Vision Simulator EyesArc v4.0 User Manual

This application is designed to simulate vision through intraocular lenses (IOLs) and to provide images for explaining and demonstrating these to patients. For monofocal IOLs, it allows the adjustment of various parameters such as defocus values and pupil diameter, enabling the presentation of visual simulations corresponding to different refractive indices and actual visual acuities. For multifocal IOLs, it allows for explanations to patients about the differences in vision and the characteristics of dysphotopsia caused by the IOL.

<Required Operating Environment>

The application requires one of the following three environments to function correctly.
*Please note that using environments other than those listed below may result in operational issues.

■ **OS: Windows 10, Browser: Chrome**
If you are using a Windows device (including tablets), please use Windows 10 as the OS and the latest version of Chrome as the browser.

■ **OS: OS X 10.10 (Yosemite) or later, Browser: Safari**
If you are using a Mac, please use OS X 10.10 or later and the latest version of Safari as the browser.

■ **OS: iPadOS 13.1 or later, Browser: Safari**
If you are using an iPad, please use iPadOS 13.1 or later and the latest version of Safari as the browser.

Additionally, this application operates on a web browser, so an online connection is required. Please ensure you have a wired or Wi-Fi connection.

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Vision Simulator EyesArc - About This Application

Through optical simulation and extensive clinical data, it has become possible to predict the full-distance visual acuity of monofocal IOL eyes based on postoperative refractive values and pupil diameter. However, even if postoperative full-distance visual acuity is explained using visual acuity values, patients may not fully understand how they will see in their daily lives. As a tool to clearly explain postoperative vision to patients, EyesArc has developed the Vision Simulator (Vision Simulator EyesArc), which can display everyday scenes on a monitor that reflect full-distance visual acuity.

The development is currently underway to accommodate various conditions, such as defocus for different distances, contrast, pupil size, refractive values, and astigmatism. Regarding multifocal IOLs, which are evolving daily, we have provided default options showing the average vision and characteristics of glare and halos for various IOLs. Although there are still limitations to the conditions and accuracy that can be replicated, we have confirmed that the accuracy is sufficient for clinical use. Therefore, we have made this simulator available to ophthalmology facilities and ophthalmology-related companies in Japan. We hope that by using this simulator, it will help improve postoperative satisfaction and quality of life (QOL) for cataract patients.

Yoji Sasaki, Chairman of the Non-Profit Organization Eyes Arc, Protecting Eyes from UV Rays

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<Regarding the Current Accuracy of the Application>

■ Defocus

We developed a method for measuring visual acuity in a virtual space. Based on this method, we created a correlation chart of visual acuity and defocus values, which is represented on the simulator for visual acuity ranging from 0.2 to 1.2.

■ Contrast

MTF values are measured based on the following reference:
Norrby S, Piers P, Campbell C, van der Mooren M. "Model eyes for evaluation of intraocular lenses." Appl Opt. 2007 Sep 10;46(26):6595-605.
We plan to re-measure the MTF under common conditions and reflect it in the simulator.

■ Glare, Halo, and Starburst (Dysphotopsia)

Tests of photopsia using model eyes were conducted, and the results are reflected in the simulator.

■ Astigmatism

Rather than an expression based on optical simulation, at this stage, it is limited to a representation that increases defocus horizontally at a predetermined intensity.

■ Cataract Symptoms

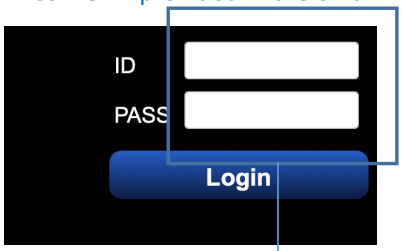
It is limited to expressing general symptoms with varying degrees of severity.

Startup Guide

This tutorial introduces the basic operations.

STEP1

After purchase, enter the ID and PASSWORD provided in the email.



After purchase, log in from the top right of the site to display the start screen.

STEP2

Press the START button to launch the simulator in full-screen mode.
(It is recommended to use it in full-screen mode as a general rule.)

You can access data management (details on Page 28), the user manual (this PDF), and the terms of use from the button at the bottom right.

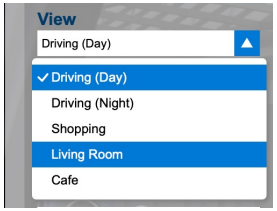
STEP3

When you launch the simulator, the screen shown on the left will be displayed. At startup, the scene is set to "Driving (Day)" and the lens is set to "Monofocal Intraocular Lens (Distance)."

For example, you will notice that while the distance vision is clear, the near vision is defocused, making it difficult to read text on items like wristwatches or steering wheel controls.

From the menu on the right, you can use various functions such as selecting scenes and intraocular lenses, adjusting settings, and recording or retrieving data.

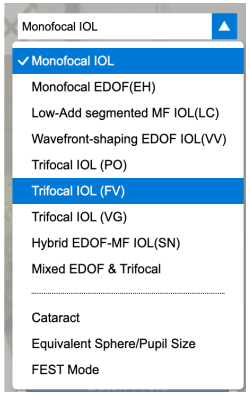
First, try pressing the ▼ button on the scene selection menu at the top right to choose the "Living Room" scene.



STEP4

Once switched to the Living Room scene, you will see that while the intraocular lens for distance remains the same, only the scene has changed.

Next, press the ▼ button on the intraocular lens selection menu to choose the ”Trifocal IOL(FV)”.

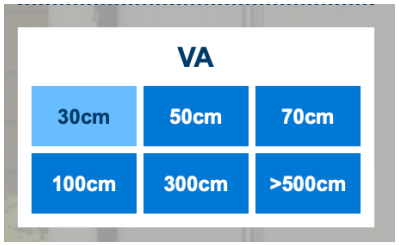


STEP5

The screen changes to show the view with a Multifocal Intraocular Lens +2.75, making it easier to identify near objects and slightly reducing the overall contrast of the screen.

The visual acuity for different distances can be freely adjusted between 0.2 and 1.2. Note that the adjustable focal distance varies depending on the scene.

From the vision menu, try pressing the button for 30 cm.

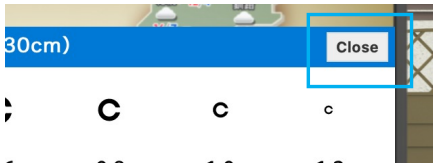


STEP6

Objects at a distance of 30 cm will be displayed in blue, and a slider will appear that allows you to adjust the visual acuity for that area.

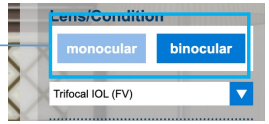
Adjust the visual acuity by moving the slider handle left and right. You can also fine-tune the adjustment in 0.01 units by pressing the ◂ and ▸ buttons on either side.

Once you have finished adjusting, press the Close button to make the slider disappear and reflect the adjusted visual acuity.



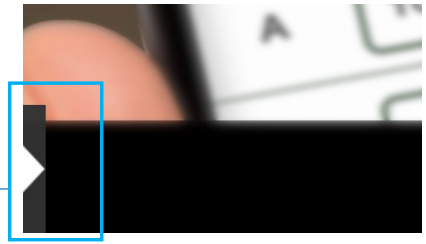
STEP7

You can switch between monocular and binocular view using a button.(Some IOL types are not supported due to insufficient clinical data.)

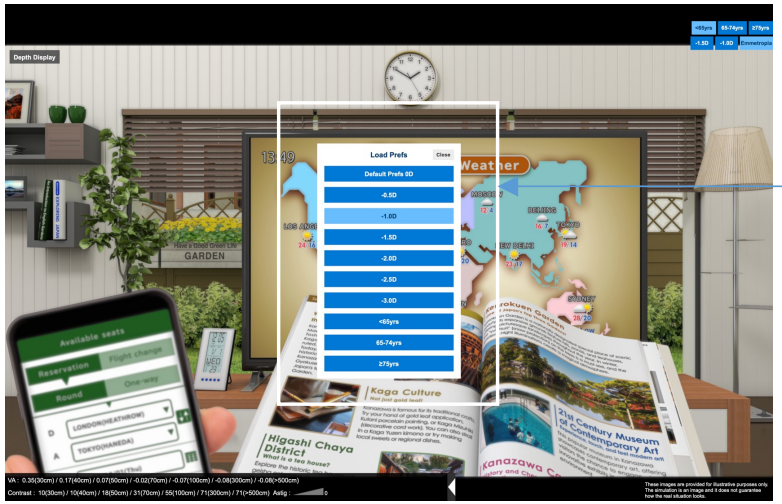


STEP8

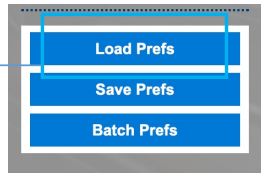
The values for visual acuity and contrast can be reviewed by pressing the ▸ button in the lower left corner, which opens the status bar and displays the list.



