



**OMRON Corporation**  
**Electronic and Mechanical**  
**Components Company**

# **Human Vision Component (HVC-P2)**

## **B5T-007001**

### **Evaluation Software**

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<b>Manual</b>
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## ■ Revision History

Date	Rev	Contents	Prepared by	Reviewed by	Approved by
2016/7/19	A	First release	AOB 2016/07/19 Tanaka	AOB 2016/07/22 Inoue	AOB 2016/07/22 Yamada
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## Additional Notes

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Note that the contents of this document or specifications for B5T-007001 noted in this document may change without notice.

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# Introduction

This document is the manual (hereafter referred to as “This Manual”) for the OMRON Human Vision Component B5T-007001 Evaluation Software V1.0 (hereafter referred to as the “Application”).

## 1 Outline

The Application is used to evaluate the various functions of the OMRON Human Vision Component B5T-007001 (hereafter referred to as the “Device”) on a machine.

The Device incorporates 10 algorithms of the **OKAO™ Vision** Image Sensing Technology, including **Face Recognition**, **Expression Estimation** and **Hand Detection**, to recognize the conditions of people. Information on people's conditions can be obtained by just mounting the Device on equipment.

The available functions in the Application are as follows:

- (1) **Human Body Detection**, (2) **Hand Detection**, (3) **Face Detection**, (4) **Face Direction Estimation**,
- (5) **Age Estimation**, (6) **Gender Estimation**, (7) **Gaze Estimation**, (8) **Blink Estimation**,
- (9) **Expression Estimation** and (10) **Face Recognition**.

## 2 Caution

Make sure to read the Device’s documentation before using it.

Make sure to read the Device’s documentation when verifying its proper operation.

Make sure to follow the instructions in the Device’s documentation when using it.

Take note that the images processed by the Device are in greyscale format and as such will not be displayed in color in the Application.

Note that in This Manual, “left” refers to the left side of the image, i.e. the actual right of the subject in the image, and vice versa.

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## 3 Operating Environment

The Application was tested in the environment described below.

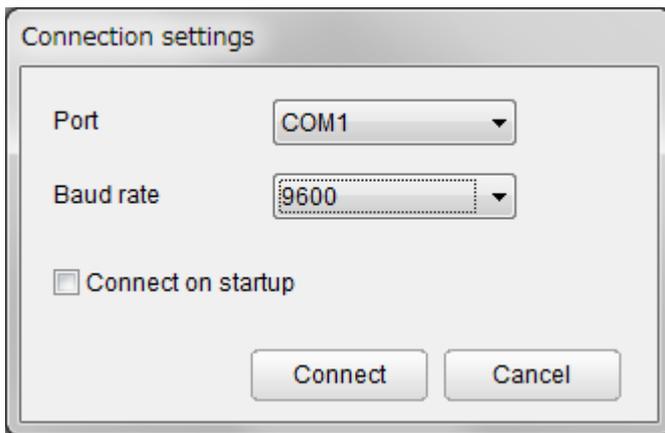
OS	Windows 7 Professional SP1 32-bit /64-bit Windows 8.1 Professional SP1 32-bit / 64-bit Windows 10 Professional SP1 32-bit / 64-bit
CPU	Intel® Core™ i7-3770 CPU @ 3.40GHz Note that the machine specifications may cause communication errors. Refer to <b>8 Troubleshooting</b> for details.
Communication	USB, UART

## 4 Operating Procedures

1. Connect the Device to the machine to be used with a USB cable. Drivers need to be installed when connecting the Device for the first time. Refer to the “B5T-007001 Driver Installation Manual” for details.
2. Make sure that the LED of the Device is lit before running the Application.
3. Run the Application. The startup screen will be displayed the first time the Application is run.  
Refer to **5 Startup Screen** for details on the rest of the procedures.

## 5 Startup Screen

The “Connection Settings” window will be displayed when the Application is run for the first time.



### 5.1 Port

Specify in “Port” the COM port number of the USB cable connecting the Device to the machine used.

The default value is COM1. Make sure to select a different port if necessary.

It is possible to confirm the number of the port used for the Device by looking in “Device Manager” > “Ports (COM & LPT)” > “USB Serial Port (COM#)” on the machine used.

Note that proper operations will not be guaranteed if the wrong port is specified.

The driver for the USB Serial Port needs to be installed when running the Application for the first time. Connect the Device to the machine to be used with a USB cable. Refer to the “B5T-007001 Driver Installation Manual” for details.

The following error message will be displayed if the wrong port is selected when running the Application for the second time and forward.



In order to reset the port settings, close the Application once and run it again to display once more the Settings window.

The same error message will be displayed if the Device is not connected to the machine using the Application.

## 5.2 Baud Rate

The Baud rate will specify the transmission speed of the UART communication of the Device.

Possible values are 9600, 38400, 115200, 230400, 460800 and 921600.

In order to reset the Baud rate settings, close the Application once and run it again.

## 5.3 Connect on Startup

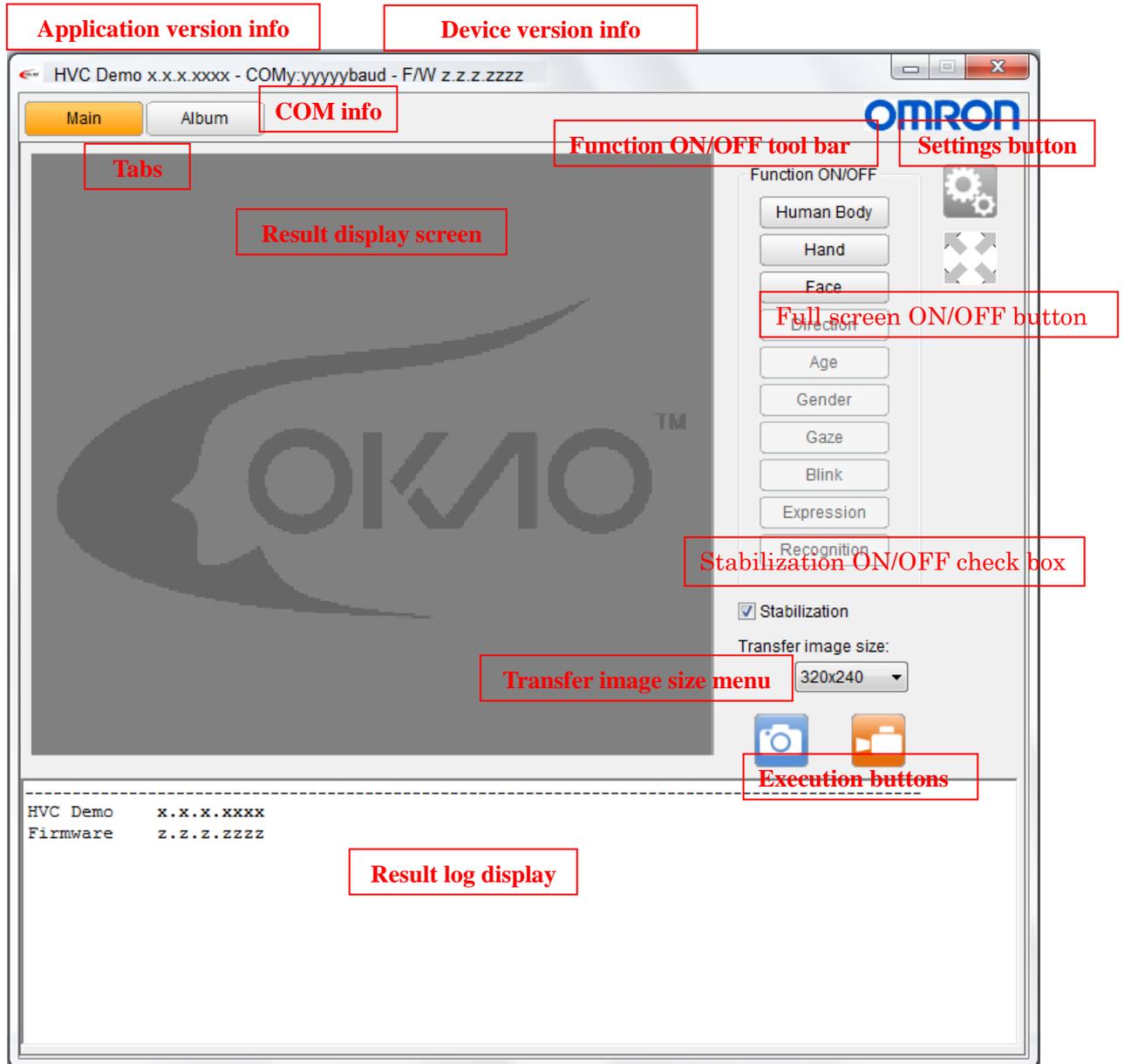
Check the “Connect on startup” box to save the current specified port, Baud rate and camera angle settings.

Starting the Application again when “Connect on startup” is checked will skip the startup screen and go directly to the Main screen.

The “Connect on startup” box can be unchecked in the “Device” tab of the Settings.

# 6 Application Screen

Once the settings are completed, the screen of the Application at startup is displayed as below.



■ Application version info

The version info of the Application is displayed on the top left of the Main tab.

HVC Demo x.x.x.xxxx	Version info for the Application
COMy:yyyyybaud	Connection settings (COM settings and baud rate)
Firmware z.z.z.zzzz	Device version info

Refer to 5. Startup Screen for details.

■ Tabs

Switch to the appropriate tab when using the Application. Refer to **6.1 Main Tab** and **6.2 Album Tab** for details.



The currently selected tab will be displayed in orange.

- Result display screen

Display the image transmitted from this Device here. Refer to **6.1.1 Result Display Screen** for details.

- Function ON/OFF tool bar

This is the function ON/OFF tool bar. Refer to **6.1.2 Function ON/OFF Tool Bar** for details.

- Settings button

This is the settings button. Refer to **6.1.3 Settings Button** and **6.3 Settings** for details.

- Full-screen ON/OFF button

This is the full-screen ON/OFF button. Refer to **6.1.4 Full screen** for details.

- Result Stabilization ON/OFF Check Box

This is the stabilization ON/OFF check box. Refer to **6.1.5 Stabilization ON/OFF Check Box** for details.

- Transfer image size menu

This is the transfer image size menu. Refer to **6.1.6 Transfer Image Size Menu** for details.

- Execution buttons

This is the execution buttons. Refer to **6.1.7 Execution Buttons** for details.

