any application built on Pro SDK.</p>

2 What's in the Pro Spectrum box

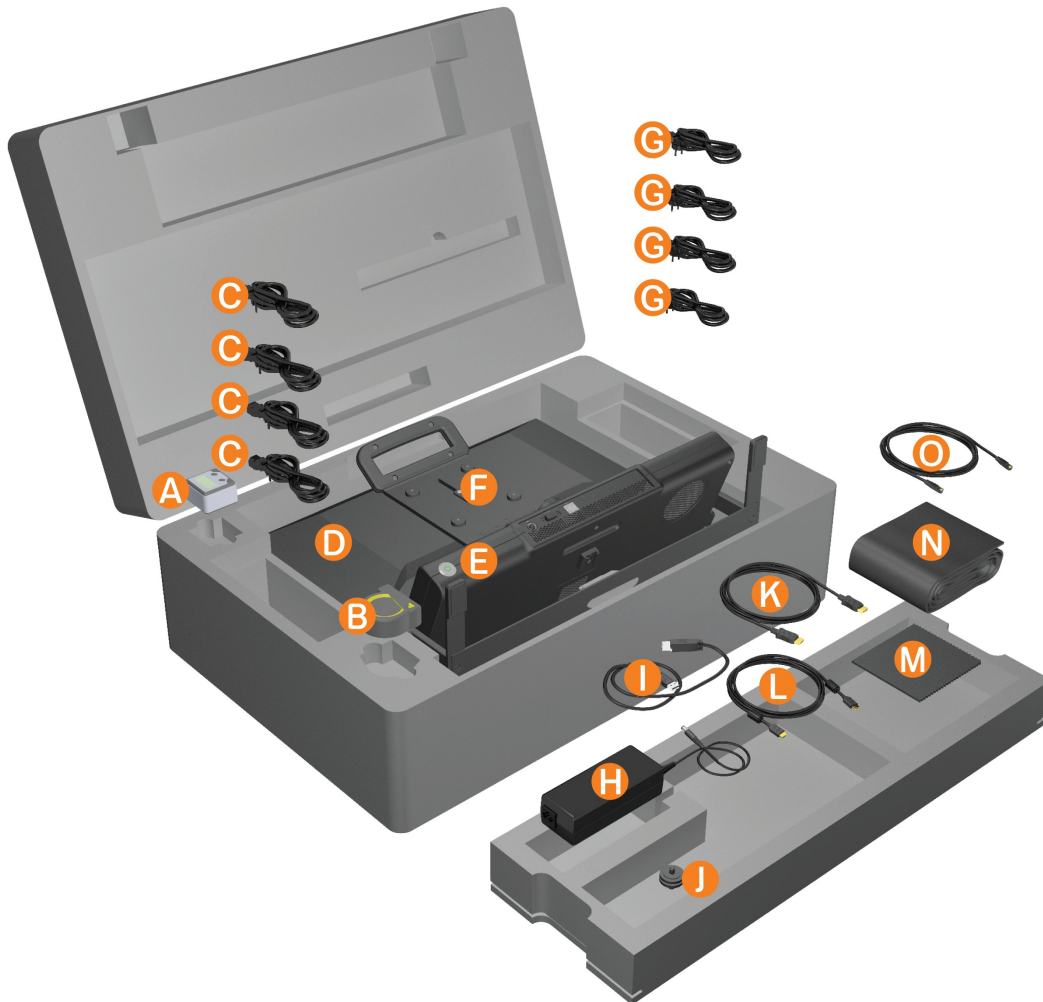


Figure 1. What's in the Pro Spectrum box

A. Angle meter	I. USB cable for connection between the PC and the monitor's integrated USB hub
B. Measuring tape	J. Cold shoe for mounting of a user camera
C. Power cables for monitor (UK, US, EU and Aus/China)	K. DisplayPort cable
D. Monitor	L. HDMI cable
E. Eye tracker	M. Cleaning cloth
F. Monitor mounting bracket	N. Fabric cord sleeve for collecting the cables
G. Power cables for eye tracker (UK, US, EU and Aus/ China)	O. Ethernet cable

H. Power adaptor for eye tracker	
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3 Technical Specifications

3.1 Eye tracking specifications

The characteristics of the gaze data from an eye tracker are described in terms of accuracy and precision. Accuracy indicates the angular average distance from the actual gaze point to the one measured by the eye tracker. Gaze precision indicates the spatial variation between successive samples collected when the subject fixates at a specific point on a stimuli.

