

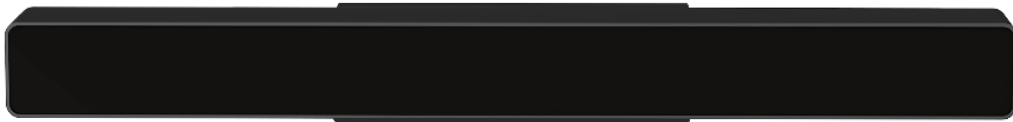


# Startup Guide

Matlab

v 1.1.15

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## Introduction

### About

The EyeLogic Software Development Kit (SDK) is a free software package for building custom applications which use an EyeLogic eye tracking device. It offers the possibility to connect with your device via an application programming interface (API) from any custom application. The EyeLogic SDK is available for the programming languages

- C++,
- C#,
- C,
- Python, and
- Matlab

It is also usable with any other programming language that is capable of importing dynamic link libraries (DLLs), e.g. Visual Basic.

For each directly supported language, there is a short and simple sample program to help you get started with the development of your first EyeLogic application.

This guide describes the use of the EyeLogic API for Matlab and gives a step-by-step introduction on how to start with your own Matlab program.

### System Requirements

For the system requirements of the EyeLogic Server and an installation guide, please refer to the Server's documentation.

The SDK has no additional requirements. It is built for Microsoft Windows only (32 bit or 64 bit).

## Installation and Getting Started

### Download Software

In order to use an EyeLogic eye tracking device from within your application, you need the EyeLogic Server and the EyeLogic SDK. Check the download-page to get the latest release of

both packages: <https://www.eyelogicsolutions.com/help-center/>

## Compatibility

The software is written to support backwards-compatibility, i.e. an update of the EyeLogic Server software will not break support for your device, irregardless of the model. The actual guide assumes that you are installing the newest version of the EyeLogic Server. Please always update to the newest server version before reporting an error to the EyeLogic support.

On the other hand, updating the SDK and API-DLLs is not always necessary. Since you as a programmer would have to recompile your application with every SDK-update, we designed the SDK such that the server is able to communicate with older API versions. Therefore, when shipping your application, just add the EyeLogic API DLLs of the actual version to your package. It is compatible with servers of the actual and newer releases.

See Section Shipping your Application for a tutorial on how to ship your application.

## Install EyeLogic SDK on Windows

The EyeLogic SDK does not need to be installed. It ships as .zip file which just needs to be extracted to some directory on your hard disk. Be sure, that you have user-rights to that directory, e.g. any directory inside C:\Program Files or similar is problematic, since it requires admin rights to access those files every time you start your program. It is recommended to use a user-local directory.

Note: The SDK has to be installed on the same computer as the server. Please see the main server manual for help on installing the server.

After extracting the .zip file, the directory contains one subfolder for each supported programming language. Open the matlab folder, the content should be:

1. `eyelogic` - contains the Matlab package which binds to the EyeLogic API
2. `demo_basicsusage` - contains a sample Matlab script which demonstrates the use of the EyeLogic API

## Getting Started with the Sample Code

In the directory, into which you unpacked the SDK **EyeLogicSDK**, navigate to the sub-directory **matlab**. Open the `demo_basicsusage\Sample.m` file with Matlab.

You may run the application by pressing F5 or by clicking the "Run" button. The location of the script needs to be either the current directory or listed in the Matlab paths. On the first run,

Matlab asks if you want to change the current directory or add the script location to the path list. Choose whatever is more suitable to you, both choices work.

Before running the application check that the EyeLogic Server is running (see the EyeLogic Server manual). If the server is running, there is an EyeLogic icon in the windows tray bar.

Note that your firewall might block the connection between your program and the server. In this case, add a rule to your firewall to allow your application to open TCP/UDP ports to an application on localhost (for the windows defender, just click "accept").

If you reached this point, you have properly set up your EyeLogic SDK. You may now start with the development of you own application. See the next section for the basic programming concepts and for a tutorial on how to deploy and ship your application.

## Concepts

### Server-Client Setup

The EyeLogic software consists of two main parts: The **server** and the **API**. The server is the neccessary driver for your eye tracking device. It detects your device and handles the communication. The API is part of the EyeLogic Standard Development Kit (SDK). It consists of .dll files which can be used by your application to set up a connection to the EyeLogic Server, start tracking and receive eye tracking data.

The server is designed to run permanently on your computer as a background process. While not actively tracking the server requires an insignificant portion of your computer's resources. Once an EyeLogic eye tracking device is plugged in, the server application detects it automatically and allows the user to set it up via the servers' configuration dialog (see the server icon in the windows tray bar). If for any reason the server background process is not running (the tray icon is missing), you may start the server manually via the windows start menu.

The API is a set of .dll files which can be used by any custom program (called the **user application**). With these DLLs the user application can establish a connection to the (running) server via the TCP protocol.