STEP9

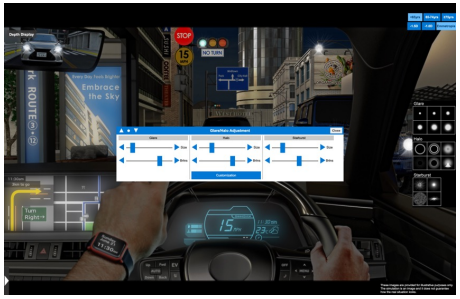


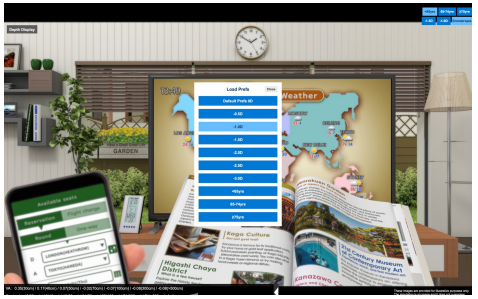
From the Settings menu, you can select vision based on different refractive errors.

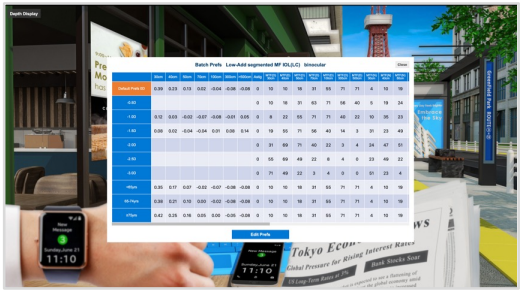


Great job! You have learned the basic operations.

This concludes the startup guide, but there are many other features available.
Please refer to this manual and try them out.







Operation Methods

Here we introduce various setting methods.

Vision Simulator EyesArc - Operation Screen

You can choose from five types of scenes: Driving (Day), Driving (Night), Shopping, Living Room, and Café.

The default setting is Driving (Day).

Driving (Day)

Driving (Night)

Shopping

Living Room

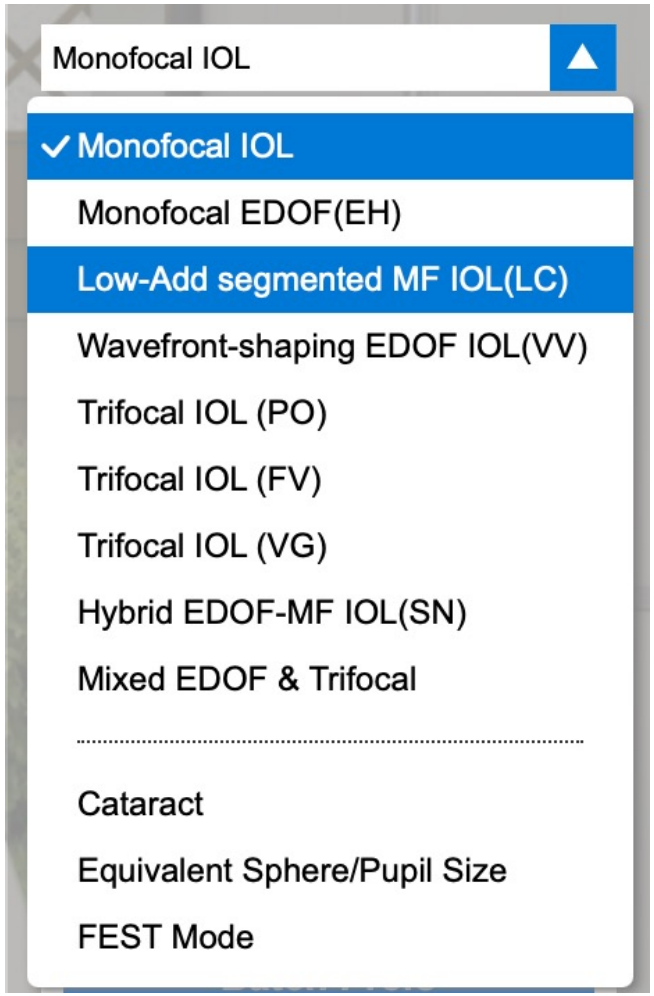
Café

A button that allows you to zoom in and compare different focal distances.

You can choose from various types of IOLs (additional types will be added as needed). Additionally, selecting Cataract allows you to view the vision under cataract conditions. The default setting is Monofocal Intraocular Lens (Distance).

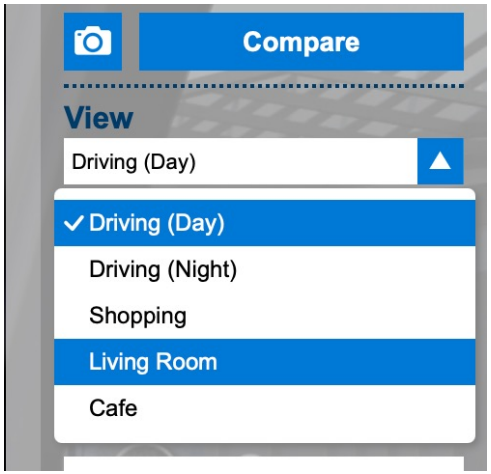
Please note that if you change settings before selecting another lens, the settings will be reset when you return to the original lens.

To save settings, please use the “Save Settings” feature.

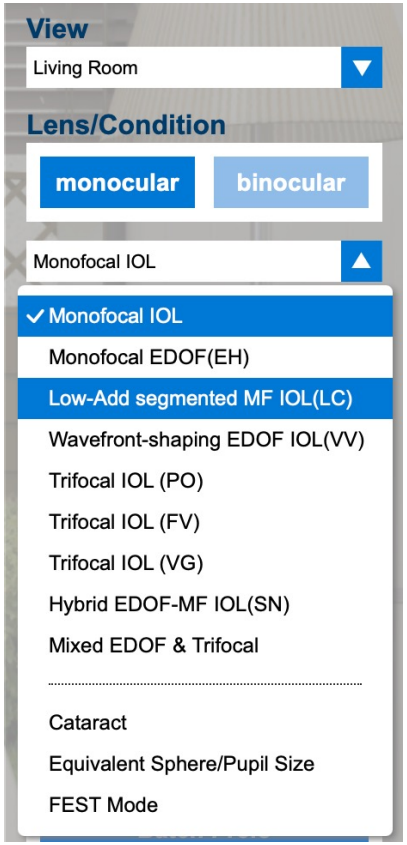


At the start of the application, the scene is set to Driving (Day) and the lens is set to Monofocal Intraocular Lens (Distance). To change these settings, select the scene and intraocular lens from the respective buttons.

*You can choose the order in which you make these selections.

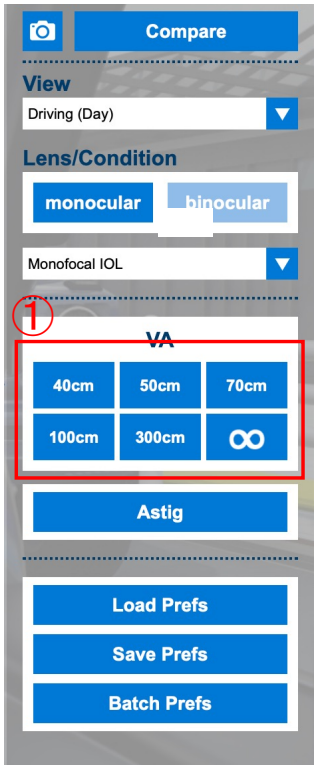


Select Scene



Select IOL/Symptom

1. Press the "Focal Distance Button" for visual acuity, and an adjustment slider will appear in the center of the screen.
2. Move the slider handle left or right to adjust the visual acuity value, which will be reflected on the screen. Set it to your desired value.
3. Press the "Close Button" to confirm the adjustment.

