



Manual Calibration

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1. Manual calibration introduction

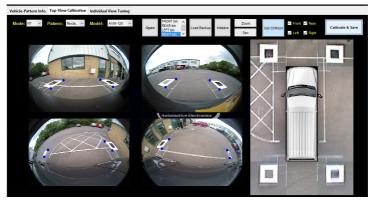
1.1. Purpose

Manual calibration involves the user inputting the image coordinates and manually setting the figures in the PC software.

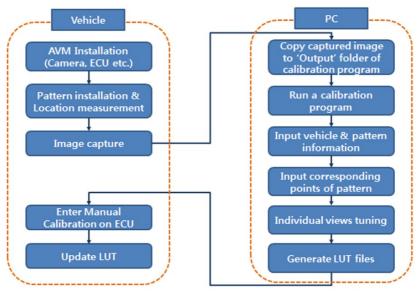
1.2. Manual calibration software

Recommended PC operating system:

Windows 7, Windows 8, Windows 8.1



2. Manual calibration overview



3. Manual calibration process

3.1 Setup MCR program

First, find out what bit version your PC is running by taking the following steps :

- Click Start, and then click 'Control Panel'.
- Click on 'System & Security', then 'System'
- The operating system is displayed under 'System type:'

MCR must be installed in order to run the calibration software. **N.B. MCR only needs to be installed once on the PC it is being used.**

If you have a 64-bit PC, run installer called: 'MCR_R2014a_win64_installer' from the SD card provided.

| Manual Calibration Software | 07/06/2016 10:34 | File folder | |
|-----------------------------|------------------|-----------------|------------|
| 코 360 programming mat | 14/06/2016 13:42 | Adobe Acrobat D | 21 KB |
| 🛋 360 programming mat | 14/06/2016 13:36 | PNG File | 33 KB |
| 🔁 Manual calibration V2 | 21/06/2016 16:54 | Adobe Acrobat D | 7,323 KB |
| MCR_R2014a_win64_installer | 24/05/2016 12:48 | Application | 602,458 KB |

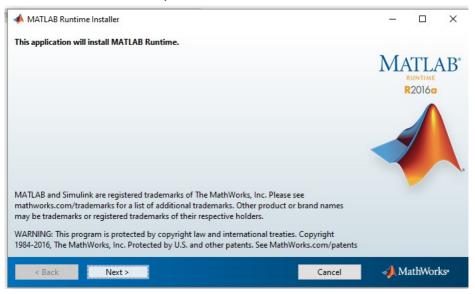
The files will then be extracted:



If you are running a 32-bit PC, run installer called: MCR_R2014a_win32_installer' instead

| | 07/06/2016 10:34 | File folder | |
|------------------------------|------------------|-----------------|------------|
| 🗾 360 programming mat | 14/06/2016 13:42 | Adobe Acrobat D | 21 KB |
| 📓 360 programming mat | 14/06/2016 13:36 | PNG File | 33 KB |
| 🗾 Manual calibration V2 | 28/07/2016 08:57 | Adobe Acrobat D | 7,321 KB |
| 🖏 MCR_R2014a_win32_installer | 07/06/2016 10:38 | Application | 550,062 KB |
| 🖏 MCR_R2014a_win64_installer | 24/05/2016 12:48 | Application | 602,458 KB |

Once extracted, the setup window will open automatically. Press 'Next' to continue the setup.



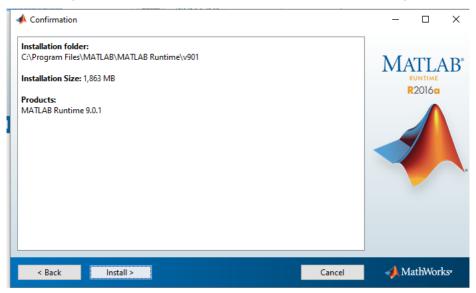
Agree to the licensing terms and conditions by selecting 'Yes' and then press 'Next' to continue.

