



GAZEPOINT CONTROL USER MANUAL



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1 Introduction

The Gazepoint Control system is a high-performance biometric data capture system that provides eye gaze data, pupil diameter, heart rate and galvanic skin response (GSR) as well as self-reporting dial, all at an extremely affordable price. The hardware and software setup are also very straightforward and easy to operate. Gazepoint eye trackers are also compatible with the Microsoft Eye Control accessibility features available in Windows 10.

2 Technical Specification and Requirements

Eye Tracking	GP3	GP3HD
Sampling Rate	60 Hz	150 Hz
Accuracy	0.5 – 1 degree	0.5 – 1 degree
Spatial Resolution (RMS)	0.1	0.1
Eye Tracking Mode	Binocular	Binocular
Operating Distance	50 cm – 80 cm	50 cm – 80 cm
Tracking Range (Head Box)	25 cm x 11 cm	35 cm x 22 cm
Calibration	5 or 9 point	5 or 9 point
Tracking Recovery Time	< 50 ms	< 20 ms
System Latency	< 50 ms (end to end from event to API output)	
Data Connection	USB 2.0	USB 3.0
Dimensions	235 mm x 43 mm x 47 mm	235 mm x 43 mm x 47 mm
Weight	115g	123g
Eyewear Compatibility	Works with most glasses and contact lenses	
Processor	Intel i5 (i7 recommended)	
Memory	4 GB (8GB recommended)	
OS	Window 7/8/10, 32/64 bit	

3 Hardware Setup

3.1 Eye Tracker Hardware

The Gazepoint eye tracking system ships with the eye tracker (SD or HD), tripod, and 2 USB cables, one for camera image data and one to power the infrared illumination.



Figure 1 - Gazepoint GP3 and Tripod

3.2 Data and Power Connections

Before connecting the hardware to your computer, first install the Gazepoint software which will install the required camera drivers (see software setup below). To connect the eye tracker simply plug in the USB data cable and power cable to both the device and the computer.

Ideally the data cables should be connected directly to the USB port on your computer if sufficient ports are available. If there are insufficient USB ports, a USB 3.0 hub can be used provided it is connected to a USB 3.0 (or better) port on the computer. The eye tracker power cable can connect to any powered USB power port and does not need to be connected to the PC (for example a phone charger plug will also work).

3.3 Eye Tracker Placement

Position the eye tracker directly below your computer screen. Avoid using in a room with direct or indirect sunlight on the face of the user. The eye tracker should be approximately arm's length distance away and centered and pointed at your face, the ideal distance is 65 cm to your eyes. If the user is wearing glasses, it is best to tilt the unit upwards at a greater angle to prevent reflections from appearing off the glasses lenses.

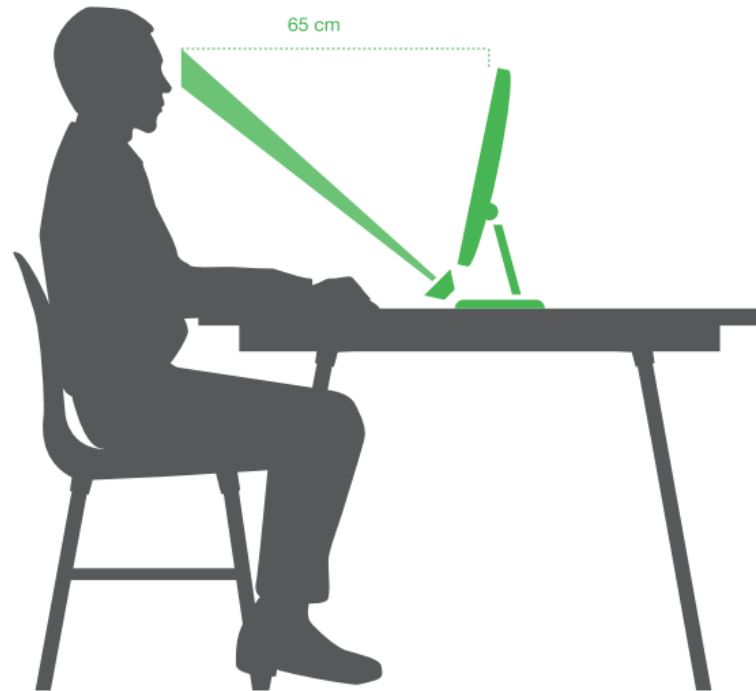


Figure 2 - Gazept GP3 Tripod Setup

4 Software Setup

The software is available to download from the Gazept website here: <http://gazept.com/downloads/>. A password is required to download the software and will be sent to you at the time of purchase.

