Tobii Pro Nano
Product Description

tobii pro

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1 Introduction

This document describes the features and functionality of the Pro Nano eye tracker.

1.1 Overview

Tobii Pro Nano is our smallest, most light-weight research grade eye tracker, featuring the latest technology advancements from Tobii Pro. Portability and the ability to track almost anyone makes it perfect for collecting data efficiently in the field. The system measures 170 mm (6.69'') long and weights 59 grams (2.1 oz.). Pro Nano uses a sampling rate of 60 Hz and is designed for fixation-based studies, in fields like psychology, marketing research and education. Use Pro Nano for studies on:

- PC and Mac computers with an optimal screen size of 19″ or less (16:9)
- Mobile devices, with our Mobile Device Stand
- Real-world setups like physical objects and social interactions, with the Tripod Stand
- Projections, simulators, and larger screens, with the Tripod Stand

1.2 Application areas

The Pro Nano system has been tested and proven capable of tracking a large proportion of the population in regards of gender and ethnicity, with very high accuracy and precision on portable screens. Its discrete appearance, with fully embedded processing of eye tracking data, encourages for flexible and unobtrusive data collection methods. The eye tracker attaches easily with supplied mounting plates on various screens and connects via a USB 2.0 port to your PC or Mac computer.

Pro Nano is perfect for any researcher who wants to get started with or explore quality eye tracking as a research method to perform fixation-based eye tracking studies:

- Psychology and cognition
- Package design in marketing research
- User interface design and development

Pro Nano is our smallest research grade eye tracker designed for portable labs to enable easy data collection in the field:

- Make your own portable research lab that fits in a rucksack
- Collect data wherever your participants are, for instance at universities, hospitals, and public spaces

Pro Nano is well suited for equipping universities with portable eye tracking solutions to allow students to try out eye tracking and build knowledge how the technology can be used in different fields, answer research questions and enhance commercial endeavors.

1.3 How Your Tobii Pro Nano Eye Tracker Works

During tracking, Tobii Pro eye trackers use infrared illuminators to generate reflection patterns on the corneas of the participant's eyes. These reflection patterns, together with other visual data about the participant, are collected by image sensors. Sophisticated image processing algorithms identify relevant features, including the eyes and the corneal reflection patterns. The Pro Nano is a single camera system that uses a combination of dark and bright pupil tracking. Complex mathematics is used to calculate the 3D position of each eyeball, and finally the gaze point; in other words, where the participant is looking.

Eye trackers from Tobii Pro are primarily designed for use in indoor office environments with adult participants.

2 Technical Specifications

2.1 Eye tracking specifications

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

Eye-tracking technique	Corneal reflection, dark and bright pupil illumination, one camera system
Sampling frequency	60 Hz
Accuracy*	0.3° at optimal conditions (down to 0.1°)
Precision*	0.10° RMS at optimal conditions (down to 0.06°)
Binocular eye tracking	Yes
Total system latency	17 ms
Blink recovery time	1 frame (immediate)
Gaze recovery time	250 ms
Freedom of head movement	Width × height: 35 cm × 30 cm (13,78" × 11,81") at 65 cm (at least one eye tracked)
Operating distance	45–85 cm (18”–33”) from the eye tracker’s reference point
Max gaze angle	30 degrees
Max screen size	19” (16:9 aspect ratio)
Data sample output**	Timestamp Gaze origin Gaze point Pupil diameter Validity code

*Tobii Pro uses an extensive test method to measure and report performance and quality of data. The data quality test report provides detailed information. Download it at: https://www.tobiipro.com/pop-ups/metrics-report-nano/

** For more information about output data and the supplementary data stream, download the Pro SDK documentation from Tobii Pro’s website: http://www.tobiipro.com/product-listing/tobii-pro-sdk/.

2.2 Tobii Pro Nano Eye Tracker specifications

Dimensions	170 mm × 18 mm × 13 mm (6.69“ × 0.71“ × 0.51“)
Weight	59 g (2.1 oz)
Connectors	USB 2.0 Type A
Eye tracker processing	Tobii EyeChip™ with fully embedded processing
Power consumption	Typically* 1.5 W via single USB 2

*Typical power consumption for an office with the participant sitting at 65 cm from the eye tracker. If the participant sits far from the eye tracker, the illuminators need more power to generate good eye-tracking. In such a case the average power tops at 2.3 W. A USB 2.0 ports typically outputs 2.5 W. If, for some reason your computer USB 2 port doesn’t provide enough power to the eye tracker, the Pro Nano will not work. In those rare cases, we recommend connecting an external powered USB hub between the computer and the eye tracker.

2.3 Compatible Tobii Pro software

Pro Lab	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. https://www.tobiipro.com/product-listing/tobii-pro-lab/
Pro SDK	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. http://www.tobiipro.com/product-listing/tobii-pro-sdk/
Pro Eye Tracker Manager	Pro Eye Tracker Manager is a tool used to perform firmware upgrades, configure eye tracker settings and more. https://www.tobiipro.com/product-listing/eye-tracker-manager/
Third-party software	This term refers to any application built on Pro SDK.

2.4 System requirements

Operating system	Windows 10 Professional or Enterprise editions macOS High Sierra and Mojave
CPU	1 GHz, 2 cores
RAM	2 GB RAM memory Software for eye-tracking research might require higher RAM
Connectors	USB 2.0 Type A

3 Compliance and Certification

The certification and compliance statements in this section are valid for the Pro Nano eye tracker.