| 📣 License Agreement | | - | | × | | |
|---|--------|-----|---------|----|--|--|
| The MathWorks, Inc. | | | | ^ | | |
| MATLAB RUNTIME LICENSE | | | | | | |
| IMPORTANT NOTICE BY CLICKING THE "YES" BUTTON BELOW, YOU ACCEPT THE TERMS OF THIS LICENSE. IF YOU ARE NOT WILLING TO DO SO, SELECT THE "NO" BUTTON AND THE INSTALLATION WILL BE ABORTED. | | | | | | |
| 1. LICENSE GRANT. Subject to the restrictions below, The MathWorks, Inc. ("MathWorks") hereby grants to you, whether you are an individual or an entity, a license to install and use the MATLAB Runtime ("Runtime"), solely and expressly for the purpose of running software created with the MATLAB Compiler (the "Application Software"), and for no other purpose. This license is personal, nonexclusive, and nontransferable. | | | | | | |
| 2. LICENSE RESTRICTIONS. You shall not modify or adapt the Runtime for any reason. You shall not disassemble, decompile, or reverse engineer the Runtime. You shall not alter or remove any proprietary or other legal notices on or in copies of the Runtime. Unless used to run Application Software, you shall not rent, lease, or loan the Runtime, time share the Runtime, provide service bureau use, or use the Runtime for supporting any other party's use of the Runtime. You | | | | | | |
| Do you accept the terms of the license agreement? | | | | | | |
| < Back Next > | Cancel | 🥠 М | athWork | S* | | |

Select the location for the files to be installed by clicking 'Browse', then press 'Next'. Select 'Yes' in the popup window to create a new folder.

| A Folder Selection | | _ | | × |
|--|------------------------|-----|---------|------|
| Todel Selection | | | | ~ |
| Choose installation folder: | | | | |
| C:\Program Files\MATLAB\MATLAB Runtime | Browse | MA | TI | A R° |
| | | | RUNTIME | n |
| | Restore Default Folder | 1 | 2016a | |
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| < Back Next > | Cancel | 🥠 M | athWor | ks• |
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Review the installation folder on the next screen and then when satisfied press 'Install'. N.B. installation takes 2-3 minutes to complete.



Installation window:

Finish

< Back

| 📣 68% Complete | | | <u> (111)</u> | | × |
|---------------------------|-----|--------|---------------|---------|-----------------|
| Installing | | | | | |
| | 68% | | | | |
| | | | | Pau | JSE |
| | | | | | |
| | | | | | |
| | | | | | |
| | | Cancel | 📣 M | lathWor | 'ks• |
| Installation complete: | | | | | |
| 📣 Installation Complete | | | | | × |
| Installation is complete. | | | | | |
| | | | | | 4B [∗] |
| | | | | | |

Once the installation is complete, press 'Finish' to complete the MCR setup.

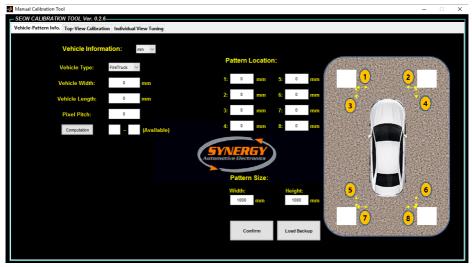
📣 MathWorks•

Cancel

Next, run the .exe file called 'Synergy_Calibration' from the SD card provided.

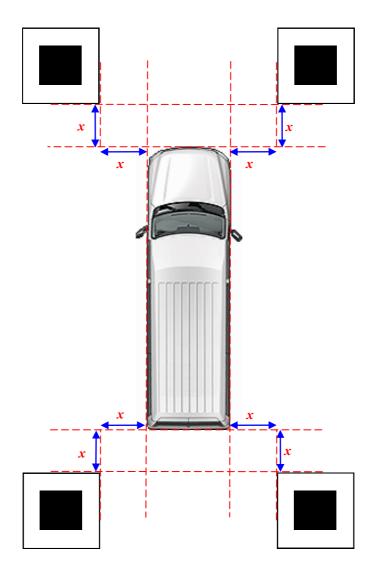
| | Backup | 24/05/2016 09:33 | File folder | |
|-----------|---------------------|------------------|---------------|----------|
| | Output | 24/05/2016 09:33 | File folder | |
| | overlayFiles | 24/05/2016 09:33 | File folder | |
| | VehicleData | 24/05/2016 09:33 | File folder | |
| | 🖾 background_img | 31/07/2015 15:51 | JPG File | 11 KB |
| | pattern_Location | 17/09/2015 17:45 | PNG File | 392 KB |
| | 📄 sample | 24/05/2016 08:53 | Text Document | 1 KB |
| | 🖻 seon_bg | 23/05/2016 21:58 | BMP File | 2,487 KB |
| | 🖻 splash | 23/05/2016 21:37 | PNG File | 504 KB |
| \square | Synergy_Calibration | 25/04/2016 16:12 | Application | 7,814 KB |
| | | | | |