The Gazept Control software performs the data collection and provides the data to software clients such as Gazept Analysis. The software also operates the data server which provides data to third-party programs through the Open Gaze API.

4.1 Gazept Control Main Window

There are only a few buttons needed to control the Gazept hardware:

- **Calibrate:** Start the eye-tracker calibration process
- **Gaze pointer:** Move mouse cursor wherever you look (block the sensor to get back control)
- **Select Screen:** For multi-monitor systems, selects the active screen
- **Update Rate:** Select between 60 Hz and 150 Hz data rate (GP3 is 60 Hz only)
- **Biometrics:** Toggle on/off biometrics data capture
- **Settings:** Configuration settings (described below)

If a GP3 or GP3HD eye tracker is found, the captured face image will be displayed along with feedback on the correct head distance. The top indication bar shows **Close** to **Far** with the ideal head depth in the middle of the bar.

System feedback information is provided through the bottom status bar:

- **Frame rate:** Should be 62 Hz (~16.6ms) or 150 Hz (~6.7ms). If the frame rate is lower you may need more CPU power for proper operation
- **Server:** Indicates how many clients are connected and if data is being transmit. Double click to set the TCP/IP port for API communication (must match Analysis).
- **IPD:** The inter-pupillary distance the internal system model is using. If real-world pupil diameter measurements are need see calibration below.
- **Information:** Indicates the software version number, hardware serial number, USB connectivity (USB2 or USB3 required for GP3HD) and # of eye trackers.

