A comprehensive ADAS overview.

- You should be able to:
  - Have a good understanding of what ADAS is.
    - And is not.
  - Discuss the differences between an active and a passive calibration.
  - Be aware of the different sensors used in ADAS.
    - Their limitations.

Topics

- What is ADAS?
- Why ADAS?
- ADAS Basics
- How to Begin Calibration & Diagnosis
- Case Studies

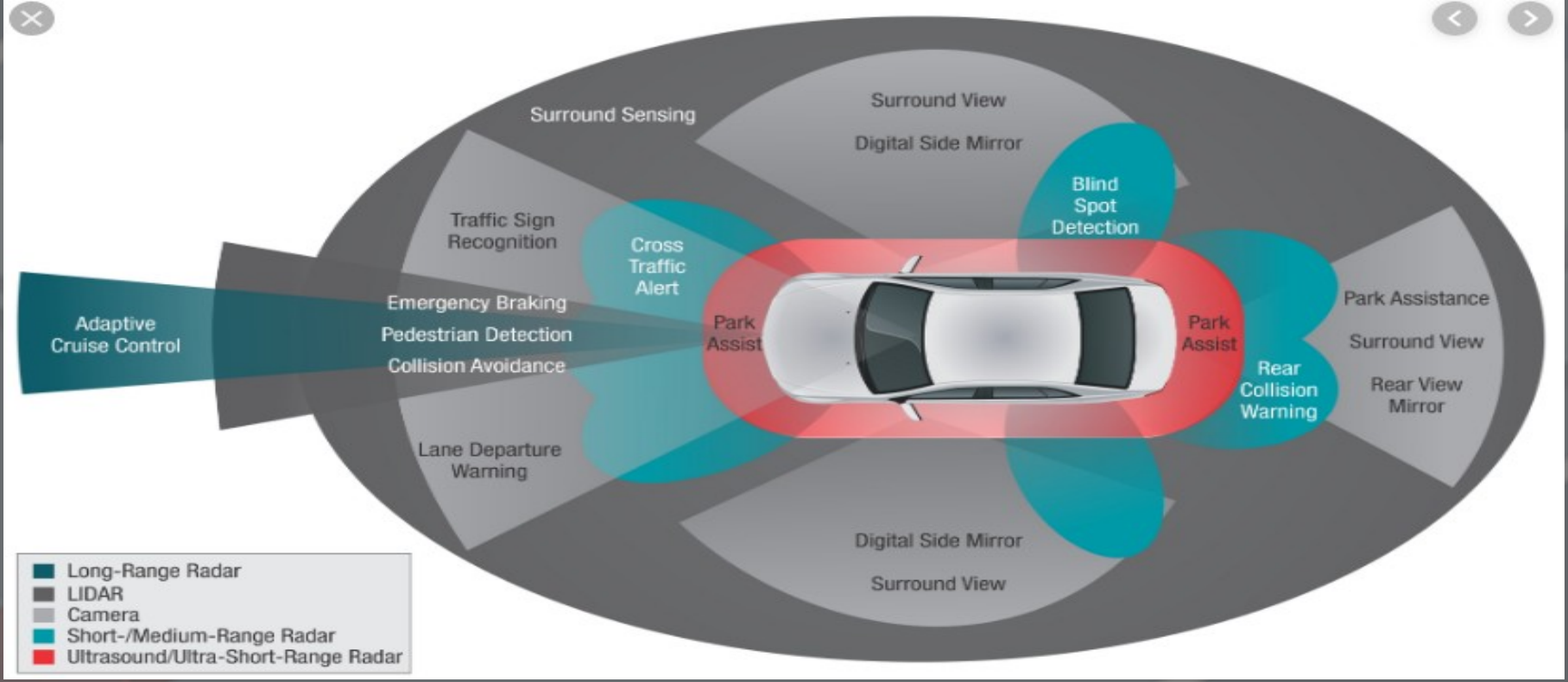
Driver Assistance Systems are not New!

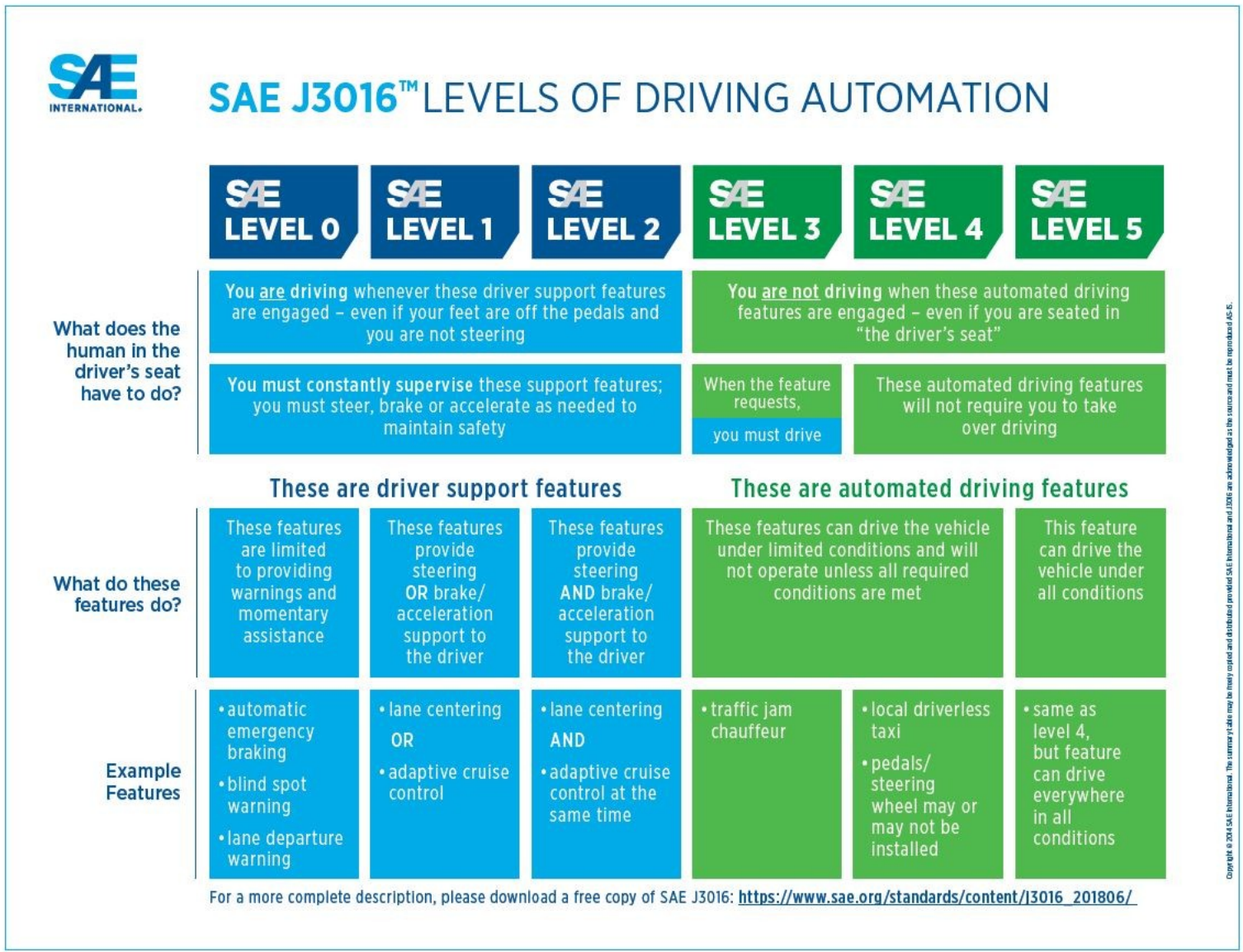
- Provide a visual, audio or tactile warning only.
  - Designed to promote safe driving
- Backup Cameras
- Monitoring Systems
  - Blind spot, cross traffic, parking

