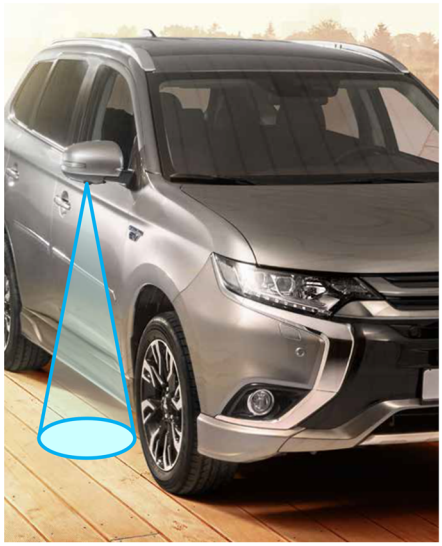
Multi Around Monitor



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Multi Around Monitor (MAM)

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2. Birds eye view
3. Display view types
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5. System operation and screen transition
6. System block diagram
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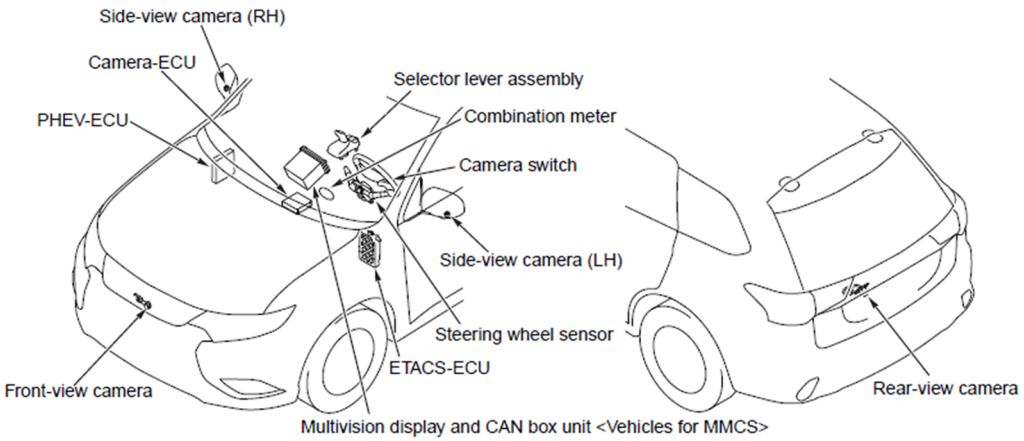
System overview

The multi around monitor system consists of four cameras; front, rear and right/left side (on outside mirrors). By using these cameras, the system displays front, rear and side views as well as birds eye view and guide lines on the MMCS to help the driver monitor the safety around the vehicle.



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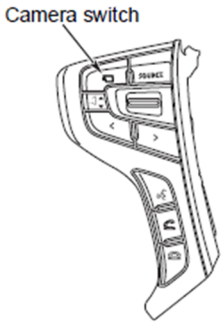
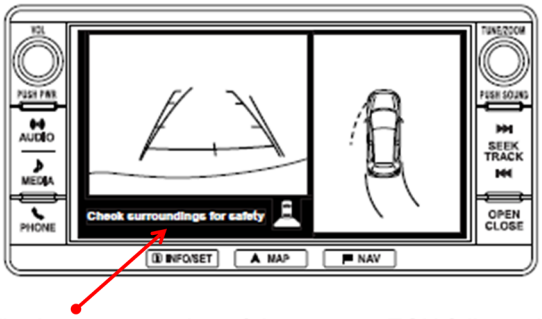
System overview

The multi around monitor view in the MMCS is activated in reverse (R) or when the camera switch on the steering wheel is operated. It is possible to change the display type view with the camera switch.





The language setting of the camera ECU follows the meter language.