- Result log

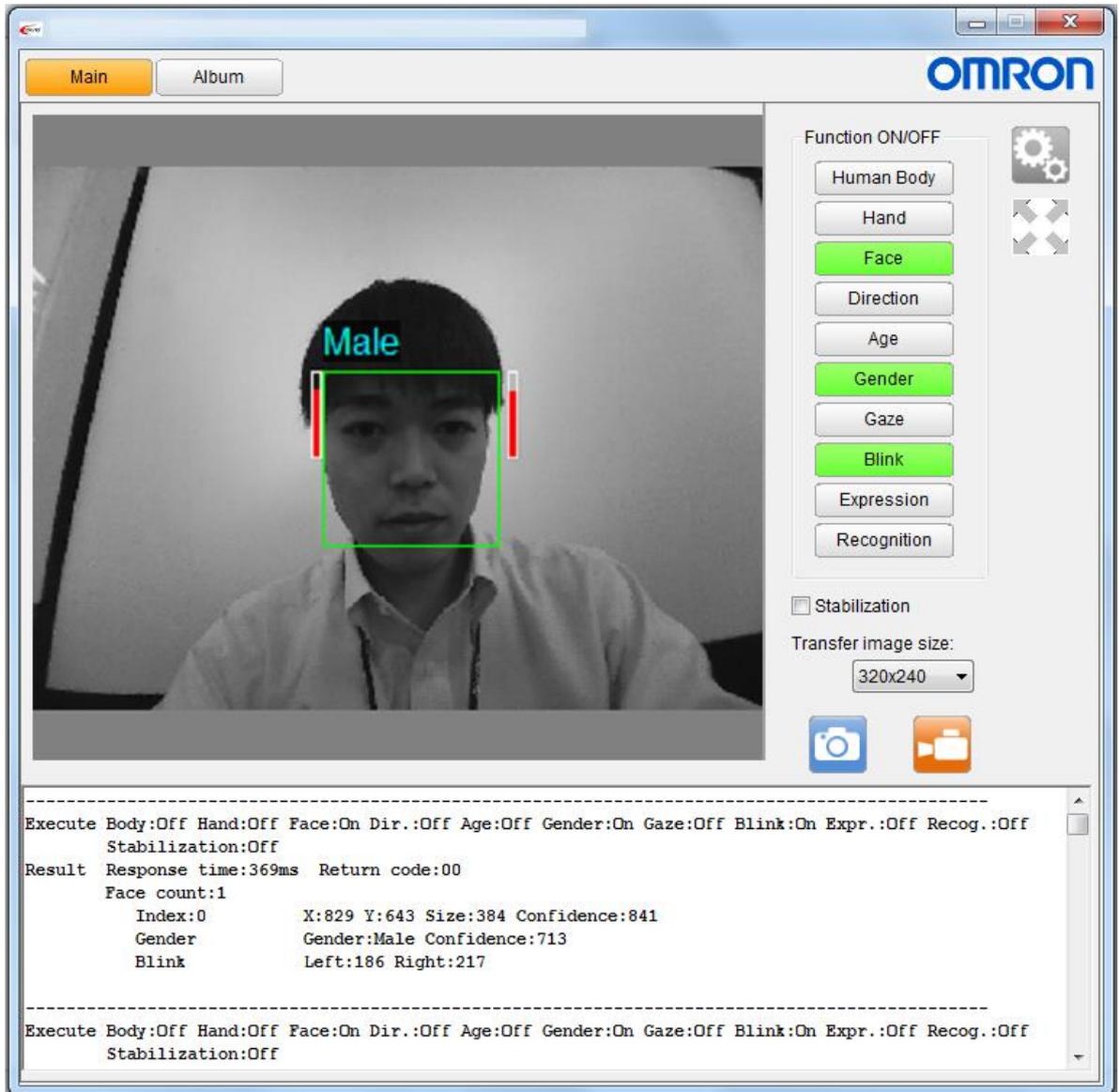
Display the result log. Refer to **6.1.8 Result Log** for details.

Note that the version of the Application (“HVC-P Demo”) and of the Device (“Firmware”) will be indicated in the result log at startup.

## 6.1 Main Tab

The Main tab contains the interface to use all the functions available in the Application.

The image below is an example of the Main tab when the Application is used.

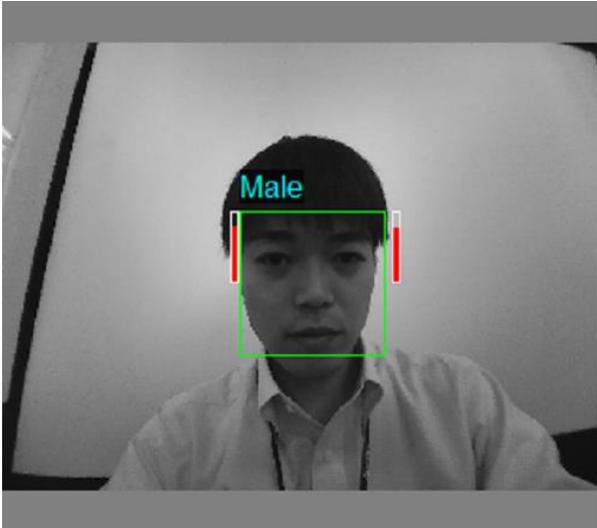


---

## 6.1.1 Result Display Screen

The result display screen on the left side of the Main tab displays the image sent from the camera of the Device. It also displays the results of the selected functions to be used with the Application.

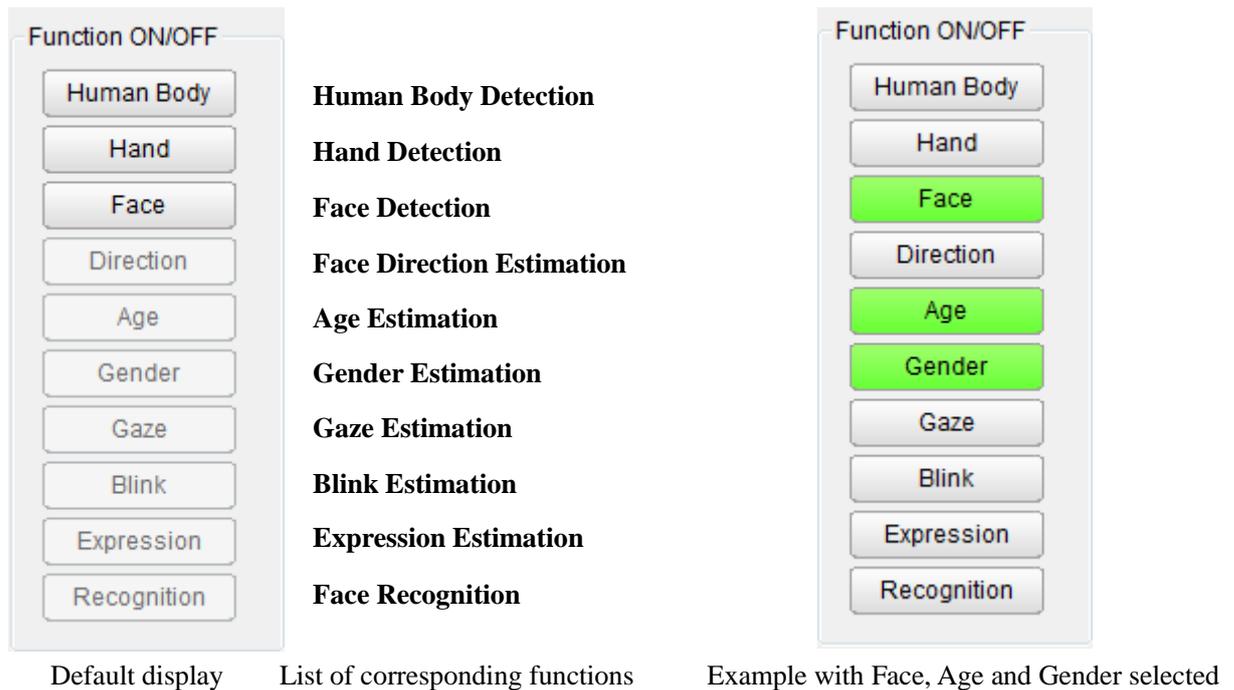
Note that when the transfer image size is set to “no image”, no image will be displayed on the result display screen.



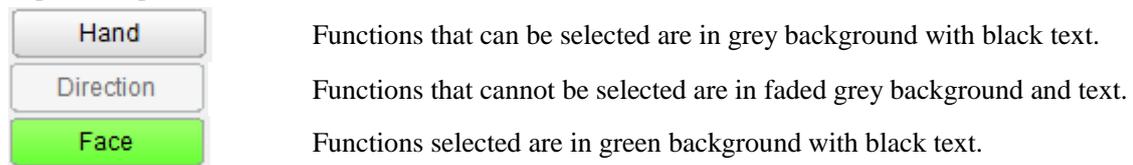
This is an example of an image on the result display when **Face Detection, Gender Estimation and Blink Estimation** were selected.

## 6.1.2 Function ON/OFF Tool Bar

The function ON/OFF tool bar displaying all the available functions in the Application is located on the right side of the Main tab.



Click on a function's button to select it. Note that while multiple functions can be selected at the same time, the process speed will be slower the more functions selected.



Note that the following functions can only be selected if **Face Detection** is selected first:

**Face Direction Estimation, Age Estimation, Gender Estimation, Gaze Estimation, Blink Estimation, Expression Estimation, Face Recognition.**

Note that **Face Recognition** will only be useable after one or more users and some recognition data has been registered in the Recognition tab. Refer to **6.2 Album Tab** and **7.10 Face Recognition** for details.

### 6.1.3 Settings Button

The settings button is located on the right side of the function ON/OFF tool bar of Main screen.

Clicking this button will open the settings menu. Refer to **6.3 Settings** for details.



Settings button for the Application

### 6.1.4 Full-screen display

The full-screen display button is located below the setting button.

Clicking this button will make the result display screen go full-screen on your computer. To back the normal display, press any key on the keyboard or click anywhere on the screen,



Full-screen display button

### 6.1.5 Result Stabilization ON/OFF Check Box

The result stabilization ON/OFF check box is located below the Function ON/OFF toolbar .Refer to 6.3.4 Stabilization for details.

<input type="checkbox"/> Stabilization	Stabilization OFF	invalid
<input checked="" type="checkbox"/> Stabilization	Stabilization ON	valid

## 6.1.6 Transfer Image Size Menu

The transfer image size menu is located below the function ON/OFF tool bar.

Transfer image size:

320x240

Transfer image size setting (display when set to 320×240)

Select the transfer image size between 320×240 (default value), 160×120 or “no image”.

Note that selecting 160×120 will speed-up the processing speed of the Application but will also reduce the quality of the image on the result display screen.

When set to “no image”, no image will be shown on the result display screen but the result info, e.g. the face rectangle, estimated age, etc., will still be visible. Refer to **6.1.7 Result Log** for details on the result info display settings.

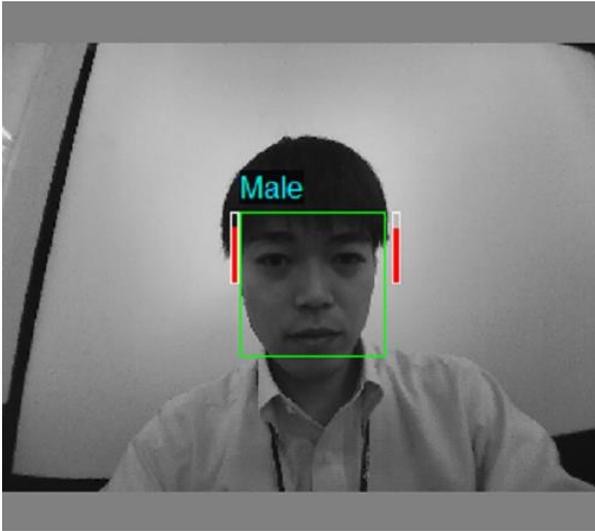


Image with 320×240 set.

