

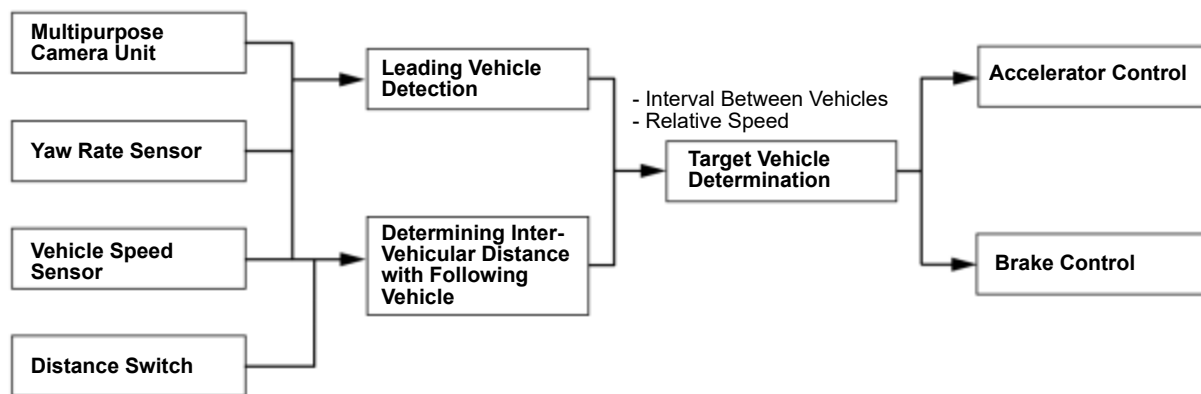
Adaptive Cruise Control (ACC) System Description

Function

The ACC system uses the multipurpose camera to calculate and adjust the vehicle speed to maintain the appropriate following interval between your vehicle and the vehicle detected ahead based on your vehicle speed and driving conditions. When another vehicle cuts in between your vehicle and the vehicle detected ahead, the system switches the target vehicle to a new vehicle using the image information (vehicle and lane information) from the multipurpose camera. When the vehicle detected ahead changes lanes or goes out of the detection range, the vehicle drives at the preset vehicle speed until detecting a new target vehicle. ACC system works with the cruise control system to adjust the vehicle speed.

The cruise control mode can be entered by operating the distance switch while the ACC is working.