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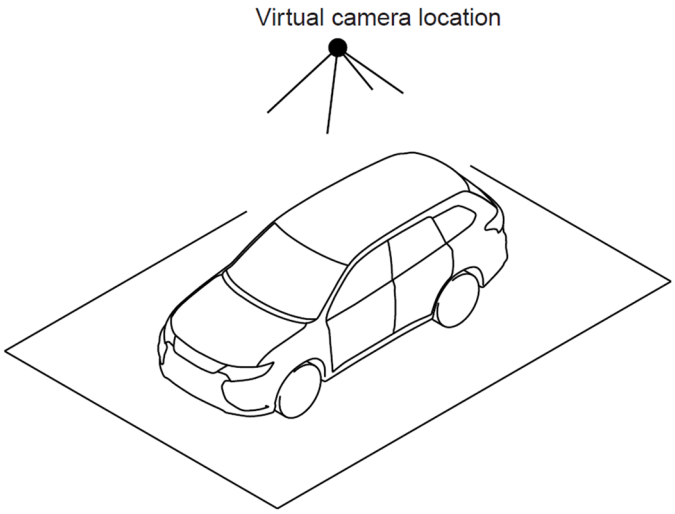
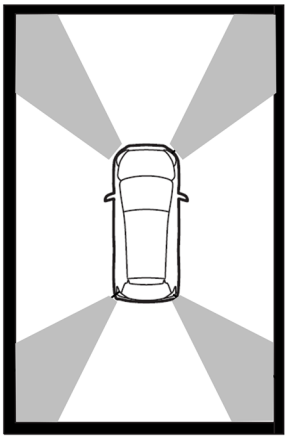
Birds eye view

The camera-ECU processes four camera images and stitches them together to realize a birds eye view.





Stitch area

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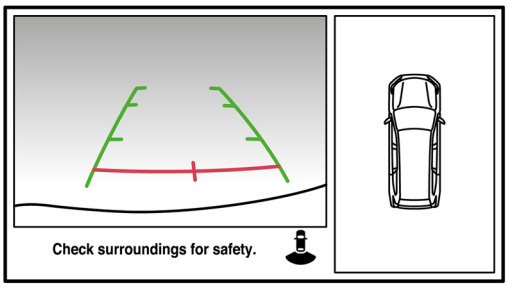
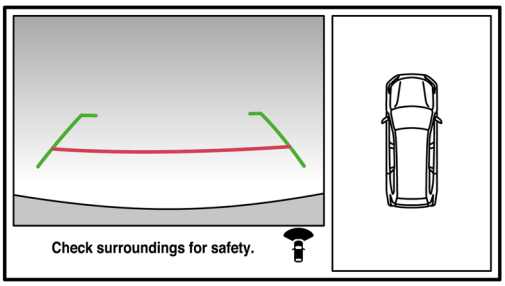
4 Display view types

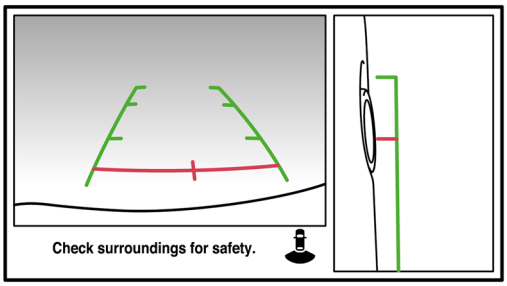
Rear + Birds eye view



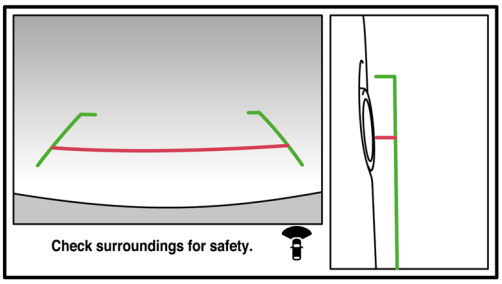
Front + Birds eye view



Rear + Side view



Front + Side view



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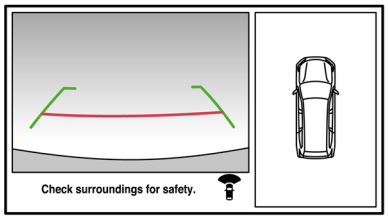
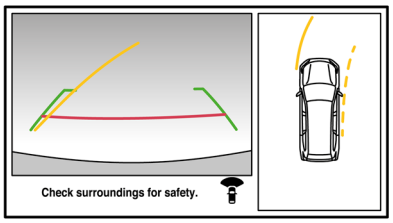
Predictive guide line

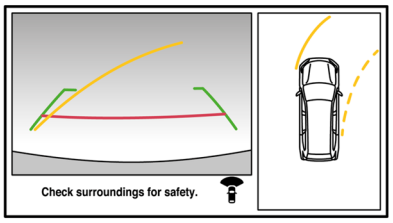
Displays a driving path, which is expected in accordance with the steering wheel angle. This predictive driving path is indicated in forward and reverse driving direction.