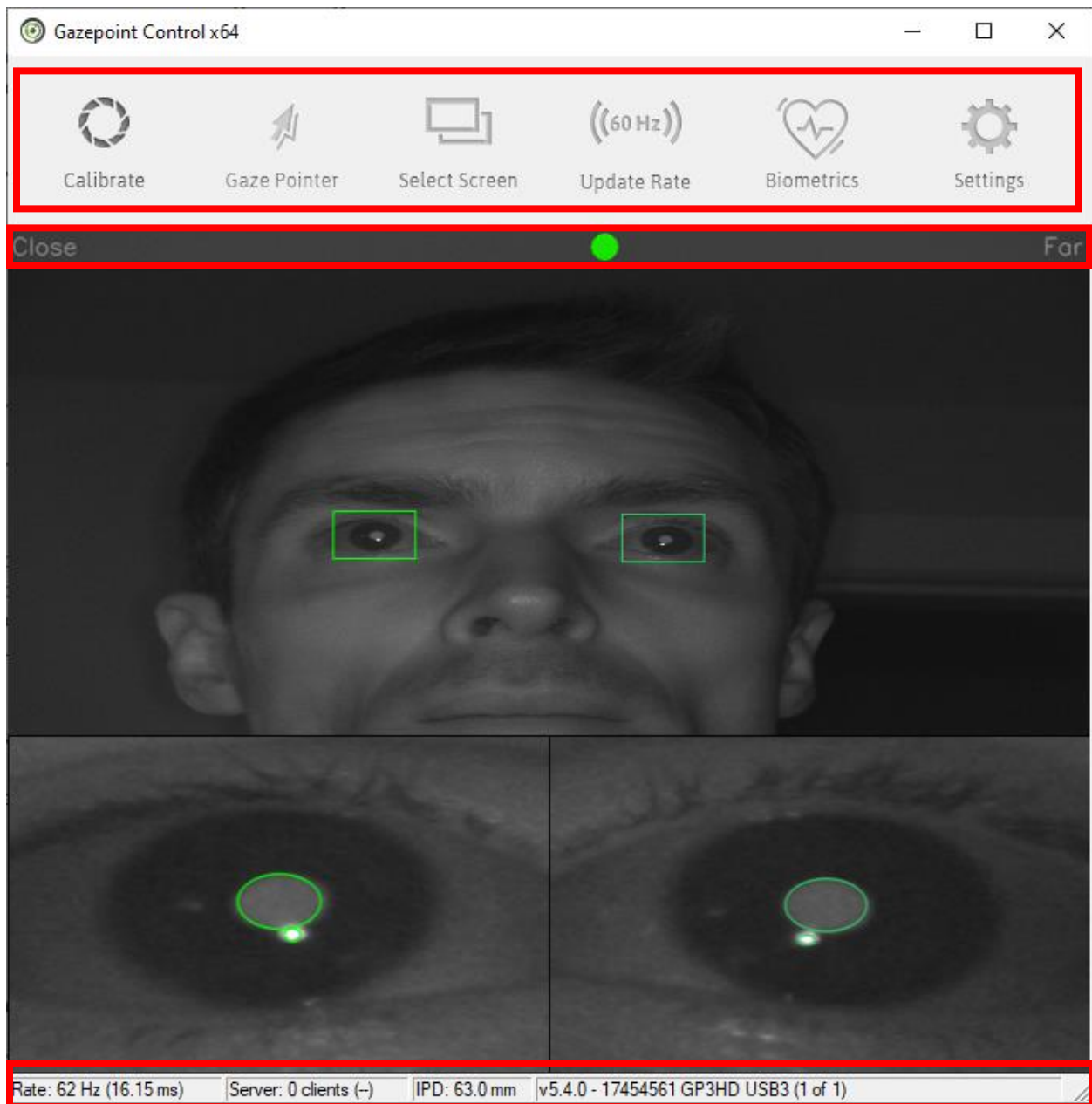


Figure 3 - Gazepoint Control Main Interface

4.2 Gazepoint Control Settings Window

- **Enable Auto Gain:** Enable if the subject has very bright or very dim pupils and the system has difficulty initially locking. The camera gain will sweep from low to high until pupils are found.
- **Monocular Tracking:** Force tracking on only one eye. Assign visible eye as Left or Right.
- **Enable Auto Switch:** If multiple eye trackers are connected, automatically select the eye tracker on the screen being viewed by the user.
- **Next Tracker:** If multiple eye trackers are connected, select the next eye tracker.
- **Eye Control Assistant:** To use Gazepoint eye-trackers with Microsoft Eye Control, run the Eye Control assistant to connect Control to the Microsoft system.
See the following for details on Eye Control:

<https://support.microsoft.com/en-us/help/4043921/windows-10-get-started-eye-control>

- **Minimize to Tray:** When Control is minimized (such as when using Eye Control) the icon will reside in the tray next to the clock rather than the lower taskbar.
- **Cursor Smoothing:** The moving window average filter length when using gaze (APOG) as a cursor and Windows Eye Control (default 15 samples).
- **API Port:** The TCP/IP communication port used by the API (default 4242).
- **API Address:** The TCP/IP communication address used by the API.
- **Mobile Port:** The TCP/IP communication port used to calibrate a mobile device using the webpage (default 4243).
- **Mobile Status:** The connection status of the mobile calibration webpage.