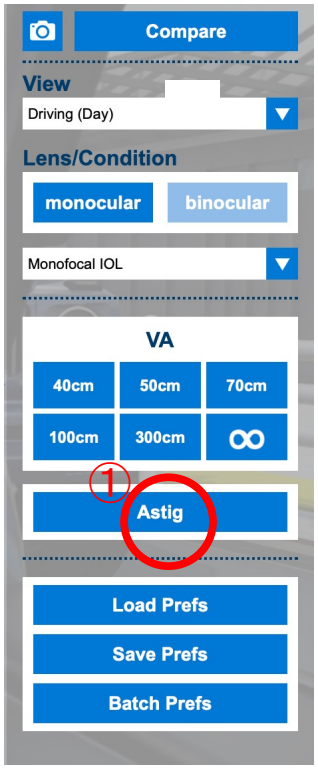


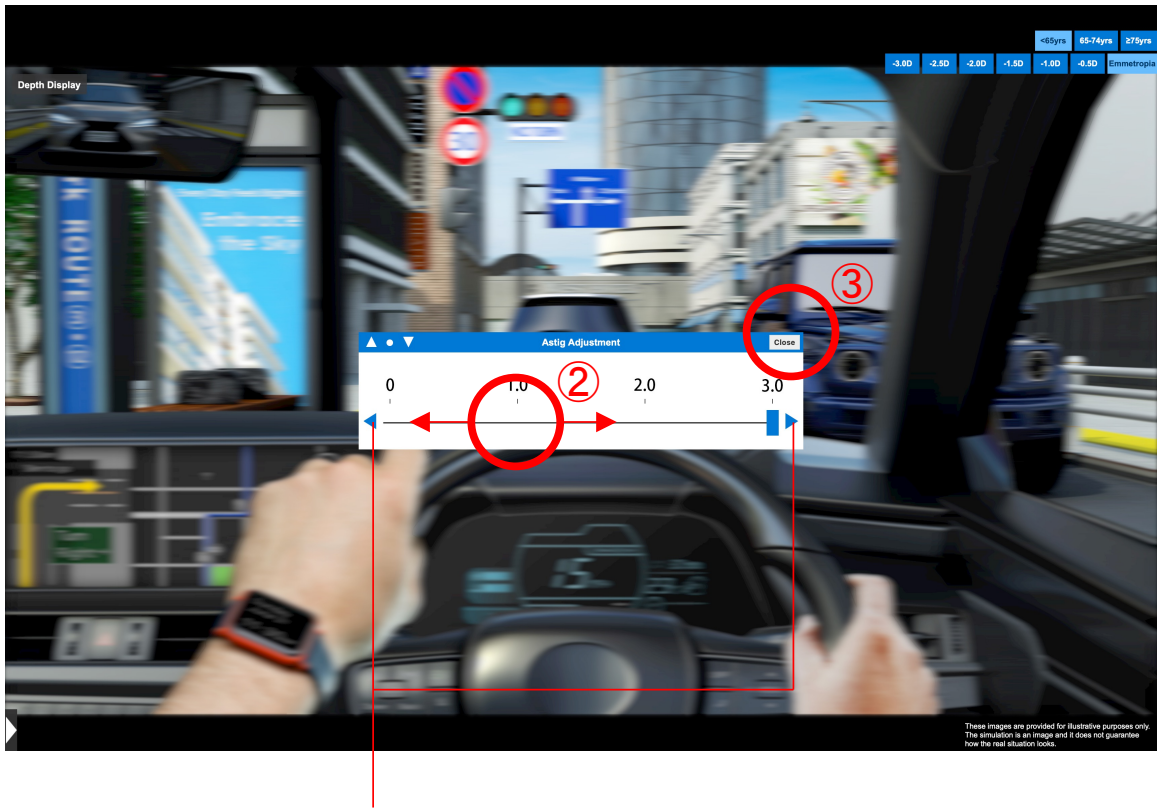
Fine adjustments can be made using the ◂ and ▸ buttons on either end.

1. Press the "Astigmatism Button" to display an adjustment slider in the center of the screen.

2. Move the slider handle left or right to adjust the astigmatism intensity, which will be reflected on the screen. Set it to your desired value. Please proceed slowly as this process can be quite intensive.

3. Press the "Close Button" to confirm the adjustment.





Fine adjustments can be made using the ◂ and ▸ buttons on either end.

1. Press the "Glare & Halo Button" to display an adjustment slider in the center of the screen.

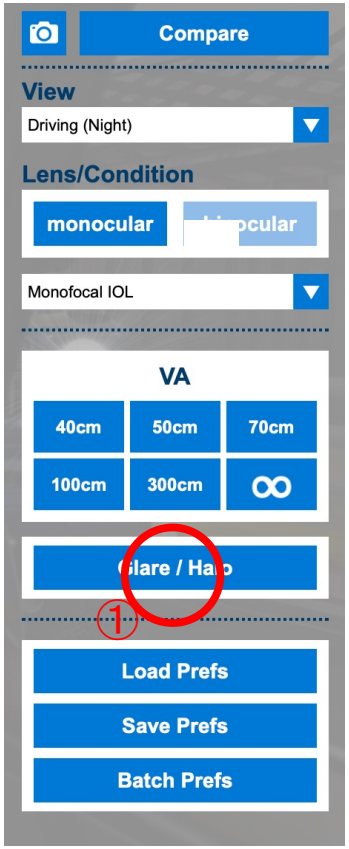
2A. Move the glare slider left or right to adjust the size and brightness of the glare, which will be reflected on the screen.

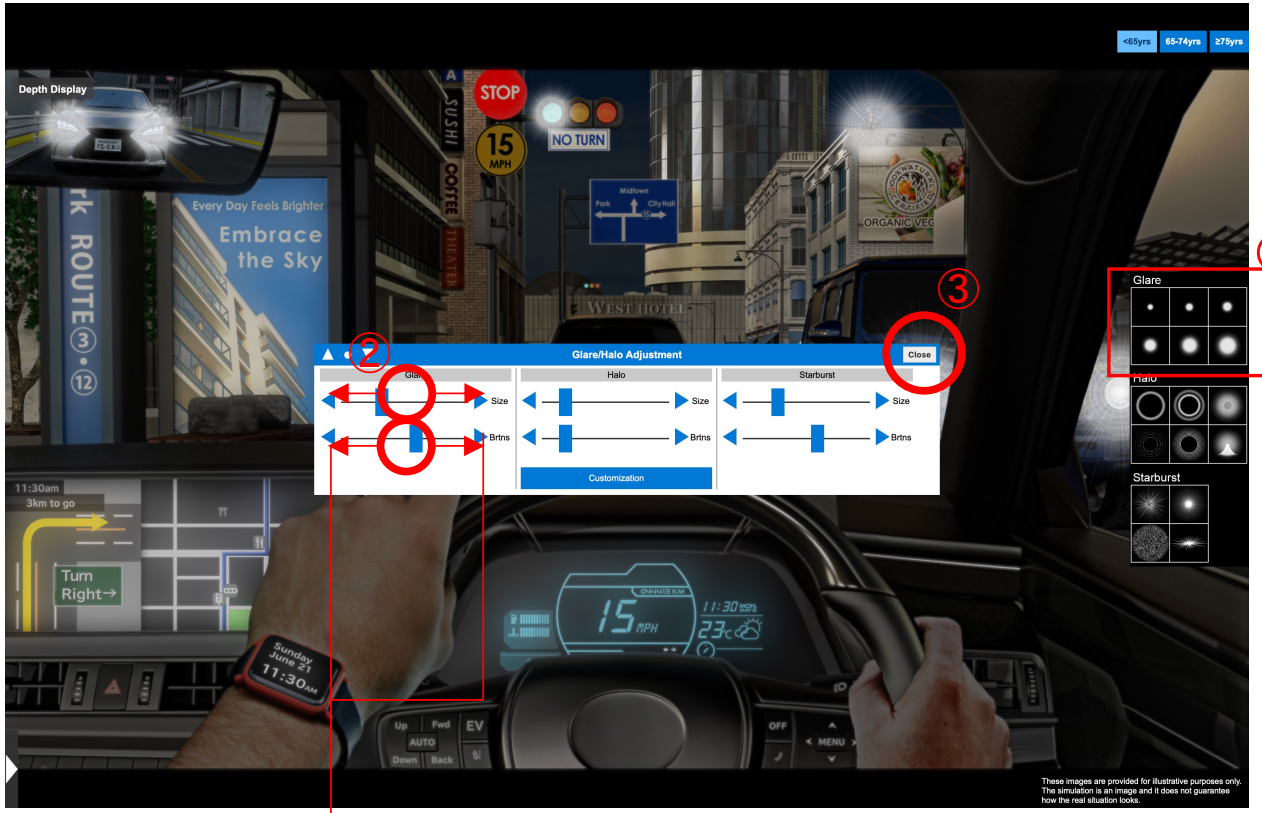
Set it to your desired value.

2B. You can also select the glow size from the presets on the right side.

3. Press the "Close Button" to confirm the adjustment.

*Note: The halo adjustment feature is available only in the Driving (Night) scene.