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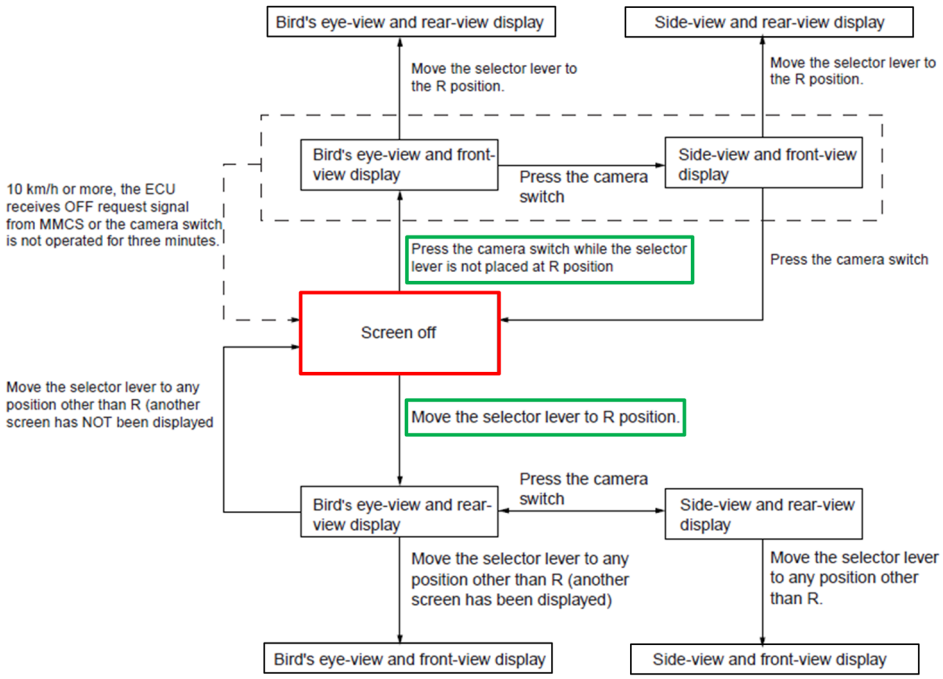
System operation and screen transition



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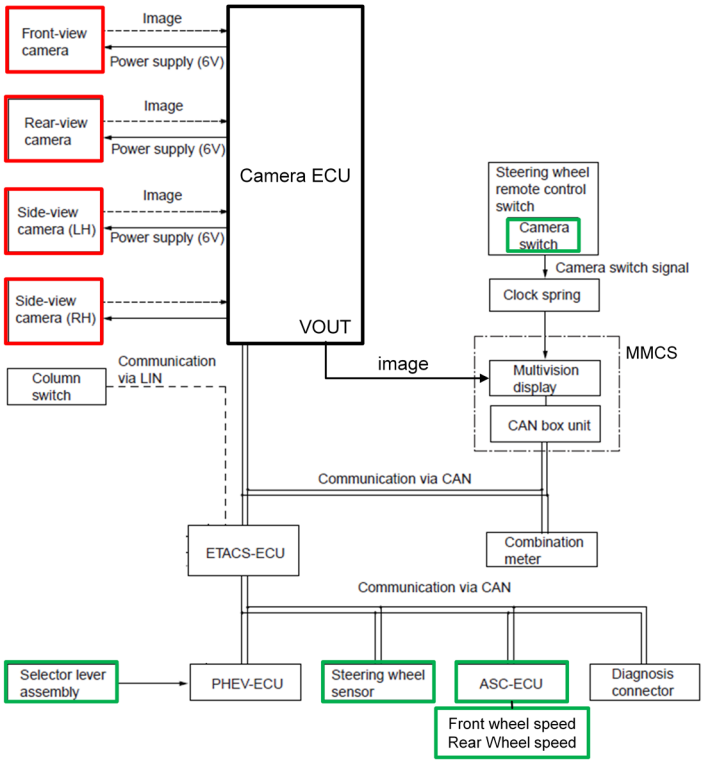
System Block diagram