Control Block Diagram



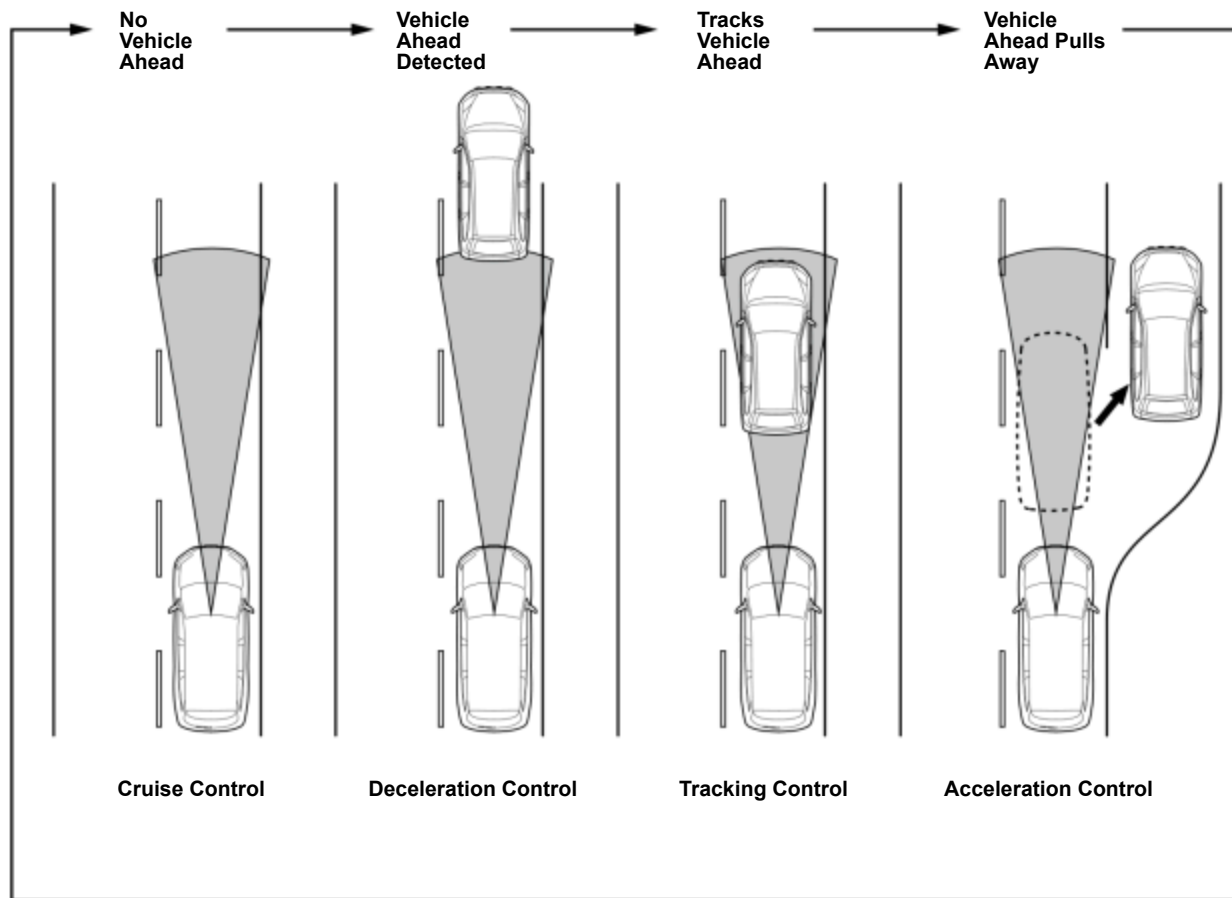
Operation Conditions

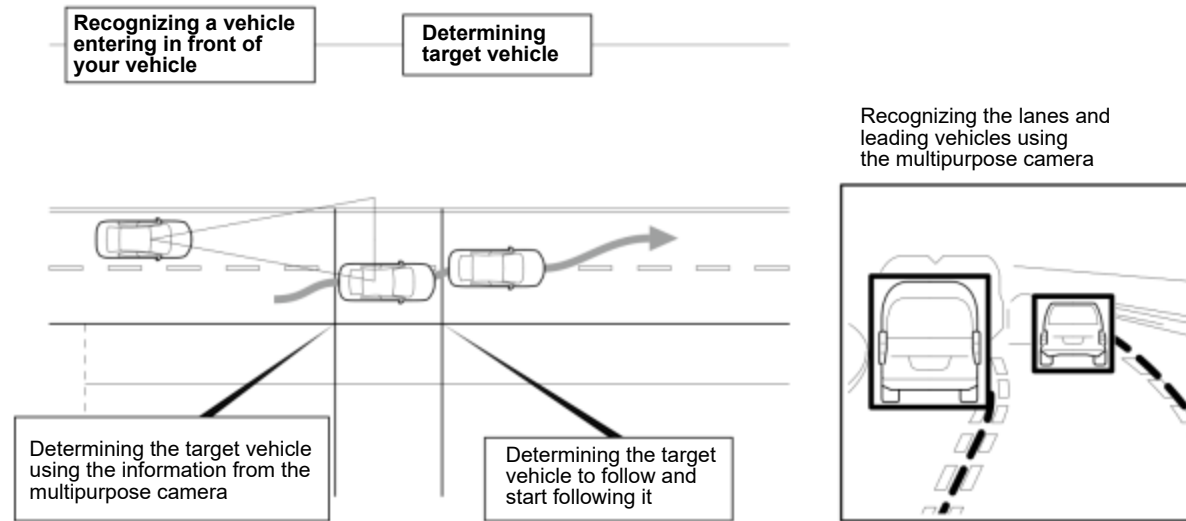
Control vehicle speed	Set speed range: 25 - 90 mph (40 - 145 km/h)
Left/right detection angle of multipurpose camera	100.3 ± 3.0 degrees
Up/down detection angle of multipurpose camera	39.3 ± 1.0 degrees
Road inclination	Less than 6%
Detection object	Vehicle, Pedestrian

Basic Controls of ACC

- The ACC system uses the multipurpose camera to detect the vehicle ahead, determine the target vehicle based on the lane and vehicle position information. Also measures the distance to the target vehicle and its vehicle speed.
- When there is no vehicle detected ahead, your vehicle drives at the preset speed. When there is a vehicle detected ahead, your vehicle follows the vehicle and drives within the preset speed.

- When there is a vehicle detected ahead, your vehicle follows the vehicle and drives within the preset speed.
- If the vehicle ahead pulls over out of the way, the ACC accelerates the vehicle to the set speed and maintains that speed.
- If the ACC detects a slow vehicle and the distance to the vehicle ahead is closing, the vehicle speed is reduced primarily by closing the throttle, and additional slowing is accomplished by using the brakes. If the vehicle detected ahead is too close, an alarm sounds.
- If a slower vehicle ahead accelerates, the throttle is opened to accelerate the vehicle (up to the set speed) to maintain the following interval.



Determination of the target vehicle

Multipurpose Camera Aiming

Special Tool Required

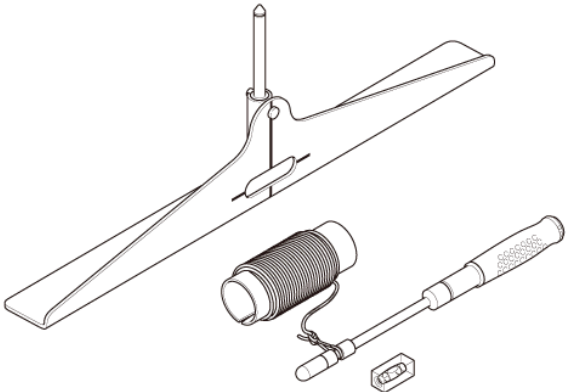
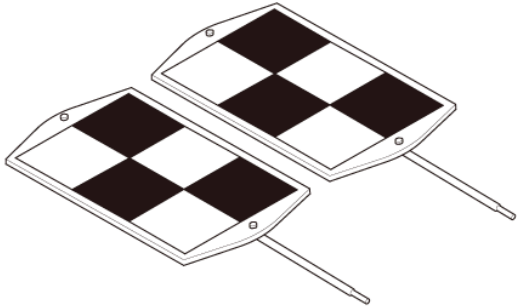
Image	Description/Tool Number
	Alignment Set 07AAJ-STKA210
	Target Set 07AAK-5K0A100

