Contents

1 Preface ................................................................................................................................. - 1 -
2 Cautions ............................................................................................................................... - 1 -
3 Product List .......................................................................................................................... - 1 -
4 Hardware Specification ....................................................................................................... - 2 -
5 Computer Configuration Requirements .............................................................................. - 2 -
6 Assembly and Disassembling ............................................................................................ - 2 -
   6.1 Guide Video ..................................................................................................................... - 2 -
   6.2 Assembly ........................................................................................................................ - 2 -
   6.3 Disassembling ................................................................................................................ - 4 -
   6.4 Assembly of Vision Corrective Lens ............................................................................ - 5 -
   6.5 Disassembling of Vision Corrective Lens ..................................................................... - 5 -
7 Software Download and Installation ................................................................................... - 5 -
   7.1 Download ....................................................................................................................... - 5 -
   7.2 Installation ..................................................................................................................... - 5 -
   7.3 Environment Setup ......................................................................................................... - 9 -
   7.4 Startup ........................................................................................................................... - 9 -
8 User Management ............................................................................................................... - 10 -
   8.1 Create User .................................................................................................................... - 10 -
   8.2 Delete Current User ........................................................................................................ - 11 -
   8.3 Switch User ................................................................................................................... - 11 -
9 Eye Mode Option ................................................................................................................ - 11 -
   10 Calibration ...................................................................................................................... - 12 -
   10.1 Device Adjustment and Gaze Point Verification ......................................................... - 13 -
   10.2 Pupil Alignment .......................................................................................................... - 14 -
   10.3 Calibration ................................................................................................................... - 14 -
   10.4 Verification .................................................................................................................. - 15 -
   10.5 Exit ............................................................................................................................... - 15 -
11 Eye-Tracking Applications ................................................................................................. - 15 -
   11.1 Foveated Rendering .................................................................................................... - 16 -
   11.2 Eye Control Interaction ............................................................................................... - 16 -
   11.3 Eye Movement Data Analysis ..................................................................................... - 17 -
1  Preface

Dear users,
Thank you so much for choosing 7invensun VR eye tracking module aGlass-vi-1. aGlass-vi-1 is only adapted for VR HMD HTC Vive. Please read the instructions carefully before use to better exert the superior performance of the product.

2  Cautions

- Please keep or use this product at normal temperature.
- Do not expose this product in rain or moisture.
- Do not throw this product to avoid any damage.
- Do not disassemble, repair or reform this product by yourself.
- Do not clean this product with any chemical solvent.
- Do not throw away and do not put it in high temperature (higher than 60°C) or fire to avoid danger.

3  Product List

1)  aGlass module for left eye
2)  aGlass module for right eye
3)  Myopic lens : 3 pairs (200 degree, 400 degree, 600 degree)
4)  USB key
5)  Lens disassembly tool
And:

- Lens cleaning cloth
- USB cable
- User manual

4 Hardware Specification

- VR Device Adapted: HTC Vive
- Precision: < 0.5°
- Frame frequency: 120Hz
- Delay: < 10ms
- Interface: USB 2.0, one end with Type B, one end with Type C
- FOV: >110°

5 Computer Configuration Requirements

- Desktop Video Card: GeForce GTX 970 or higher
- Laptop Video Card: GeForce GTX 980 or higher
- CPU: Intel Core i5-4590 or higher
- Memory: 8G or more
- Interface: 3 USB 3.0 interfaces, 1 HDMI 1.3 interface
- OS
  - 64bit Windows 7
  - 64bit Windows 10

6 Assembly and Disassembling

6.1 Guide Video

Please open the web site www.aglass.com/user. The video on the web has the detailed process demonstration of assembly and disassembling of the product.

6.2 Assembly

1) First of all, on the basis of ensuring the module being in good condition, unpack the external package and place the module on a stable table in a gentle manner.

2) Hold HTC Vive in the front, direct the inner side at yourself. The operation shall be done with eyes level.

3) Turn the lens distance knobs on both sides of HTC Vive to the maximum. When it reaches about to the maximum, turn the knob gently. Be careful to avoid overexertion damage.
4) Turn the IPD (interpupillary distance) knob beneath HTC Vive clockwise to the maximum. When it reaches about to the maximum, turn the knob gently. Be careful to avoid overexertion damage.

5) Support the lower part of the apparatus with left hand, with eyes directed to the inner side horizontally. Break apart the nose rest with thumb and press it without loosening, the other four fingers support the apparatus stably.