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Functional description

Part name	Functional description
Cameras (4x)	Sends the camera image to the Camera-ECU.
Camera switch (Steering Wheel)	Sends the camera switch signal to the MMCS.
Steering wheel sensor	Transmits the steering wheel angle through Main CAN-C.
Camera-ECU	Uses the following Sub CAN-C information: • Camera switch signal • Vehicle speed signal • Selector lever position • Column switch position • Lighting control sensor signal • Parking brake switch • Supplies power to the cameras • Receives the image of each camera (4x) • Creates a combined camera image • Overlays a guide line on the camera image • Sends a camera image output request signal (through Sub CAN-C) • Sends the combined camera image to the MMCS (analog video signal)
MMCS	• Receives camera image output request signal from the camera-ECU through the CAN box unit. • Receives the combined camera image signal from the camera-ECU, and displays the image on the screen. • Receives the camera switch signal from the steering wheel switch. • Transmits the camera switch status on Sub CAN-C via the CAN box unit.

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Functional description

Part name	Functional description
ETACS-ECU	Gate way function (Main CAN-C> Sub CAN-C): • Steering wheel angle • Selector lever position • Vehicle speed signal Transmits on Sub CAN-C: • Lighting control sensor signal • Ignition status • Column switch position • Vehicle coding information
PHEV-ECU	Receives on Main CAN-C: • Front and Rear wheel speed (calculates vehicle speed) Transmits on Main CAN-C: • Vehicle speed • Selector lever position
ASC-ECU	Transmits on Main CAN-C: • Front and rear wheel speed
Selector lever assembly	Sends the selector lever position to the PHEV ECU
Combination meter	Transmits on Main CAN-C: • Parking brake switch status

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DTC list Camera ECU (1/2)

DTC	Failure name
B2501	Rear view camera fault
B2503	Front view camera fault
B2505	ECU internal error (EEPROM) fault
B2540	CPU fault
B2541	ASIC fault
B2542	SDRAM fault
B2543	EEPROM fault at start up
B2544	Flash ROM fault
B2546	LH side view camera fault
B2547	RH side view camera fault
B2548	Calibration not completed
B254A	Steering angle sensor fault
B254B	Camera output voltage fault
B254E	Camera ECU output pictures fault
B254F	IG status fault
U0100	PHEV-ECU CAN timeout (displayed as “engine ECU timeout”)
U0141	ETACS CAN timeout
U0155	Meter CAN timeout

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DTC list Camera ECU (2/2)

DTC	Failure name
U0245	NAVI/DISP.AUDIO CAN timeout vehicles with MMCS
U1195	Coding not completed
U1197	Coding data unavailable

Actuator test

Item No.	MUT-III Display	Driven component
1	Display output	Switches the images on the display forcibly (check camera switch)

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Special function

Initialization

Item No.	MUT-III Display	Contents
1	Calibration data initialization	To delete all calibration data

Calibration

Item No.	MUT-III Display	Contents
1	Front camera	Starts calibration of the front camera
2	Rear camera	Starts calibration of the rear camera
3	Left side camera	Starts calibration of the left side camera
4	Right side camera	Starts calibration of the right side camera

Write learned value (exchanged ECU)

MUT-III Display	Contents
Learned value read and save	To store the calibration data of the camera ECU in the MUT-III unit
Saved learned value writing	To write the stored calibration data from the MUT-III to the camera ECU

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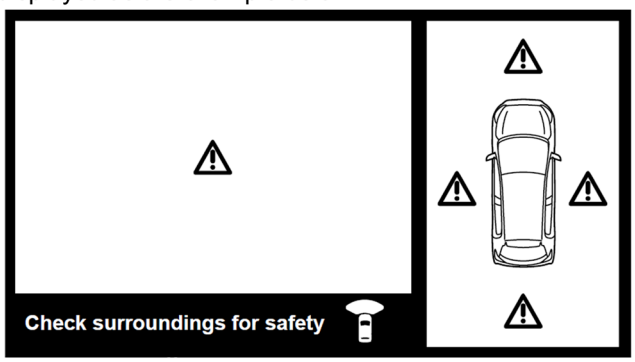
Camera calibration

If one the cameras is not calibrated it will be displayed by a warning in the display, on the position of the not calibrated camera image the following sign will be displayed.



In case none of the cameras are calibrated it will be displayed as the example below.



Note: The camera-ECU always monitors its own status and the camera signals. If the ECU detects a failure, it will set a diagnosis code and display a message to alert the driver.