What is ADAS?

- Systems designed to intervene in a limited manner using:
  - Cameras
  - Radar
  - Ultrasonic sensors
  - LiDAR
- Examples
  - Lane Keep Assist
  - Automatic Parking
  - Emergency Brake Assist
- **ADAS is not an autonomous vehicle**

Example ADAS Systems




SAE INTERNATIONAL
SAE J3016™ LEVELS OF DRIVING AUTOMATION
SAE LEVEL 0
SAE LEVEL 1
SAE LEVEL 2
SAE LEVEL 3
SAE LEVEL 4
SAE LEVEL 5
What does the human in the driver's seat have to do?
You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering
You are not driving when these automated driving features are engaged – even if you are seated in "the driver's seat"
You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety
When the feature requests, you must drive
These automated driving features will not require you to take over driving
These are driver support features
These are automated driving features
What do these features do?
These features are limited to providing warnings and momentary assistance
These features provide steering OR brake/ acceleration support to the driver
These features provide steering AND brake/ acceleration support to the driver
These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met
This feature can drive the vehicle under all conditions
Example Features
• automatic emergency braking
• blind spot warning
• lane departure warning
• lane centering OR
• adaptive cruise control
• lane centering AND
• adaptive cruise control at the same time
• traffic jam chauffeur
• local driverless taxi
• pedals/ steering wheel may or may not be installed
• same as level 4, but feature can drive everywhere in all conditions
For a more complete description, please download a free copy of SAE J3016: https://www.sae.org/standards/content/j3016_201806/
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Why worry about ADAS?

- ADAS systems have an effect on other vehicle systems:
  - Alignment
  - Headlamp, radiator, condenser replacement
  - Windshield etc.
- ADAS is involved with:
  - PCM/TCM
  - EPS (Electronic Power Steering)
  - ABS

What should you be able to do?

- Read, understand, follow detailed instructions without skipping steps
- Make precision measurements with a metric tape measure
- Utilize a plumb-bob and string
- Create a true 90° triangle
- Draw on the ground with chalk or a marker
- Use a conventional or laser level
- Use most Scan Tool functions