6) Pick up the prepared left eye aGlass module with right hand. Place the narrow side upward into between the HTC Vive face cushion and lens. Then place the wide side into it while turning the module clockwise. Adjust position of the module until it is fixed on the position beneath the face cushion above lens. It shall be ensured that the narrow side is placed on the inner side, and the wide side on the outer side (in conformity to the inner lowness and outer highness of the radian of aGlass module).
7) Assembly the right eye module as the same method, but the turning direction is anticlockwise when put the module into the HTC Vive.

8) Open the lid above the HTC Vive, and connect the USB Type B end to the reserved USB Socket, and make the cable pass through the wire guide.

9) Connect the USB Type C end to aGlass eye tracking module and ensure it firm.

6.3 Disassembling

1) First of all, place HTC Vive on a stable table in a gentle manner.

2) Hold the HTC Vive in the front, direct the inner side at yourself. The operation shall be done with eyes level.

3) Turn the lens distance knobs on both sides of HTC Vive to the maximum. When it reaches about to the maximum, turn the knob gently. Be careful to avoid overexertion damage.

4) Turn the IPD (interpupillary distance) knob beneath HTC Vive clockwise to the maximum. When it reaches about to the maximum, turn the knob gently. Be careful to avoid overexertion damage.

5) Support the lower part of the apparatus with the left hand, with eyes directed to the inner side horizontally. Break apart the nose rest with thumb and press it without loosening, the other four fingers support the apparatus stably.
6) Firstly, lift up the narrow side of left eye aGlass module, until it loosens from the HTC Vive lens. Then turn it anticlockwise gently, until the bottom part of aGlass module loosens and emerges, take out the whole module. Take out the right eye aGlass module on the other side in the same way.

7) After the aGlass module is taken out and maintained, place it in clean and dampproof area away from light, for next-time use.

6.4 Assembly of Vision Corrective Lens

1) From the three pairs of lens, choose the one fitting yourself.

2) Make sure that your hands are clean, take out the lens. With convex surface of the lens downward, place the lens into the center of VR eye-tracking module in a stable condition according to the shape of the lens gently.

6.5 Disassembling of Vision Corrective Lens

1) Firstly, place HTC Vive on a stable table in a gentle manner.

2) Make sure that both hands and table top are clean, take out lens disassembly tool. Choose the curved thin end, then, at the groove on the inner side of module, pry the inner side gently, to loosen the lens, then take out the lens with finger pulp gently.

3) The lens shall be washed and wiped clean, before it is placed in the box, for use next time.

7 Software Download and Installation

Note: The screen shots in this manual are under Windows 10.

7.1 Download

Runtime software download site: www.aglass.com/download.

7.2 Installation

After the download, double click Setup.exe to start installation.

Note: You must login the Windows OS and install aGlass Runtime by administrator authority, or the aGlass Runtime may malfunction.

The first step is welcome, operations:

➢ Next: continue to next step.
➢ Cancel: stop the installation.

The interface is shown below:
The next step is license agreement, operations:
- Next: continue to next step if you choose “I agree to the terms of this license agreement”.
- Back: return to the previous step.
- Cancel: stop the installation.

The interface is shown below:
The next step is installation path choosing, operations:

- **Set installation path:** input the path directly or click Change to choose the path.
- **Next:** continue to next step.
- **Back:** return to the previous step.
- **Cancel:** stop the installation.

The interface is shown below:

![Installation Folder Interface](image)

The software will be installed in the folder listed below. To select a different location, either type in a new path, or click Change to browse for an existing folder.

**Install aGlass Runtime to:**

C:\Program Files\aGlass

**Space required:** 97.2 MB

**Space available on selected drive:** 83.40 GB

The next step is ready to installation, operations:

- **Next:** continue to next step.
- **Back:** return to the previous step.
- **Cancel:** stop the installation.

The interface is shown below:
The next step is installation, you should wait for a moment while the program is installing, operation:

- **Cancel**: stop the installation.

The interface is shown below:

The next step is installation complete, operation:

**Finish**: complete and exit the installation.
The interface is shown below:

7.3 Environment Setup

For aGlass Runtime working, Steam and SteamVR is need to be installed. You can download Steam and SteamVR from [http://steamcommunity.com/](http://steamcommunity.com/) and install them.

For aGlass Runtime working correctly, follow the steps below:

- HTC Vive assembly correctly according to its user manual
- aGlass module is assembled and connected correctly
- aGlass USB key plugs in the computer correctly
- Start SteamVR (Note: Ensure that SteamVR starts and works correctly before aGlass Runtime)
- Start the aGlass Runtime

7.4 Startup

You can launch aGlass Runtime by click shortcut icon [G], and aGlass Runtime icon will show up inside the system tray, and a balloon message as shown below:

The balloon message will be disappear in 3 seconds.
The functions of aGlass Runtime includes mainly calibration, users management, eye mode setup and running demo.