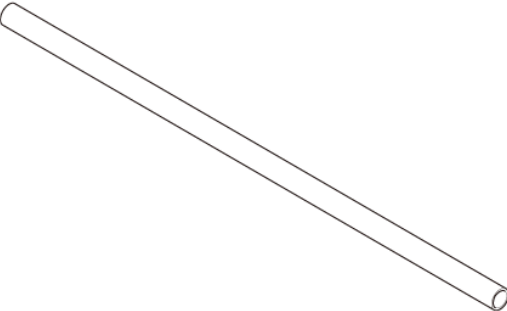
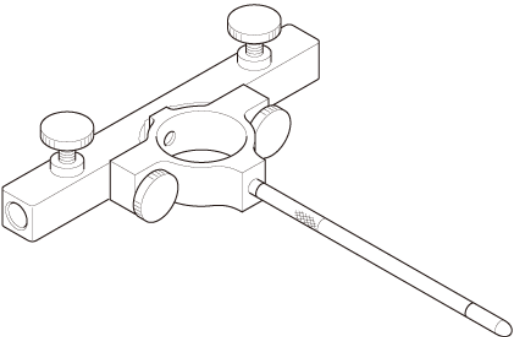
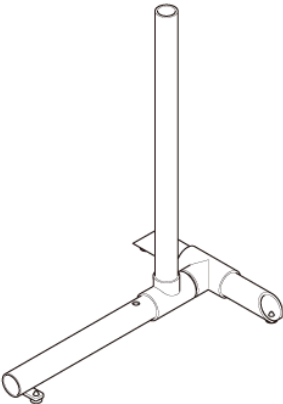
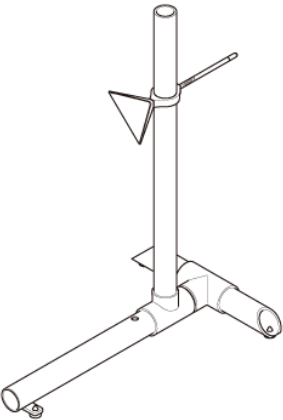
Image	Description/Tool Number
	Stand Pole (Aluminum) 07AAK-5K0A120*

Image	Description/Tool Number
	Target Adjuster 07AAK-5K0A110
	Stand 07AAJ-TK8A100*
	Stand Set 07AAJ-STKA220*

* (07AAJ-TK8A100/07AAJ-STKA220): Switch out the included PVC pole for the 07AAK-5K0A120 Aluminum Stand Pole, and use Stand 07AAJ-TK8A100 or Stand Set 07AAJ-STKA220 can be used for aiming.

Adjustment

[How to use this manual.](#)

NOTE:

- There are two methods of aiming for the multipurpose camera: Dynamic camera aiming and static camera aiming, and do either one aiming procedure.
- The multipurpose camera aiming is the automatic learning of vertical/horizontal reference points using the HDS. The multipurpose camera unit has a self-diagnosis function, and if the aiming fails or is incomplete, a DTC will be stored.
- The multipurpose camera unit must be re-aimed if the multipurpose camera unit or windshield is removed or replaced.

Precautions before static camera aiming:

Set up the vehicle:

- The warning indicators (amber) of the ACC, CMBS, LKAS, RDM, and Safety Support are blinking or off.
- There are no DTCs for the integrated driver support system stored (Except DTC [B2A60-54](#)).

NOTE: If a DTC is indicated, troubleshoot the DTC first.
- If the vehicle you are aiming was involved in a collision or if you suspect the wheel alignment is out of specifications, you must perform a wheel alignment prior to aiming the multipurpose camera unit.
- Make sure the suspension has not been modified.
- Make sure all tire sizes are correct and that their pressures are correct.
- Make sure that there are no stains, dust, or dirt on the lens of the multipurpose camera unit and the windshield area where the camera is mounted.
- The removed parts are installed.
- Remove all cargo from the vehicle except the tool kit and the spare tire (if equipped).
- Do not put any objects on the dashboard.
- Make sure the steering wheel is pointed straight ahead, and do not turn it after setting the vehicle.
- Make sure there is no one in the vehicle while the multipurpose camera is being adjusted (aiming).
- Make sure that all doors are closed.
- Turn off the headlights.

Conditions for the aiming environment:

- Aiming should be done on a flat space.
- Amount of space required in front of the vehicle:
4.3 m (14 ft) measured from the front axle
1.8 m (5.9 ft) in width
1.8 m (5.9 ft) in height, measured from the floor
- Make sure there are no black and white checkered or dark and light alternating patterns directly behind the targets as this will affect the static camera aiming.
- Make sure the vehicle is not facing any direct light sources as this will affect the static camera aiming.
- If oil drips on the floor, wipe it off.

- When the multipurpose camera is adjusted on a floor surface that is not flat (drainage slope, etc.), the camera aiming cannot be adjusted correctly, check the levelness of the floor surface.

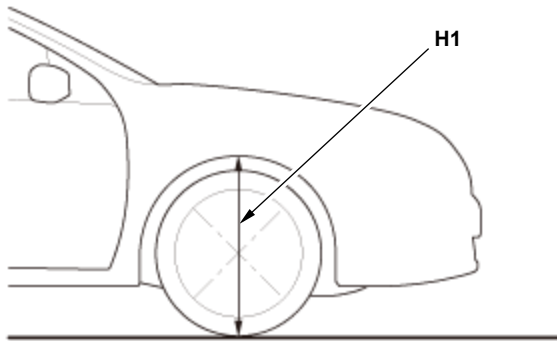
Prepare these items:

- HDS
- Tape measure and ruler
- Felt-tip pen
- Tape
- String
- Plumb bob

1. Front Wheel Arch Height - Set

■ Procedure

1. Measure the right and left front wheel arch height "H1" from the floor surface to the top-center of the wheel arch.



2. Calculate the average value between the left and right front wheel arch height "H1". This average is referenced as "H2".