### Set Up a Project for your Application

For an easy start to develop a new application it is recommended to copy the existing sample folder to a new location (e.g. EyeLogic\_SDK\matlab with all its contents). The sample source file already provides a fully functional implementation. Starting from this sample code, you can easily modify and extend the code to suit your customized experiment.

Alternatively you can start a new Matlab project from scratch. In that case be sure that your

development environment is able to find the path for the EyeLogic matlab module (which is **<Location of your EyeLogic\_SDK>\matlab\eyelogic**).

## Control Flow between API and server

The usual control flow between the custom application/API and server is characterized by the following steps:

- **initialize:** Before calling any other function the API DLLs need initializing.
- **connect to server:** Establish a connection to the server via TCP.
- **find eye tracking device:** Obtain an info of connected eye trackers, otherwise wait until an eye tracker is plugged in.
- **start tracking:** Request tracking. If successful, the device will start tracking and the server reports **GazeSamples** to the user application, see also Section GazeSamples.
- **perform calibration:** Request a calibration. The screen will show some calibration points which the user has to look at. After calibration the system is calibrated and ready to use.
- **shut down:** At the end of your experiment either stop the tracking or simply shutdown the API.

All information which is passed from the server to the user application will be passed via **asynchronous callbacks**. The application has to register those callback functions in the API (see Section Example Program for an example implementation).

Note that you need to calibrate in order to obtain valid gaze samples (see Section GazeSamples). All gaze samples which are reported before the system is calibrated contain no valid eye data.

## Example Program

In this section, the code of the Matlab example program is explained in some detail.

The file starts with importing the EyeLogic class.

```
api = EyeLogicAPI;
```

Note that the folder **<SDK>\matlab\eyelogic** must be added to the Matlab paths before, using the method **addpath()**.

In the next section, the application implements its control flow. It consists of the following code lines:

```
retConnect = api.connect();
```

Connects to the EyeLogic server. Check for the return value in order to find out whether the connection was established successfully.

```
screenConfig = api.getActiveScreen();
```

and

```
device = api.getDeviceConfig();
```

are called in order to obtain information about the active screen and the connected eye tracking device. If no device is connected, then the returned device is 'empty' (check by calling `isempty(device)`).

```
retStart = api.requestTracking(0);
```

Tells the device to start tracking and the Server to begin sample processing. The parameter 0 specifies the frame rate mode. If your device is capable of multiple frame rate modes (60Hz, 120Hz or 250Hz), you can also enter a different number. The list of available frame rate modes is stored in the member **frameRates** of **device**, whereas the first frame rate mode (0) is the default mode, which usually is the highest available speed mode of your system.

```
retCalibrate = api.calibrate(0);
```

Performs a calibration. This method blocks until the calibration ends - i.e. completed or aborted. The parameter 0 denotes the type of calibration. A list of available calibration methods is stored in member **calibrationMethods** of **device**.

The example program waits for 5 seconds and collects incoming GazeSamples. Since the Matlab SDK does not allow for callback functions, the only way of obtaining GazeSamples is to regularly call

```
api.getNextGazeSample( ms )
```

in a loop. If you specify a timeout **ms** in milliseconds, the method blocks until a GazeSample arrives or the timeout is reached. Check the return value in order to find out if there was a new GazeSample in that time. You may also pass `ms=0` if you do not want that the method blocks, but just want to check for and collect a new incoming GazeSamples.

Note, that beside GazeSamples, the EyeLogic API may send you Events which are notifications e.g. for a disconnected eye tracking device. In order to obtain all events and GazeSamples, you have to call both

```
api.getNextGazeSample( ms )
```

and

```
api.getNextEvent( ms )
```

alternating. Note that they may be more than one event/GazeSample pending at a time. A call to one of the methods obtains just the next event/GazeSample in the buffer.

Finally, the connection to the EyeLogic Server is closed.

```
api.unrequestTracking()  
api.disconnect()  
api.delete()
```

## GazeSamples

GazeSamples are the most essential data which is generated by the eye tracker. The eye tracker delivers one GazeSample per frame. Each sample contains information on the time of measurement, the position of the eyes, the pupil radius and the point where the user looks at on some stimulus plane (usually a computer monitor).

## Shipping your Application

When you want to ship your application, be sure to include all relevant files so that it may run on different computers. The EyeLogic functionality will only work on computers which have the EyeLogic Server installed. The installed server needs to at least be of the same version as the shipped API DLLs (a newer server version is permissible).

Beside the relevant files of your application, you need to ship the eyelagic/ subfolder (from **SDK path/matlab** with all its content. The matlab interpreter must be able to locate this folder in order to locate the eyelagic module on your destination machine. You may place the eyelagic/ folder inside the working directory of your application and ship them altogether.

## Appendix

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## About EyeLogic

EyeLogic is a manufacturer of high precision and high quality eye tracking devices, mainly for scientific and research use cases. EyeLogic GmbH is a spin-off of the Free University of Berlin, faculty of mathematics and computer science and has a vast experience in image processing and computer vision.

## Contact and Support

For technical support questions contact us via mail at: `<code>support@eyelogicsolutions.com</code>`

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