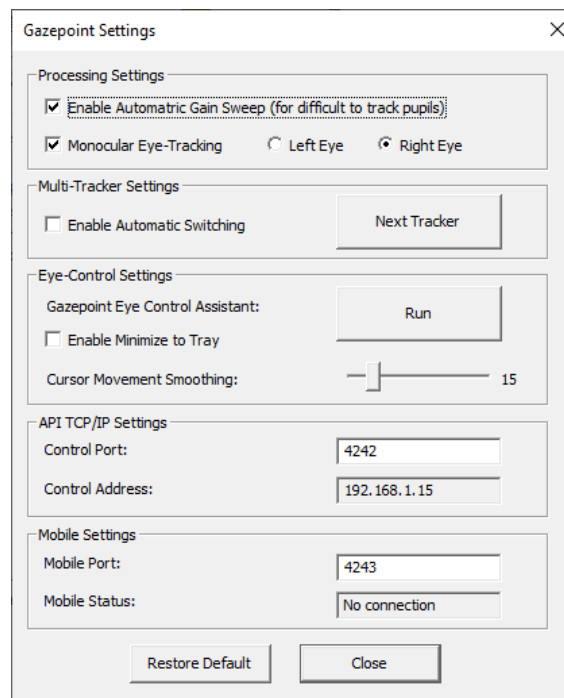


Figure 4 - Gazepoint Control Settings Interface

4.3 Gazepoint Control Calibration Window

When the calibration process begins, the screen will go blank and a calibration marker will move through five positions on the screen. Simply look at the marker at each of the calibration positions. After calibration a green point-of-gaze estimate will be drawn on the screen to check the calibration accuracy by observing points on the display. If the calibration is not satisfactory, a second calibration will often improve the results, as first-time users may not have followed the calibration dots well.

- Press 'C' to perform the calibration again.
- Press '5' to start using the five-point calibration process. This is the fastest calibration which provides good accuracy.
- Press '9' to start using the nine-point calibration process. In some circumstances a little more accuracy may be desired, traded off with a slightly longer calibration.
- Press '1' to start a one-point calibration. This uses a default set of values for calibration and does a minor correction with the 1 point. This is the fastest calibration, but may be VERY inaccurate depending on how different the system setup and subject are from the default calibration.
- Press 'U' to undo the calibration and reload the last calibration ('U' toggles between the current calibration and the previous calibration).
- Press 'S' to enable a short tone to play at each calibration point.
- Press '+' or '-' to increase or decrease the calibration animation times or 'D' to load the default times. The default values are optimal for most circumstances. For children a slower speed might improve the calibration performance.

