



## ADAS Cameras: How They Work and Why They Need Calibration



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Modern vehicles rely heavily on cameras to support critical driver assistance features, and these ADAS cameras are some of the most important sensors in the entire system. They guide lane-keeping, detect obstacles, read traffic signs, and provide the visual data needed for emergency braking and collision avoidance. For these features to work correctly, the camera must see the road exactly as the manufacturer intended, which is why proper calibration is so important. This article breaks down how ADAS cameras function, where they're located, and the specific reasons calibration is essential for accurate, dependable performance in today's safety-driven vehicles.

### What is an ADAS camera?

ADAS cameras, an important function to advanced driver assistance systems, are automotive camera sensors, crucial for assisting drivers with tasks like lane-keeping and collision avoidance. These ADAS cameras vary in positioning based on the vehicle's design and features, including forward-, side-, and rear-mounted options. The versatility and functionality of ADAS cameras make them essential components in modern vehicles for enhanced driver safety and assistance.

Forward-facing cameras are the most common type of ADAS camera, while side and rear-mounted cameras are growing in popularity. Forward-facing ADAS cameras are mounted to the inside of the vehicle's windshield, near the rear-view mirror. Most automakers use one forward camera, while some, like Subaru, use two. Front ADAS cameras provide sensor data to inform several ADAS systems, including the following:

- Lane Departure Warning – cameras track road markings
- Lane Keeping Assist – sees lane markings and forward path
- Road Departure Mitigation – sees road edge markings, specifically
- Traffic Sign Recognition (some have a dedicated camera though)
- Forward Collision Warning – cameras look for obstructions
- Automatic Emergency Braking – detecting distance to next vehicle
- Adaptive Cruise Control – detecting and gauging distance to next vehicle
- Pedestrian Detection – determining pedestrians from other moving things
- Automatic high beams – senses light levels, detects vehicles

Rear and side-mounted camera systems are becoming more common. These sensors provide data for several ADAS systems, including the following applications:

- Parking assistance
- Blind spot detection
- Cross traffic alert – both rear and forward
- Around view monitoring

There are many different types of ADAS cameras, but they all work on the same basic principle: using sensors to detect objects in the environment and then processing that information to make decisions about how to respond.

## How do ADAS cameras work?

ADAS cameras capture images of the scene. The computer processes these images to identify any objects in the scene. The computer then uses algorithms to track these objects and determine how far away they are from the car. This information is used by the ADAS system to make decisions about how to respond, such as whether to initiate emergency braking or steer away from a potential collision.

## ADAS Camera Sensors vs Radar Sensors vs Lidar Sensors

There is some debate about which type of sensor is better for ADAS technology: cameras, radar, or lidar? The answer is that it depends on the specific application. Cameras are good at detecting small, stationary objects, while radar and lidar are better at detecting moving objects. For general purpose ADAS tasks such as lane-keeping and collision avoidance, a camera is usually sufficient. However, more specialized tasks such as autonomous driving, radar, and lidar are necessary for fully autonomous vehicles. Compared to camera-based ADAS systems, radar and lidar are more expensive to implement and maintain. However, they are better at detecting objects in difficult environments such as harsh weather or low light conditions.

### CAMERA

#### Pros

- High resolution
- Closest to human vision, detecting colors, and 2D shapes

- Relatively low-cost sensor

#### Cons

- Sunlight can blind them
- Poor vision during low visibility weather
  - Contrast is an issue
- Depth information not available

### RADAR

#### Pro

- Detects in bad weather and in the dark

#### Con

- Doesn't have high resolution at range (trouble telling bicycles from motorcycles)

### LIDAR

#### Pros

- High resolution at range
- Very accurate 3d modeling and object detection

#### Cons

- Lesser 2D resolution than camera
- Can't see through bad weather as well as radar
  - High cost
- Requires significant computing power

## ADAS Sensor Fusion

In ADAS, redundancy is important, hence sensor fusion. Most ADAS use a combination of optical and radar sensors to detect objects in the environment. By combining information from both types of sensors, the ADAS camera can more accurately identify and track objects in the environment. This means more accurate ADAS warnings and interventions, with fewer false alarms.

## ADAS Camera Calibration

**Calibration** is the process of adjusting the ADAS camera sensor so that it is correctly aligned with the vehicle. This involves setting the camera's position and angle, as well as its focus and zoom settings.

### Why

If the ADAS camera is not properly calibrated, it may not be able to correctly detect and track objects in the environment, which could lead to inaccurate results. In some cases, an uncalibrated ADAS camera may even fail to detect objects that are in plain sight.

### When

ADAS cameras need to be calibrated when removed or replaced, including after windshield replacement. Additionally, changes in alignment and airbag deployment may also be a cause for calibration. Several manufacturers have mandated recalibration of the front windshield camera after all collision repair work, greater than cosmetic repair.

It's also a good idea to calibrate the camera if you notice that it is not performing as well as it should be. For example, if the camera is having trouble detecting objects, or not working the way it used to, you may need to have it recalibrated.

***There are recent studies, identifying camera sensor degradation.*** Sunlight, car washes, and sand/gravel from roadway driving are some of the contributors to camera sensor degradation.

## How

Calibration is a very technical process that requires special equipment, a controlled environment, and special training. Due to several implementation hurdles, most auto shops cannot even handle calibrating ADAS sensors. This is why ADAS Solutions exists. With all the space, equipment, and training needed, ADAS Solutions centers can provide accurate calibrations of ADAS sensors quickly and reliably.

## ADAS Cameras FAQ

### What is an ADAS camera?

An ADAS camera is a vehicle sensor that assists with tasks like lane-keeping and collision avoidance, using visual data to inform various driver assistance systems.

### How do ADAS cameras work?

They capture images of the driving environment, which are processed to identify and track objects, aiding decisions like emergency braking or steering.

### Why is ADAS camera calibration necessary?

Calibration ensures the camera's accuracy in detecting objects, crucial for the reliable operation of driver assistance features.

### When should ADAS cameras be calibrated?

Calibration is needed after windshield replacement, collision repairs, or if there's a noticeable decline in system performance.

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