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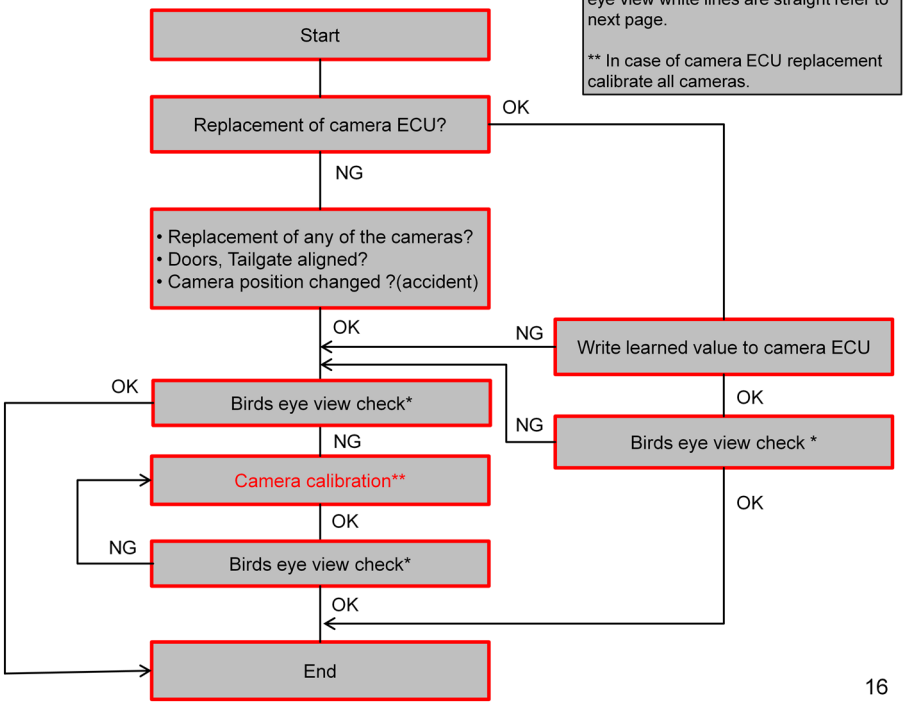
Necessity of Camera calibration

*Check if on the stitch lines of the birds eye view white lines are straight refer to next page.

** In case of camera ECU replacement calibrate all cameras.



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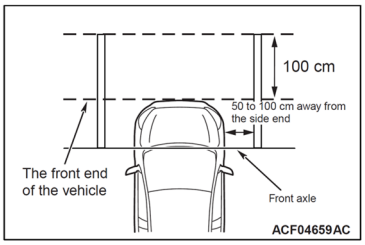
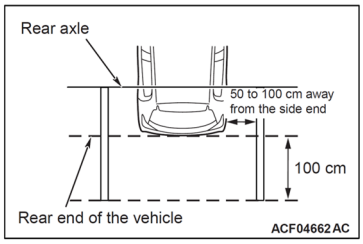
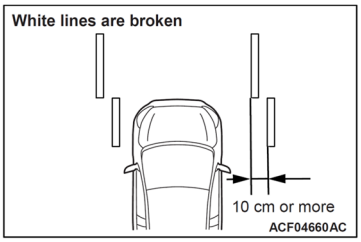
Birds eye view check

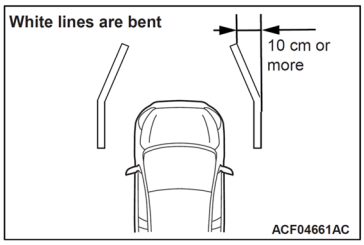
Checking the image of the front and rear view camera





1. Draw a white 10 cm-wide lines next to either side of the vehicle.
2. Press the camera switch on the steering wheel to display the bird's eye-view on the multivision display
3. Two white lines should be displayed as "straight line". When the line is broken or offset, calibrate the cameras.