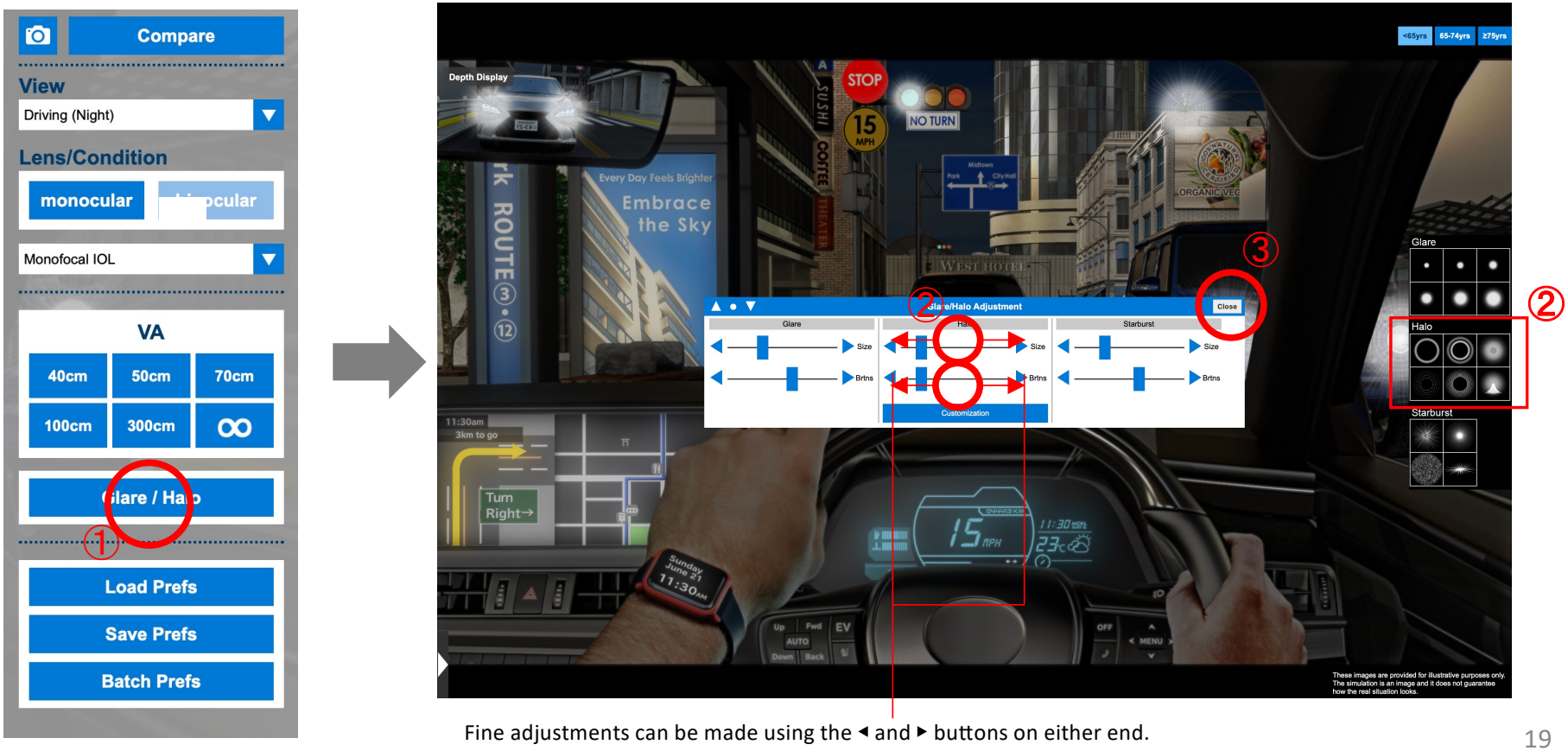




Fine adjustments can be made using the ◂ and ▸ buttons on either end.

1. Press the "Glare & Halo Button" to display an adjustment slider in the center of the screen.
2. Select the type of halo from the presets on the right side.
3. Move the halo slider left or right to adjust the halo size and brightness, which will be reflected on the screen. Set it to your desired value.
4. Press the "Close Button" to confirm the adjustment.

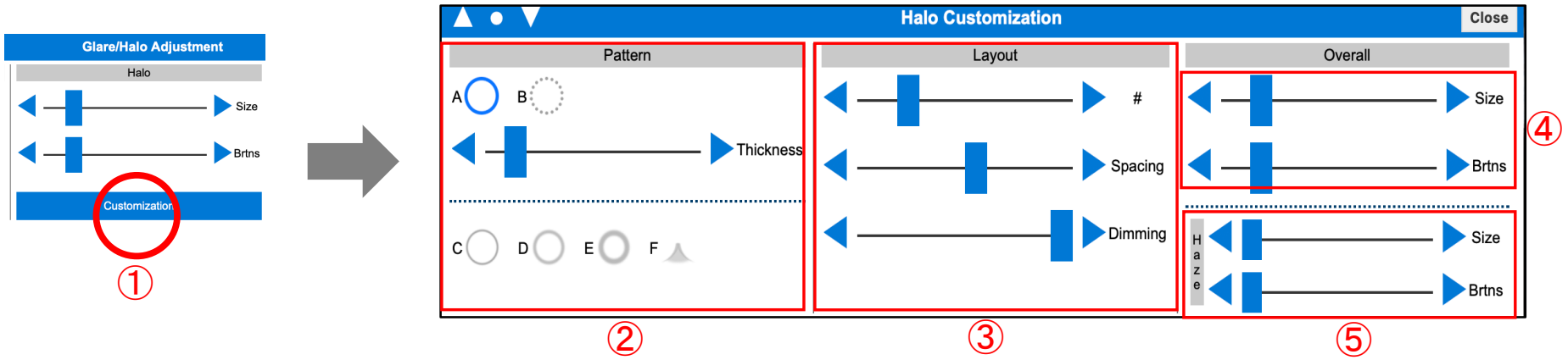
*Note: The halo adjustment feature is available only in the Driving (Night) scene.



Halo can be customized in detail.

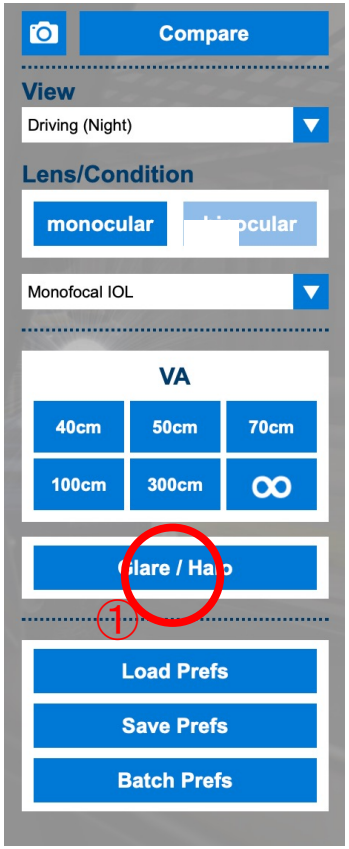
Please proceed slowly as this process can be quite intensive.

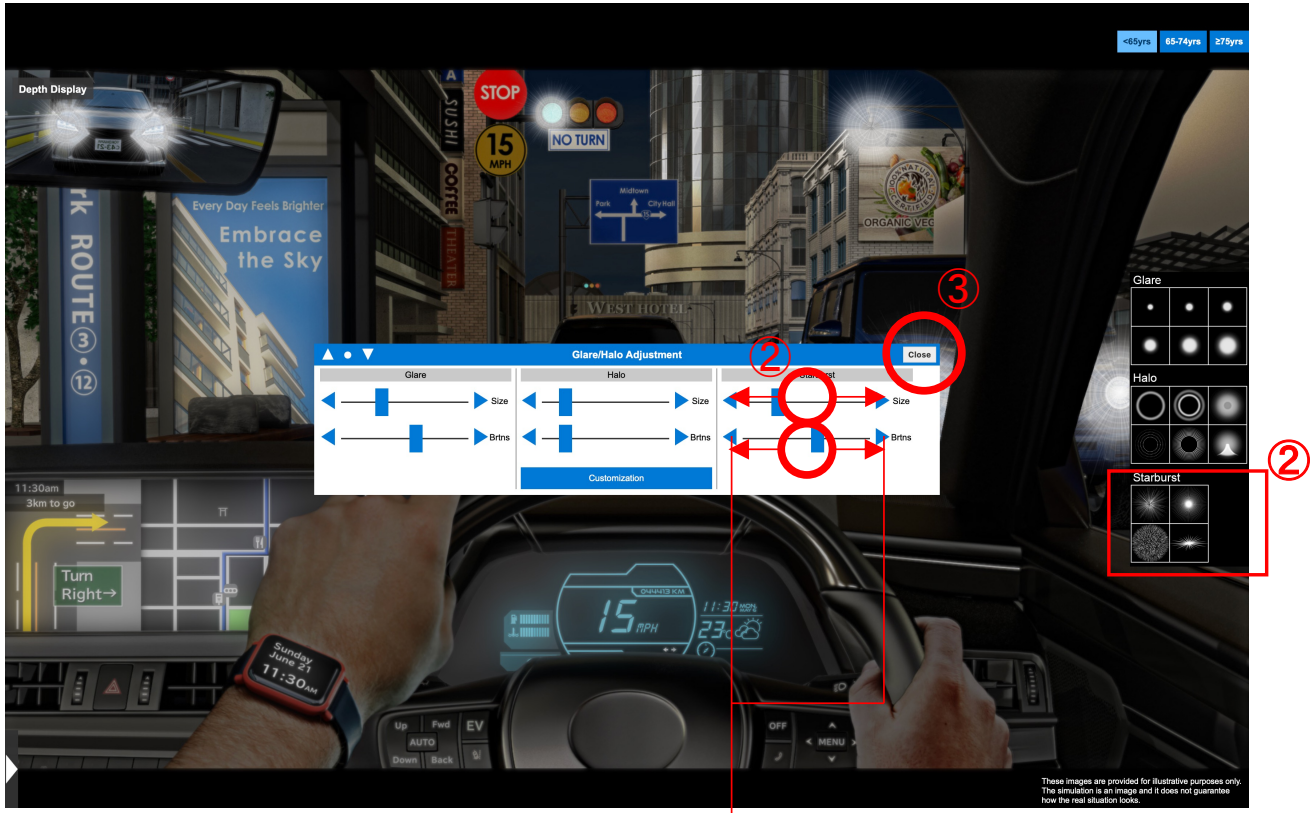
1. Press the "Customize" button located below the halo slider to open the customization screen.
2. Choose from six ring patterns labeled A through F. Patterns A and B allow you to adjust the thickness using the slider.
3. Adjust the number of rings, spacing, and attenuation strength. As the slider moves to the right, the transparency of the outer rings increases.
4. Change the overall size and brightness. This functions similarly to the halo slider in the previous screen.
5. Adjust the haze effect.



