pupil labs

Product Catalog

Hardware Overview

Pupil Headset

Pupil Headsets are plug and play USB devices carefully designed to be lightweight, unobtrusive, and easy to use. You wear Pupil like a pair of glasses. Cameras record your field of view and your eye movements. Data is correlated with Pupil software that runs on your computer. Pupil is designed as a modular system to support the diverse needs of researchers in the fields of eye tracking, pupillometry, and egocentric vision.

Total Weight	45g
Frame Material	Laser sintered PLA
Nose Pads	Silicone nose pads can be exchanged to customize fit
Interface	Single USB C connector on collar clip (USB 2/3 compatible)

World Camera

Sensor	2D	high speed - 1920x1080 @30fps, 1280x720 @60fps, 640x480 @120fps high resolution - 1910x1080 @30fps
	3D	3d - See Intel R200 data sheet for details
Lens	2D	high speed - Lenses are exchangeable. Hardware ships with 100 deg and 60 deg FOV lenses with M8 threads high resolution - 90 degrees diagonal with auto focus lens.
Latency	2D	5.7ms
	3D	See Intel R200 data sheet for details

Eye Cameras

Binocular and Monocular configurations available

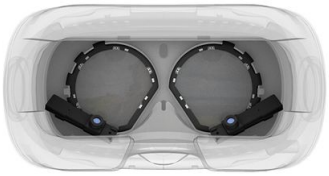
Sensor	Maximum frame rate of 200fps at 200x200 pixels with global shutter.
Illumination	IR illumination (dark pupil tracking)
Latency	4.5ms

Operation Configurations

Direct	Pupil headsets connect directly to a computer via a single USB 2.0/3.0 cable
Mobile Device	Pupil headsets connect to an Android mobile device via a single USB C cable. Pupil Mobile Android app enables local recording and WiFi streaming of world and eye video.

VR/AR

We have created eye tracking add-ons for the current range of leading VR and AR platforms. Our add-ons enable eye tracking without compromising your VR/AR experience. Use the VR/AR hardware you already own, and augment it with our drop-in eye tracking hardware.



Supported Devices

HTC Vive, Oculus CV1, Oculus DK2 and HoloLens

Basic Capabilities

Mono | Stereo	Both, depending on desired setup
Field of View	HTC Vive, Oculus CV1, Oculus DK2, Hololens: up to HMD limits
Gaze Accuracy	Approx. 1.0deg
Gaze Precision	Approx. 0.08deg

Latency

Camera Latency	4.5ms
Processing Latency	3-4ms on i5 CPU

Eye Cameras

Frequency	HTC Vive and Oculus DK2: 120hz, HoloLens and Oculus CV1: 200hz
Connection	USB 2.0
Saturation	Interconnected bandwidth USB 2.0 ~60% saturation

Data Output

Combined Eye Gaze	Yes
Independent Eye Gaze	Yes - 1 gaze point per eye
Pupil Position	Yes
Pupil Diameter	Yes - units in pixels using 2d appearance, units in mm using 3d model
Velocity | Acceleration	Can be implemented if desired
Eye Accomodation	Yes, using binocular vergence

Calibration

Method	2D	9 points
	3D	5 points

Power Performance Memory

Host CPU % Utilization	50% of one core per eye

Connectivity

SDK	Through network message based API
Plugin for Game Engines	Reference plugin implementation for Unity3D

Software Overview

Pupil software runs on macOS, Linux, and Windows 10. Pupil software enables you to record, visualize, and analyze eye tracking data. Pupil software is open source and updates are released on a regular basis. Use Pupil Capture for data acquisition and real-time applications. Pupil Player for visualizationa and analysis (post-hoc). Pupil Mobile for data acquisition and streaming. You can easily extend functionality of Pupil by developing your own plugins in Python or modify the source code!

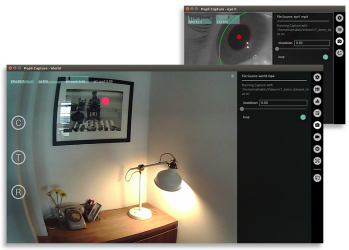
Download Software

Pupil Mobile

Documentation

Pupil Capture

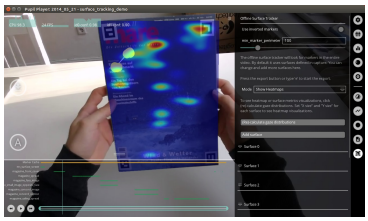
Pupil Capture is the software used with the Pupil Headset and is used to receive video and audio streams, detect your pupil, track your gaze, track surfaces in your environment, stream data in real-time over the network, and record data in an open format.