Example

Left front wheel arch height : 678 mm (26.69 in)

Right front wheel arch height : 676 mm (26.61 in)

$H2 = (678 \text{ mm (26.69 in)} + 676 \text{ mm (26.61 in)}) / 2 = 677 \text{ mm (26.65 in)}$

3. Subtract the front wheel arch height standard value "H3" from the average value of "H2".

$$H = H2 - H3$$

Distance Details

Specification value (H3)
674 mm (26.54 in)

Example

$$H = 677 \text{ mm (26.65 in)} - 674 \text{ mm (26.54 in)} = 3 \text{ mm (0.12 in)}$$

4. Refer to the following table to determine the difference "H" between the mean height of the front wheel arch "H2" and the standard height "H3".

Setting Value Details

Setting value number	Value
(1)	$+5 \text{ mm (0.20 in)} \leq H \leq +15 \text{ mm (0.59 in)}$
(2)	$-5 \text{ mm (-0.20 in)} \leq H < +5 \text{ mm (0.20 in)}$
(3)	$-15 \text{ mm (-0.59 in)} \leq H < -5 \text{ mm (-0.20 in)}$
(4)	$-25 \text{ mm (-0.98 in)} \leq H < -15 \text{ mm (-0.59 in)}$
(5)	$-35 \text{ mm (-1.38 in)} \leq H < -25 \text{ mm (-0.98 in)}$

Example

$H = -2 \text{ mm (-0.08 in)}$

The setting value number which corresponds to the numerical value (2).

NOTE:

- Use this setting value number when choosing the front wheel arch height in the HDS.
- If the measured value exceeds $+15 \text{ mm (0.59 in)}$ or less than $-35 \text{ mm (-1.38 in)}$, the multipurpose camera aiming will not work. Check for frame/suspension damage or modification.

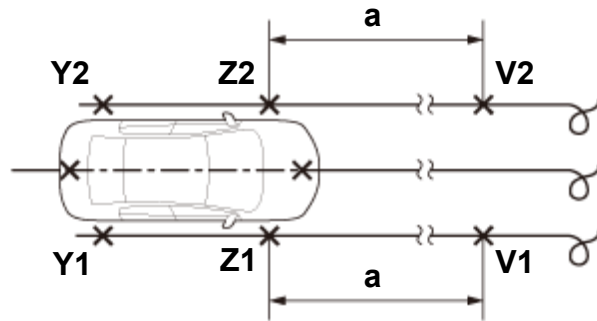
2. Marking of the Target Position - Set**■ Preconditions**

- Transmission P Position/Mode (CVT) or Neutral Position (M/T)
- Parking Brake Applied

Figure 1**■ Procedure**

NOTE: When marking on the floor surface, use suitable tape to mark the exact locations.

1. [Make points \(Z1, Y1, Z2 and Y2\) and set a string along the center-line of the vehicle.](#)
2. [Place a string between point Z1 and point Y1, point Z2 and point Y2 and tape both ends of the string on the floor surface.](#)



3. Measure and make a new point V1 on the floor surface in front of the vehicle from the point Z1. (Figure 1)

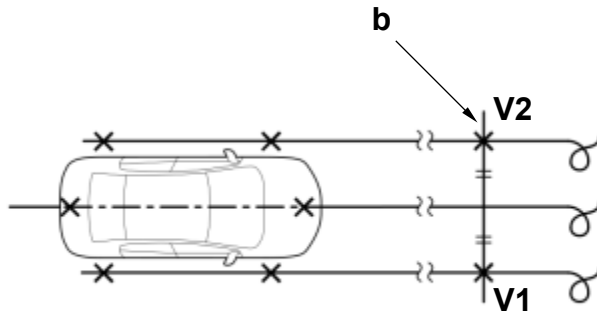
NOTE:

- Y1, Z1 and V1 are on the same straight line. (Figure 1)
- Repeat this step for the opposite side, and mark a new point V2. (Figure 1)

Distance Details (Figure 1)

Value	
a	4,000 mm (157.48 in)

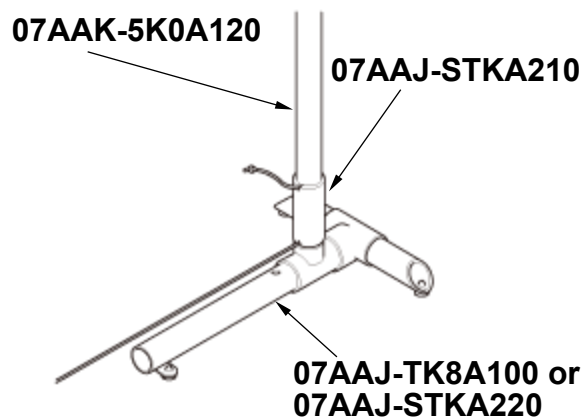
Figure 2



- Set the string (b) between point V1 and point V2, and tape both ends of the string on the floor surface. (Figure 2)