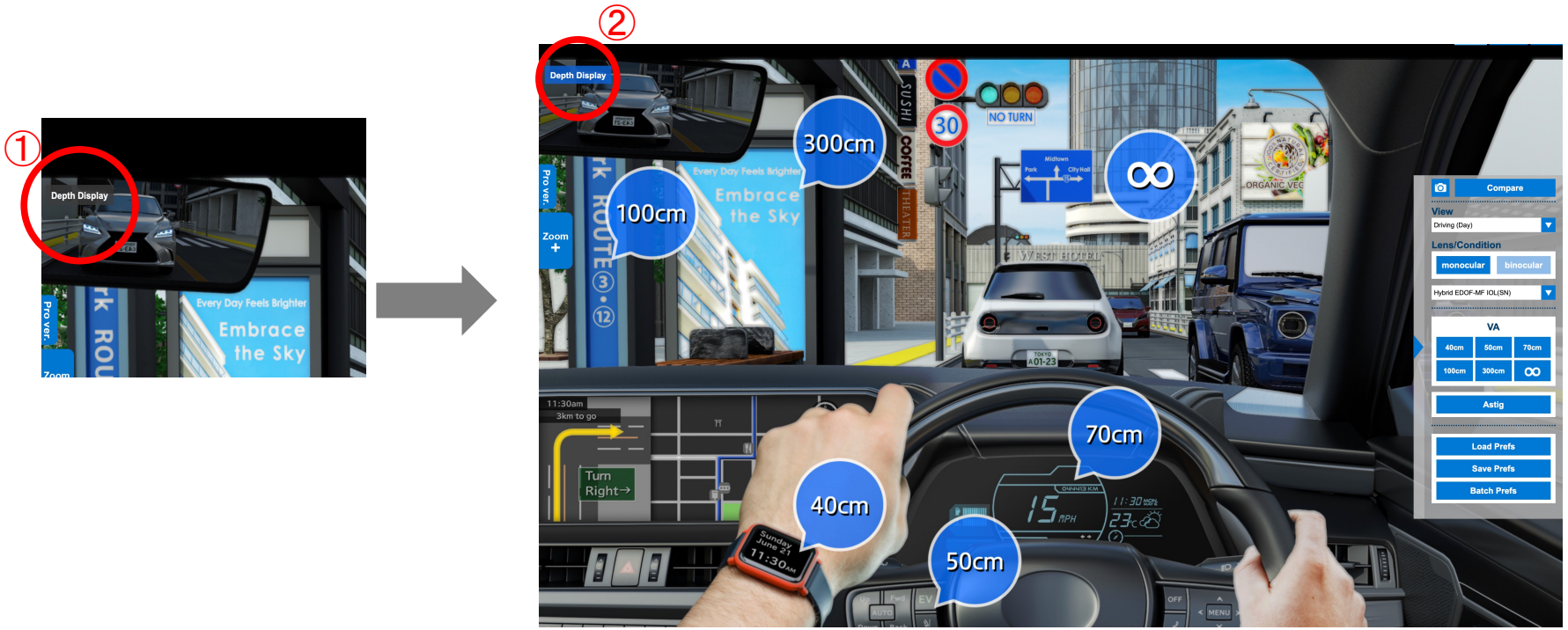
1. Press the "Glare & Halo Button" to display an adjustment slider in the center of the screen.
2. Select the type of starburst from the presets on the right side.
3. Move the starburst slider left or right to adjust the size and brightness of the starburst, which will be reflected on the screen. Set it to your desired value.
4. Press the "Close Button" to confirm the adjustment.

*Note: The starburst adjustment feature is available only in the Driving (Night) scene.





1.Press the "Depth Display Button" in the upper left to show the depth on the screen.
2.Press the "Depth Display Button" again to hide the depth.



Data Handling

Saving, retrieving, and managing settings data

You can save the settings that you have customized. Please note that saved data is stored in the browser's cache.

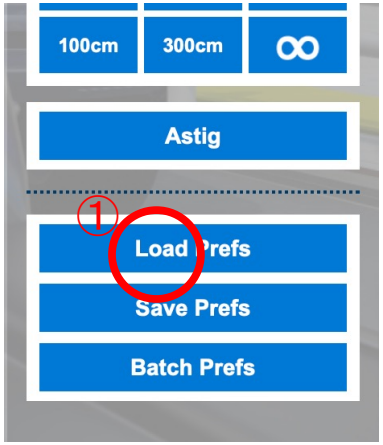
Clearing the browser cache will erase all saved data, so be cautious. Before clearing the cache with saved settings, please use the CSV download feature described on Page 28 to store your data.

1. Press the "Save Settings" button to display the "Save Settings" screen in the center of the screen.
2. You can save up to 8 settings. For example, pressing the "Setting 6" button and closing the screen with the "Close" button will save the data to "Setting 6." You can also rename the setting at this time.

You can recall data that you have saved. Please note that saved data is stored in the browser's cache.

Clearing the browser cache will erase all saved data, so be cautious. Before clearing the cache with saved settings, please use the CSV download feature described on Page 28 to store your data.

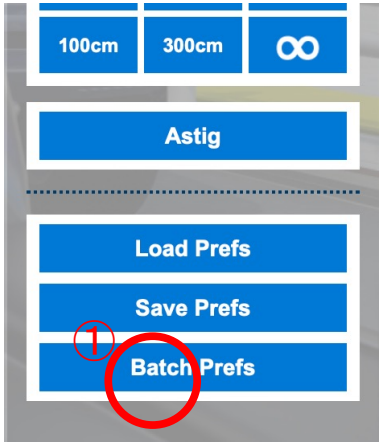
1. Press the "Recall Settings" button to display the "Recall Settings" screen in the center of the screen.
2. Select the setting you want to recall, press the corresponding "Setting" button, and close the screen with the "Close" button to apply that setting. You can also press the "Default Settings" button and close the screen to revert to the default settings.

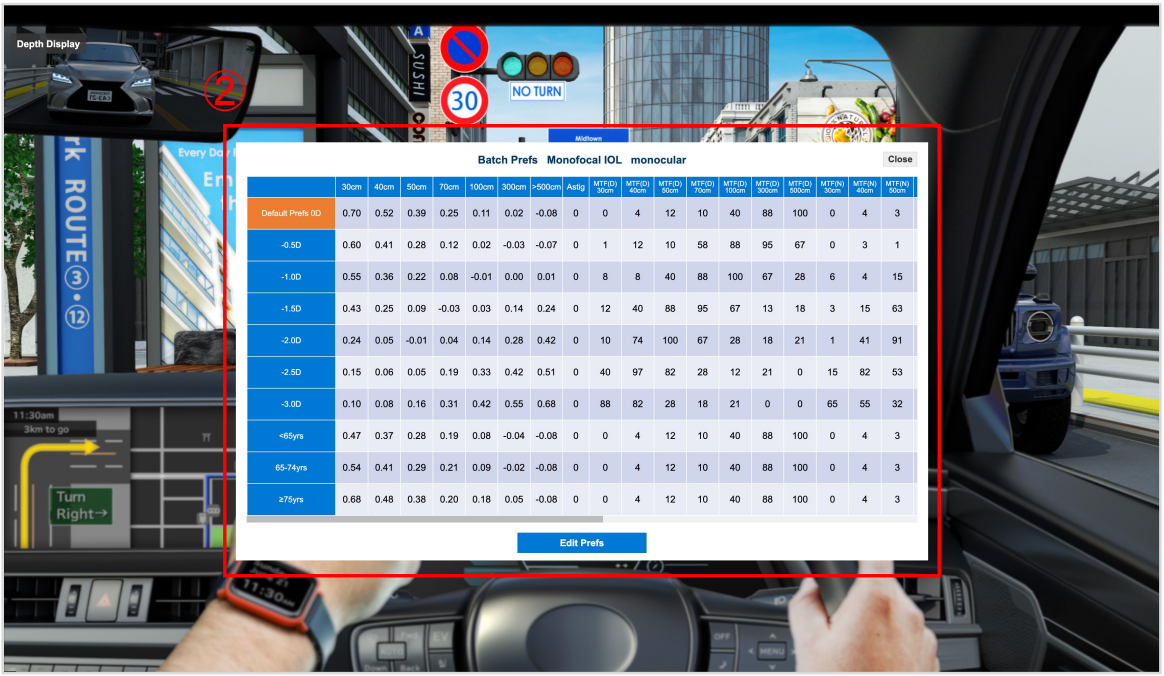


You can set configurations for each lens in a summary table. Please note that saved data is stored in the browser's cache.

Clearing the browser cache will erase all saved data, so be cautious. Before clearing the cache with saved settings, please use the CSV download feature described on Page 28 to store your data.

1. Press the "Batch Settings" button to display the "Batch Settings + Lens Name" screen in the center of the screen.
2. Select each cell, input the values, press the "Change Settings" button, and then press the "Close" button to apply the changes to the settings. Be careful not to forget to press the "Change Settings" button.