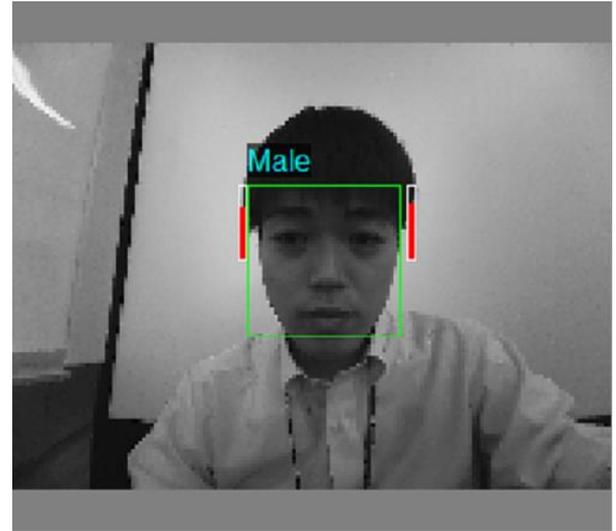


Image with 160×120 set.

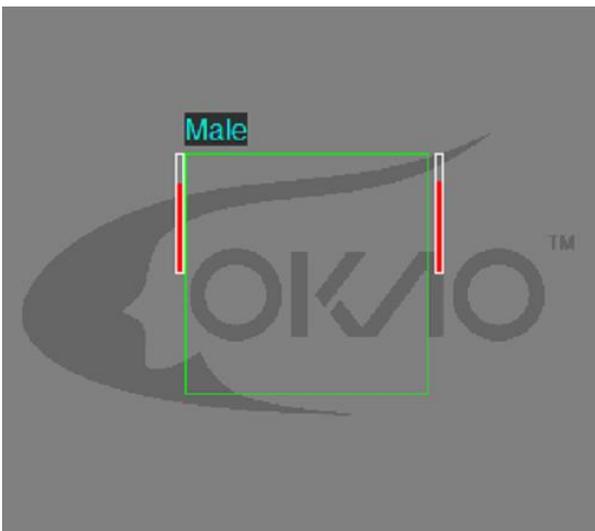


Image with “no image” set.

---

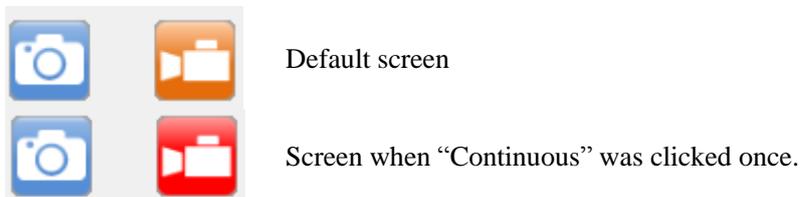
## 6.1.7 Execution Buttons

The “One Shot” and “Continuous” execution buttons are located below the transfer image size menu.



Clicking on “One Shot” will take a single picture with the Device’s camera and send it to the Application. It will then be displayed on the result display screen. A single result log will be displayed.

Clicking on “Continuous” will repeat continuously the process for “One Shot”. The result log for each picture will be displayed in succession. Clicking on it again will stop the process.



Clicking on “One Shot” will not change the button’s color.

## 6.1.8 Result Log

The result log is located at the bottom of the main screen. An example of result log is displayed below.

```
-----
Execute Body:Off Hand:Off Face:On Dir.:Off Age:On Gender:On Gaze:Off Blink:Off Expr.:On Recog.:Off
Result Response time:2122ms Return code:00
      Face count:1
          Index:0           X:367 Y:262 Size:450 Confidence:634
          Age              Age:49 Confidence:222
          Gender           Gender:Male Confidence:311
          Expression       Expression:Surprise Score:35 Degree:-83
```

All the available functions and their respective function ON/OFF setting are listed on the “Execute” line.

The available functions are listed as “Body” for **Human Body Detection**, “Hand” for **Hand Detection**, “Face” for **Face Detection**, “Dir.” for **Face Direction Estimation**, “Age” for **Age Estimation**, “Gender” for **Gender Estimation**, “Gaze” for **Gaze Estimation**, “Blink” for **Blink Estimation**, “Expr.” for **Expression Estimation** and “Recog.” for **Face Recognition**.

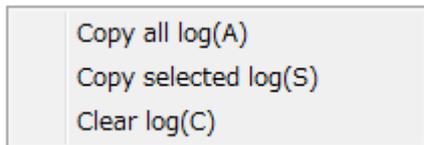
The response time is listed in milliseconds on the “Result” line.

The result info of each selected function is listed below the response time.

Refer to **7 Function Description** for details on the result log of each function.

The result log can display up to 150 results. Note that the oldest results will be discarded first when reaching more than 150 results.

Clicking on the result log window will open the following menu:



Select the appropriate action in order to copy the result log in a text file outside the Application if required.

The “Copy selected log(S)” option can only be chosen if a section of the result log is selected.

The log can also be output as a log file if the option is selected in the “General” tab of the Settings. Refer to **6.3 Settings** for details.

The version and firmware information of the Application will be displayed in the result log when the Application is run.

```
-----
HVC Demo      2.2.0.0
Firmware      1.0.1.9372
```

---

## ■ Stabilizing Result

An example of result log with stabilization is displayed below.

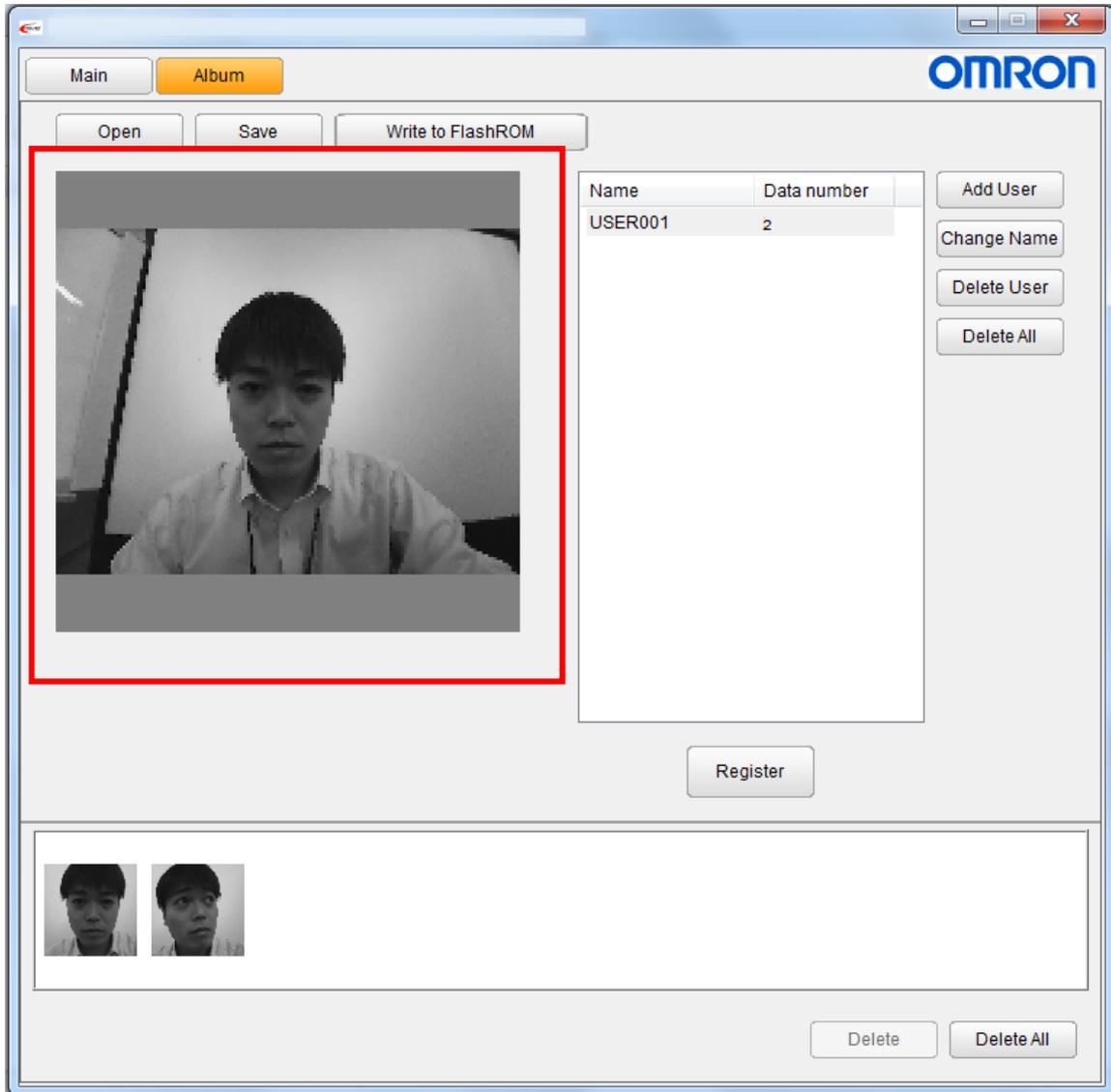
Note (\*) will be on the final result.

```
-----  
Execute Body:Off Hand:Off Face:On Dir.:Off Age:On Gender:On Gaze:Off Blink:Off Expr.:Off Recog.:Off  
Stabilization:On  
Result Response time:197ms Return code:00  
Face count:1  
Index:0 X:882 Y:585 Size:322 Confidence:602 TrackingID:0  
Age Age:22 Confidence:500 (*)  
Gender Gender:Male Confidence:529 (*)
```

## 6.2 Album Tab

The Album tab contains the interface to register users and data in order to use the **Face Recognition** function of the Application.

The image below is an example of the Album tab when the Application is used. The image sent from the camera of the Device is displayed in the red rectangle.



Note that the transfer image size setting when in the Album tab will always be set to 160×120.

---

## 6.2.1 Face Recognition Outline

**Face Recognition** is done by extracting the face feature data of the face displayed in the image sent from the Device and matching it with the user data already registered in the Application in order to identify that face.

The face feature data includes the features of the face displayed.

The user data includes information about the user (user name, data number and thumbnail images) and is saved in the Application.

The face feature data and the user data (hereafter referred to as the registration data) are saved on the Application.

---

## 6.2.2 Registration Image Display Screen

The registration image display screen on the left side of the Album tab displays the image sent from the camera of the Device. The image sent from the camera of the Device is displayed in the red rectangle.

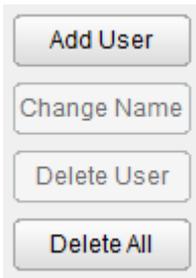


Note that the transfer image size setting is always to be set to 160×120 in the Album tab.

Note the face rectangle and any other result info will not be shown in the image displayed in the Album tab.

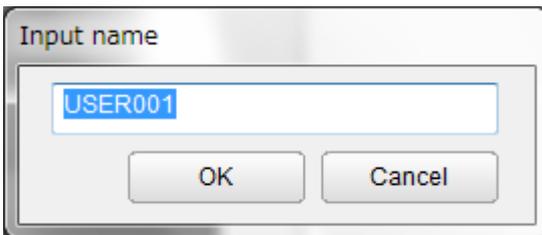
## 6.2.3 Registration Tool Bar

The registration tool bar is displayed on the right side of the Album tab.