3. Special Tools Set-Up, Target Pattern Surface Height Adjustment, and Positioning - Set

Figure 1



■ Procedure

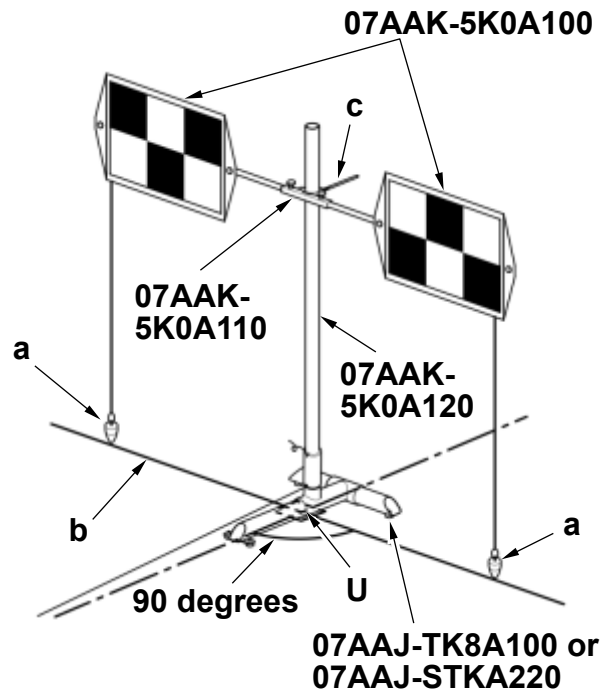
NOTE: Switch out the included PVC stand pole for 07AAK-5K0A120 Aluminum Stand Pole. (Figure 1)

1. Use the stand pole (aluminum).

NOTE: The PVC stand pole is too low to align the camera.

2. Route the cord through the collar and place it on the aiming stand.

Figure 2



3. Assemble the aiming target.

NOTE: For correct orientation of the aiming target panels, make sure the target patterns match the illustration.

4. Dangle two plumb bobs (a) from the lower corners of the target to the floor and secure the plumb bob string to the target with tape. (Figure 2)
5. Position the aiming target assembly at point U. (Figure 2)
6. Make sure that both plumb bobs touch directly on the line (b). If they do not, loosen the pointer (c) and rotate the target assembly as necessary. (Figure 2)

Figure 3

7. Adjust the aiming target panel (d). (Figure 3)

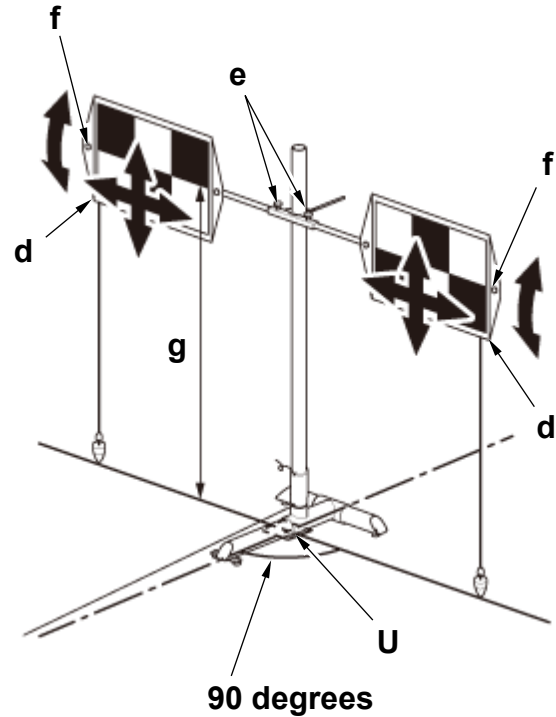
- 1. Put the level on the target panel surface. Loosen the adjustable screws (e), and adjust the vertical angle of the target panel surface so that the air bubble in the level is centered. Tighten the adjustable screw once the adjustment is completed. (Figure 3)
- 2. Put the level on the top edge of the target panel. Loosen the adjustable screws (f), and adjust the horizontal angle of the target panel surface so that the air bubble in the level is centered. Tighten the adjustable screw once the adjustment is completed. (Figure 3)

- 3. Adjust the height of the target panel to specifications (g). (Figure 3)

NOTE: The horizontal center line is a horizontal division line on the panel where the black and white boxes meet.

Height Details (Figure 3)

Value	
g	1,500 mm (59.06 in)



4. Multipurpose Camera - Static Camera Aim

■ Preconditions

- [HDS Connected](#)

■ Procedure

NOTE: Headlights should be turned off.

1. Check for DTCs with the HDS.

NOTE: Troubleshoot any DTCs first before proceeding. If DTC B2A60-54 is indicated, proceed with the aiming procedure.

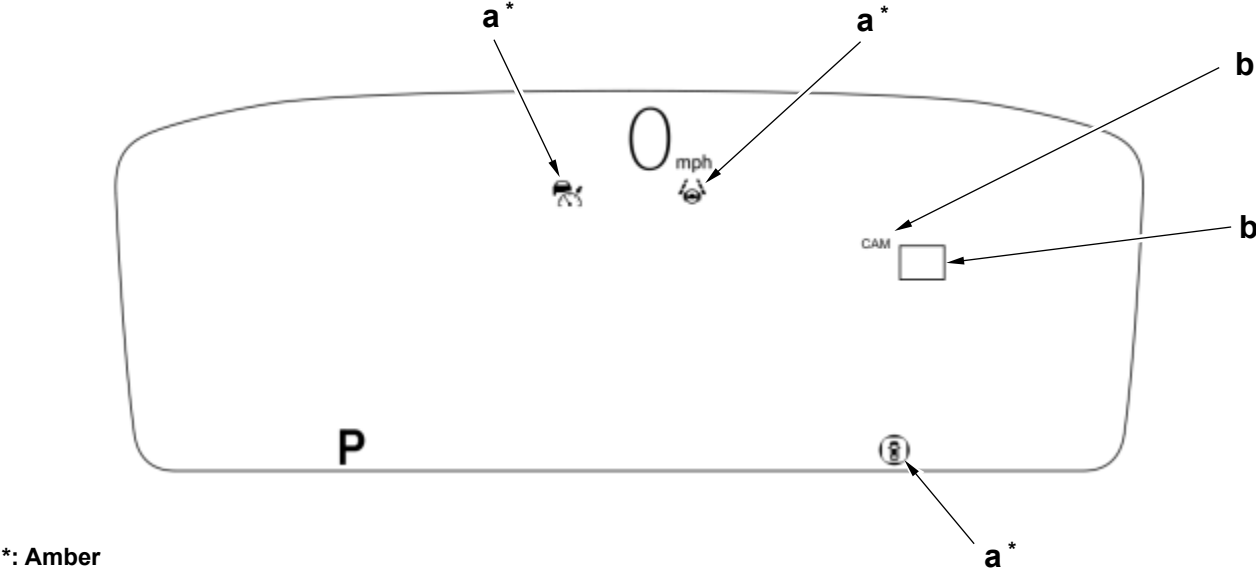
2. Select the following menu buttons on the HDS screen in sequence.