	30cm	40cm	50cm	70cm	100cm	300cm	>500cm	Astig	MTF(D) 30cm	MTF(D) 40cm	MTF(D) 50cm	MTF(D) 70cm	MTF(D) 100cm	MTF(D) 300cm	MTF(D) 500cm	MTF(N) 30cm	MTF(N) 40cm	MTF(N) 50cm
Default Prefs OD	0.70	0.52	0.39	0.25	0.11	0.02	-0.08	0	0	4	12	10	40	88	100	0	4	3
-0.5D	0.60	0.41	0.28	0.12	0.02	-0.03	-0.07	0	1	12	10	58	88	95	67	0	3	1
-1.0D	0.55	0.36	0.22	0.08	-0.01	0.00	0.01	0	8	8	40	88	100	67	28	6	4	15
-1.5D	0.43	0.25	0.09	-0.03	0.03	0.14	0.24	0	12	40	88	95	67	13	18	3	15	63
-2.0D	0.24	0.05	-0.01	0.04	0.14	0.28	0.42	0	10	74	100	67	28	18	21	1	41	91
-2.5D	0.15	0.06	0.05	0.19	0.33	0.42	0.51	0	40	97	82	28	12	21	0	15	82	53
-3.0D	0.10	0.08	0.16	0.31	0.42	0.55	0.68	0	88	82	28	18	21	0	0	65	55	32
<65yrs	0.47	0.37	0.28	0.19	0.08	-0.04	-0.08	0	0	4	12	10	40	88	100	0	4	3
65-74yrs	0.54	0.41	0.29	0.21	0.09	-0.02	-0.08	0	0	4	12	10	40	88	100	0	4	3
≥75yrs	0.68	0.48	0.38	0.20	0.18	0.05	-0.08	0	0	4	12	10	40	88	100	0	4	3

You can export and import all lens settings configured in the simulator as CSV data.

※ Settings related to FEST mode are excluded.

※ This function is not available on iPad.

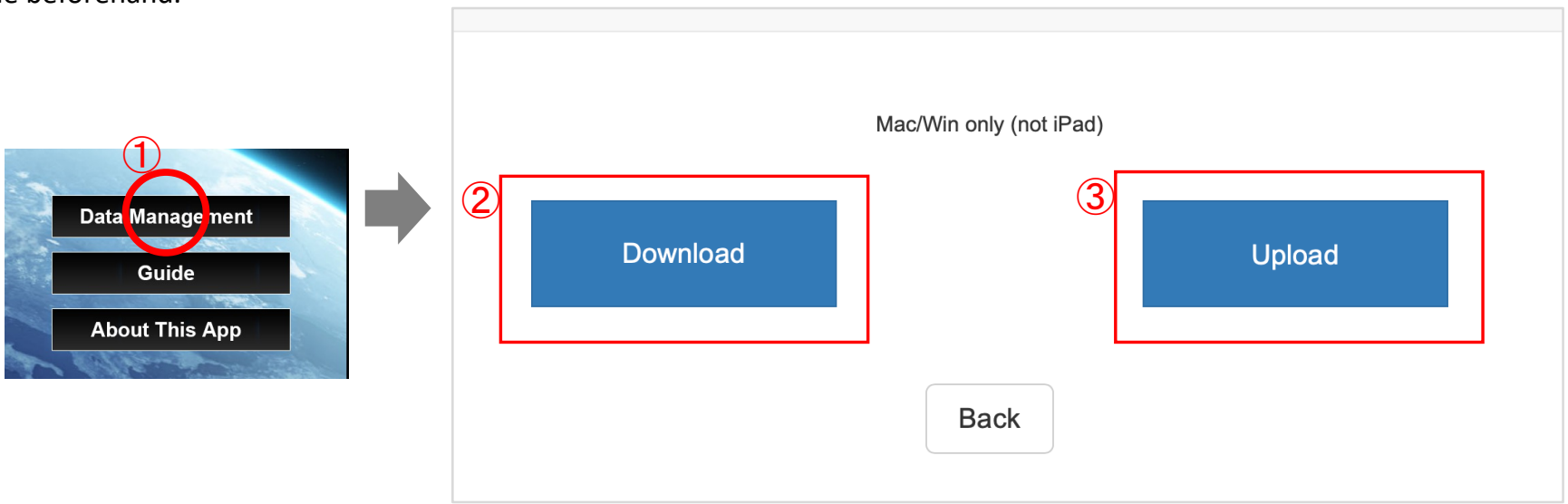
① Tap the “Data Management” button on the title screen to open the Save/Restore screen.

② Tap the “Download” button to export all currently stored settings (excluding FEST mode) in the browser as a CSV file.

③ Tap the “Upload” button to open the file selection window.

Select your CSV file to apply the settings.

※ Please note: uploading a file will overwrite all current settings, so we recommend downloading and saving a backup CSV file beforehand.



Modes

Different modes allow for more detailed simulations.

Equivalent Spherical Value/ Postoperative Distance Pupil Diameter

This mode allows you to reflect combinations of "Equivalent Spherical Value" and "Postoperative Distance Pupil Diameter" on the simulator. Visual acuity by distance is calculated from correlations with all postoperative distance pupil diameters and reflected in a nomogram. The application refers to this nomogram to set visual acuity by distance. The measurement conditions for creating the nomogram are as follows:

Measurement Device
For pupil diameter measurement related to cataract surgery, it is preferable to use a device like the WAM-5500, which is an automatic refractometer with pupil diameter measurement and open-eye measurement in daily vision environments.

Measurement Environment
The brightness of the examination room greatly affects pupil diameter measurements. For practical clinical use, a vision examination room environment is sufficient, but for accuracy, a lighting range of 1000 to 1400 lux is recommended.

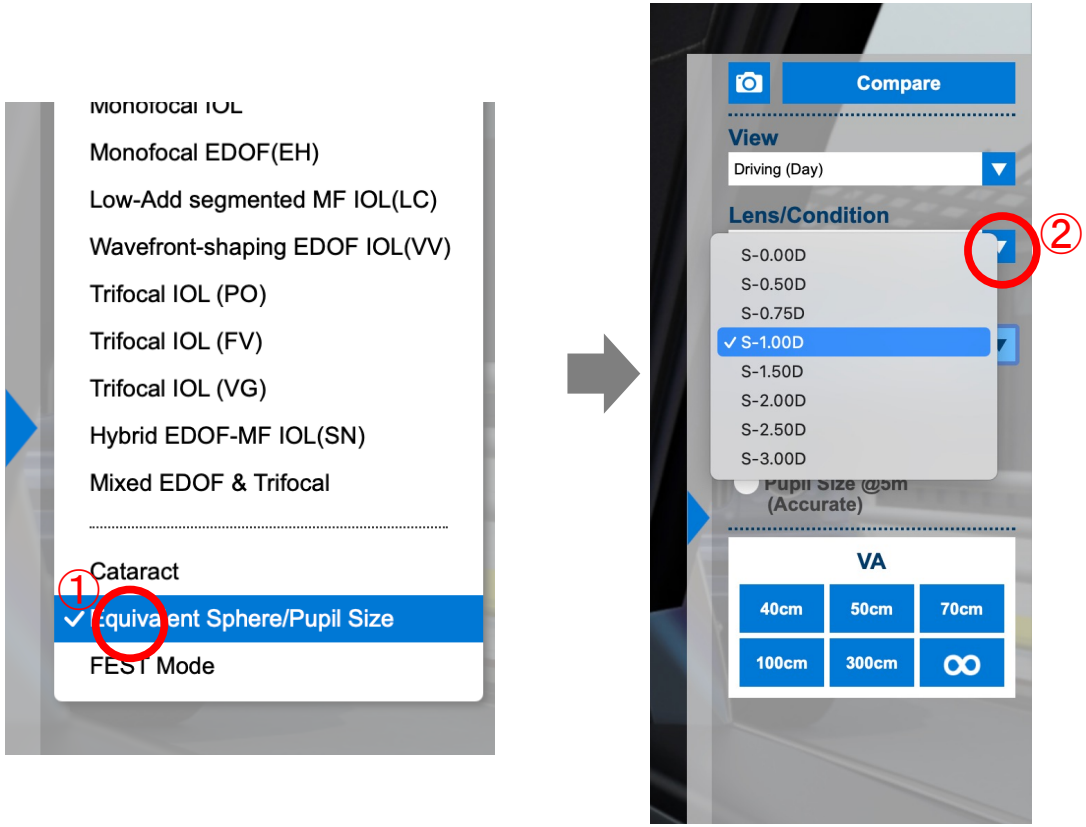
Measurement Method
1. WAM-5500 Automatic Refractometer with Pupil Diameter Measurement
1-1. Enter the fully corrected refraction values obtained from subjective refraction at a 5m distance into the trial frame.
1-2. Place a fixation target 5m away and measure for approximately 20 seconds.
Note: If the visual acuity is poor and the target is not visible, use a larger target. In cases of high myopia or hyperopia, measurement might be difficult due to lens thickness. Adjusting the trial frame size or lens position may improve this.
1-3. The pupil diameter measured under refraction correction needs to be converted to uncorrected pupil diameter using the following formula:
Conversion Formula from Pupil Diameter under Refraction Correction to Uncorrected Pupil Diameter:
Uncorrected Pupil Diameter (mm) = Pupil Diameter under Refraction Correction (mm) / Lens Magnification
Lens Magnification = 1 / (1 - 0.015 × Spherical Value (D))
Note: For spherical values: use equivalent spherical values in the presence of astigmatism.For analysis: remove outliers in continuous measurements of pupil diameter before analysis.