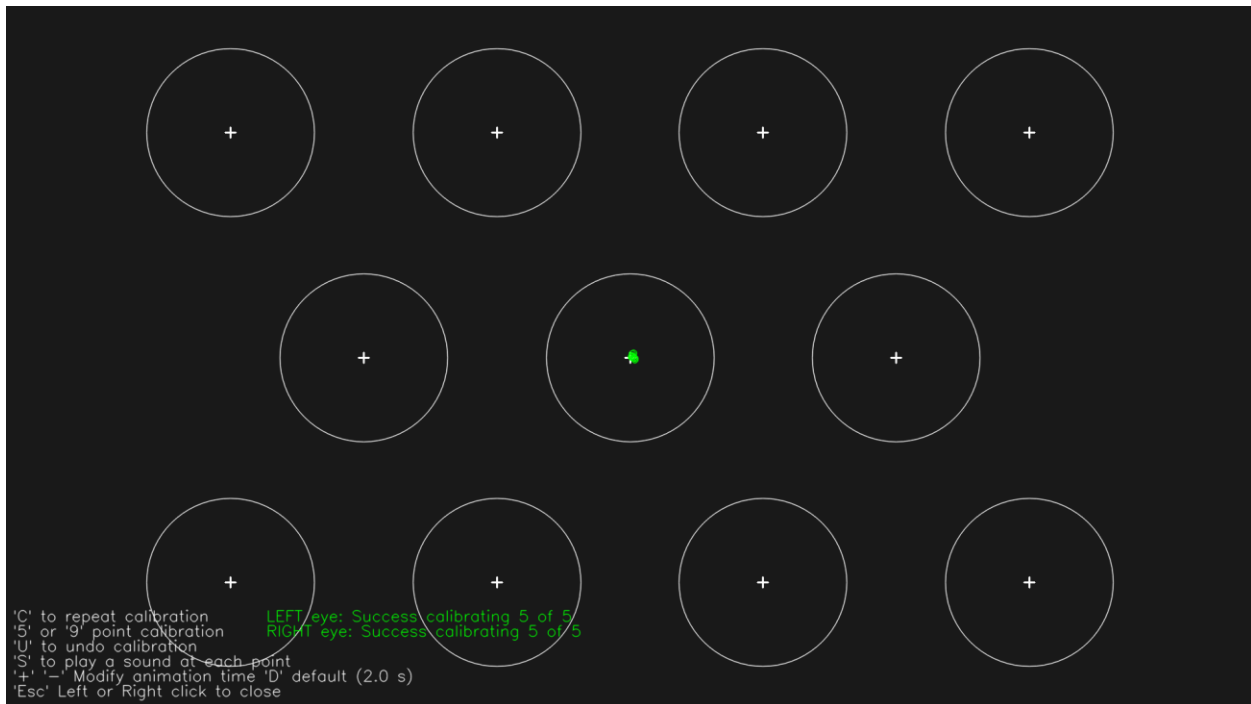


Figure 5 - Gazepoint Control 5-Point Calibration Results

4.4 Gazepoint Control Calibration Customization

It is possible to replace the default calibration animation circles with custom images and sounds. To replace a calibration point, place the custom PNG image and MP3 audio file in the **Gazepoint** subfolder in the **Documents** folder on the computer, typically: **C:\Users\???\Documents\Gazepoint**, where ??? is the name of the Windows computer user.

The audio file should be named **CalibPoint1.mp3** and the image file named **CalibPoint1.png** for point 1. Replace the number with 2, 3, 4, 5, etc for subsequent calibration points. For the best look use a square image, with the image background color RGB=25,25,25 which will blend with the calibration window. Sample calibration points can be found in the installation folder under **calibpoints**.

4.5 Gazepoint Control IPD Calibration

To increase the accuracy of the pupil diameter measurements, a calibration of the inter-pupil distance (IPD) is possible by imaging a marker of known size during calibration. Print the marker below and ensure the width and height are as close to 11 mm as possible. Some printers do not print exactly and so it is best to measure after printing with a pair of calipers or ruler. Using a small strip of tape affix to the forehead between the eyes. During calibration press 'm' to confirm the marker has been identified (outlined in red). Redo calibration as normal and the IPD should be calculated.