- ① Driving Support (System Selection Menu)
- ② Monocular Camera Driver Support System
- ③ Adjustment
- ④ Static Camera Aiming

3. Enter the setting value number of the front wheel arch height follow the screen prompts on the HDS. The warning indicators (a) and the aiming indicators (b) are displayed on the MID as follows. (Figure 1 and 2)

NOTE: Use the "Setting value number" which was recorded in the previous step.

Figure 1




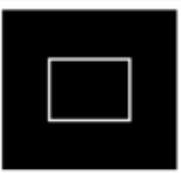



*: Amber

Figure 2

Warning indicator and aiming Indicator Status					
After entering front wheel arch height	OFF	ON	BLINK	BLINK	BLINK

4. Perform the Static Camera Aiming with the HDS. The warning indicators and the aiming indicators are displayed on the MID as follows. (Figure 3)

Figure 3

Warning indicator and aiming Indicator Status					
During the aiming	BLINK	ON	BLINK	BLINK	BLINK
Camera aiming is completed	OFF	OFF	OFF (Green: ON)	OFF	OFF
Camera aiming has failed	ON	ON	ON	ON	ON


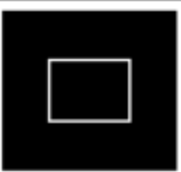



5. Confirm the multipurpose camera aiming completion on the HDS. (Figure 3)
- If the any indicators are indicated, confirm the failure codes and message on the HDS.
6. Turn the vehicle to the OFF (LOCK) mode.
7. Turn the vehicle to the ON mode.

■ Result

Confirm the warning indicators are off on the MID. (Figure 4)

- If the aim fails for some reason during the aiming, or if it is stopped halfway, an error code will be displayed on the HDS. Refer to "Failure Codes and Messages" and repair or replace parts as necessary. After the work, you must start the aiming procedure again.

Figure 4

Warning indicator and aiming Indicator Status					
Camera aiming is completed	OFF	OFF	OFF (Green: ON)	OFF	OFF
Camera aiming has failed	OFF	OFF	BLINK	BLINK	BLINK

Failure Codes and Messages

Failure code (on the HDS)	Failure message (on the HDS)	How to solve
01	ECU Failure <ul style="list-style-type: none"> DTC is detected. 	<ul style="list-style-type: none"> Check for DTCs with the HDS. After the DTC is cleared, do the aiming again.
02	Target Placements Error	After confirmation, perform re-aiming. <ul style="list-style-type: none"> Check the distance between targets. Check the target height.
03	Camera Posture Angle Out of Range <ul style="list-style-type: none"> The multipurpose camera unit is not correctly installed. There is cargo in the vehicle. The tire pressure in the tire is not correct. The vehicle leans or is at an odd angle (check for a modified or damaged suspension components, etc.). 	After confirmation, perform re-aiming. <ul style="list-style-type: none"> The multipurpose camera unit is correctly installed. Remove cargo from the vehicle except the tool kit. Make sure all tire sizes are correct and that their pressures are correct. The suspension and other related components must be original and undamaged. If necessary, do the wheel alignment.
09	Camera Temperature Out of Range	After confirmation, perform re-aiming. <ul style="list-style-type: none"> Wait for the temperature of the multipurpose camera

Failure code (on the HDS)	Failure message (on the HDS)	How to solve
		unit to drop.
0B	Visual Contact Disturbed <ul style="list-style-type: none">Target is hidden behind something.Target is not facing the vehicle.	After confirmation, perform re-aiming. <ul style="list-style-type: none">Remove that is shielding the target.Target is properly positioned.
0F	Too Many Targets	After confirmation, perform re-aiming. <ul style="list-style-type: none">Make sure there are no black and white checkered or dark and light alternating patterns directly behind the targets as this will affect the static camera aiming.
11	Vehicle Not Stop	After confirmation, perform re-aiming. <ul style="list-style-type: none">Stop the vehicle completely

Failure code (on the HDS)	Failure message (on the HDS)	How to solve
12	Under other Routine processing	After confirmation, perform re-aiming. <ul style="list-style-type: none">• Wait until other processing is finished.

Multipurpose Camera Aiming**Adjustment**

NOTE:

[How to use this manual.](#)

- There are two methods of aiming for the multipurpose camera: Dynamic camera aiming and static camera aiming, and do either one aiming procedure.
- The multipurpose camera aiming is the automatic learning of vertical/horizontal reference points using the HDS. The multipurpose camera unit has a self-diagnosis function, and if the aiming fails or is incomplete, a DTC will be stored.
- The multipurpose camera unit must be re-aimed if the multipurpose camera unit or windshield is removed or replaced.