2. Other Pupil Measurement Devices
Devices such as the Haab pupil gauge and the Mita pupil gauge, which measure by visual inspection, offer convenience but provide rough estimates with lower accuracy.
The FP-10000Ⅱ (TEI) measures actual pupil diameter (corrected for magnification due to the cornea) and is portable with selectable visual targets. However, while it allows open-eye measurement, the measurement eye is covered, slightly reducing accuracy.
The Iriscoder Dual C-10641 (Hamamatsu Photonics) provides high accuracy with infrared pupilometers, but various types, such as closed-type vs. open-type and binocular vs. monocular, have different characteristics based on their principles and measurement conditions. Closed-type devices generally show about a 0.2mm larger pupil diameter compared to open-type devices. Monocular measurements tend to be about 1.0mm larger than binocular measurements, so using these values in the Vision Simulator is not recommended.

(As of November 14, 2020)

To use this mode, first switch to the "Equivalent Spherical & Pupil Diameter Mode." Then, follow the steps below to select the equivalent spherical refraction rate:

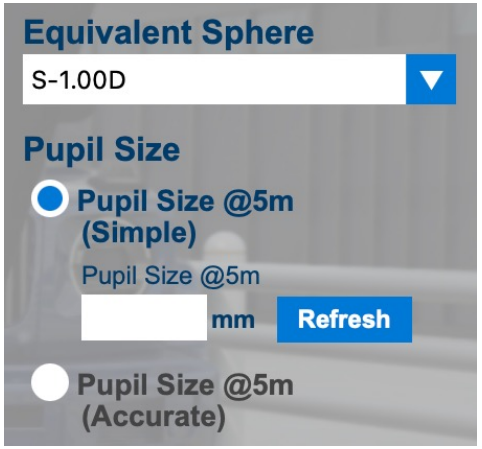
1. Select "Equivalent Spherical & Pupil Diameter" from the lens options.
2. Press the ▼ button for the equivalent spherical value and choose from the available options. (Default: S-0.00D)



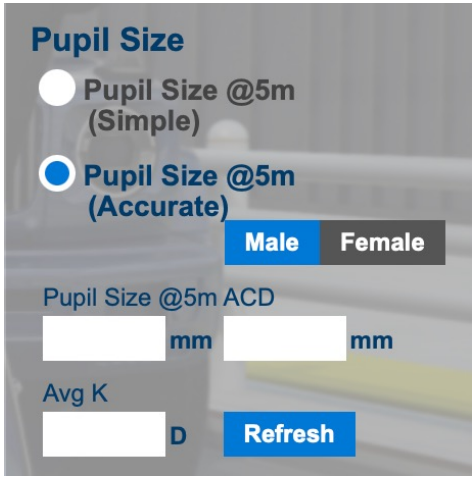
There are two methods for entering the postoperative distance pupil diameter. Click on the ○ to select the method you need. The default setting for the postoperative distance pupil diameter is 3.0 mm.

・Simplified Calculation: A basic method where you enter the 5m uncorrected pupil diameter to perform the calculation.
・High-Precision Calculation: A more accurate method that involves entering four parameters: sex, 5m uncorrected pupil diameter, anterior chamber depth, and average corneal refractive power.

簡易計算



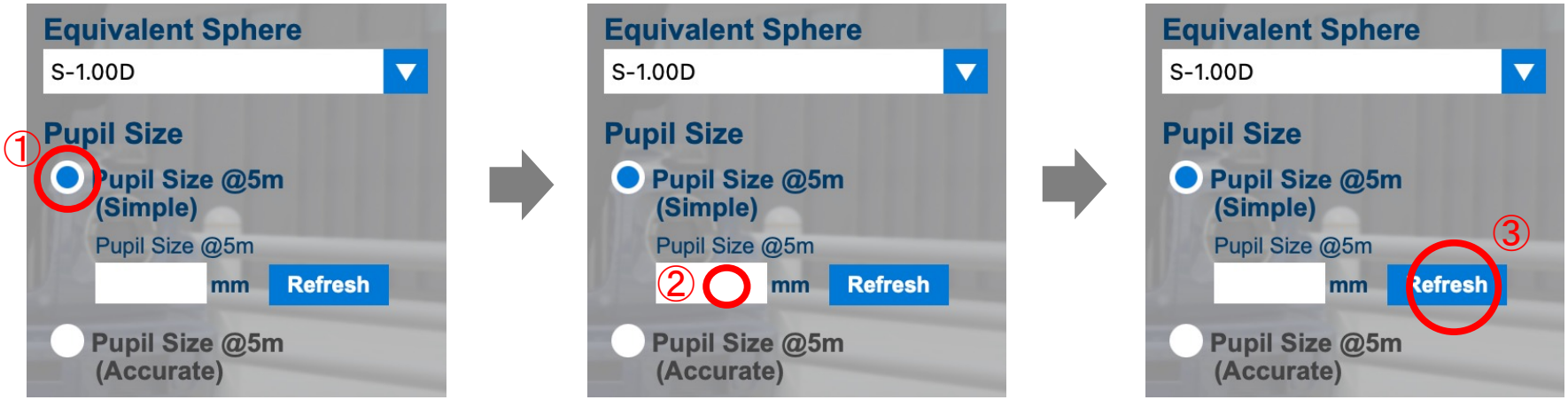
高精度計算



Note:
The "Actual Pupil Diameter" on the application refers to the "Postoperative Distance Pupil Diameter."
The postoperative distance pupil diameter available for reference in the nomogram ranges from 1.6 to 4.0 mm.

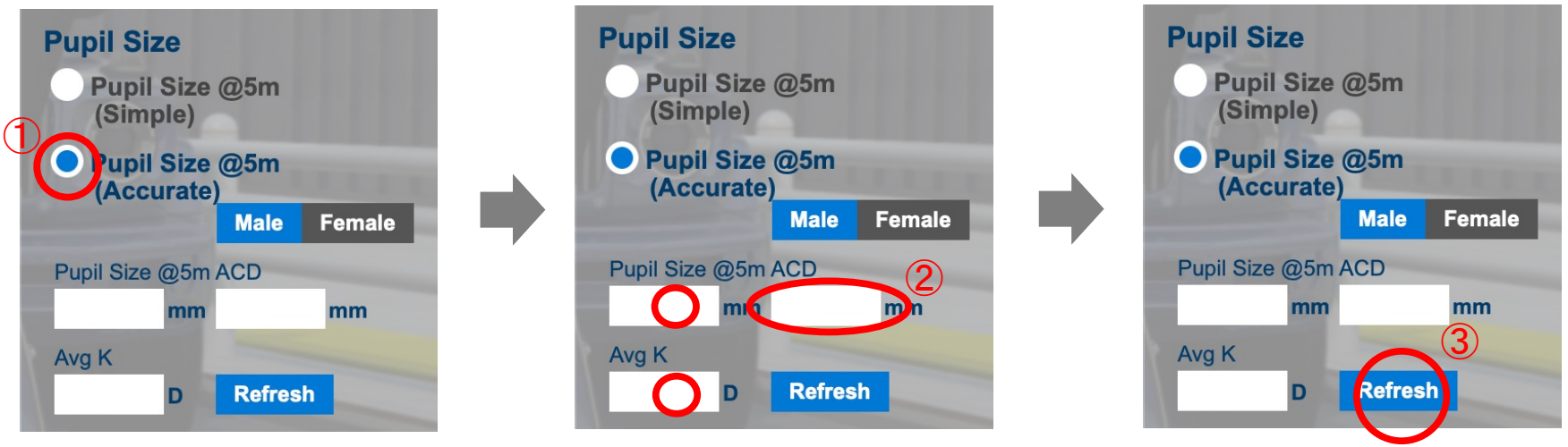
This section introduces a method for calculating and inputting the postoperative distance pupil diameter using the uncorrected pupil diameter at 5m.

1. Click on the ○ to select "5m Uncorrected Pupil Diameter Input (Simplified)."
2. Enter the value for "5m Uncorrected Pupil Diameter" in the form.
3. Press the Update button to calculate the postoperative distance pupil diameter. The screen will be updated with vision values based on the nomogram.



This section introduces a method for calculating the postoperative distance pupil diameter with high precision by inputting gender, 5m uncorrected pupil diameter, anterior chamber depth (distance from the corneal front to the lens front), and average corneal refractive power.

1. Click on the ○ to select "5m Uncorrected Pupil Diameter Input (High Precision)."
2. Select "Gender," and enter the values for "5m Uncorrected Pupil Diameter," "Anterior Chamber Depth," and "Average Corneal Refractive Power" in the respective forms.
3. Press the Update button to calculate the postoperative distance pupil diameter. The screen will be updated with vision values based on the nomogram.