Figure 6 - Gazepoint Control IPD Calibration Marker

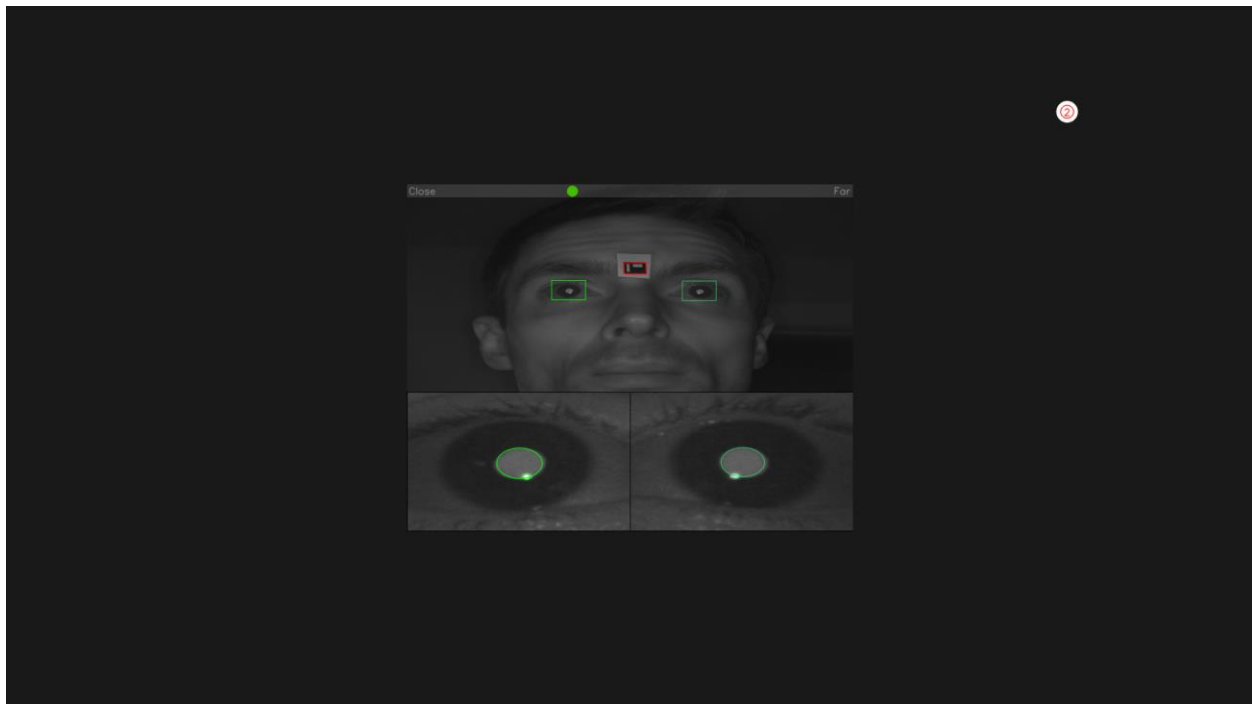


Figure 7 - Gazepoint Control Calibration Showing IPD Marker Tracked

4.6 Lab Streaming Layer

A lab streaming layer (LSL) app is included in the Gazepoint software installation directory under `Gazepoint/demo/ls/LSLGazepoint.py`. The Gazepoint LSL app is a Python script which streams data from Gazepoint Control to the LSL recorder.

The Gazepoint LSL app opens two LSL data streams, `GazepointEyeTracker` and `GazepointBiometrics`. The `GazepointEyeTracker` stream contains point-of-gaze fixation gaze data determined by the Gazepoint fixation filter. The `GazepointBiometrics` stream contains dial, GSR, and heart rate data.

In order to run the Gazepoint LSL app, first ensure PyLSL is installed on your PC. Next, open Gazepoint Control. You can then run `LSLGazepoint.py`, and start using LSL to stream eye gaze and biometrics data from Gazepoint Control.

5 Demo Programs and Source Code

A number of example demo programs and source code are provided to get you started quickly using the Open Gaze API. These files can be found in the Gazepoint software installation folder, typically:

For 32bit OS: `C:\Program Files\Gazepoint\Gazepoint\demo\`

For 64 bit OS: `C:\Program Files (x86)\Gazepoint\Gazepoint\demo\`

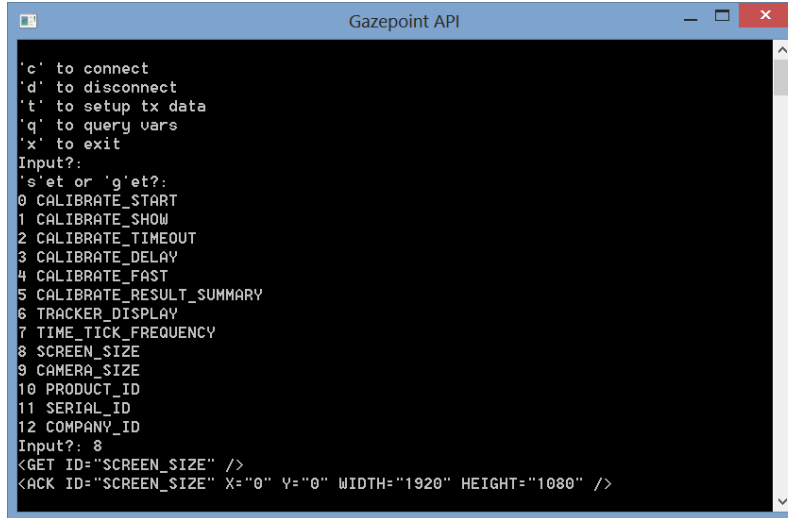
If you wish to compile these programs, it is best to copy the demo folder to another location such as the desktop or `c:\temp\`, as your operating system will prevent you from creating compile files in the "Program Files" folder.

5.1 GPClient Class

The `GPClient` class in the `\Demo\Include\` folder is an MFC based class which simplifies all tasks needed to use the API. This class is used for all Gazepoint software projects which communication using the API.

5.2 C++ apiclient

The `apiclient` uses the `GPClient` Class and enumerates the API commands so you can send them one at a time. This program is great for watching what commands look like as you send them back and forth with the server.



```
Gazepoint API
'c' to connect
'd' to disconnect
't' to setup tx data
'q' to query vars
'x' to exit
Input?:
's'et or 'g'et?:
0 CALIBRATE_START
1 CALIBRATE_SHOW
2 CALIBRATE_TIMEOUT
3 CALIBRATE_DELAY
4 CALIBRATE_FAST
5 CALIBRATE_RESULT_SUMMARY
6 TRACKER_DISPLAY
7 TIME_TICK_FREQUENCY
8 SCREEN_SIZE
9 CAMERA_SIZE
10 PRODUCT_ID
11 SERIAL_ID
12 COMPANY_ID
Input?: 8
<GET ID="SCREEN_SIZE" />
<ACK ID="SCREEN_SIZE" X="0" Y="0" WIDTH="1920" HEIGHT="1080" />
```

Figure 8 - Gazepoint API Client example program

5.3 C++ Template

The *template* project is a simple project which illustrates connecting to the server, sending data, and printing incoming data to the screen. These are good starting points for developing your own C++ applications.