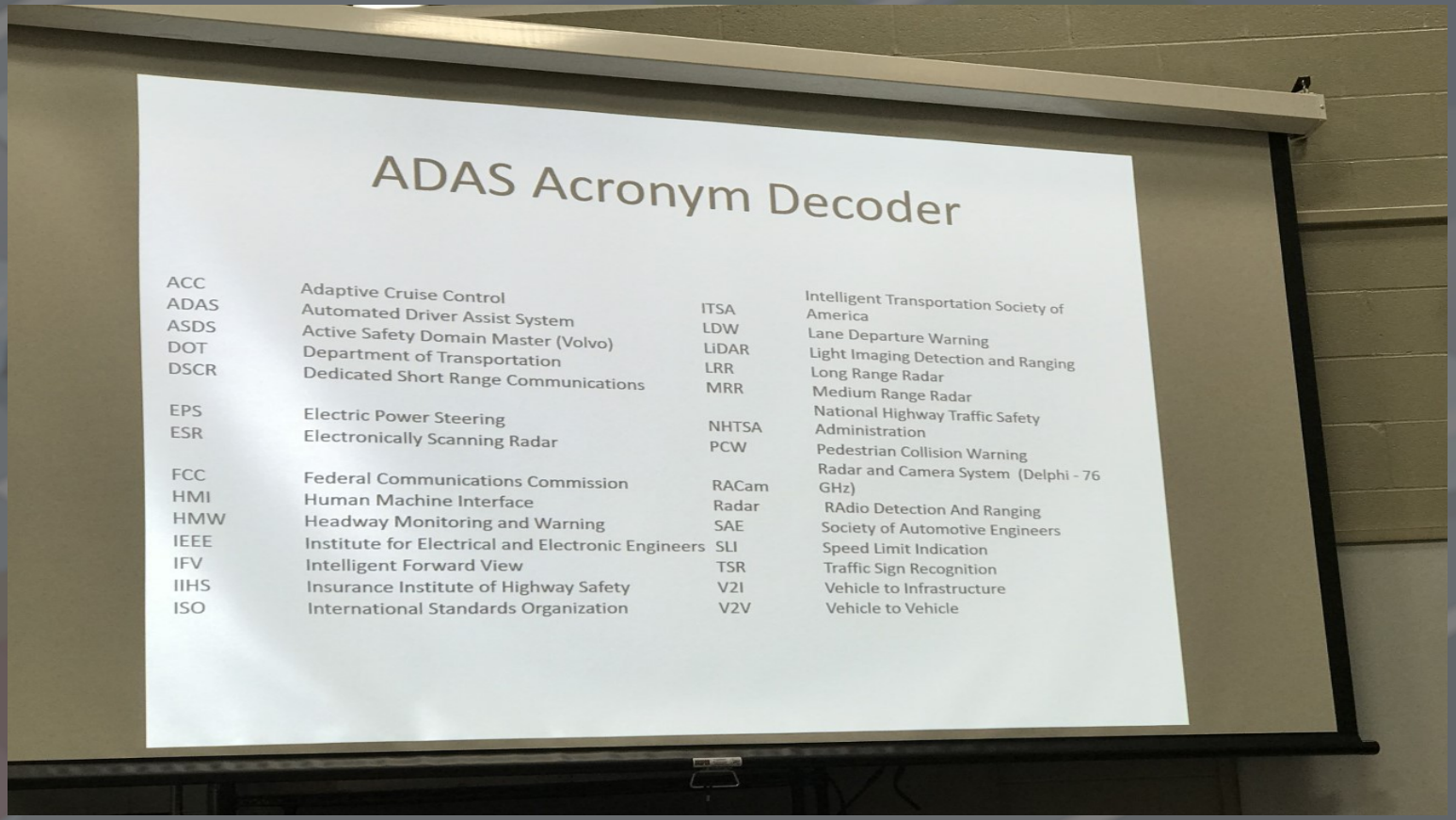
ADAS Basics

- How is the vehicle equipped?
- How is the vehicle supposed to function?
- Read all related procedures to completion before starting any calibration or repair procedures.
- Make sure you have the required tools before beginning.
- Perform vehicle pre and post module scans
- There are many similarities between vehicles from different manufacturers.

Document Everything

- Pre-scan and post-scan report
- Photograph pre-existing damage
- Alignment printout/ screen capture
- Steering angle sensor screen capture
- Odometer/ License plate
- Calibration static/dynamic completion screens

Do you know the secret code?



The Components

- Radar
  - Short, medium and long range
- Ultrasonic Sensors
- Lidar
- Cameras
- Many Modules
- Network Communication

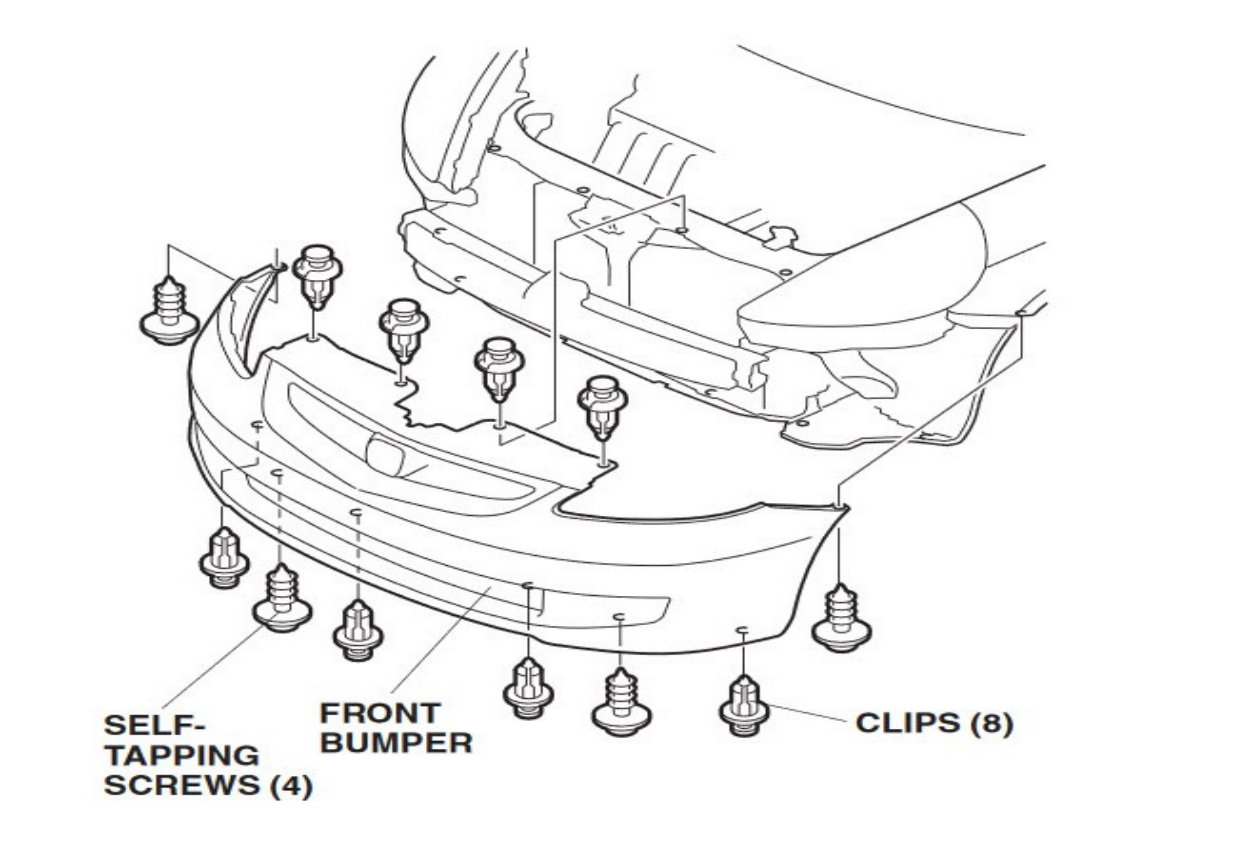
Radar

- Long Range
  - Detection angle 30°
  - Distances vary by manufacturer – 100ft to 650ft
  - Carrier Frequency: 77 GHz “Doppler Principle”
- Medium/Short Range
  - Detection angle 90°
  - Some units have built-in heater element

Front Radar

More Front Radar…

Will removing the fascia effect calibration?