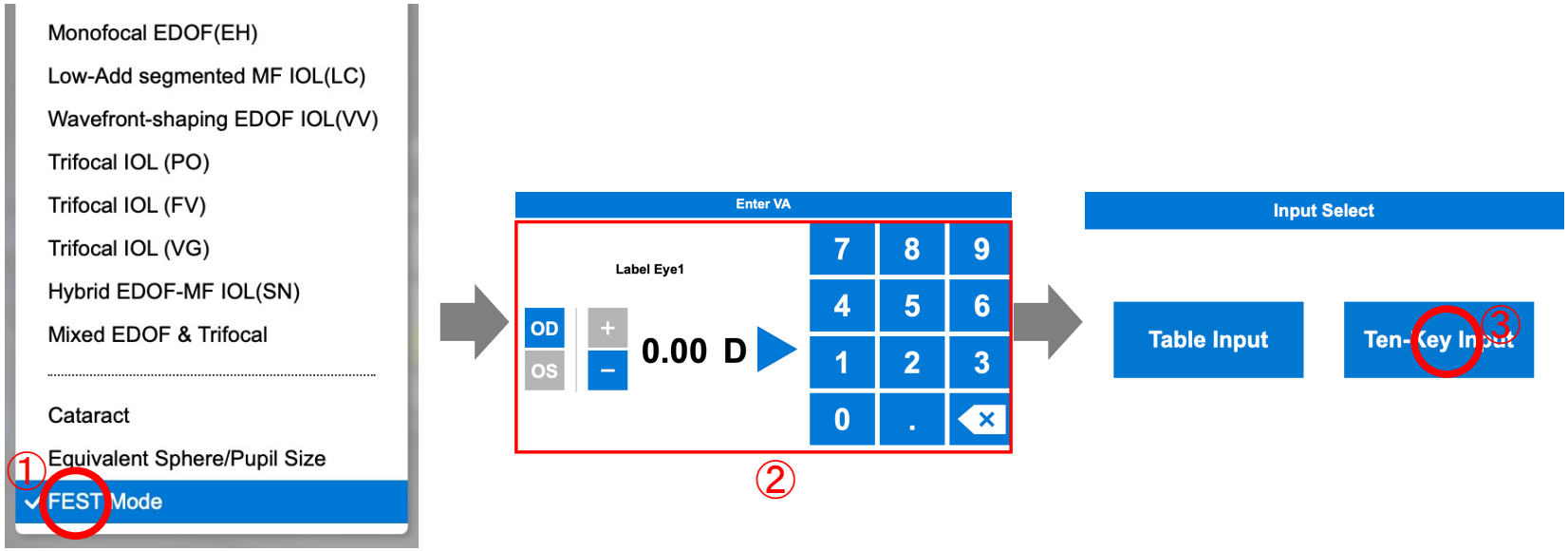


FEST Mode

FEST Mode allows for comparison with monocular switching and also supports switching to binocular addition.

Note: Binocular addition is a simple method that reflects the better vision between the two eyes.

1. Press the "FEST" button from the lens options.
2. From the small input window, enter the values for left/right, +/-/D. This will serve as the label. Input is possible using the right-side numeric keypad.
3. Press ▶ to proceed to the vision input for each distance. Before that, "Input Selection" window will appear, allowing you to choose between Table input and Ten-Key input.



When Key-Pad Input is Selected:

4. The "Vision Input" screen will appear. Input the vision values for each distance sequentially. Press ▶ to move to the next distance.
5. After entering all distances, a window will appear asking if you want to input another set. Press "No" to finish the input and move to the display switch screen. Press "Yes" to continue to input the next set.
6. Use the upper buttons to switch the CG display. The label highlighted in red represents the current settings reflected in the CG.
7. Press the "Binocular Addition" button to calculate and reflect binocular addition in the CG.
8. You can later input or correct vision values by pressing the buttons on "Vision Re-Setting."

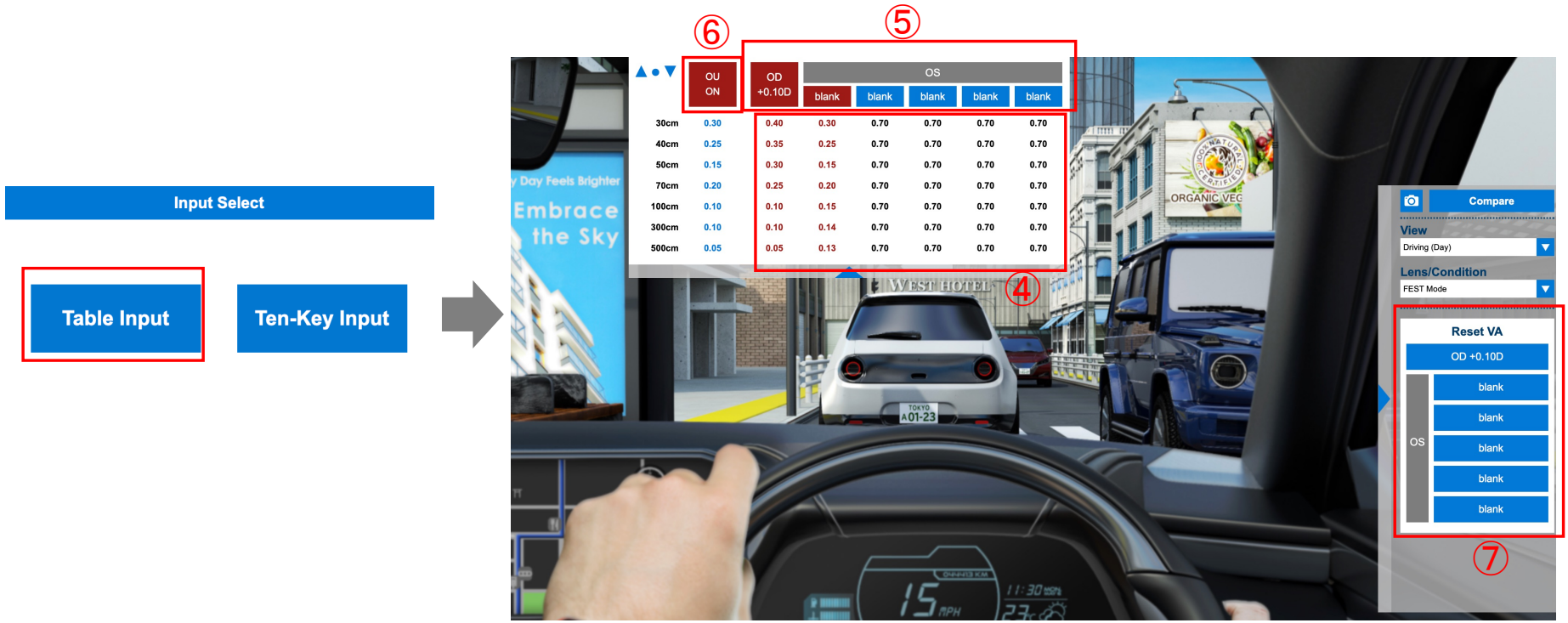
When Table Input is Selected :

4. The input screen will appear, allowing you to click on each value and enter it directly.

5. Press the upper button to switch the CG display. The label highlighted in red represents the settings currently reflected in the CG.

6. Press the "Binocular Addition" button to calculate the binocular addition and reflect it in the CG.

7. By pressing the buttons for "Reset Vision," you can input or correct vision settings later.

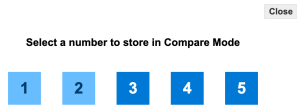


Comparison Mode

Comparison Mode allows you to easily capture and compare the currently displayed settings. Although similar comparisons can be done using the "Save and Recall Settings" function, this mode is designed to provide a more intuitive way to switch between screens and compare settings directly. For detailed setting management and data storage, please continue to use the "Save and Recall Settings" function.

Repeat steps 1 and 2 to save the settings you want to compare into each memory slot (1–5).

② Press the camera button to reveal the memory slot buttons. Press the desired slot button to save the current settings.



① Set the type of lens and various values as needed.

You can also adjust distance-specific visual acuity and contrast as required.

To switch to Comparison Mode and perform comparisons:

① Press the "Switch to Comparison Mode" button to switch the operation menu.

③ Press the "Switch to Normal Mode" button to return to the regular screen from Comparison Mode.

You can also change scenes during comparisons.

② Press buttons 1 through 5 to switch between screens and compare settings.

■ Display Issues
The cache might not be loaded correctly.
Please back up your data using the CSV method (Page 28) before trying the following. Note that all browsing data will be erased, so proceed at your own risk.

iPad, Safari:
Go to Settings > Safari > Clear History and Website Data > Restart Safari.

Windows, Chrome:
Click the three dots in the upper-right corner of Chrome > Settings > Clear browsing data >
Select All time > Browsing history, Cookies and other site data, Cached images and files > Clear data.

Mac, Safari:
(Instructions needed)

■ Site Not Loading After Login
Cookies might be blocked. Try the following:

iPad, Safari:
Go to Settings > Safari > Block All Cookies > OFF.

Windows, Chrome:
Click the three dots in the upper-right corner of Chrome > Settings > Cookies and other site data > Block third-party cookies in Incognito > ON.

Mac, Safari:
Go to Safari Preferences > Privacy > Block All Cookies > OFF.

■ Safari Not Found on iPad
Restrictions might be enabled. Try the following:

Go to Settings > Screen Time > Content & Privacy Restrictions > Allowed Apps > Safari > ON.

For inquiries before purchase or questions regarding technical and medical aspects, please contact us via email at the address below:

Non-Profit Organization Protect Eyes from UV Rays Eyes Arc

Vision Simulator Eyes Arc

Contact Email: info@vs-eyesarc.org