The calibration tool opens up as follows:



Before proceeding to the next stage — format an SD card so that it is blank, and insert it into the Smart Vision ECU. This is where the calibration images will be stored.

3.2 Calibration pattern positioning



x = 500 mm

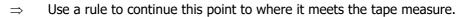
Drawing not to scale

 \Rightarrow Run a tape measure or straight edge along one side of the vehicle, ensuring that it is absolutely parallel to the tyres.



 \Rightarrow Use a T-square to run from the very front (i.e. the point furthest forward) of the vehicle to the ground, and mark this point.



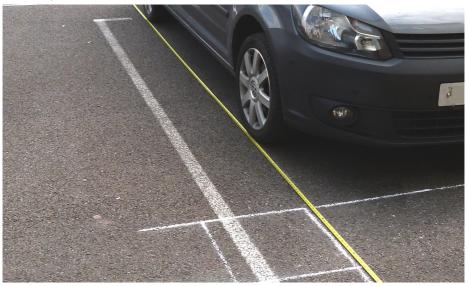




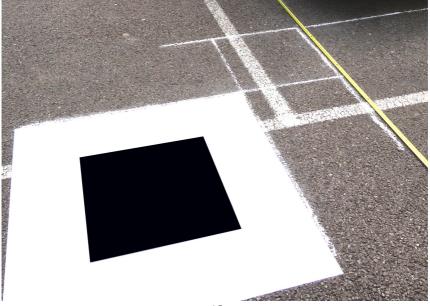
 \Rightarrow Use the T-square to continue the line approximately 750 mm beyond the tape measure.



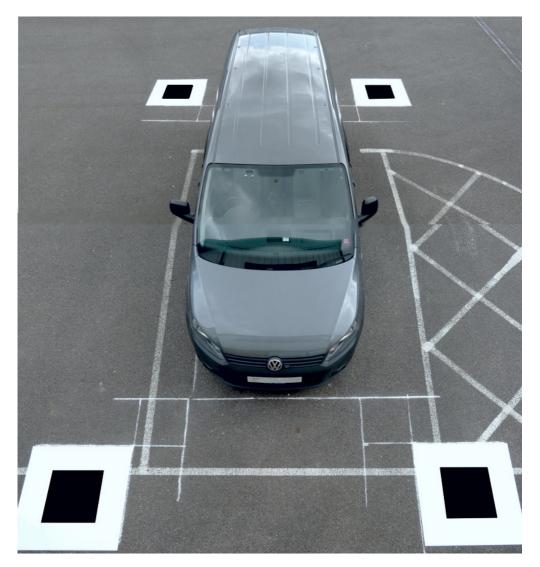
⇒ Measure 500 mm along the line from the tape measure and mark this point. Then measure 500 mm along the perpendicular line and mark this point. Use a rule to draw lines (approximately 750 mm in length) from the two points just marked to form a square that will be 500 x 500 mm.



⇒ Place the calibration pattern so that one corner of it is adjacent to the furthest corner of the square that has just been marked, ensuring that it is parallel to the guide lines.



 $\Rightarrow \quad \text{Repeat this process on the other front side of the vehicle, then repeat for rear left and rear right. Please check the below image for reference on how all four calibration patterns should look when positioned correctly.}$



N.B. Ensure that all the doors are closed and the area around the vehicle is clear before beginning the pattern capturing process!

3.3 Capturing pattern image

Ensuring that there is a **blank SD card in the ECU**, enter calibration mode on the main menu.



View 'Front/Rear/Left/Right' menus in turn to check that two patterns are fully visible in each view.