### ■ Add User

Clicking on "Add User" will open the window below.

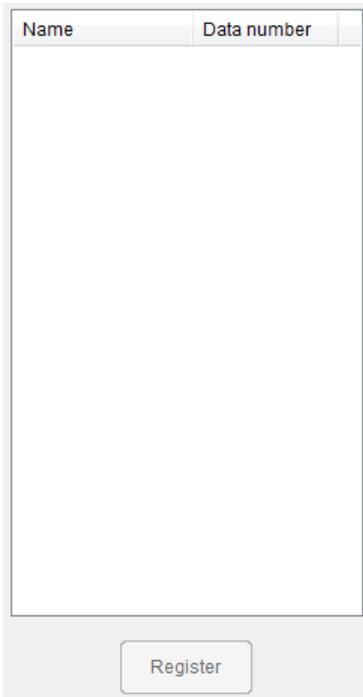


Type the name of the user to be added and click "OK" to register it.

An error message will be displayed if the input user name is already in use. In such a case, input a new user name.

The registered users will be listed to the right of to the registration image display screen in the center of the Album tab.

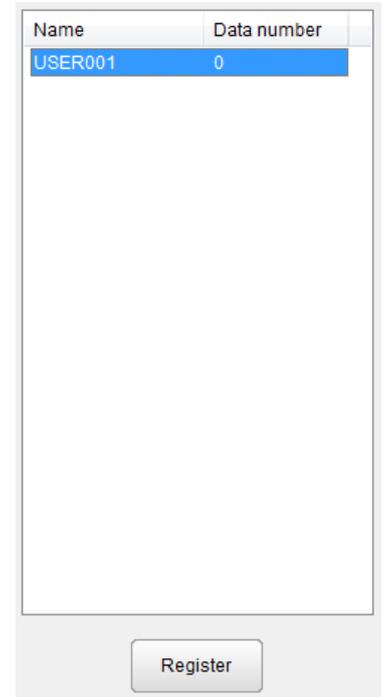
Select and highlight a user name in order to register recognition data. The greyed-out button will become available only when a registered user is selected.



List with no user registered

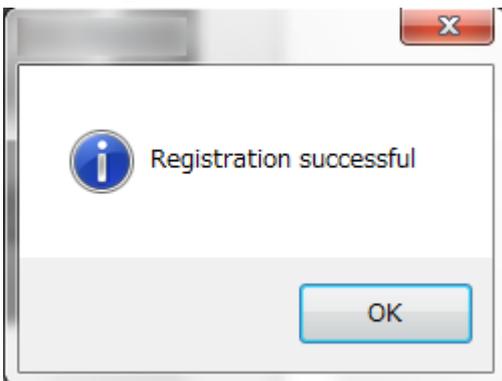


List with no registered user selected



List with registered user selected

Clicking on “Register” will register the image displayed on the left side of the Album tab to the appropriate selected registered user.



Message window displayed when registration was successful

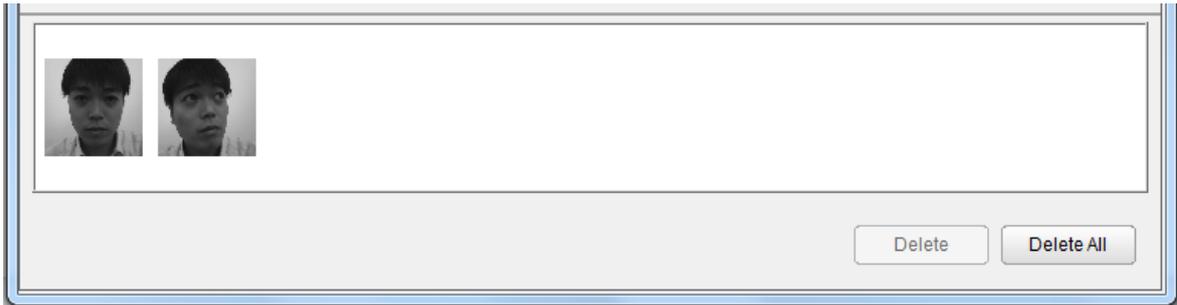
The maximum number of users that can be registered is 500. Up to 10 images can be registered per user.

Note that the face of the subject for registration must be clearly displayed in the image when clicking on the “Register” button.

Note that only one face should be displayed in the image when registering data.

Note that registration will fail and an error message will be displayed if there are multiple faces in the image or if the face is not clearly displayed in the image.

Thumbnails of the successfully registered data will be displayed at the bottom of the Album tab.



Individual images of the registration data can be deleted by selecting the appropriate thumbnail and clicking on the “Delete” button. Clicking on the “Delete all” will delete all the thumbnails registered.

Note that deleting the thumbnails of the registration data will not delete the registered users. In order to do so, select the appropriate user from the user’s name list and click on “Delete user” from the registration menu tool bar. Clicking on “Delete all” will delete all the registered users. Note that deleting a single or all the registered users will also delete all their respective face feature data. Save the Album on the machine beforehand if required.

A message window will be displayed when registration was not possible due to the face not being found. In such a case, try to do the following:

- move the face in the recognition display screen in order to center it
- move the Device itself in order to change the camera orientation
- make sure that only one face is shown in the recognition display screen

Note that successful face detection is required for successful data registration.

The performance of **Face Detection** will increase when the face in the registration display screen is a frontal face, i.e. facing the camera. Furthermore, changing the threshold value of **Face Detection** or the face angle settings in the Settings will allow the Application to detect faces more easily. Refer to **6.3 Settings** for details.

Note that changing the threshold value of **Face Recognition** in the Settings will affect the performance of **Face Recognition** in the Main tab and not of the registration process in the Album tab. Change the **Face Detection** setting to do so.

An error message will be displayed if a communication error occurs. In such a case, try to do the following:

- make sure that the port setting for the Application is properly done
- make sure that the Baud rate setting of the Application and of the Device match
- restart the Application and/or the Device

An error message will be displayed if an internal error occurs. In such a case, try to do the following:

- restart the Application and/or the Device

---

Refer to **8 Troubleshooting** should errors continue to occur.

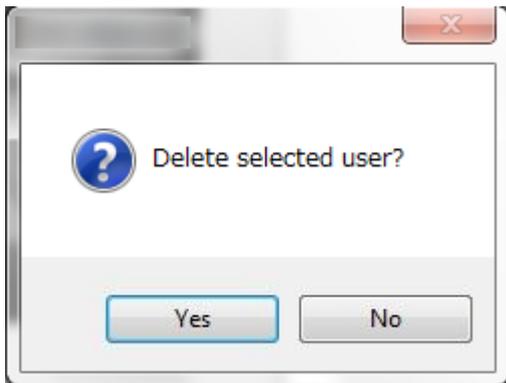
■ **Change Name**

Selecting a registered user from the name list and clicking on “Change Name” will open a window in order to input a new name for that specified user.

Note that an error message will be displayed if the new name is already in use.

■ **Delete User**

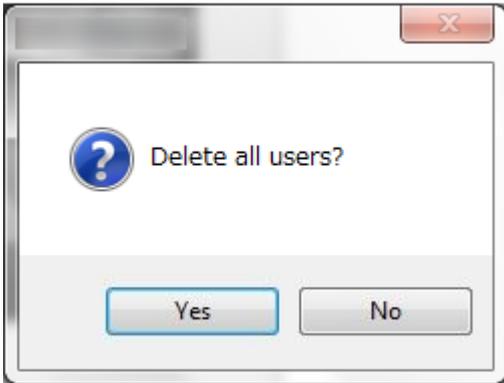
Selecting a registered user from the name list and clicking on “Delete User” will delete that specified user and all the registration data for that user.



Confirmation screen when deleting a selected user

## ■ Delete All

Clicking on “Delete All” will delete all the registered users and their respective registration data.



Confirmation screen when deleting all users

An error message will be displayed if a user cannot be deleted. In such a case, try to do the following:

- restart the Application and/or the Device.

Refer to **8 Troubleshooting** should errors continue to occur.

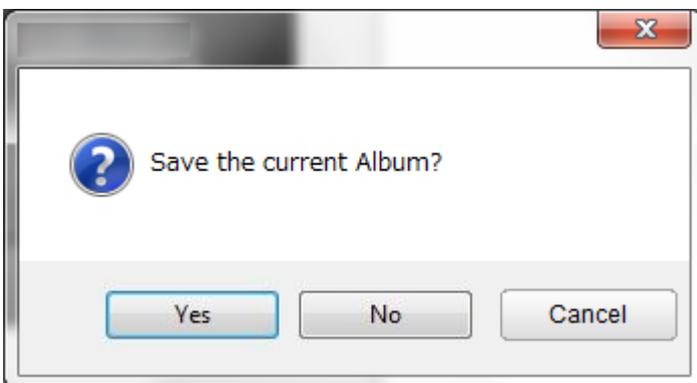
## Album Maintenance

The “Open” and “Save” buttons on the left side of the Album screen can be used to load or save the registration data upon the machine.



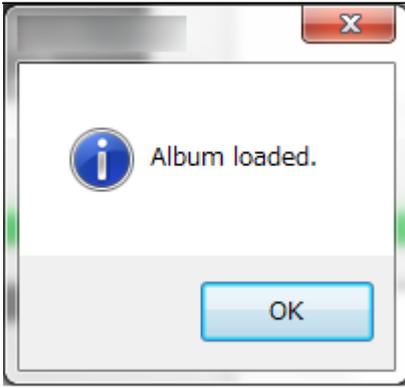
Clicking on the “Save” button will save the current registration data unto the machine operating the Application. Select the name and the folder location for the saved Album (a .hac file).

Clicking on the “Open” button will restore a saved Album. The following message will be displayed before restoring the saved Album.



Selecting “Yes” will save the currently displayed Album file before restoring a saved Album file.

The following message will be displayed when the Album file is successfully restored:



## 6.2.4 Write to Flash ROM

The face feature data will be saved on the Application. To save the data on the device, writing to Flash ROM is necessary.

- Write to Flash ROM

Clicking on the “Write to Flash ROM” will write the face feature data on the ROM of this device.

The following message will be displayed when closing the Application.

## 6.2.5 Registration Data Consistency

Face Recognition Performance will not be guaranteed and a confirmation screen will be displayed when the registration data saved on the Application and the one saved on the Device do not match.

In such a case, try to do the following;

-choose “Yes” or “No” to match those data.

Selecting “Yes” will use the data saved on the Application. Writing to Flash ROM will apply at the same time.

Selecting “No” will use the data saved on the Device. As such,

The Registration Data will be overwritten. Save the data if necessary. Saving menu will be displayed when “No” is selected.

This will change registered user name as “USER 001” or “USER 002”. The image will be blacked out as there is no thumbnail data for each user.