Precautions before dynamic camera aiming:

Set up the vehicle:

- The warning indicators (amber) of the ACC, CMBS, LKAS, RDM, and Safety Support are blinking or off.
- There are no DTCs for the integrated driver support system stored (Except DTC [B2A60-54](#)).

NOTE: If a DTC is indicated, troubleshoot the DTC first.

- If the vehicle you are aiming was involved in a collision or if you suspect the wheel alignment is out of specifications, you must perform a wheel alignment prior to aiming the multipurpose camera unit.
- **Make sure the suspension has not been modified.**
- Make sure all tire sizes are correct and that their pressures are correct.
- Make sure that there are no stains, dust, or dirt on the lens of the multipurpose camera unit and the windshield area where the camera is mounted.
- The removed parts are installed.
- **Remove all cargo from the vehicle except the tool kit and the spare tire (if equipped).**
- Do not put any objects on the dashboard.
- Make sure that all doors are closed.

Prerequisite for Aiming:

- Vehicle speed 11 mph (18 km/h) or more (constant speed), straight driving a road (R = 600 or more)

Recommended environment:

- Driving at a constant speed of 19 mph (30 km/h) or more

- In daytime without rainy, snowy, or foggy
- Roads with the scattering stationary targets such as telephone poles

Standard distance for completing the aiming:

- Aiming will be completed in about 1 km of city driving in the recommended environment.

NOTICE

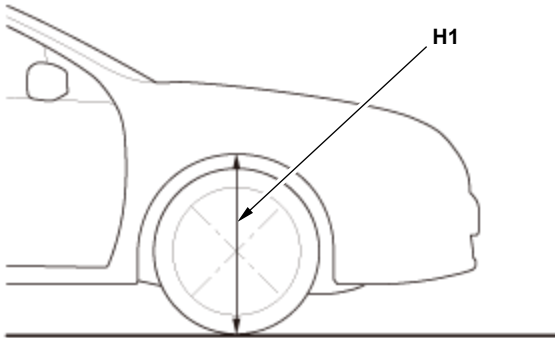
- If the prerequisites do not match during aiming that is put on hold, and resumed when the conditions are match.
- Aiming is possible even in the rain or at night, but it may take longer to complete.
- If the driving environment is out of the recommended environment, perform the static camera aiming.

Prepare these items:

- HDS
- Tape measure and ruler

1. Front Wheel Arch Height - Set**■ Procedure**

1. Measure the right and left front wheel arch height "H1" from the floor surface to the top-center of the wheel arch.



2. Calculate the average value between the left and right front wheel arch height "H1". This average is referenced as "H2".

Example

Left front wheel arch height: 678 mm (26.69 in)

Right front wheel arch height: 676 mm (26.61 in)

$H2 = (678 \text{ mm (26.69 in)} + 676 \text{ mm (26.61 in)}) / 2 = 677 \text{ mm (26.65 in)}$

3. Subtract the front wheel arch height standard value "H3" from the average value of "H2".

$H = H2 - H3$

Distance Details

Specification value (H3)
674 mm (26.54 in)

Example

$H = 677 \text{ mm (26.65 in)} - 674 \text{ mm (26.54 in)} = 3 \text{ mm (0.12 in)}$

4. Refer to the following table to determine the difference "H" between the mean height of the front wheel arch "H2" and the standard height "H3".

Setting Value Details

Setting value number	Value
(1)	$+5 \text{ mm (0.20 in)} \leq H \leq +15 \text{ mm (0.59 in)}$
(2)	$-5 \text{ mm (-0.20 in)} \leq H < +5 \text{ mm (0.20 in)}$
(3)	$-15 \text{ mm (-0.59 in)} \leq H < -5 \text{ mm (-0.20 in)}$
(4)	$-25 \text{ mm (-0.98 in)} \leq H < -15 \text{ mm (-0.59 in)}$
(5)	$-35 \text{ mm (-1.38 in)} \leq H < -25 \text{ mm (-0.98 in)}$

Example

$H = -2 \text{ mm (-0.08 in)}$

The setting value number which corresponds to the numerical value (2).

NOTE:

- Use this setting value number when choosing the front wheel arch height in the HDS.
- If the measured value exceeds +15 mm (0.59 in) or less than -35 mm (-1.38 in), the multipurpose camera aiming will not work. Check for frame/suspension damage or modification.

2. Dynamic Camera - Aim

■ Preconditions

- [HDS Connected](#)

■ Procedure

1. Check for DTCs with the HDS.

NOTE: Troubleshoot any DTCs first before proceeding. If DTC [B2A60-54](#) is indicated, proceed with the aiming procedure.

2. Select the following menu buttons on the HDS screen in sequence.

- ① Driving Support (System Selection Menu)
- ② Monocular Camera Driver Support System
- ③ Adjustment
- ④ Dynamic Camera Aiming

3. Enter the setting value number of the front wheel arch height follow the screen prompts on the HDS. The warning indicators (a) and the aiming indicators (b) are displayed on the MID as follows. (Figure 1 and 2)

NOTE: Use the "Setting value number" which was recorded in the previous step.