Front view



Rear view



Left view



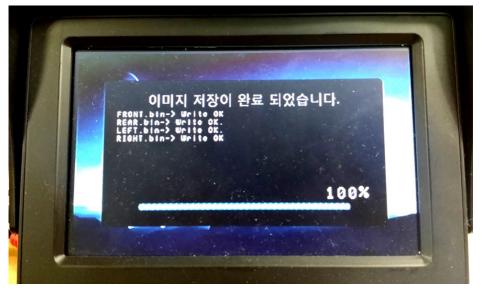
Right view



- \Rightarrow After checking all 4 camera images, return to the main menu by pressing the `Full' key on the remote control.
- \Rightarrow Enter 'Capture' menu.



Image capture will run as follows, and generate the following files on the SD card: 'FRONT.bin', 'REAR.bin', 'LEFT.bin', 'RIGHT.bin'



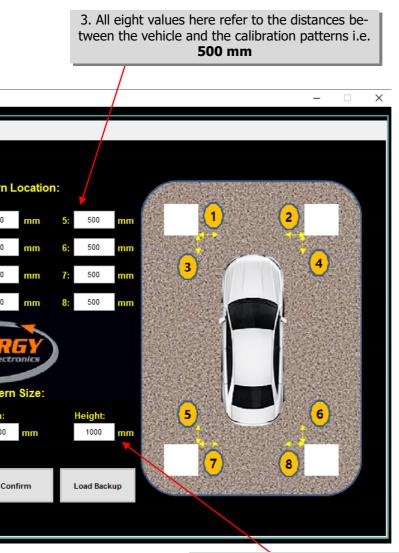
When image capture has reached 100%, switch off ignition, remove the SD card from the ECU and check that all four .bin files are present. Then copy these files to the 'Output' folder within the main 'Synergy_Calibration' folder on your PC. If the folder already contains files of same names, then replace them.

3.4 Using the Synergy Calibration tool

 \Rightarrow Run the program 'Synergy_Calibration'

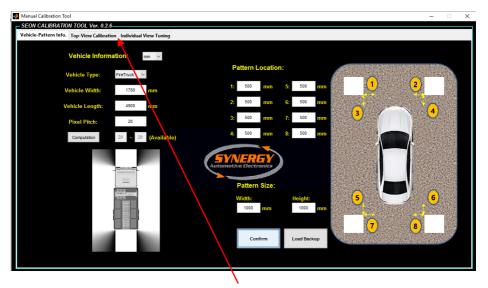
1. Enter vehicle details here, including width and length (in millimetres) Manual Calibration Tool - SEON CALIBRATION TOOL Ver. 0.2.6 Vehicle-Pattern Info. Top-View Calibration Individual View Tuning Vehicle Information: mm 🗸 Patter Vehicle Type: CargoVan 50 1: Vehicle Width: 1780 mm 50 2: Vehicle Length: 4900 mm 50 3: Pixel Pitch: 20 50 4 20 (Available) Computation 20 comotive Ele Patt Width 10

2. The 'Pixel Pitch' value will be calculated automatically based on the vehicle details when the 'Computation' button is pressed

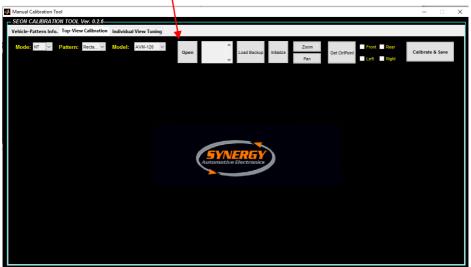


4. The pattern size is the same as the default values here i.e. **1000** by **1000 mm.** This refers to the dimensions of the calibration patterns

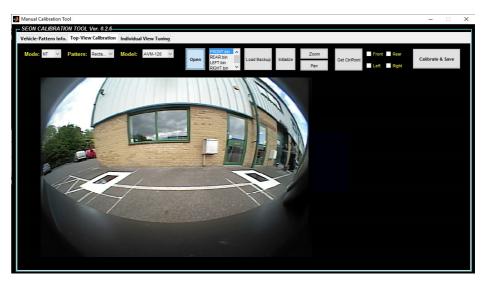
⇒ Click 'Confirm' when the settings are correct. This will generate the vehicle and pattern information files. **(N.B. this process can take a couple of minutes).** Press 'OK' on the popup window when the process is complete.