Pro Nano has been tested to be safe for use in indoor environments, and is intended for office and industrial environments, as well as laboratories, classrooms and homes. The product is compliant to regulation related to electro-magnetic safety and eye safety. Pro Nano follows the regulations related to sustainability, such as restriction of hazardous substances and waste.

Pro Nano has market compliance in the following countries:

- European Economic Area
- USA
- Canada
- Japan
- China
- Australia and New Zealand
- South Korea

Safety

Safety standards:	• IEC 60950-1:2005 +A1 +A2, Safety of Information Technology Equipment • IEC/EN 62471:2008, Photo Biological Safety of Lamps and Lamp Systems
Certification and declaration of conformance:	CE, RCM

EMC

EMC standards:	• EN 55032:2015, Electromagnetic compatibility of multimedia equipment. Emission requirements • EN 55024:2010+A1:2015, Information technology equipment, Immunity characteristics, Limits and methods of measurement • EMC Emission: EN 61000-6-3:2007, Generic Emission standard for residential, commercial and light industry environments • EMC Immunity: EN 61000-6-1:2007, Generic Emission standard for residential, commercial and light industry environments • FCC part 15, Class B • ICES-003, Class B • AS/NZS CISPR32:2015, Electromagnetic compatibility of multimedia equipment - Emission requirements • KC standard (KC-KN-32/35)
Certification and declaration of conformance:	CE, FCC part 15, Class B, ICES-003 Issue 5, KC standard (KC-KN-32/35), RCM
Directives:	2014/30/EU (EMC) - Electromagnetic Compatibility Directive

Sustainability

Directives:	• 2011/65/EU (RoHS) - Restriction of Hazardous Substances Directive • 2012/19/EU (WEEE) - Waste Electrical and Electronic Equipment Directive

Appendix A Glossary

Binocular eye tracking	Tracks and reports data for both left and right eye.
Blink recovery time (time to tracking recovery for blinks)	When a subject blinks, the eye tracker loses the ability to track eye gaze because the eye is covered by the eyelid. If the pupil is occluded for only a short period (a few hundred milliseconds), the system will regain tracking immediately when the pupil becomes visible again, but only if the subject has maintained approximately the same head position during the blink. Data during blinks are only lost when the pupil is occluded, i.e. during the eye lid movement itself or when the eye is closed.
Eye-tracking processing unit	The CPU in which the gaze processing and calculations are made. Tobii Pro eye trackers have either an embedded CPU in the eye tracker or an external processing unit.
Eye-tracking technique	Tobii Pro Eye Trackers use two techniques to determine eye position: 1. Bright pupil eye tracking, where an illuminator is placed close to the optical axis of the imaging device, causing the pupil to appear lit up (the same phenomenon that causes red eyes in photos). 2. Dark pupil eye tracking where the illuminator is placed away from the optical axis, causing the pupil to appear black.
Freedom of head movement	Describes the region in space where the participant may move his/her head and still have at least one eye within the eye tracker's field of view.
Gaze accuracy	Describes the angular average distance from the actual gaze point to the one measured by the eye tracker.
Gaze data output frequency	The number of data samples per second output for each eye.
Gaze precision	Describes the spatial angular variation between individual and consecutive gaze samples (Root Mean Square), calculated on raw data.
Gaze precision filtered	Describes the spatial angular variation between individual and consecutive gaze samples (Root Mean Square), calculated after a smoothing filter has been applied to the raw data - Savitzky A. and Golay, J.E., 1964. Smoothing and Differentiation of Data by Simplified Least Squares Procedure Savitzky-Golay. Anal. Chem., vol.36, pp. 1627-1639. Filter settings: Polynomial order 2, with a 20 millisecond sampling window.
Gaze recovery time (time to tracking recovery after lost tracking)	An eye tracker working in a natural user environment may occasionally lose track of the subject's eyes, e.g., when the subject completely turns away from the tracker. If a period of a few hundred milliseconds elapses during which the eye tracker is unable to detect the eyes in close proximity to where they were last detected, the eye tracker will start searching for the eyes within the entire head movement box. The stated measurement is the typical time to tracking recovery in such a situation.
Max gaze angles	The maximum gaze angle for witch the eye tracker can perform robust and accurate tracking by finding at least one eye. The gaze angle is the angle ABC with A = center of the eye tracking sensors (midpoint between the two eye tracking sensors, for dual camera systems, and center of the eye tracking sensor for single camera systems), B = eye position (midpoint between the left and the right eye) and C = stimuli point.

Max head movement speed	Describes the maximum head movement speed allowed while maintaining robust tracking. The specified number is for sideways head movement.
Operating distance	Describes the minimum and maximum distances between the subject's eyes and the surface covering the eye tracker sensors at which eye tracking can be done while maintaining robust tracking.
Processing Latency	Describes the time required by the eye tracker processor to perform image processing and eye gaze computations.
Sampling rate	Number of data samples per second.
Timestamp precision as specified in each data sample	The temporal deviation of the timestamp in the data sample received by the client application. This includes any offset in the clock sync between the eye tracker processing unit and a typical client computer.
Total system latency	The duration from the mid-point of the eye image exposure, to when a sample is available via the API on the client computer. This includes half of the image exposure time, image read-out and transfer time, processing time and time to transfer the data sample to a client computer.