Eye tracking technique	Video-based pupil- and corneal reflection eye tracking with dark and bright pupil illumination modes. Two cameras capture stereo images of both eyes for robust, accurate measurement of eye gaze and eye position in 3D space, as well as pupil diameter.
Sampling frequency	60, 120, 150, 300, 600 or 1200 Hz (max. frequency depends on hardware version)
Precision*	0.01° RMS at optimal conditions** 0.06° RMS at optimal conditions (raw signal)
Accuracy*	0.3° at optimal conditions
Binocular eye tracking	Yes
Total system latency***	Mean latency < 2 ms @ 1200Hz (SD < 0.2 ms)
Blink recovery time	One frame (immediate)
Gaze recovery time	Less than 150 ms
Data Sample Output****	Timestamp Gaze origin Gaze point Pupil diameter
Eye image data stream	Eye image stream frequency is approximately 10 Hz (one image with both eyes). Zoomed-in eye images available in tracking mode. Full-frame camera images are available in gaze recovery mode.
TTL input stream	8-bit timestamped data (256 event codes). Event driven detection with a timestamp accuracy of 50 µs.
Tracker and client time synchronization	Integrated between the eye tracker time domain and the client computer time domain with an accuracy of 100 µs.


* Tobii Pro uses an extensive test method to measure and report performance and quality of data. Please download the [Tobii Pro Spectrum Eye Tracker Data Quality Test Report](#) for more detailed information.

** Applying Savitzky-Golay filtering (settings listed in the [Tobii Pro Spectrum Eye Tracker Data Quality Test Report](#)).

*** Visit [Tobii Pro Connect](#) for more information on how to optimize your Pro Spectrum setup. Note: FW v.2.2.3 and Pro SDK v.1.9 or later are required to obtain the stated performance.

**** For more information about output data and the supplementary data stream, please read the [Tobii Pro SDK documentation](#).

3.2 Setup

Head movement tolerance	Excellent -Dual-camera system, with more images than a one camera system, gives a more accurate data calculation and the best level of precision and robustness for head movement.
Freedom of head movement* (at 65 cm distance)	Width x height: 34 cm x 26 cm (13.5" x 10") (At least one eye tracked)
Freedom of head movement* (at 75 cm distance)	Width x height: 42 cm x 26 cm (16,5" x 10") (At least one eye tracked)
Operating distance (mounted on screen)	55 to 75 cm (22" and 30") from the eye tracker
Optimal screen size	24" (16:9 aspect ratio)
Tracker setup options**	
Recommended monitor	Supplied 23.8" monitor

* Describes the region in space where the participant can move his/her head and still have at least one eye within the eye tracker's field of view (trackbox) at the specific distance.

** Tracker mounted on stand, allows for even larger screens and physical objects to be tracked.

3.3 Software compatibility

Software and framework compatibility	Tobii Pro Lab Tobii Pro Eye Tracker Manager Tobii Pro SDK Any applications built on Tobii Pro SDK
Operating system	Windows, Mac, Linux

3.4 Hardware versions

300 Hz
600 Hz
1200 Hz

3.5 Pro Spectrum eye tracker specifications

Tobii Pro Spectrum is an integrated eye tracker with a removable 23.8" monitor. Removing the monitor transforms the integrated eye tracker into a standalone eye tracker.