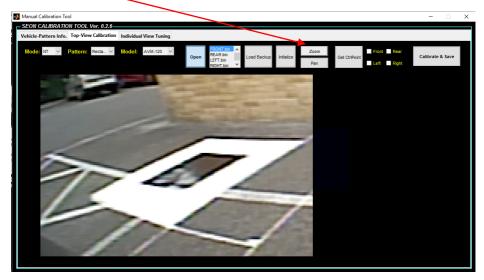
- \Rightarrow Go to the second tab 'Top View Calibration'. This page is used to pick out the corners of the calibration patterns in the captured camera images.
- ⇒ Click 'Open' and select the 'Output' folder on the PC (do not open the folder, just select it), then press 'Choose folder'. This tells the calibration software where the .bin image files are being read from.



 \Rightarrow The image files will be loaded into the calibration software as shown below ('Front.bin' first). The next step is to select the two nearest corners of each calibration pattern.



⇒ View each pattern close up by clicking the 'Zoom' button (turns yellow when in Zoom mode) and then clicking the image until the desired zoom level is reached. To zoom back out hold the SHIFT key whilst clicking. To exit Zoom mode, click the 'Zoom' button again. Pan mode behaves the same way, and lets the user grab the image and move it as desired.

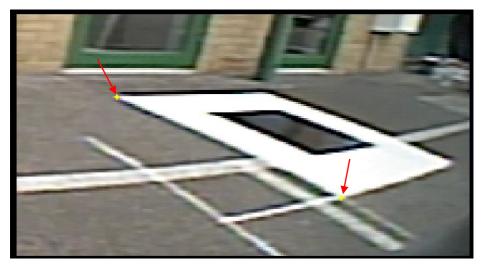


Ensure that Zoom and Pan mode have been exited before placing corner points

 \Rightarrow Click the corner of the calibration pattern to add a point. Click and hold in order to move a point after it has been placed. A point should be placed on the two corners closest to the vehicle.



 \Rightarrow Repeat the process for the other visible calibration pattern in the front image.



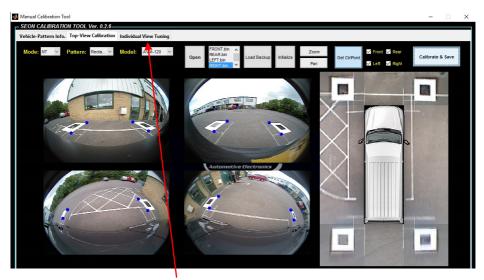
 \Rightarrow Once all four points have been selected, move to the next camera image by clicking 'Get CtrlPoint' .



⇒ Repeat the process for the 'Rear.bin', 'Left.bin' and 'Right.bin' image files. After the four corner points have been added to each captured image, all the checkboxes will be ticked as shown:



⇒ This indicates calibration is complete, click 'Calibrate & Save' and the screen will appear as below, with the yellow corner points now visible in blue:



 \Rightarrow Move to the next tab 'Individual View Tuning' to fine tune each image.



3.5 Fine tuning side images

- \Rightarrow Click 'Input Image' button and select the same 'Output' folder as before.
- \Rightarrow This screen allows the user to individually adjust the left and right camera images.



- \Rightarrow **Roll:** Rotates the image
- \Rightarrow W-scale: stretches image vertically
- \Rightarrow H-scale: stretches image horizontally
- \Rightarrow Trans. H: adjusts the position of the image horizontally
- \Rightarrow Trans. V: adjusts the position of the image vertically

After adjusting the images as required, click 'Apply' and then 'Save'. This will save the new settings back to the 'Output' folder on the PC.

Re-format the SD card so that it is blank again, and this time copy ALL the files from the 'Output' folder onto it.