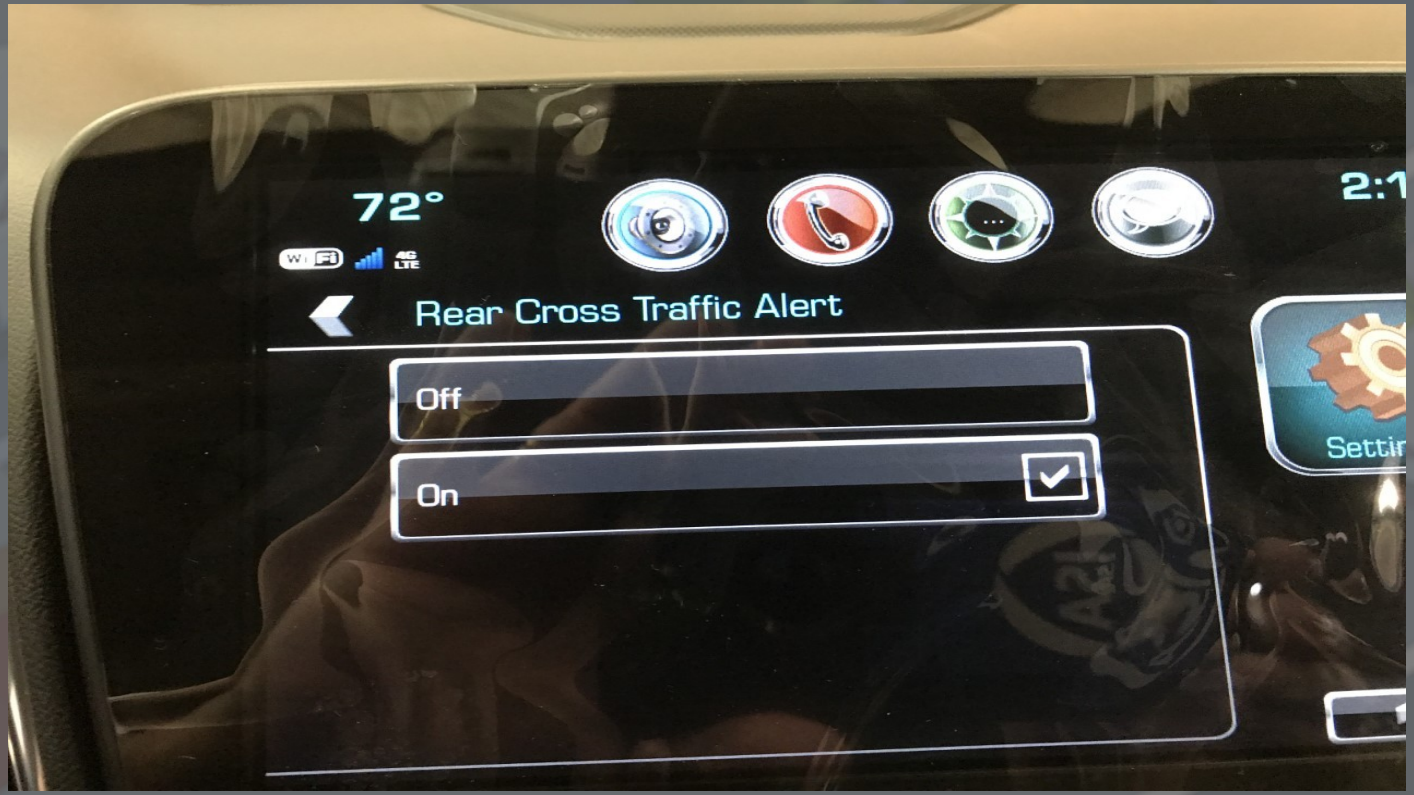


Will removing the radiator affect calibration?

Radar Cruise Inoperative

Sensor covered in Ice!