## 6.3 Settings

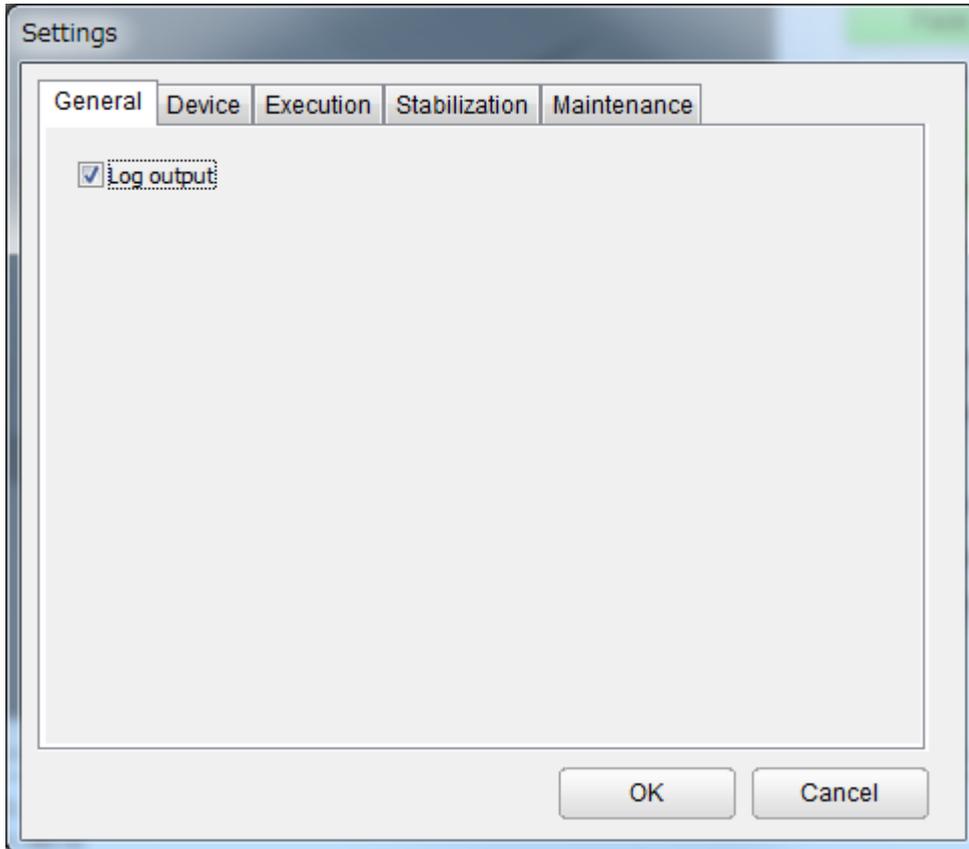
The settings button is located on the right side of the function ON/OFF tool bar of Main screen.

Clicking this button will open the settings menu.

The settings menu include three tabs, the “General” tab, the “Device” tab, the “Execution” tab, “Stabilization” and the “Maintenance” tab . Click on the appropriate tab to select it.

Clicking on “OK” will save the settings specified and return to the Main screen.

### 6.3.1 General Tab

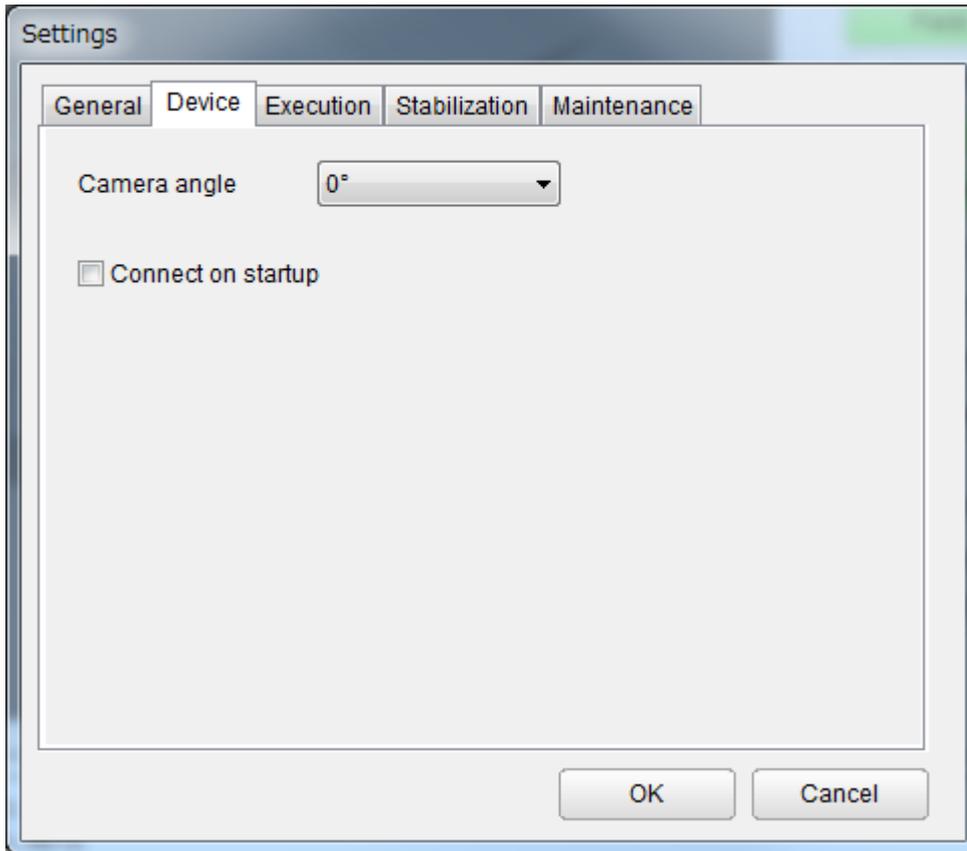


Select the “Log ouput” box to output the result log onto the machine using the Application.

Log data wil be made under Log folder in the downloaded evaluation software folder.

Note that this folder will be made when the software is run for the first time.

## 6.3.2 Device Tab



### ■ Camera mounting direction

The camera angle setting can be changed in the Device tab.

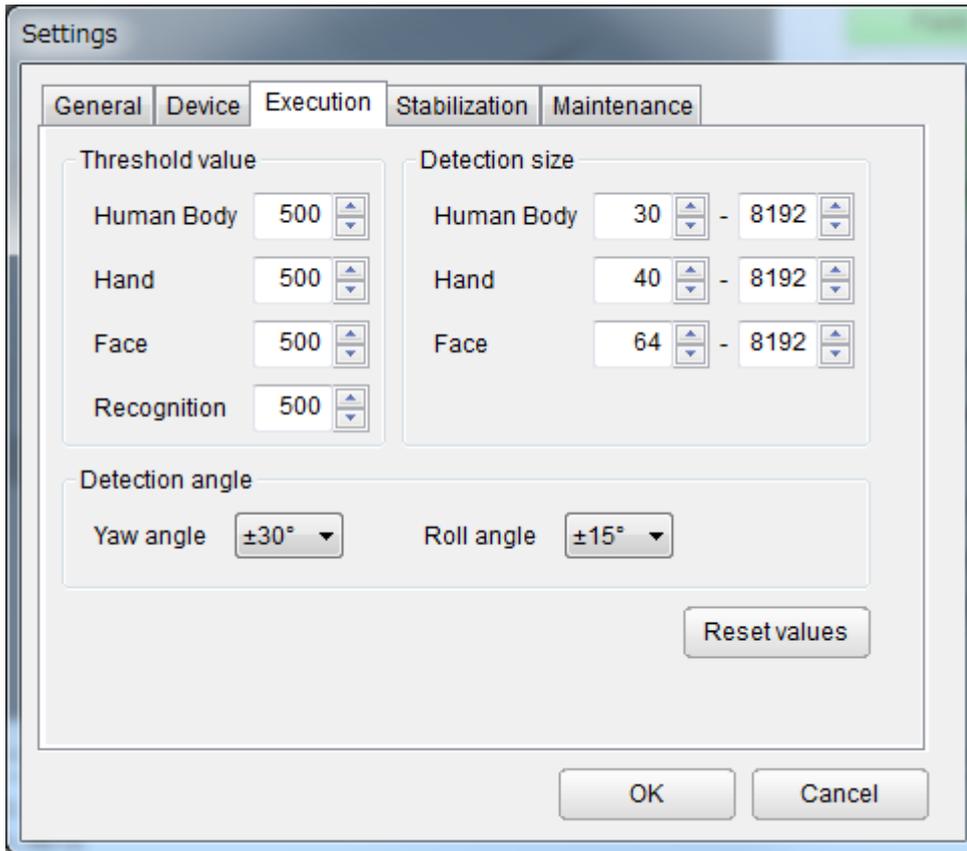
This indicates the Device mounting orientation. The result display of the Demo may be upside-down or at 90° depending on the mounting orientation. As such, change the camera angle settings in order to restore the proper result display orientation. The following settings are available: 0°, 90°, 180° and 270°

Refer to the Note \*1 in "Mounting Method" of the Instruction Sheet documentation for the Device for details.

### ■ Automatic connection on startup

The "Connect on startup" box is also available. Refer to **5.3 Connect on Startup** for details.

## 6.3.3 Execution Tab



The “Threshold value”, “Detection size” and “Face angle” settings can be changed in the Execution tab. Furthermore, a “Reset values” button is also available.

### ■ Threshold value

The threshold value for **Human Body Detection**, **Hand Detection**, **Face Detection** and **Face Recognition** can be changed in here. The specification range is from 0 to 1000 for the detection functions and from 1 to 1000 for **Face Recognition**. The default value for all threshold values is 500.

Note that when using **Human Body Detection**, **Hand Detection** or **Face Detection**, the result info of objects detected with a degree of confidence lower than the set threshold value will not be output. Likewise, when using **Face Recognition**, faces with a degree of confidence below the set threshold value will be identified as “not registered”.

Refer to **7 Function Description** for details on the above functions.

### ■ Detection size

The detection size range for **Human Body Detection**, **Hand Detection** and **Face Detection** can be changed in here. While the specification range is from 20 to 8192, the default range is 30 to 8192 for **Human Body Detection**, 40 to 8192 for **Hand Detection** and 64 to 8192 for **Face Detection**.

Note that reducing the minimum detection size will increase the processing time for detection.

Note that objects with a size outside of the specified detection range will not be detected.

### ■ Face angle

The face angle, i.e. the yaw and roll angle range to be used for **Face Detection**, can be changed in here.

The possible values for the face direction yaw angle range are  $\pm 30^\circ$ ,  $\pm 60^\circ$  and  $\pm 90^\circ$ .

The possible values for the face inclination roll angle range are  $\pm 15^\circ$  and  $\pm 45^\circ$ .