Right click the aGlass Runtime system tray icon, menu will be display as shown below:

8  User Management

8.1  Create User

There is a default user “Guest” in the system, but it is recommended for users to create own account, so as to use fixation points more accurately, and also to be convenient for multiple users.

Click “Current User -> Create a User”, you can create a new user account.
8.2 Delete Current User

If you hope to delete some user account, please switch it to the current user at first, then click “Delete Current User”.

The user will be deleted if you click confirm.

8.3 Switch User

During the process, if you want to change the user, account switch is required. Because different users’ calibration data varies from each other, and if employing others’ account, maybe the gaze point will be incorrect, resulting in poor performance.

9 Eye Mode Option

After the module is assembled, click on “Eye Mod” menu of Runtime to show the options, please choose the option according to your module assembled.
10 Calibration

Because people’s eye feature is different from one another, calibration is needed for better use of aGlass after user creation and eye mode setup. You can choose user account Guest and make no calibration of course, but it’s recommended for you to create your own user account and calibration.

Click “Calibration” in menu, “9-Point Calibration” and “3-Point Calibration” will be displayed. 9-point calibration is more accuracy than 3-point calibration and 3-point calibration is rapider than 9-point calibration. You can choose according to the up-application’s request for accuracy.

After clicking “9-Point Calibration” or “3-Point Calibration”, you can take on the HTC Vive HMD and see the scenes on the HMD’s screen, then you should operate according to the tips on the scenes.

You can use keyboard or HTC Vive controllers to operate the calibration. HTC Vive controllers buttons definition:

1. Menu button
2. Trackpad
3. System button
4. Status light
5. Micro-USB port
6. Tracking sensor
7. Trigger
8. Grip button
10.1 Device Adjustment and Gaze Point Verification

Device adjustment and gaze point verification scene displays in HTC Vive HMD first. In the scene, there are some verification points and the dots indicating gaze point and the tip for adjusting device, as shown below:

Please adjust the visual range, pupillary distance and wearing gesture to make your view clear.

The distance between peripheral circles and central circle will be the distance between calibration points. Check if your eyes can see all the circles in the view. If you can’t see the peripheral circles, you can click downward key on keyboard or trackpad downward on HTC Vive controller to reduce the distance of the circles.

If you have already done the calibration before, you can check if the calibration is accuracy. If the gaze point has been accuracy, click ESC on keyboard or menu button on HTC Vive controller to exit the calibration procedure.

If you want to calibrate, click the space on keyboard or trigger on HTC Vive controller to enter the next scene “Pupil Alignment”.

The operation methods in this scene sums up as follows:

<table>
<thead>
<tr>
<th>Functions</th>
<th>HTC Vive Controller</th>
<th>Keyboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase the distance between the</td>
<td>Trackpad Upward</td>
<td>Upward</td>
</tr>
<tr>
<td>peripheral circles and central circle.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decrease the distance between the</td>
<td>Trackpad Downward</td>
<td>Downward</td>
</tr>
<tr>
<td>peripheral circles and central circle.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revert to default distance between the</td>
<td>Trackpad Rightward</td>
<td>Rightward</td>
</tr>
<tr>
<td>peripheral circles and central circle.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exit the calibration</td>
<td>Menu button</td>
<td>ESC</td>
</tr>
<tr>
<td>Next step</td>
<td>Trigger</td>
<td>Space</td>
</tr>
</tbody>
</table>
10.2 Pupil Alignment

The interface of “Pupil Alignment” is shown below:

Users adjust the device to move the white spot into the center of the circle. When the white spot is within the circle, the circle will turn green, as shown in the picture. Then you can click space on keyboard or trigger on HTC Vive controller to continue to calibration.

10.3 Calibration

A tip will appear first, as shown below:

The tip will display for 10 second, then number count backwards 3, 2, 1 display in the center of the scene, and then the first calibration point will appear, as shown below:
Some calibration points will appear in turn in the scene. Please insure that you stare at the red spiral sector center. If you do this, the calibration point will shrink and disappear and move to another position, your gaze should follow it and always stare at the red spiral sector center. During the process, if you don’t stare at the calibration point, the point will not shrink and disappear, but stay there until you stare at it again.

If a calibration point (except for the first one) can’t pass during a long time, you can click W on keyboard or grip button on HTC Vive controller to pass forcibly, or you can wait for 15 seconds to pass.