Some Systems are Driver Selectable



Ultrasonic Sensors

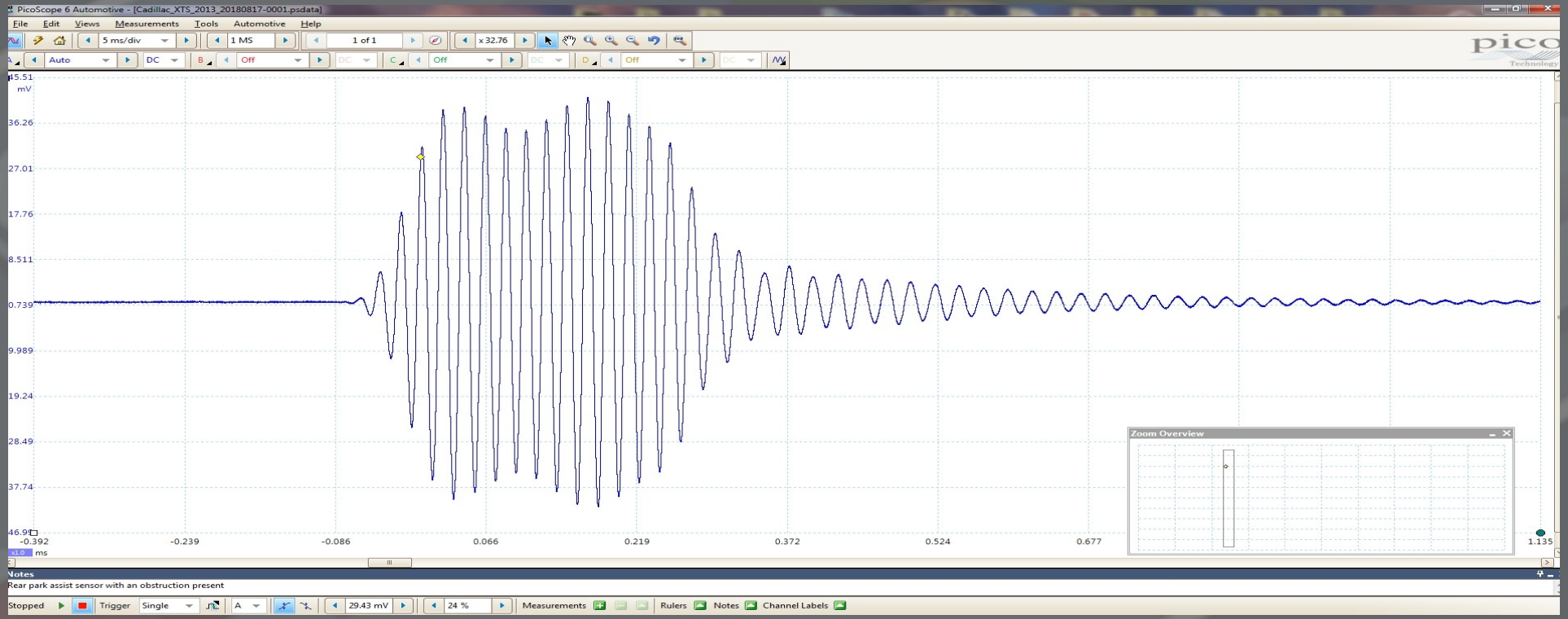
- Most commonly used for parking assist
- Operating frequency above human and animal hearing (48 – 58 kHz)
- Close in ranging (1-2 feet)

Rear Sensors

Front Sensors

Pico Ultrasonic Parking Sensor Detector (TA329)

Pico using TA329 detector



Case Study

- 2011 Cadillac Escalade
- Park Assist System Inoperative after collision repair.
- DTC for ultrasonic sensor error
- Issue: Paint thickness on the sensor
  - GM sensors can be repainted once
  - This was a second repair
  - 6 mils too much paint (measured electronically)
  - Sensors were replaced to resolve problem

Cameras

- The use of cameras provides the system the ability to identify objects while extending the distance for the detection of possible hazards.
- The down side of cameras is they do not function as well in poor weather and they may have poor ability to determine distance.

Subaru EyeSight Cameras

Radar & Camera Combination

Camera

Case Study

- 2019 Ram 2500 – Collision repair
- Camera would not calibrate after windshield replacement
- OEM windshield resolved issue
- Aftermarket glass quality was concern

LiDAR

- A surveying method that measures distance to a target by illuminating the target with laser light and measuring the reflected light with a sensor.

LiDAR

- Limited use
- Volvo using a radar/LiDAR combination unit
- Unsightly
- Newer solid-state units being developed for future use

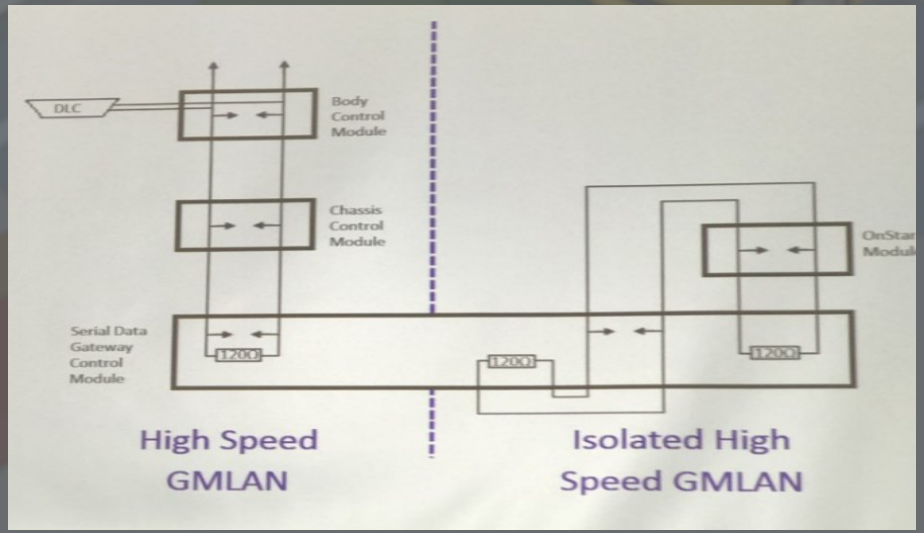
Modules

- Power
- Ground
- Communication
- Replacement likely requires programming

Warm to the Touch

Network Communication

- Vehicles have familiar networks for operation
- Isolated networks for cyber security



Sensor Fusion

- A sensor may used by multiple systems
- One system will not operate because of a failure in a different system

When is Calibration Needed?

Camera

- Windshield repaired or replaced
- Camera removed or replaced
- DTCs present
- Wheel alignment
- Change in tire size
- Change in ride height