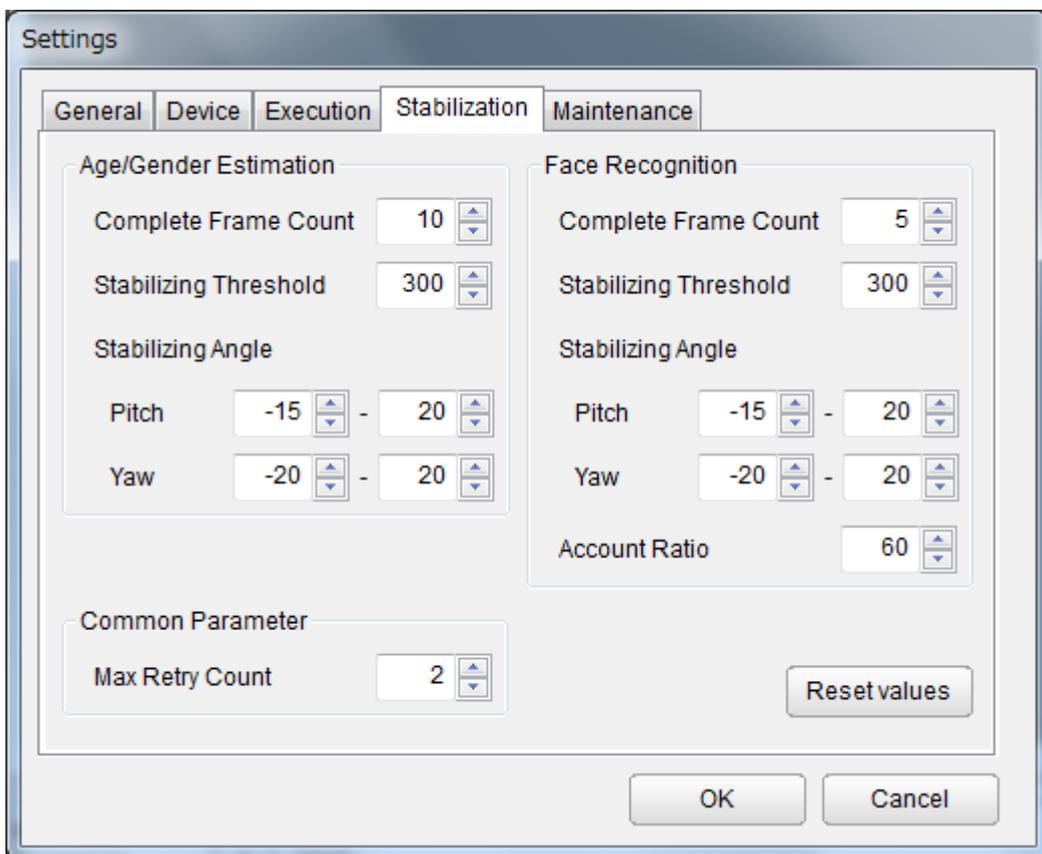
Note that setting a higher angle range value will increase the processing time required for detection.

Note that the face angle is calculated from the camera angle setting displaying a frontal face. As such, even if the angle of a face is within the specified face angle, it might not be properly detected depending on the camera angle setting specified. Make sure to verify the camera angle setting when specifying the face angle.

### ■ Reset values

A “Reset values” button is located at the bottom of the Execution tab, clicking on it will reset all the threshold values, detections sizes and face angle to their default values.

## 6.3.4 Stabilization



### ■ Age/Gender

- Frame count: the number of frames for stabilizing can be changed here from 1 to 20.
- Stabilizing Threshold: The threshold value of reliability degree for Face Direction Estimation can be changed here. The specification range is from 0 to 1000.
- Stabilizing Angle: The angle of Face Direction Estimation can be changed here. The specification range is from  $-90^\circ$  to  $90^\circ$ .

Note that fulfilling both Stabilizing Threshold and Stabilizing Angle condition frame will be used as stabilizing candidate.

### ■ Face Recognition

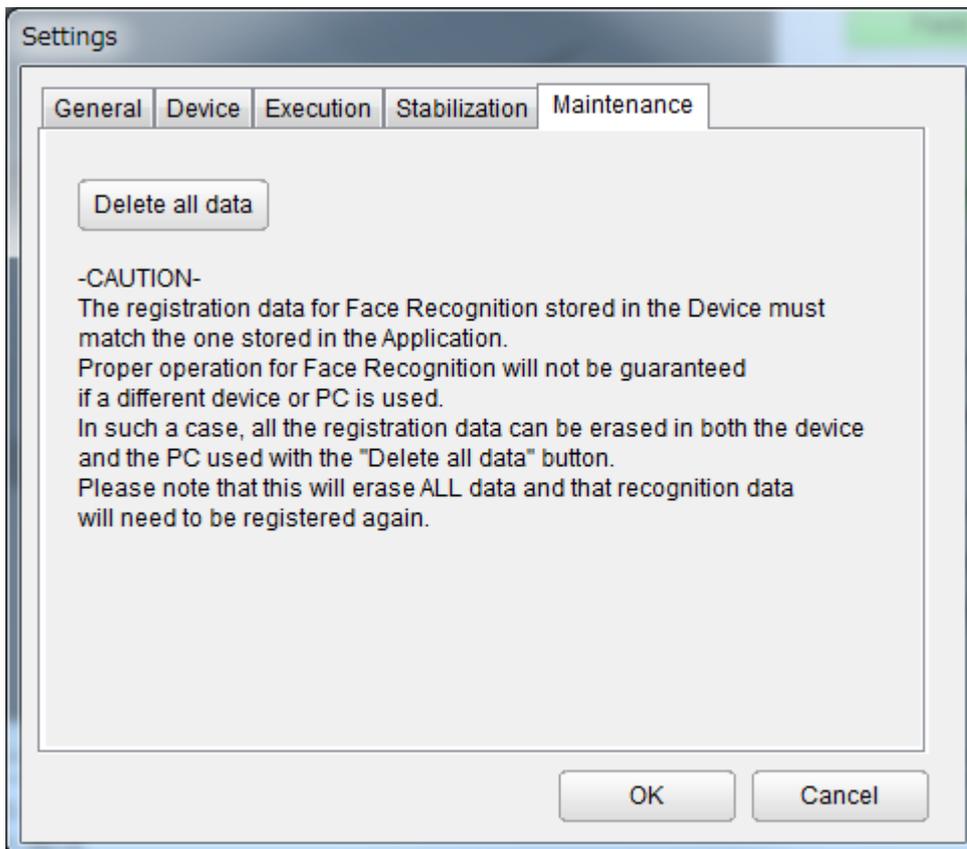
- Frame count: Same as above “Age/Gender”.
- Stabilizing Threshold: Same as above “Age/Gender”.  
However the range is from 1 to 1000.
- Stabilizing Angel: Same as above “Age/Gende”.
- Account Ratio: It can settle the result when the specific user account ratio achieves the specification range in stabiization candidate frame.

### ■ Common Parameter

Max Retry Count : The number of how many more frames to track when a face won't be found can be changed here.

In a case of not finding a face in the number of frames set here, the stabilizing value will be Reset. The specification number range is from 0 to 300.

## 6.3.5 Maintenance



The registration data for Face Recognition stored in the Device must match the one stored in the Application. Proper operation will not be guaranteed if they don't match.

In a case of not matching by changing connection or some other reason, conduct “Delete all data” button.

Note that this will delete all data stored in both the Device and the Application. To save the data stored in the Application, operate saving from the Album tab located on the top of the screen beforehand.



## 7 Function Description

### 7.1 Human Body Detection

The **Human Body Detection** function of the Application will detect human bodies (upper-body) in the image sent from the camera of the Device.

A red rectangle will be displayed around the detected human bodies in the result display screen.

The result info output will include the number of detected human bodies, their respective X & Y coordinates, their size and the degree of confidence of their detection.

The degree of confidence will be output from 0 to 1000. A higher value indicates a higher confidence in the detection. The detection result will not be output if the degree of confidence is lower than the threshold value set in Settings > Execution > Threshold value > Human Body.

When multiple human bodies are detected, the result info for each one will be displayed in the result log, identifying the human bodies from Index:0 to Index:34. Note that the index numbers will be attributed from 0 to 34 for each object type (human body, hand and face) separately when multiple detection functions are selected.

An example of the result log and the result display image is shown below.

```
-----
Execute Body:On Hand:Off Face:Off Dir.:Off Age:Off Gender:Off Gaze:Off Blink:Off Expr.:Off Recog.:Off
  Stabilization:Off
Result Response time:1052ms Return code:00
  Body count:2
    Index:0      X:384 Y:634 Size:768 Confidence:791
    Index:1      X:1292 Y:593 Size:588 Confidence:983
```



The **Body Detection** result info display in the image above is set to ON.

## 7.2 Hand Detection

The **Hand Detection** function of the Application will detect hands (open palms) in the image sent from the camera of the Device.

A blue rectangle will be displayed around the detected hands in the result display screen.

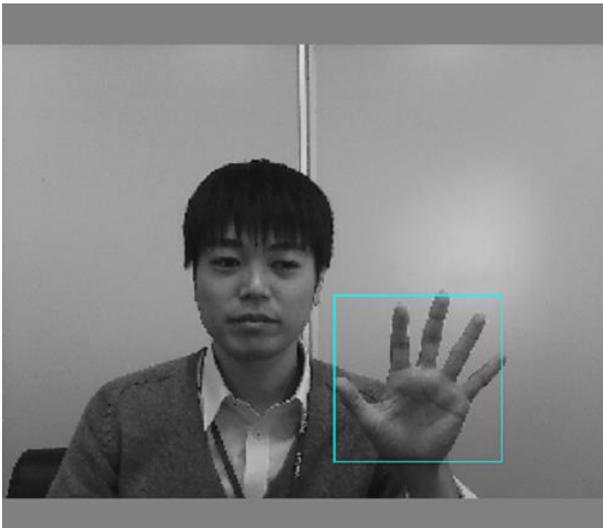
The result info output will include the number of detected hands, their respective X & Y coordinates, their size and the degree of confidence of their detection.

The degree of confidence will be output from 0 to 1000. A higher value indicates a higher confidence in the detection. The detection result will not be output if the degree of confidence is lower than the threshold value set in Settings > Execution > Threshold value > Hand.

When multiple hands are detected, the result info for each one will be displayed in the result log, identifying the hands from Index:0 to Index:34. Note that the index numbers will be attributed from 0 to 34 for each object type (human body, hand and face) separately when multiple detection functions are selected.

An example of the result log and the result display image is shown below.

```
-----
Execute Body:Off Hand:On Face:Off Dir.:Off Age:Off Gender:Off Gaze:Off Blink:Off Expr.:Off Recog.:Off
      Stabilization:Off
Result Response time:434ms Return code:00
      Hand count:1
          Index:0           X:1094 Y:882 Size:441 Confidence:1000
```



The **Hand Detection** result info display in the image above is set to ON.

## 7.3 Face Detection

The **Face Detection** function of the Application will detect the position of faces in the image sent from the camera of the Device.

A green face rectangle will be displayed around the detected faces in the result display screen.

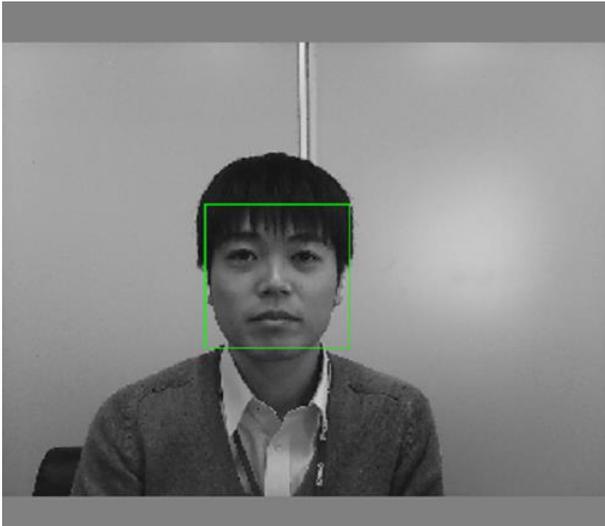
The result info output in the result log will include the number of faces detected, their respective X & Y coordinates, their size and the degree of confidence of their detection.