Eye tracker

Dimensions (L x H x W) in cm/inches	55 x 18 x 6 (22" x 7" x 2") The eye tracker is mounted on a stand, which raises it from the surface by 9 cm (approximately 4").
Weight	5.1 kg (11.4 lbs.) With the power supply unit, the weight is 5.7 kg (12.9 lbs.)
Connectors	TTL input: 8-bit (DB-9 connector) Communication: Ethernet (RJ-45 connector) Power supply: 24 VDC (5.5 mm connector)
Data processing	Fully embedded data processing
Eye tracking cameras	2
Illuminators	Dark pupil Illumination Modules, Bright pupil Illumination Modules
User camera mount	Standard 1/4" thread
Power Consumption	Typical power consumption: 60 W Max. rated power consumption: 96 W

Power Options	Input: 100-240 VAC 50/60Hz Max. rated power consumption: 120 W No load power consumption: <0.15 W Energy efficient level: VI Complies with EISA 2007/DoE, NRCAN, AU/NZ MEPS, EU ErP and CoC Version 5
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Monitor

Monitor model name	EIZO FlexScan EV2451
Panel type	IPS, LED backlight
Screen size (diagonal)	23.8"
Weight	3.8 kg (8.4 lbs), incl. mounting
Aspect ratio	16:9
Resolution	1920 x 1080 pixels
Screen response time	5 ms (gray-to-gray)
Connectors	DVI VGA HDMI Display port 1 port for monitor control (USB 3.0) 2-port USB hub (USB 3.0) C13 power connector Audio input connector: 3.5 mm Headphone jack: 3.5 mm
Built in speakers	1.0 W + 1.0 W
Power supply	100-240 VAC 50/60 Hz
Power	Maximum rated power consumption: 42 W Typical power consumption: 13 W Power save Mode: 0.5 W Power Management: Power Save (VESA DPM, Display Port- Rev 1.1a, and DVI DMPM)

4 Display Settings



Figure 2. Display options for Pro Spectrum.

1. Pro Spectrum as delivered with the monitor mounted on the eye tracker.
2. Pro Spectrum as a standalone eye tracker without monitor.
3. Eye tracker and monitor together on a VESA 100x100 mount.
4. Standalone with monitor.



You can use the eye tracker with another monitor, but that is not recommended. For more information, read [Recommended monitor](#).

5 Safety

5.1 Mounting Warning



Tobii Pro Spectrum should be mounted according to the instructions of the approved mounts used. Tobii Pro AB or its agents are not liable for damage or injuries to a person or its property due to Pro Spectrum falling from a mounted configuration. The mounting of Pro Spectrum is done entirely at the user's own risk.

5.2 Emergency Warning



Tobii Pro Spectrum is to be used for research purposes only. Be aware that due to the low, but possible risk of failure or distraction, Pro Spectrum should not be relied upon or used in dangerous or otherwise critical situations.

5.3 Infrared Warning



When activated, Tobii Pro Spectrum emits pulsed infrared (IR) light. Certain medical devices are susceptible to disturbance by IR light and/or radiation. Do not use Pro Spectrum when in the vicinity of such susceptible medical devices as their accuracy or proper functionality could be inhibited.

5.4 Epilepsy Warning



Some people with photosensitive epilepsy are susceptible to epileptic seizures or loss of consciousness when exposed to certain flashing lights or light patterns in everyday life. This may happen even if the person has no medical history of epilepsy or has never had any epileptic seizures.

A person with photosensitive epilepsy would also be likely to have problems with TV screens, some arcade games, and flickering fluorescent bulbs. Such people may have a seizure while watching certain images or patterns on a monitor, or even when exposed to the light sources of an eye tracker. It is estimated that about 3-5% of people with epilepsy have this type of photosensitive epilepsy. Many people with photosensitive epilepsy experience an "aura" or feel odd sensations before the seizure occurs. If you feel odd during use, move your eyes away from the eye tracker.