Radar

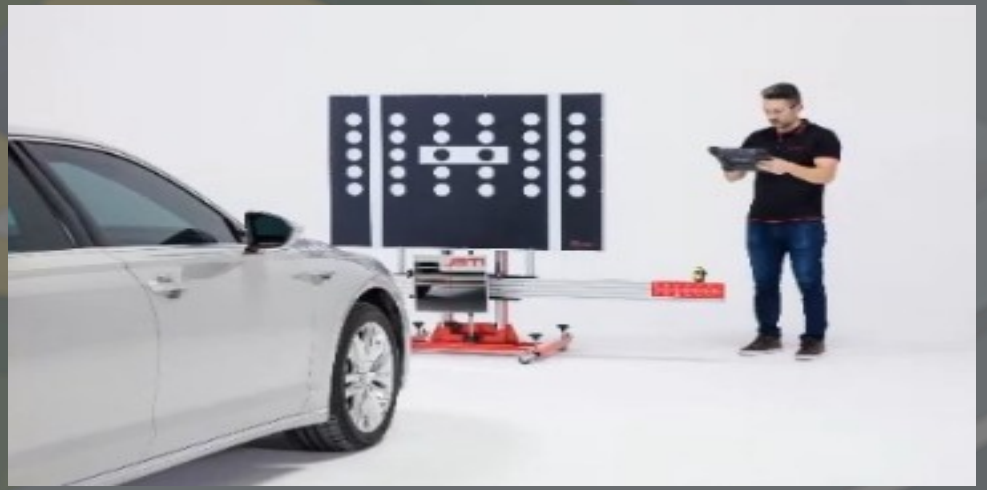
- Radar removed and replaced
- After a minor collision
- Bumper cover removed and replaced
- Grill removed and replaced
- Wheel Alignment
- DTCs present

Dynamic Calibration

- OE Requirements
  - Good weather conditions
  - Clear lane markings
  - Objects on the side of the road
  - Speed of 32 mph +
  - Minimal lane changes
  - Flat road, minimal curves
  - Minimal traffic

Static Calibration

- OE Requirements
  - Controlled environment
    - Bright, even lighting
    - No windows
    - No background clutter
  - Flat, level floor
  - Targets, patterns, accessories
  - Calibration procedures and specifications



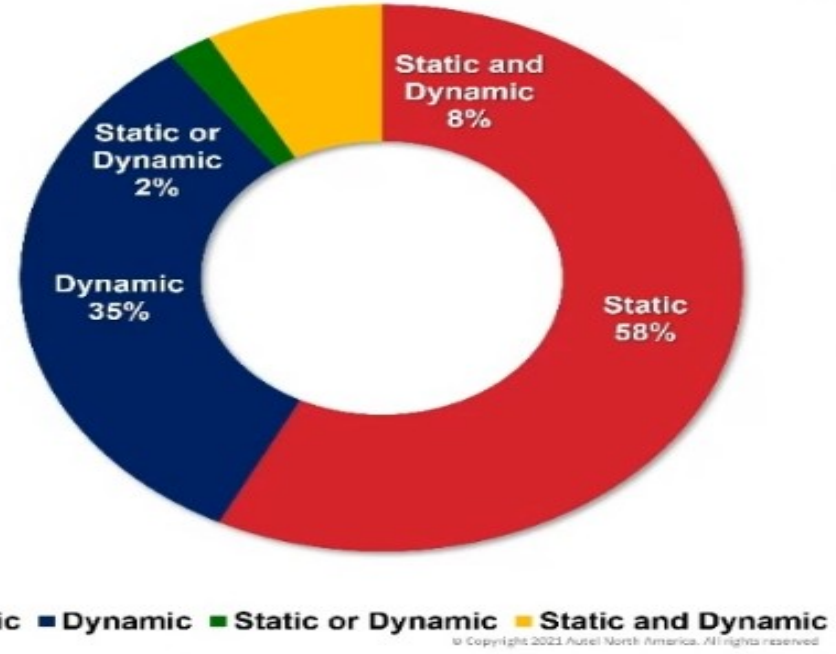
Static & Dynamic Calibration

- Some vehicles require both:
  - Static in a controlled environment
  - Dynamic under specific driving conditions
  - These are two separate calibrations

Calibration Trends

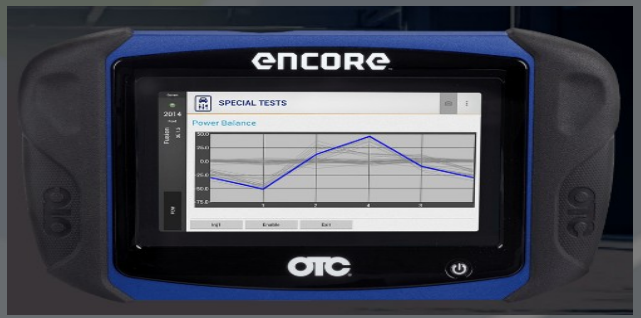
- Static Only **58%**
- Dynamic Only **35%**
- Static *and* Dynamic **8%**
- Static *or* Dynamic **2%**