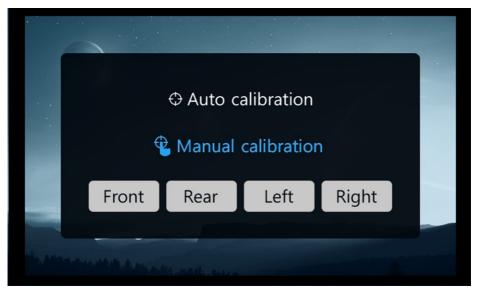
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| Documents | | 26/05/2016 10:25 | DN File | 518.48 | | |
| | | 26/05/2016 10:56 | BIN File | 564.83 | | |
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| C508 | itCatine71 | 26/05/2016 09:58 | SMP File | 142.88 | | |
| | itCatineNT | 26/05/2016 09:58 | EMP File | 131.88 | | |
| | Rectaura | 25/05/2016 09:58 | DMP File | 542 KB | | |
| Windows (C) | RCHNT | 25/05/2016 09:58 | DMP File | 34.63 | | |
| Network | ieCarl? | 26/05/2016 09:58 | DAP File | 10.43 | | |
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| 🗎 0526 | itLineFT | 26/05/2016 09:58 | EMP File | 142 KB | | |
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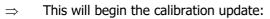
3.6 Updating ECU

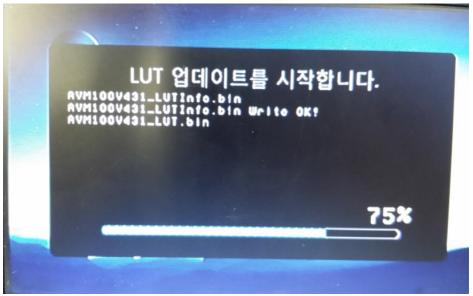
 \Rightarrow Ensuring that the system is off, insert SD card into the ECU, and then boot up.



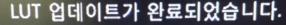
 \Rightarrow Select 'Calibration' from the main menu to update the ECU with the new settings. On the next screen choose 'Manual calibration'







- \Rightarrow When the ECU is updating, an amber LED flashes on the unit housing. When the update is finished, the LED is on constant.
- \Rightarrow When the following window appears, turn off the vehicle ignition, remove the SD card, then reboot the system.



AVM100V431_LUTInfo.bin AVM100V431_LUTInfo.bin Write OK! AVM100V431_LUT.bin AVM100V431_LUT.bin Write OK CAR IMAGE UPDATE OK. Static Overlay IMAGE UPDATE OK.

\Rightarrow Completed calibration will appear as follows:



4. Calibration failure and solutions

| Situation | Cause |
|---|---|
| Cannot read the file | Cause: When calibration update file is missing or SD card format was not done correctly. Solution: Format SD card properly and check update file on SD card. Insert SD card into ECU and run calibra- tion again. |
| Update failure Full State | Cause: Due to invalid files or unusual situations such as car engine stalled so that ECU turns off, the manual calibration does not run properly. Solution: Format corrupted files and SD card and then copy calibration file again. Run calibration again. When manual calibration is running, maintain circum- stances until update is done. |

5. Calibration restrictions

| No | Environmental conditions | Comment | Notes |
|----|--|--|---|
| 1 | Height difference in road | Road and vehicle is not horizontal in the field of view e.g.) if left or right side of the road is a cliff, or if the road has a slope. | Find flat spots and then run man- ual calibration. |
| 2 | If the object is detached from the road surface | The object hung in midair, for example | Check the image and reinstall the object. |
| 3 | If foreign material adheres to the lens | Deformed images of camera due to dusty or wet lens | Check the camera and keep clean. |
| 4 | If the position of the camera is changed | If external force has changed camera position or if camera position is moved because of the door opening and closing | Run re-calibration |
| 5 | Vehicle size and camera position | Vehicle size presents over 30 percent contrast to the full width and height of the standards. Height of installation of cameras pre- sents over 30 percent contrast to the standards. | Rerun calibration fulfilling the requirements. |
| 6 | Camera malfunc- tion | At least one of the cameras used for Smart Vision 360 is not operating properly. | Replace camera |
| 7 | If you see the vehicle bumper in the front/rear image | If you can see the vehicle bumper over than 30% of image from the front and rear images (This can raise showing the bumper from the top-view image.) | 1 11년 30% 이상 |
| 8 | If the angle of the vehicle twisted violently in the side image | If the angle of the vehicle is over ±10° twisted on the basis of the standard images. (This can raise twisted image from the Top-view image) | |
| 9 | If the pattern is badly damaged | The pattern is badly damaged so cannot be applied to manual calibration. | Replace pattern |