5.5 Child Safety



Tobii Pro Spectrum is an advanced computer system and electronic device. As such it is composed of numerous separate, assembled parts. In the hands of a child certain of these parts have the possibility of being separated from the device, possibly constituting a choking hazard or another danger to the child.

Young children should not have access to, or use, the device without parental or guardian supervision.

5.6 Do not open Tobii Pro Spectrum



Non-compliance will result in loss of Warranty! There are no user serviceable components inside. Contact Tobii Pro Support if your Tobii Pro Spectrum is not working properly.

5.7 Environment



Tobii Pro Spectrum is designed for use in dry indoor environments. Avoid any exposure to direct sunlight as this will affect eye tracking quality and longer exposure can overheat the equipment. Avoid exposure to any liquids, gels, moist, rain, sweat or other damp materials or environments. Do not use the eye tracker near water - the device is not water resistant.

Keep the eye tracker in a clean and dust free environment. When using the equipment take adequate precautions against dust and dirt.

Do not place or use the equipment in places subject to extreme temperatures and humidity, such as on top of and or near a heating element, in a hot or damp room, or in a hot automobile in the sun.

6 Compliance

The certification and compliance statements in this section are only valid for the eye tracker unit. For compliance and certification of the monitor and external power supply, please see the separate compliance documentation of those.

Safety

Safety standards:	IEC 60950-1:2005 (Second Edition) + Am 1:2009 + Am 2:2013 EN 62368-1:2014 +A11:2017 UL 60950-1 Edition 2 +A1 +A2 CSA 60950-1 Edition 2 + A1 + A2 J60950-1 (H29) National differences for Australia to IEC 60950-1, 2nd Edition IEC 62471:2006 (First Edition) IEC 62368-1:2014
Certification and declaration of conformance:	ETL Listed (US & Canada) CB Certificate CE UKCA

EMC

EMC standards:	EN 55032: 2015, Class B
	EN 55024: 2010 + A1
	EN 61000-6-1: 2007
	EN 61000-6-3: 2007 + A1
	FCC 47 CFR Part 15 (2015): Class B
	ICES-003 Issue 6: Class B
	CISPR 32: 2015, Class B
	CISPR 35: 2016
	KN 32:2015, class A
	KN 35:2015
	KN 61000-4-2:2013
	KN 61000-4-3:2011
	KN 61000-4-4:2011
	KN 61000-4-5:2008
	KN 61000-4-6:2013
KN 61000-4-11:2008	
Certification and declaration of conformance:	FCC, CAN ICES-3 (B)/NMB-3(B), ACMA (RCM), CE, UKCE, KC* *Test coverage for KC certification doesn't include use of the TTL Input port.

See ETL and CB certificates for details.

Sustainability

Directives:	RoHS Directive 2011/65/EU REACH Directive EC 1907/2006 Restriction of hazardous substances (RoHS). UK SI 2012 No. 3032
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This product is exempt from CCC.

7 Additional information

7.1 Transportation and storage

Before storage or shipping, disconnect all cables and use the travel case and packaging materials provided.

For transportation and storage, the recommended range for temperature and humidity for the device is as follows:

- **Temperature:** -40°C to 70°C (-40°F to 158°F)
- **Humidity:** 20% to 95% (no condensation on the device)



Tobii Pro Spectrum is not waterproof or water resistant. The device should not be kept in excessively humid, damp or wet conditions. Do not submerge the device in water or in any other liquid. Be careful not to spill liquids on the device.

7.2 Cleaning

Before cleaning Tobii Pro Spectrum, unplug all cables. Use a soft, slightly damp, lint-free cloth. Avoid getting moisture in openings on the device. Don't use window cleaners, household cleaners, aerosol sprays, solvents, alcohol, ammonia, or abrasives to clean the device.



Keep in mind that scratches on the front surface of the eye tracker may cause impaired eye tracking performance.