- Static **68%** ↑
- Dynamic **45%** ↓



AUTEL

OEM and aftermarket Scan Tool are capable of performing ADAS calibrations



Tools: Diagnosis and Service

Tools: Diagnosis and Service

This is a radar reflector

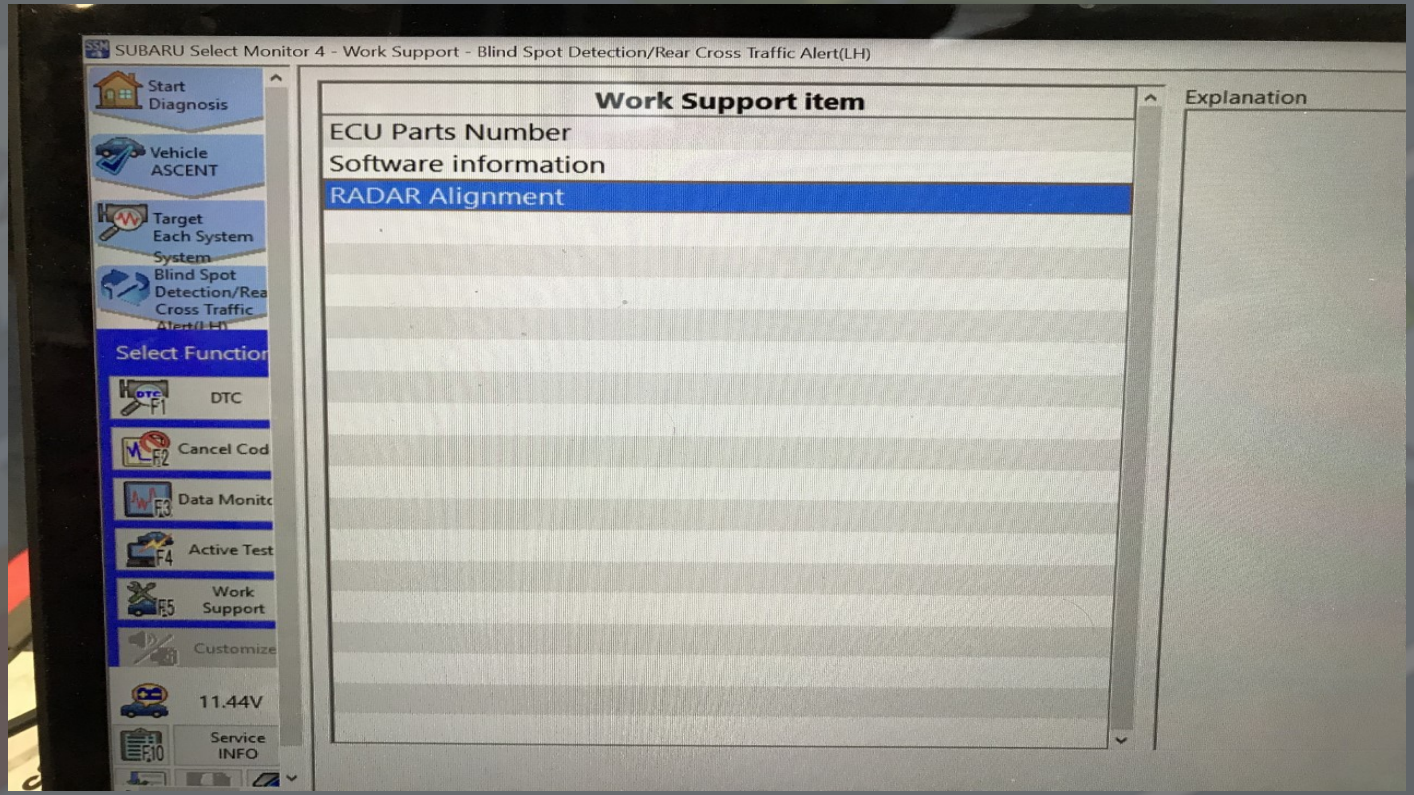
Other Tools You May Need

Vehicle Preconditioning

- All fluids at recommended levels
- Gas tank full
- Tire pressure adjusted to placard levels
- Windshield clean
- Dashboard clean
- No load in vehicle
- All lights off and doors closed
- Connect a battery maintainer
- Front wheels straight ahead
- Rear wheels straight ahead