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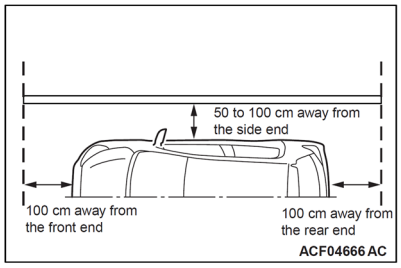
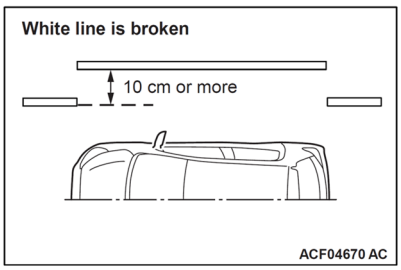
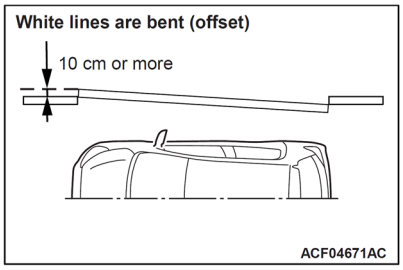
Birds eye view check

Checking the image of the side view camera



1. Draw white 10 cm-wide lines next to either side of the vehicle.
2. Press the camera switch on the steering wheel to display the bird's eye-view on the multivision display
3. Two white lines should be displayed as "straight line". When the line is broken or offset, calibrate the cameras.





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Camera calibration

For camera calibration 2 calibration (MB993003) markers are necessary. 

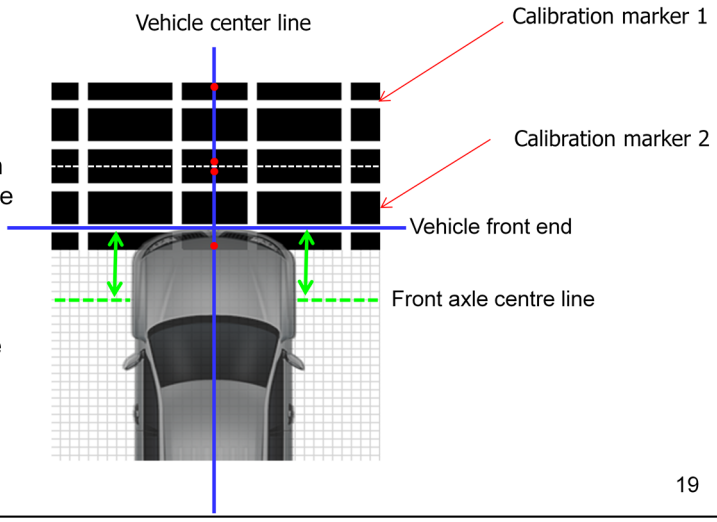
For the birds eye view check use the markers to check if lines appear in the screen as straight lines.

Position the calibration markers during calibration as shown below.

Front camera calibration:

❖ Align the vehicle front end with the middle of the white line by use of a plump line.

❖ Adjust the markers by measuring equal length from the front axle centre line (L+R) to the white line.



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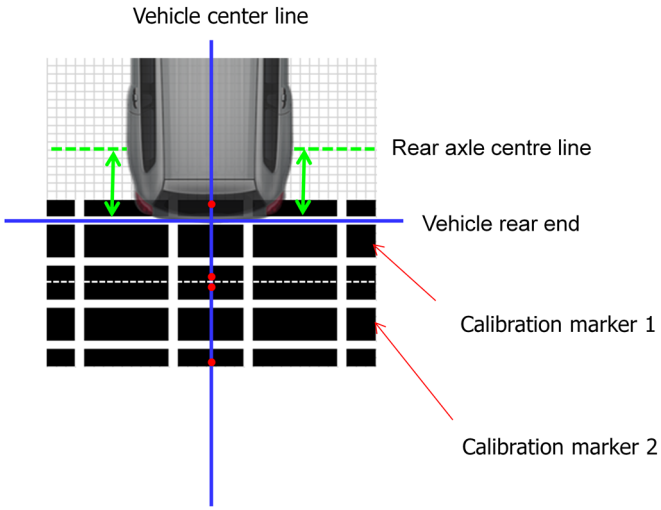
Camera calibration

Position the calibration markers during rear camera calibration as shown below.

Rear camera calibration:

- Align the vehicle rear end with the middle of the white line by use of a plump line.
- Adjust the markers by measuring equal length from the rear axle centre line (L +R) to the white line.