The degree of confidence will be output from 0 to 1000. A higher value indicates a higher confidence in the detection. The detection result will not be output if the degree of confidence is lower than the threshold value set in Settings > Execution > Threshold value > Face.

When multiple faces are detected, the result info for each one will be displayed in the result log, identifying the faces from Index:0 to Index:34. Note that the index numbers will be attributed from 0 to 34 for each object type (human body, hand and face) separately when multiple detection functions are selected.

An example of the result log and the result display image is shown below.

```
-----
Execute Body:Off Hand:Off Face:On Dir.:Off Age:Off Gender:Off Gaze:Off Blink:Off Expr.:Off Recog.:Off
      Stabilization:Off
Result  Response time:207ms  Return code:00
      Face count:1
          Index:0           X:721 Y:618 Size:378 Confidence:879
```



The **Face Detection** result info display in the image above is set to ON.

## 7.4 Face Direction Estimation

The **Face Direction Estimation** function of the Application will estimate the direction of the faces in the image sent from the camera of the Device.

Three lines of different color indicating each face direction angle will be displayed from the center of the face in the result display screen.

The face direction yaw (LR: left-right) angle of the face will be displayed in cyan blue.

The face direction pitch (UD: up-down) angle of the face will be displayed in yellow.

The face inclination roll (Roll) angle of the face will be displayed in purple.

The result info output in the result log will include the LR, UD and Roll angle values and the degree of confidence of the estimation.

The LR angle will be output from -180 to 179. 0 indicates a frontal face, a negative value a face oriented to the left and a positive value a face oriented to the right.

The UD angle will be output from -180 to 179. 0 indicates a frontal face, a negative value a face oriented down and a positive value a face oriented up.

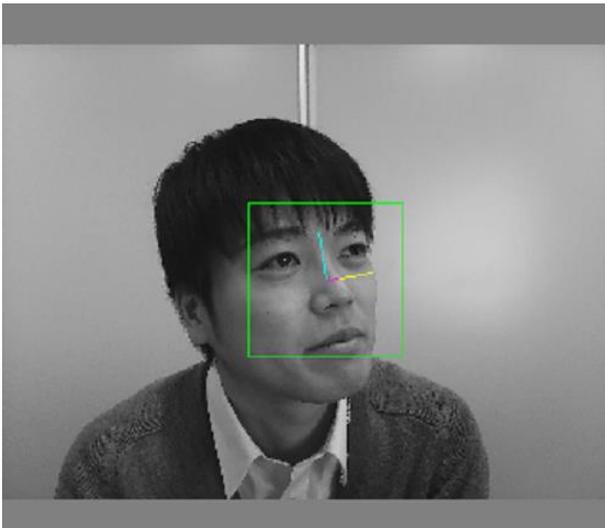
The Roll angle will be output from -180 to 179. 0 indicates a face oriented upward, a negative value a face rotated counter-clockwise and a positive value a face rotated clockwise.

The degree of confidence will be output from 0 to 1000. A higher value indicates a higher confidence in the estimation.

When multiple faces are detected, the result info for each one will be displayed in the result log, identifying the faces from Index:0 to Index:34.

An example of the result log and the result display image is shown below.

```
-----
Execute Body:Off Hand:Off Face:On Dir.:On Age:Off Gender:Off Gaze:Off Blink:Off Expr.:Off Recog.:Off
  Stabilization:Off
Result Response time:214ms Return code:00
  Face count:1
    Index:0          X:851 Y:621 Size:404 Confidence:733
    Direction       Yaw:16 Pitch:0 Roll:-10 Confidence:426
```



The **Face Detection** result info display in the image above is set to OFF.

---

## 7.5 Age Estimation

The **Age Estimation** function of the Application will estimate the age of the faces in the image sent from the camera of the Device.

The estimated age will be displayed above the face in the result display screen.

The result info output in the result log will include the estimated age and the degree of confidence of the estimation.

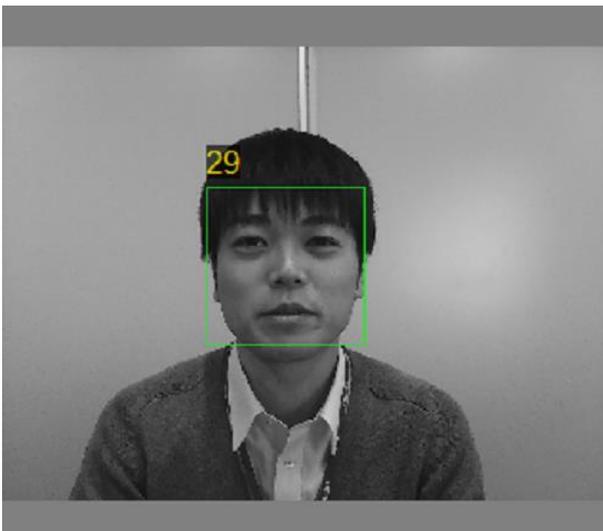
The estimated age will be output from 0 to 75. 75 will include higher ages.

The degree of confidence will be output from 0 to 1000. A higher value indicates a higher confidence in the estimation.

When multiple faces are detected, the result info for each one will be displayed in the result log, identifying the faces from Index:0 to Index:34.

An example of the result log and the result display image is shown below.

```
-----  
Execute Body:Off Hand:Off Face:On Dir.:Off Age:On Gender:Off Gaze:Off Blink:Off Expr.:Off Recog.:Off  
Stabilization:Off  
Result Response time:238ms Return code:00  
Face count:1  
Index:0 X:744 Y:580 Size:418 Confidence:797  
Age Age:29 Confidence:1000
```



The **Face Detection** result info display in the image above is set to OFF.

## 7.6 Gender Estimation

The **Gender Estimation** function of the Application will estimate the gender of faces in the image sent from the camera of the Device

The estimated gender will be displayed above the face in the result display screen.

The result info output in the result log will include the estimated gender and the degree of confidence of the estimation.

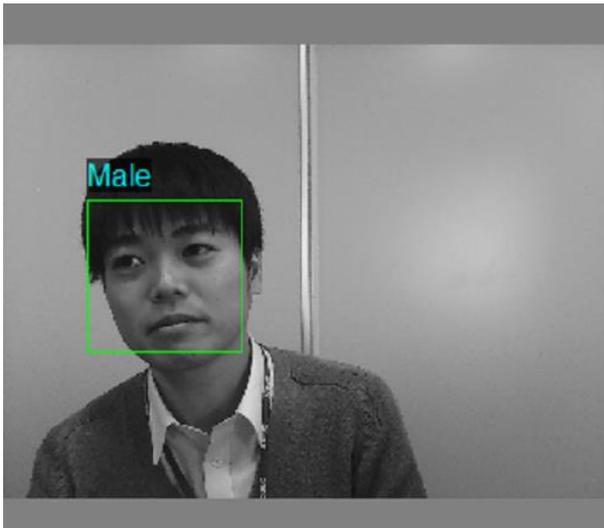
The estimated gender will be output as either “male” or “female”.

The degree of confidence will be output from 0 to 1000. A higher value indicates a higher confidence in the estimation.

When multiple faces are detected, the result info for each one will be displayed in the result log, identifying the faces from Index:0 to Index:34.

An example of the result log and the result display image is shown below.

```
-----|-----
Execute Body:Off Hand:Off Face:On Dir.:Off Age:Off Gender:On Gaze:Off Blink:Off Expr.:Off Recog.:Off
  Stabilization:Off
Result Response time:238ms Return code:00
  Face count:1
    Index:0          X:425 Y:612 Size:402 Confidence:742
    Gender          Gender:Male Confidence:671
```



The **Face Detection** result info display in the image above is set to OFF.

## 7.7 Gaze Estimation

The **Gaze Estimation** function of the Application will estimate the gaze direction of faces in the image sent from the camera of the Device.

Arrows indicating the gaze direction will be displayed from each eye of the face in the result display screen.

The result info output in the result log will include the yaw angle of the gaze (LR) and the pitch angle of the gaze (UD). The gaze estimation is for both eyes.

The LR angle is output from -90 to 90 where 0 indicates a gaze facing forward, a negative value a gaze to the left, and a positive value a gaze to the right.

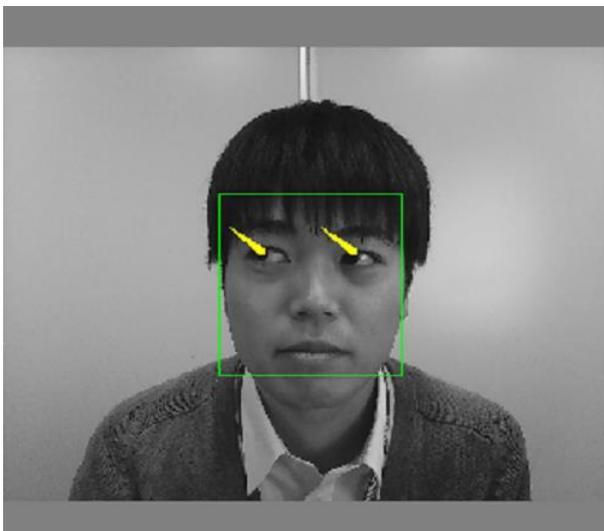
The UD angle is output from -90 to 90 where 0 indicates a gaze facing frontward, a negative value a gaze down, and a positive value a gaze up.

When multiple faces are detected, the result info for each one will be displayed in the result log, identifying the faces from Index:0 to Index:34.

Note that the arrows indicating the gaze direction will start from the area of the eyes and not from the eyes' center position itself.

An example of the result log and the result display image is shown below.

```
-----
Execute Body:Off Hand:Off Face:On Dir.:Off Age:Off Gender:Off Gaze:On Blink:Off Expr.:Off Recog.:Off
  Stabilization:Off
Result Response time:223ms Return code:00
  Face count:1
    Index:0          X:806 Y:625 Size:480 Confidence:792
    Gaze            Yaw:-18 Pitch:12
```



The **Face Detection** result info display in the image above is set to OFF.

## 7.8 Blink Estimation

The **Blink Estimation** function of the Application will estimate the blink degree of the eyes in faces in the image sent from the camera of the Device.

Bars will be displayed on each side of the face to indicate the respective left and right side eye blink degrees. A higher red level in the bar, making it look more full, will indicate that the eye is closer to be fully opened.

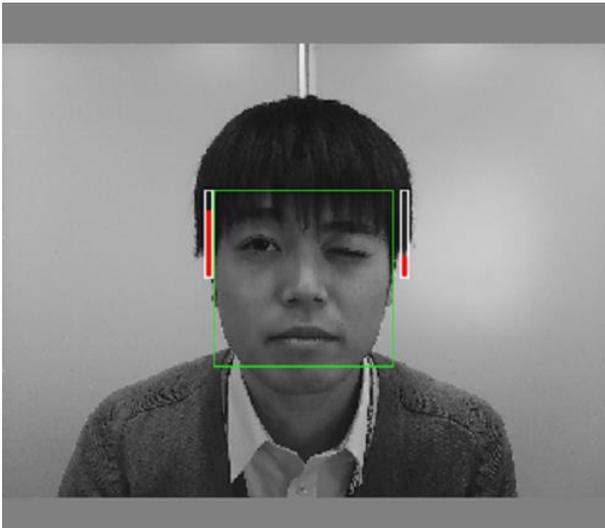
The result info output in the result log will include the blink degree for both eyes.