5.4 Matlab

Sample source code showing the API use in a Matlab programming language.

5.5 Other Languages

Since the API uses TCP/IP, any language with sockets can communicate with the server. Please contact us if you would like to see some sample code for a language not listed here.

6 Troubleshooting Tips

6.1 Difficulty tracking very young or elderly subjects

If the system is having difficulty tracking young subjects eyes (typically due to very bright pupil responses), enable the Automatic Gain Sweep in the Settings dialog. The gain sweep option cycles the system gain through the full range of values to try to catch problematic eyes. This option may also be used for elderly eyes which may exhibit a dim bright pupil response.

6.2 Difficulty tracking users with glasses

If the system is having difficulty tracking a subject wearing glasses, try tilting the unit upwards at a slightly steeper angle, which may also require the user to sit slightly higher. The steeper angle prevents the infrared reflections off the surface of the glasses from returning to the camera. In the figures below, the image on the left shows potentially problematic reflections, and the image on the right shows the result of angling the eye tracker slightly steeper, moving the reflections lower and away from the pupils.

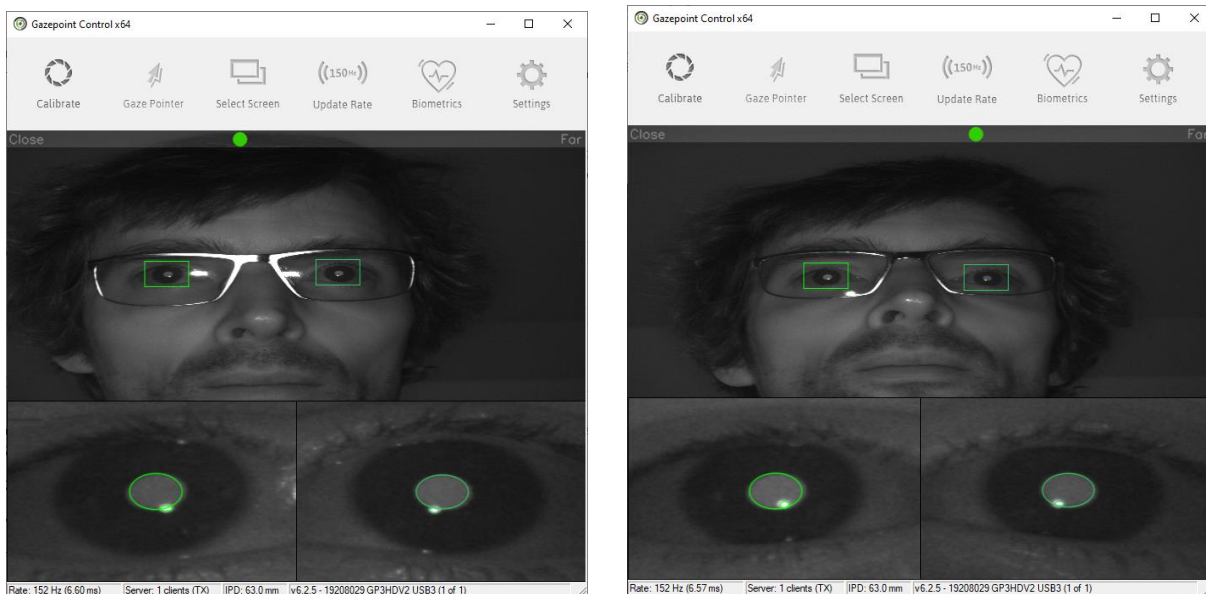


Figure 9 – Glasses reflections and mitigation

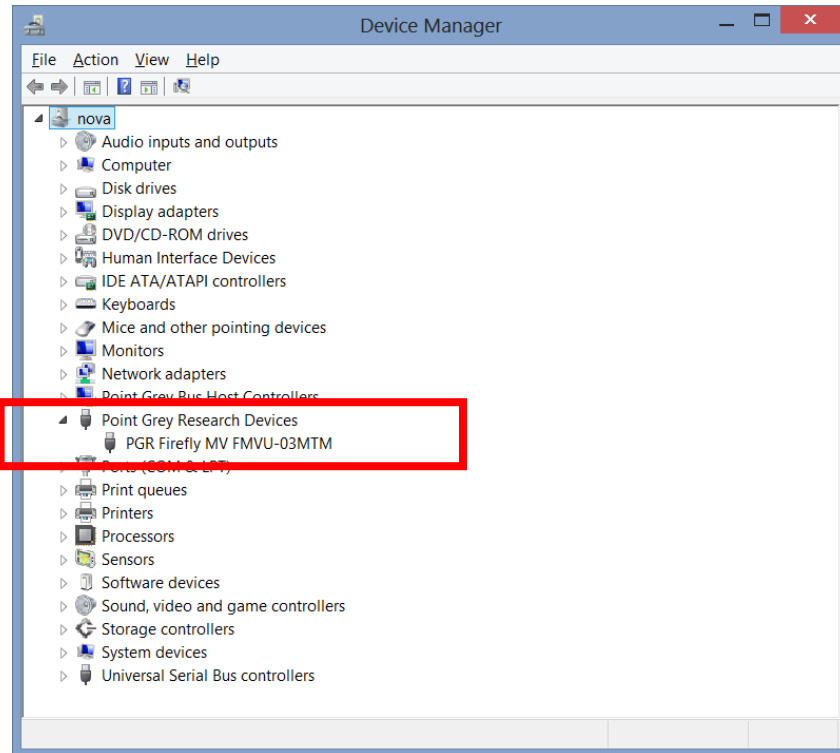
6.3 Camera Driver

If the eye-tracker is plugged in before the software is installed, sometimes the camera can get labelled as an 'Unknown Device' in the Windows Device Manager. If you think this is the case, though the device manager and look for the unknown device, right-click and select update driver, then point to the folder (Win7 or Win8):

For 32bit: *C:\Program Files\Gazepoint\Gazepoint\driver\Win8*

For 64bit: *C:\Program Files (x86)\Gazepoint\Gazepoint\driver64\Win8*

When the camera driver is installed successfully, it should be listed as a Point Grey Research device as shown in the figure below.