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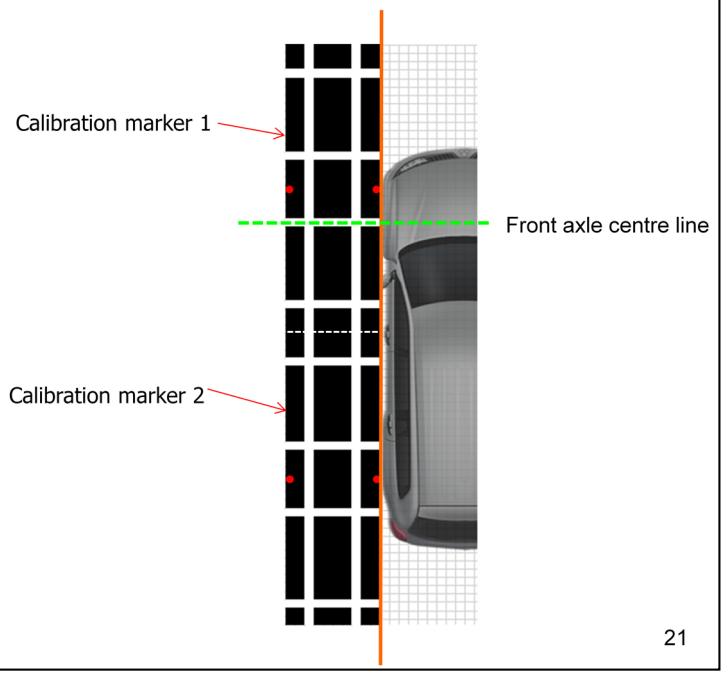
Camera calibration

Position the calibration markers during side camera calibration as shown below.

Side camera calibration:

- Align the front axle with the middle of the while line as shown.
- Position the marker against the tires. (Touching condition)



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Camera calibration

Caution: Do not interrupt the camera vision range while a camera-ECU is calibrated.

1. When the camera-ECU is replaced, first write the learned value to the camera-ECU.
2. Park the vehicle on a level surface.

NOTE: Prevent sun light rays from interfering with the camera, otherwise the monitor screen will be reflected in white. Ideally, the brightness of a road surface should be low (such as black).

3. One person should sit on the driver's seat.
4. Connect M.U.T.-III to the diagnosis.
5. Position the calibration markers (MB993003) as shown before for the camera to be calibrated.

NOTE: The calibration markers should be located in the permissible range. The range is within 3cm and 1 degree from the standard position.

6. Turn on>off>on the power supply mode.
7. Use the M.U.T.-III to calibrate the camera.

NOTE: When you execute the calibration, the applicable calibration-related data will be erased from the ECU.

8. Select "Calibration" in the "special function" for the multi-around monitor system.
9. Select a camera to be calibrated on the service data located to the left of the calibration screen and then press "OK".
10. Select the camera being calibrated in the confirmation screen, and the press "OK".
11. Press the "OK" button after the execution screen is displayed.
12. When the calibration has completed successfully, "Completed" will be displayed on the service data item No.13.
13. If the calibration has failed, "Error" will be displayed on the service data item No.13. For details of errors, refer to "Calibration error table".
14. If no problems are not found on the screen, the calibration is complete. If any problems are found, repeat the calibration.

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Camera calibration Error table

Item no.	Item name	Error content	Trouble shooting
14	Coding not complete/setting error flag	The variant coding for the ETACS-ECU has not been implemented./Requirements for calibration are not satisfied	Perform variant coding./ check position of calibration markers, check illumination on markers. (sunlight, etc.)
15	Door open detection flag	Any of the doors and tailgate are open.	Check that any of the doors and tailgate are open. If so close the door or the tailgate.
16	Front camera error flag	The front-view camera does not recognize either of the calibration markers precisely.	***1. Check the vehicle conditions.*** • Are prerequisites for the calibration satisfied? • Is the vehicle parked in a correct position? • Is the camera lens contaminated? • Are the outside mirrors in normal position. ***2. Check the calibration markers.*** • Are the calibration markers positioned correctly? • Are the calibration markers contaminated? • Is any of the calibration markers hard to see due to a sunlight refection? ***3. Repeat the calibration.***
17	Rear camera error flag	The rear-view camera does not recognize either of the calibration markers precisely.	
18	Left side camera error flag	The side-view camera(LH) does not recognize either of the calibration markers precisely.	
19	Right side camera error flag	The side-view camera (RH) does not recognize either of the calibration markers precisely.	
20	Flash ROM writing error flag	Internal malfunction of camera-ECU	1. Repeat the calibration. 2. If any error code is displayed again, replace the camera-ECU. 3. Repeat the calibration.
21	SD-RAM error flag		
22	EEPROM writing error flag		

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