The quantity of the calibration points depends on the calibration mode you choose. If you choose 9-point calibration, 9 calibration points will appear in turns. If you choose 3-point calibration, 3 calibration points will appear in turns. The next scene “Verification” will appear automatically after all calibration points completed.

10.4 Verification

After the calibration is completed, some verification points and your gaze point identifications will be displayed, so that you can determine whether the calibration is accurate.

If not accurate, click the key R on keyboard or grip button on HTC Vive controller to recalibrate until you are satisfied.

10.5 Exit

You can exit the calibration procedure by clicking the ESC on keyboard or menu button on HTC Vive controller. You can also exit the calibration and run the demo in the meantime by clicking G on keyboard.

11 Eye-Tracking Applications

aGlass-vi-1 provides eye-tracking function for HTC Vive. VR content providers will develop VR games or VR applications with eye tracking. When you play these games, or use these applications, your gaze data will be captured for foveated rendering, eye control interaction or eye movement data analysis.
11.1 Foveated Rendering

Full high-definition screen plays a key role in VR device. The current rendering method has high demand of hardware and high power consumption. The problem which all VR Hardware enterprises face is that the hardware can’t satisfy the requirement of the high-definition rendering. The foveated rendering based on eye-tracking is considered to be the best way to solve the problem.

During the process of imaging in people’s eyes, the foveal vision area is clear and with high visual acuity but only cover 1° ~ 2° view, and the peripheral vision field is blurred. With eye-tracking technology, high resolution rendering can be only carried out in gaze points. In this way, images definition can be obtained, GPU efficiency can be enhanced, hardware demanding can be reduced as well. Meanwhile, foveated rendering matches the feature of the human eyes, so it can also alleviate eye fatigue on certain level.

11.2 Eye Control Interaction

In the real world, we preferentially locate targets by rotating eyes, not moving head. The range in which people preferentially observe and track, is called Eye-Only Range (EOR), which is ±30° horizontal and ±12° vertical averagely. In other words, people are used to observe the world by eyes moving not head moving within ±30° horizontal and ±12° vertical.

However, currently, we have to locate targets by head movements based on motion perception of gyroscope, which will aggravate the sense of vertigo and prolong the procedure of targeting. While, integrating eye-tracking technology into VR devices can avoid forcible head movement, recognize users’ targets rapidly. Besides, in VR games, players can use their eyes to interact with NPC, switch menu and weapons by gaze, etc.
11.3 Eye Movement Data Analysis

In 21 centuries, data is fortune. VR content platform is predicted to be the next data platform and the final media platform. The quantity and value of the platform has huge potential to promotion. Users’ behavior data will become very valuable information fortune for many businesses such as advertising media, content provider and education.

Traditional input methods like mouse and keyboard are not suited for VR. Traditional analysis tools are not suited for VR too. What we can recognize and record are eye-tracking data. So, we can record users’ gaze coordinate, trace and time. We can analyze people’s behavior by these eye-tracking data.

Eye-tracking data will become big data when it is big enough and have big commercial value and research value. The big data can be used in many territories and satisfy many requirements of businesses and research, such as:

- **Marketing region:** E-commercial based on VR will rise and the consumer behavior analysis will become import marketing research. Enterprises can push accurate contents to consumers based on the analysis data.
- **Education region:** Eye-tracking in VR can be used to analyze behavior of learners and trainers, and can be used to correct studying and training behavior, such as students’ learning interests and attention, athletes’ consciousness and ability of cognizance.
- **Academics region:** Eye-tracking data can be used in spatial cognition and task cognition research in total control immersive VR environment.
11.4 Eye Tacking Demo

If you have completed the calibration in aGlass runtime, you can click “Run Demo” in the right-click menu to experience aGlass eye-tracking in VR applications.

The demo menu is shown first:

Under the demo menu view, you can click 1, 2 or 3 on keyboard to enter the first, second or third demo. You can click ESC on keyboard to back to the demo menu.

The first demo demonstrates the foveated rendering. The center of the green circle is your gaze point. The green circle region is high-resolution rendered; the region between the green circle and blue circle is medium-resolution rendered; the region outside of the blue circle is low-resolution rendered. The GPU’s load is reduced. You won’t feel the resolution of the peripheral region is reduced because of the feature of your eyes.

You can switch the circles indicating foveated rendering region by click D on keyboard.

This demo also demonstrates eye control interactions. When you look at some object in the view, those objects have corresponding reactions, for example, when you observe the door of the cabin, the door will open, and when you observe a pumpkin, the pumpkin will jump.