6.4 Why doesn't my GP3 appear to be Working?

Dim red lights not visible behind the black plastic on the front of the eye-tracker:

Check that power is supplied via the second USB cable; ensure that Gazepoint Control is running; kill any extra Gazepoint Control processes.

The camera window has a strange split image:

This is a known bug that occurs infrequently with the Firefly camera on the first start up of the PC or installation of a new version. Simply restart the Gazepoint Control software to solve this issue.

The camera shows my eyes properly but the GP3 doesn't lock onto my eyes:

A number of artefacts can throw off the GP3's eye-tracking algorithm:

- Sunlight has a lot of infrared content that can easily wash out the infrared LED sources; try to work in environments with halogen or fluorescent lighting. Dark environments work well too.
- Hard contact lenses can shift after a blink which can cause difficulty in tracking
- Soft contact lenses that are too dirty can reduce the specular reflections used to track eye movement. Use only clean contact lenses.
- Glasses that are dirty or scratched can cause difficulty in tracking, as well as some shiny metal frames. Glasses work best when the angle from the GP3 unit to the face is relatively steep (i.e. move your head higher and closer to the monitor and tilt the unit up).
- Some makeup, such as glitter, can lead to spurious reflections. Avoid such makeup.

The calibration isn't working:

Try a few times as some users need to see the process once before understanding how it works. Ask the user to try to focus on the dot and not to talk while calibrating. Some people anticipate where the dot will move and this throws off the calibration.

6.5 Why isn't the GP3HD running at 150 Hz?

Ensure that you have connected the eye tracker to a USB 3.0 port. You can verify by looking at the bottom right of the Control software to see what USB connectivity was detected.