7.3 Disinfection

The surfaces of Tobii Pro Spectrum can be cleaned with Isopropyl alcohol using a moist, soft, lint-free, non-scratching cloth. Do not let liquid Isopropyl alcohol enter into the unit. Be careful not to scratch the front filter surface as it is part of the optical system and scratches will reduce the product's performance.

7.4 Disposal of the eye tracker

Do not dispose of your Tobii Pro eye tracker in general household or office garbage receptacles. Follow your local regulations for the proper disposal of electrical and electronic equipment.

7.5 Limitation of liability

Except where prohibited by law, Tobii Pro AB is not liable for any loss or damage arising from the use or misuse of a Tobii Pro eye tracker or the mounting plate, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence, or strict liability.

Appendix A Recommended monitor

Tobii Pro Spectrum is supplied with a thoroughly tested and approved 23.8" 16:9 LCD monitor. Our recommendation is to use this monitor, which has been tested for weight, dimension and center of gravity for the system set up with the eye tracker unit and screen mounting solution. If you need to use a different monitor, we recommend that you choose a black monitor without any colored décor elements and that the screen bezel is as slim/thin as possible. No connections or buttons should be located underneath the monitor as this could interfere with the mounting of the eye tracker. The monitor must be equipped with a standard 100 x 100 mm VESA mounting interface on the back and it should not weigh more than the supplied monitor.



The eye tracker has undergone tipping tests with the supplied monitor attached. If you choose to use a different monitor, we can not guarantee the safety of such a combination and you will use it at your own risk.

Appendix B Limitations and considerations

B1 Intended use



Tobii Pro eye trackers are intended to be used in research activities about human behavior including eye movements, in a dry and dust free indoor environment. The product should only be used as described in this User's Manual. Please read the User Manual and other supplied documentation thoroughly before using the product.

B2 Light conditions



Tobii Pro recommends that eye tracking studies be performed in a controlled environment. Sunlight should be avoided since it contains high levels of infrared light which will interfere with the eye tracker system. Sunlight affects eye tracking performance severely and longer exposure can overheat the eye tracker. This eye tracker is not designed for exposure to (direct) sunlight. Eye tracking generally does not work in strong direct sunlight.

Shielding the eye tracker adequately from the sun may prevent sunlight from interfering with eye tracking.

B3 Eyelashes



Long eyelashes can be obstructive when the participant's eyes are less open, especially if the participant is wearing mascara. In rare cases, eyelashes may completely block the view of the participant's pupils, making eye tracking impossible.

B4 Droopy eyelids



Droopy eyelids or otherwise obstructive eyelids can block the view of the participant's pupils. In rare cases, such eyelids may completely block the view of the participant's pupils, making eye tracking impossible.

Appendix C Support, Training, and Warranty

C1 Customer Support

If you need help, please contact [Customer Support](#) at Tobii Pro. In order to receive assistance as quickly as possible, make sure you have access to your Tobii Pro device and, if possible, an Internet connection. You should also be able to supply the serial number of the device, which you will find on a sticker on the back or bottom of the device.

C1.1 Get help online

Many questions can be answered by visiting Tobii Pro Connect. It contains the latest information about contacting Support, helpful articles and FAQs, links to downloads, and much more. Log in or register to see information about your account and to reach Customer Support on [Tobii Pro Connect](#).

C2 Training and Education Services

If you are new to eye tracking, or want to extend your knowledge about eye tracking research, sign up for one of our learning programs and events on our website at [Training and Education Services](#).

C3 Warranty information

Read more online about [Tobii Pro Care and Tobii Pro's eye tracker warranty](#).



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Support for Your Tobii Pro Device

Get Help Online

Visit Tobii Pro Connect for help with your Tobii Pro device. It contains the latest information about contacting Support, links to our Learning Center, and much more. Visit connect.tobii.com.

Contact Your Solution Consultant or Reseller

For questions or problems with your product, contact your Tobii Pro sales representative or authorized reseller for assistance. They are most familiar with your personal setup and can best help you with tips and product training.

Visit tobii.com/contact.