The blink degree will be output from 1 to 1000 for each eye separately. A value closer to 1 means that the eye is closer to be fully opened while a value closer to 1000 means that the eye is closer to be fully shut.

When multiple faces are detected, the result info for each one will be displayed in the result log, identifying the faces from Index:0 to Index:34.

An example of the result log and the result display image is shown below.

```
-----
Execute Body:Off Hand:Off Face:On Dir.:Off Age:Off Gender:Off Gaze:Off Blink:On Expr.:Off Recog.:Off
  Stabilization:Off
Result  Response time:219ms  Return code:00
  Face count:1
    Index:0      X:793 Y:619 Size:468 Confidence:703
    Blink       Left:224 Right:739
```



The **Face Detection** result info display in the image above is set to OFF.

## 7.9 Expression Estimation

The **Expression Estimation** function of the Application will estimate the facial expression displayed by the faces in the image sent from the camera of the Device.

The estimated expression will be displayed above the face in the result display screen. The possible estimated expressions are “neutral”, “happiness”, “surprise”, “anger” and “sadness”.

The result info output in the result log will include the estimated expression with the highest score, the scores for all expressions listed in the order described above, and an expression degree to indicate whether the estimated expression is a positive or a negative one.

The estimated expression will be output as either of “Neutral”, “Happiness”, “Surprise”, “Anger” or “Sadness” and indicates the expression with the highest score.

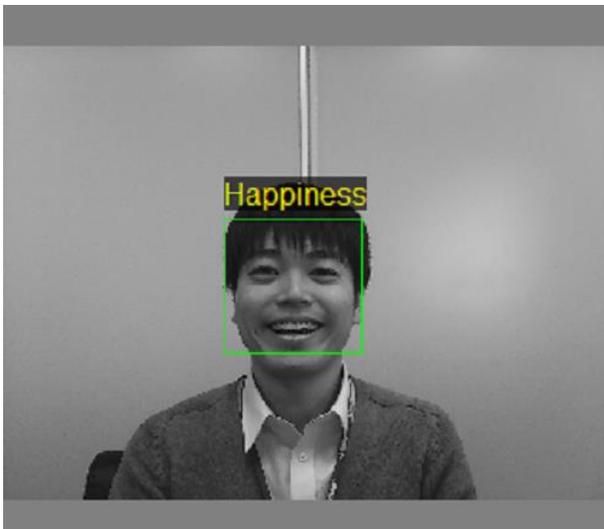
The score for each expression will be output from 0 to 100 in the order described above, a higher value indicating a higher likeliness to be of the estimated expression.

The expression degree will be output from -100 to 100. A value closer to -100 indicates a negative expression (anger or sadness) while a value closer to 100 indicates a positive expression (happiness).

When multiple faces are detected, the result info for each one will be displayed in the result log, identifying the faces from Index:0 to Index:34.

An example of the result log and the result display image is shown below.

```
-----
Execute Body:Off Hand:Off Face:On Dir.:Off Age:Off Gender:Off Gaze:Off Blink:Off Expr.:On Recog.:Off
Stabilization:Off
Result Response time:244ms Return code:00
Face count:1
Index:0 X:761 Y:634 Size:358 Confidence:726
Expression Expression:Happiness Score: Neutral:0, Happiness:100, Surprise:0, Anger:0, Sadness:0 Degree:100
```



The **Face Detection** result info display in the image above is set to ON.

## 7.10 Face Recognition

The **Face Recognition** function of the Application will compare the faces in the image sent from the camera of the Device with a database of already registered faces in order to identify them.

The user names of the recognized faces will be displayed above them.

The result info output in the result log will include the recognized user name and the degree of confidence of the recognition.

The user name output will be from the list of pre-registered user names stored in the Application.

The degree of confidence will be output from 1 to 1000. A higher value indicates a higher confidence in the recognition. The recognition result will not be output if the degree of confidence is lower than the threshold value set in Settings > Execution > Threshold value > Recognition.

Note that this function requires registering one or more users along with recognition data in order to be used. A previously saved Album file can also be restored and used for recognition.

Note that while the registration of users and images for this function is done in the Album tab, its execution is done from the Main tab.

A “data not registered” message will be displayed above a face in the result display screen of the Main tab when this function is used without any registered user or without any registered data for those users.

When multiple faces are detected, the result info for each one will be displayed in the result log, identifying the faces from Index:0 to Index:34.

An example of the result log and the result display image is shown below.

A “Not registered” message will be displayed above a face in the result display screen of the Main tab when the user is not registered or when the degree of confidence of the recognition is lower than the threshold value specified.

When multiple individuals are present in the image, recognized users will have their registered user name displayed while non-registered users will have a “Not registered” message displayed.

```
-----
Execute Body:Off Hand:Off Face:On Dir.:Off Age:Off Gender:Off Gaze:Off Blink:Off Expr.:Off Recog.:On
      Stabilization:Off
Result  Response time:270ms  Return code:00
      Face count:2
          Index:0           X:1111 Y:576 Size:318 Confidence:675
          Recognition       Not registered Confidence:289
          --
          Index:1           X:225 Y:609 Size:304 Confidence:856
          Recognition       USER001 Confidence:725
```



The **Face Detection** result info display in the image above is set to ON.

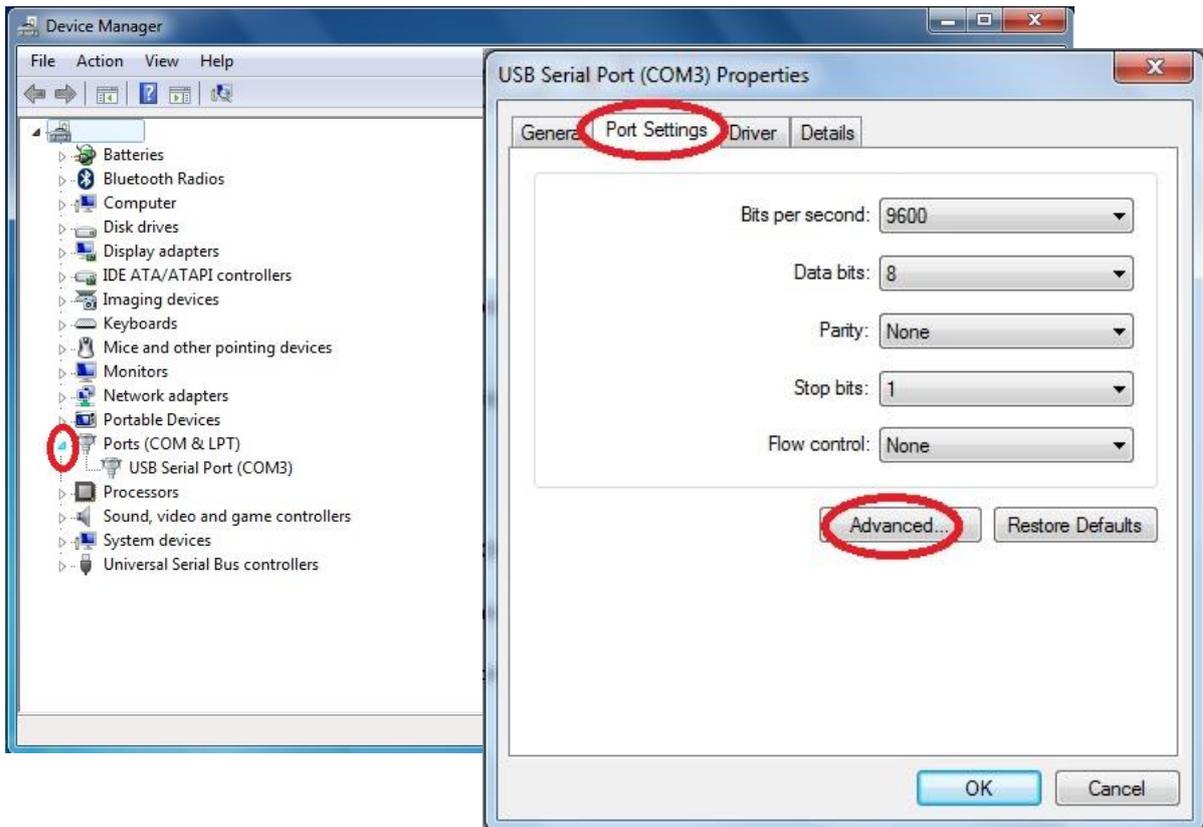
## 8 Troubleshooting

<b>The Device won't power-up</b>	
Suspected cause	The cable or the connector is not properly connected
Items to verify	
Verify the cable and the connector.	
<b>There is a communication error (communication is not possible)</b>	
Suspected cause	<ol style="list-style-type: none"> <li>1. The cable is not properly connected</li> <li>2. The communication setting is incorrect</li> <li>3. The USB driver install was not completed</li> <li>4. The machine used is not powerful enough</li> </ol>
Items to verify	
<ol style="list-style-type: none"> <li>1. Verify the cable and the connector.</li> <li>2. Verify the communication settings and the transmission speed of the Device.</li> <li>3. Verify the Port number (COM and LPT) in the device manager of the machine.</li> <li>4. Reduce the Baud rate setting, or change the USB driver settings. See <b>8.1 USB Driver Settings</b> for details on the USB driver settings.</li> </ol>	
<b>Face Detection or Face Recognition is not successful</b>	
Suspected cause	<ol style="list-style-type: none"> <li>1. The detection size and/or the threshold value settings are incorrect</li> <li>2. The appropriate functions are not selected in the Main tab</li> <li>3. The camera is blocked</li> </ol>
Items to verify	
<ol style="list-style-type: none"> <li>1. Verify that the detection size and/or threshold value are not too high.</li> <li>2. Verify that the appropriate functions are correctly selected in the Main tab.</li> <li>3. Verify that there are no obstacles in front of the camera.</li> </ol>	
<b>The image is not displayed when using the execute buttons</b>	
Suspected cause	<ol style="list-style-type: none"> <li>1. The transfer image size is set incorrectly</li> <li>2. The camera is blocked</li> </ol>
Items to verify	
<ol style="list-style-type: none"> <li>1. Verify that the transfer image size is set to a value other than "no image".</li> <li>2. Verify that there are no obstacles in front of the camera.</li> </ol>	
<b>The orientation of the image displayed is incorrect when using the execute buttons</b>	
Suspected cause	The camera angle is set incorrectly
Items to verify	
Verify the camera angle setting and the actual camera mounting direction of the camera.	

Contact the HVC Customer Service listed in the specification document should any issue persist.

## 8.1 USB Driver Settings

Open the “USB Serial Port (COM...)” of the “Ports (COM & LPT)” in the “Device Manager” of the machine connected to the Device and select “Properties”.



Then, select “Advanced...” from the “Port Settings” tab.

The communication performance will improve if the “Latency Timer (msec)” in “BM Options” is set lower than 16.

However, **setting the value too low will increase the rate of interruption of the USB and increase the load on the system.** Make sure to set a balanced value.