Pupil Detection Method		Binocular, dark pupil tracking using a 3D eye model
Calibration Procedure		Multi point calibration - 3-9 points (physical marker or on-screen marker)
Slippage Compensation		Slippage compensation using the 3D eye model
Pupil Diameter		Diameter is recorded in millimeters based on anthropomorphic eyeball size and in pixels based on apparent diameter
Accuracy & Precision Precision	2D	Accuracy : 0.6 degree of visual angle Precision : 0.08 degrees
	3D	Accuracy : 1.4 degree of visual angle Precision : 0.08 degrees
Area of Interest Tracking		Surface tracking using up to 64 unique 5x5 fiducial markers
Multi-device Sync Synchronization		Synchronization with other Pupil devices and other sensors on a wireless/wired network
Broadcast Pupil Data Over the Network		Real-time broadcast of Pupil data (gaze data, pupil data, events) over a wireless/wired network

Pupil Player

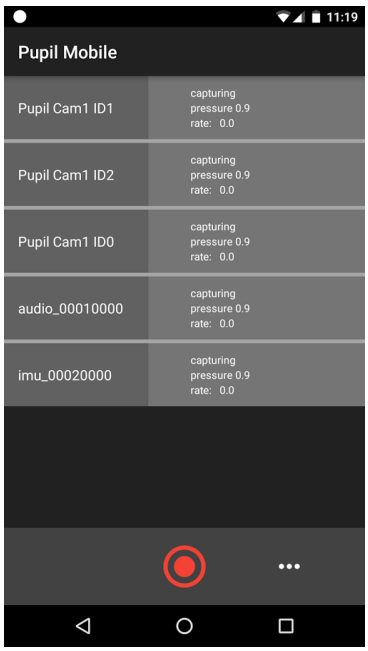
Pupil Player is a media and data visualizer at its core. You will use it to look at Pupil Capture recordings. Visualize your data and export it. You can also use Pupil Player to conduct post-hoc pupil detection and calibration (gaze estimation).



Visualization	Multiple plugins to visualize gaze data. Most visualization plugins are additive; enabling custom visualizations and analysis.
Analysis	Fixation classification and visualization (using dispersion / duration method). Export reports of all fixations within the scene. When used in combination with Surface Tracking, export fixations on surfaces.
Surface Tracking	Surface tracking using up to 64 unique 5x5 fiducial markers. Edit and add surfaces based on markers in the recording. Aggregate data, generate heatmaps, and export surface data and reports.
Export	Export videos with visualizations. Export raw data as CSV files that can be imported into a spreadsheet.

Pupil Mobile

Pupil Mobile is a companion app to Pupil Capture and Pupil Service. The app enables you to connect your Pupil eye tracking headset to your Android device via USB-C. You can preview video and other sensor streams and record video locally on your Android device. The video data can be streamed over a WiFi network to other computers (clients) running Pupil Capture.



Compatible Android Devices	Moto Z2 Play, Nexus 5x, Nexus 6p, and OnePlus 3 and
Compatible Android Version	Android 7 and up
Hardware Connection	USB-C
Compatible Pupil Hardware	All pupil headsets except world 3D camera
Local Recording Mode	Record up to 4 hours locally when using Pupil Labs Pupil Mobile Bundle (Moto Z2 Play with Battery Pack and SD card).
WiFi Streaming	Pupil Mobile can stream over local WiFi network to multiple clients using the open source MDSI protocol
Android App	Available on the Google Play Store

Pupil Headset Configurations

Pupil Headset

PID: pupil_w120_e200b_edu

World camera: high speed 120hz world camera
Eye cameras: 200hz binocular eye cameras
Academic discount

World camera: w120
Eye camera: e200b

€ 2150

Pupil Headset

PID: pupil_w120_e200_edu

World camera: high speed 120hz world camera
Eye camera: 200hz eye camera
Academic discount

World camera: w120
Eye camera: e200

€ 1250

Pupil Headset

PID: pupil_w120_enone_edu

World camera: high speed 120hz world camera
Eye camera: no eye camera
Academic discount

World camera: w120

€ 600

Pupil Headset

PID: pupil_w3d_e200b_edu

World camera: Intel RealSense R200 RGBD Camera
Eye cameras: 200hz binocular eye cameras
Academic discount

World camera: w3d
Eye camera: e200b

€ 2500

Pupil Headset

PID: pupil_w3d_e200_edu

World camera: Intel RealSense R200 RGBD Camera
Eye camera: 200hz eye camera
Academic discount

World camera: w3d
Eye camera: e200

€ 1600

Pupil Headset

PID: pupil_w3d_enone_edu

World camera: Intel RealSense R200 RGBD Camera
Eye camera: no eye camera
Academic discount