Figure 1

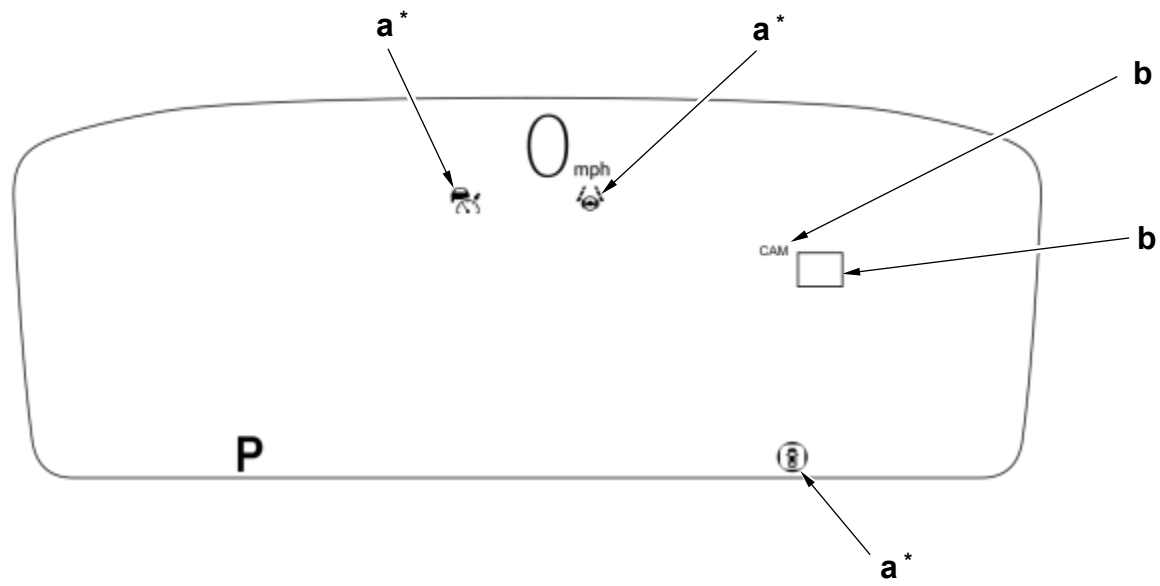
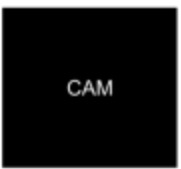
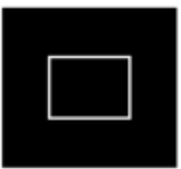





Figure 2

Warning Indicator and aiming indicator Status					
After entering front wheel arch height	OFF	ON	BLINK	BLINK	BLINK

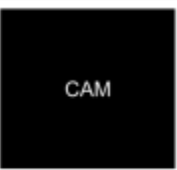
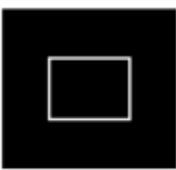



4. Perform the Dynamic Camera Aiming with the HDS and drive the vehicle at a constant speed with reference of the prerequisite conditions and recommended environment. The warning indicators and the aiming indicators are displayed on the MID as follows. (Figure 3)

NOTICE

- Drive the vehicle on the road with safety.
- If the warning indicator or the aiming indicator status changes, stop the vehicle in a safe place and check the status on the HDS screen.

NOTE: Turn on the speaker of the computer that has the HDS installed. A buzzer will beep when the aiming status changes.

Figure 3

Warning Indicator and aiming indicator Status					
During the aiming	BLINK	ON	BLINK	BLINK	BLINK
Camera aiming is completed	OFF	OFF	OFF (Green: ON)	OFF	OFF
Camera aiming has failed	ON	ON	ON	ON	ON

5. Confirm the multipurpose camera aiming completion on the HDS. (Figure 3)

- If the any indicators are indicated, confirm the Failure Codes and Message.

6. Turn the vehicle to the OFF (LOCK) mode.






7. Turn the vehicle to the ON mode.

■ Result

Confirm the warning indicators are off on the MID. (Figure 4)

- If the aim fails for some reason during the aiming, or if it is stopped halfway, an error code will be displayed on the HDS. Refer to “Failure Codes and Messages” and repair or replace parts as necessary. After the work, you must start the aiming procedure again.

Figure 4

Warning Indicator and aiming indicator Status					
Camera aiming is completed	OFF	OFF	OFF (Green: ON)	OFF	OFF
Camera aiming has failed	OFF	OFF	BLINK	BLINK	BLINK

Failure Codes and Messages

Failure code (on the HDS)	Failure message (on the HDS)	How to solve
01	ECU Failure <ul style="list-style-type: none"> DTC is detected. 	<ul style="list-style-type: none"> Check for DTCs with the HDS. After the DTC is cleared, do the aiming again.
03	Camera Posture Angle Out of Range <ul style="list-style-type: none"> The multipurpose camera unit is not correctly installed. There is cargo in the vehicle. The tire pressure in the tire is not correct. The vehicle leans or is at an odd angle (check for a modified or damaged suspension components, etc.). 	<p>After confirmation, perform re-aiming.</p> <ul style="list-style-type: none"> The multipurpose camera unit is correctly installed. Remove cargo from the vehicle except the tool kit. Make sure all tire sizes are correct and that their pressures are correct. The suspension and other related components must be original and undamaged. If necessary, do the wheel alignment.
09	Camera Temperature Out of Range	<p>After confirmation, perform re-aiming.</p> <ul style="list-style-type: none"> Wait for the temperature of the multipurpose camera unit to drop.
0E	On-road Aiming Time Out	<p>After confirmation, perform re-aiming.</p> <ul style="list-style-type: none"> Restart aiming mode because the specified time has elapsed after starting aiming mode.
12	Under other Routine processing	<p>After confirmation, perform re-aiming.</p> <ul style="list-style-type: none"> Wait until the processing of other units is completed.