The scene of the demo is shown below:
The second demo demonstrates some eye-control interactions:

- When you observe the NPC, they will communicate with you by text dialog.
- When you observe the shining circle on the path, you will move to the position of the circle.
- When you observe the goods which the NPC sells, the prices of the goods will display above the goods.

The scene of this demo is shown below:

The third demo demonstrates the gaze aim function in game. When you stare at an enemy plane, the plane will be locked. When you click space on keyboard or trigger the flying rocker, your plane will launch tracked missile aiming the locked enemy plane.

You can click R to restart the game.
The scene of the demo is shown below:

12 Troubleshooting and FAQ

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can’t assemble the module into the HTC Vive HMD, what can I do?</td>
<td>Click <a href="http://www.aglass.com/user/">http://www.aglass.com/user/</a>, watch the video of module assembly and disassembling, imitate the operations in the video.</td>
</tr>
<tr>
<td>The calibration options are all gray and have no effect when I click them, what can I do?</td>
<td>Make sure the HTC Vive is power on. Make sure the aGlass module is connected correctly, and connected with HTC Vive by USB cable.</td>
</tr>
<tr>
<td>When calibration start, the computer shows the OpenVR is failed. What can I do?</td>
<td>Make sure the SteamVR is installed. If not, install Stream and SteamVR and check the HTC Vive work correctly under SteamVR.</td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>When calibration start, the computer shows that the USB key is not found, what can I do?</td>
<td>Make sure the USB key is connected correctly, that is, the USB key is plugged in the computer.</td>
</tr>
<tr>
<td>A point can’t pass when I calibration, what can I do?</td>
<td>You can click W on keyboard or grip button on HTC Vive controller to pass forcibly, or wait for 15 minutes to pass automatically.</td>
</tr>
<tr>
<td>I want to take the module out of the HTC Vive, but failed. What can I do?</td>
<td>Click <a href="http://www.aglass.com/user/">http://www.aglass.com/user/</a>, watch the video of module assembly and disassembling, imitate the operations in the video.</td>
</tr>
<tr>
<td>Can I use it wearing glasses?</td>
<td>It’s not recommended because it will be difficult putting glasses into HTC Vive. We supply myopic lens of 200°, 400° and 600°. If it’s not suited for you, you can order customized lens from our company.</td>
</tr>
<tr>
<td>Are there any important matters need attention?</td>
<td>Make sure the HTC Vive power on and connected correctly. Make sure the aGlass module assembly correctly, and the posture is upright not skew. Make sure the nose rest doesn’t impact the assembly and doesn’t shelter the sensor beneath of the module. Make sure the USB work correctly, avoid bad connection. Avoid any obstacles between eyes and HTC Vive lens. Make sure the Steam and SteamVR is installed. Avoid stepping on the HTC Vive cable.</td>
</tr>
</tbody>
</table>

13 Handing of the Waste Electrical

This product should not be disposed with other household wastes at the end of its working life.

To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate this from other types of wastes and recycle it responsibly to promote the sustainable reuse of material resources.

Household user should contact either the retailer where they purchased this product or their local government office, for details of where and how they can take this item for environmentally safe recycling.

Business user should contact their supplier and check the terms and conditions of the purchase contract. This product should not be mixed with other commercial wastes disposal.
14 After Service

1) Consultancies: please read this user manual carefully before using this product. For any problem during using it, you can either contact our company or the local retailer, or call our customer service Hot line: 400-800-1390

2) Exchange service: within exchange time limit, for any indeliberate error during proper use, making sure the product as well as its accessories and package are all not damaged (if the appearance is damaged, it can only be repaired) you can either have it exchanger for a new one or repaired after the error is tested and examined.

3) Warranty service: within the warranty time limit, for any indeliberate error that occurs during proper use, warranty service is free for no charge (the product has warranty service for free within one year; for any deliberate damage, the warranty service should be paid.)

4) Changed warranty service: within three years counting form one year after the date the product was purchased, any error repair will be changed; and user should pay the repair components, freight and labor cost.

5) Any of the below situation is not the warranty service, but we provide changed service.
   a) The warranty date is expired.
   b) The warranty card is altered, or the series number differs from that of the product.
   c) Accidental or deliberate damage is done to the product.
   d) Cannot provide valid warranty card or invoice (other but can prove that it is within the service limit).
   e) Any error damage caused by force majeure such as earthquake, fire, flood, lightning strike etc..
   f) Deliberate assembling, repair or reform without permission form our company.

15 3rd Party Copyright Statement

HTC Vive is brand of HTC, and all rights belong to HTC.
Steam and SteamVR are brands of Valve, and all rights belong to Valve.