World camera: w3d

€ 950

Pupil Headset

PID: pupil_w30_e200_edu

World camera: high resolution 30hz world camera
Eye camera: 200hz eye camera
Academic discount

World camera: w30
Eye camera: e200

€ 1250

Pupil Headset

PID: pupil_w30_enone_edu

World camera: high resolution 30hz world camera
Eye camera: no eye camera
Academic discount

World camera: w30

€ 600

Pupil Headset

PID: pupil_wnone_e200b_edu

World camera: no world camera
Eye cameras: 200hz binocular eye cameras
Academic discount

Eye camera: e200b

€ 1900

Pupil Headset

PID: pupil_wnone_e200_edu

World camera: no world camera
Eye camera: 200hz eye camera
Academic discount

Eye camera: e200

€ 1000

VR/AR

HoloLens Binocular Add-on

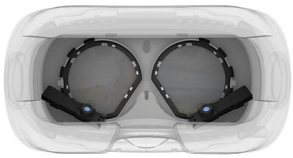
PID: hololens_w120_e200b

Microsoft HoloLens eye tracking add-on with 2 x 200hz eye cameras and 1 x high speed world camera.

€ 1750

HTC Vive Binocular Add-on

PID: htcvive_e120b



HTC Vive eye tracking add-on with 2 x 120hz eye cameras.

€ 1400

Epson BT300 Add-on

PID: epsonbt300_w120_e200b

Epson Moverio BT300 eye camera mounts, USBC clip, cable harness, binocular 200hz eye cameras, high speed world camera.

€ 1750

Additional Products

Here you will find upgrades for existing Pupil hardware and additional products like Pupil Mobile.

Eye Camera

PID: camera_e200

200hz eye camera upgrade

€ 650

Pupil Mobile Bundle

PID: pm_motoz2

Moto Z2 Play (black), hot-swappable Moto power pack, 64gb SD card, USBC-USBC cable, and is pre-loaded with the Pupil Mobile app. Connects to Pupil headset via USBC cable (included).

€ 650

USB-C Upgrade

PID: hub_usbc

Upgrade any existing Pupil headset with the new USB-C clip. Comes with USB-C to USB-A cable.

€ 210

Support Contract

PID: support_6

6 month support contract. 3 one hour video support sessions and email support.

€ 1000

Support Contract

PID: support_12

12 month support contract. 7 one hour video support sessions and email support.

€ 2000

Camera Specs

Pupil cameras are custom built by Pupil Labs. The fastest, smallest, lightest, most versatile, and resolve a wide range of eye movement motifs.

World cameras

high speed

PID: w120

World camera custom built by Pupil Labs. The fastest, smallest, lightest, and most versatile world camera in our product line. We recommend this option for most research use cases.

Sensor	Latency	FOV	Audio
1920x1080 @30fps, 1280x720 @60fps, 640x480 @120fps. Sensor model OV2710.	5.7ms	100 degrees diagonal. Lenses are exchangeable: Headset ships with 60deg and 100 deg FOV lenses.	Record audio via host device microphone

3d

PID: w3d

Intel RealSense R200 RGBD camera. Provides depth image and monocular RGB color image. (Note: This sensor is not compatible with Pupil Mobile).

Sensor	Latency	FOV	Audio
See Intel R200 data sheet for details	See Intel R200 data sheet for details	See Intel R200 data sheet for details	Record audio via host device microphone

high resolution

PID: w30

World camera with beautiful image quality and stereo microphones. We recommend this option when you want aesthetically pleasing footage and on-board microphones, and are not concerned with size, weight, or speed.

Sensor	Latency	FOV	Audio
1910x1080 @30fps	127.7ms	90 degrees diagonal with auto focus lens.	Record audio with built-in stereo microphone

Eye cameras

200hz binocular

PID: e200b

Eye cameras custom built by Pupil Labs. Our smallest, lightest, and fastest eye tracking cameras. Global shutter and 200hz speed enable robust pupil detection and eye movement motif classification

Sensor	Latency	Illumination
Global Shutter. 192x192 @ 30fps, 60fps, 90fps, 120fps, 180fps, 200fps 400x400 @ 30fps, 60fps, 90fps, 120fps, 200fps	4.5ms	IR camera with IR illumination and IR bandpass filter (dark pupil tracking)

200hz

PID: e200

Eye camera custom built by Pupil Labs. Our smallest, lightest, and fastest eye tracking camera. Global shutter and 200hz speed enable robust pupil detection and eye movement motif classification.

Sensor	Latency	Illumination
Global Shutter. 192x192 @ 30fps, 60fps, 90fps, 120fps, 180fps, 200fps 400x400 @ 30fps, 60fps, 90fps, 120fps, 200fps	4.5ms	IR camera with IR illumination and IR bandpass filter (dark pupil tracking)