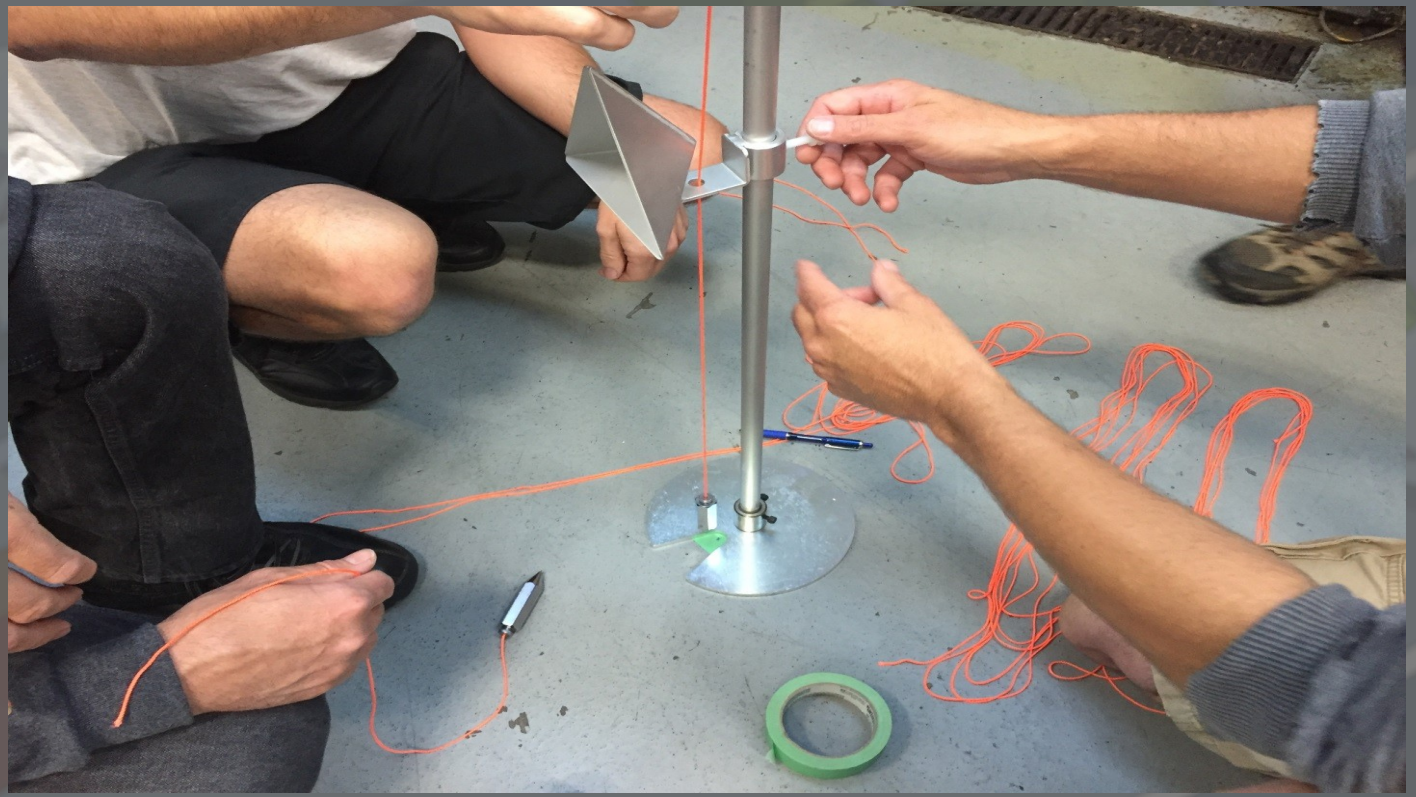
Sometimes… Calibration is this simple

Static Radar Calibration

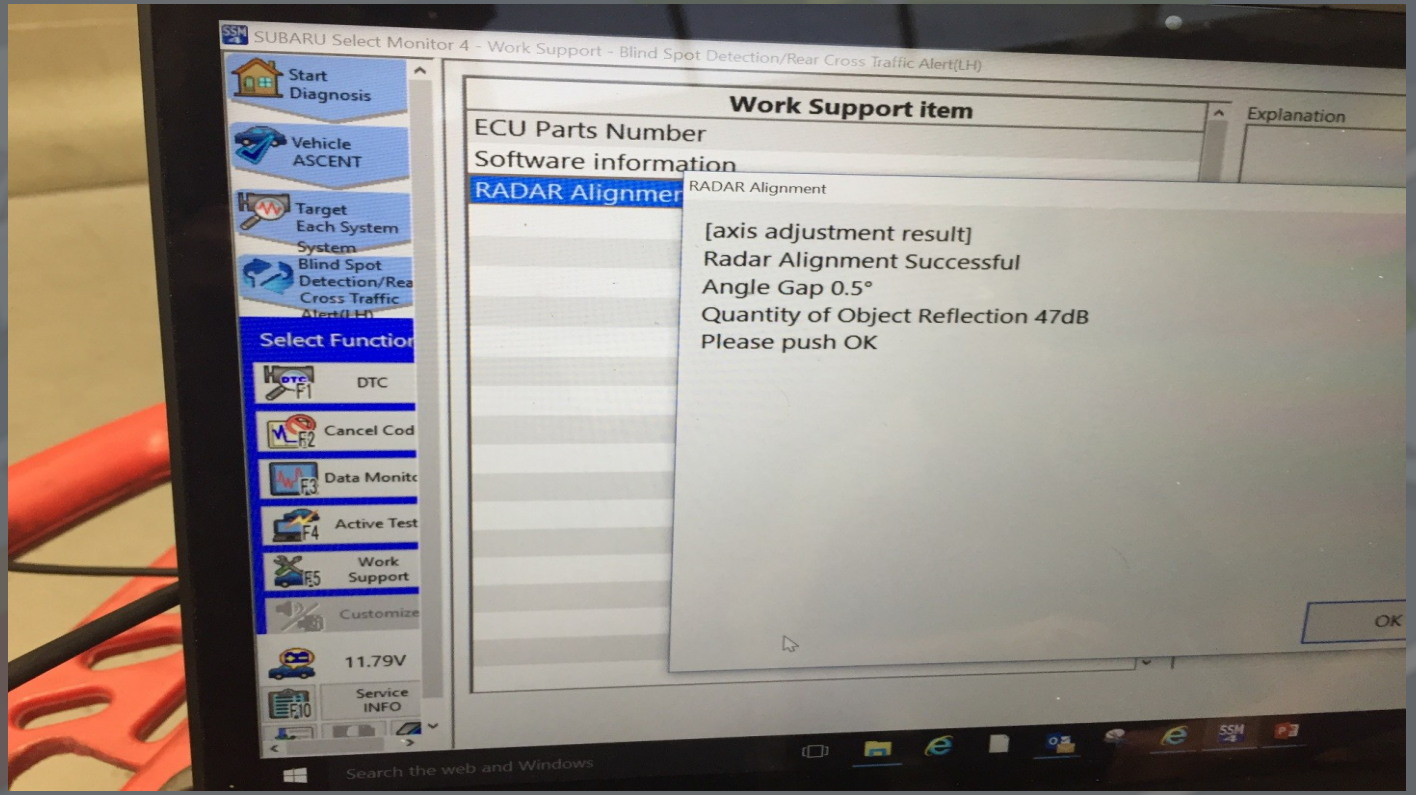


Static Calibration

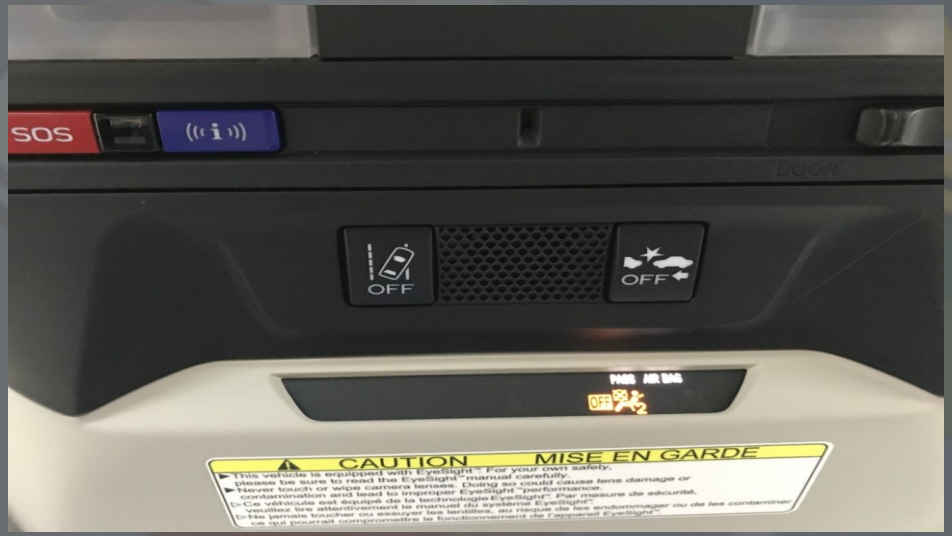
Static Calibration



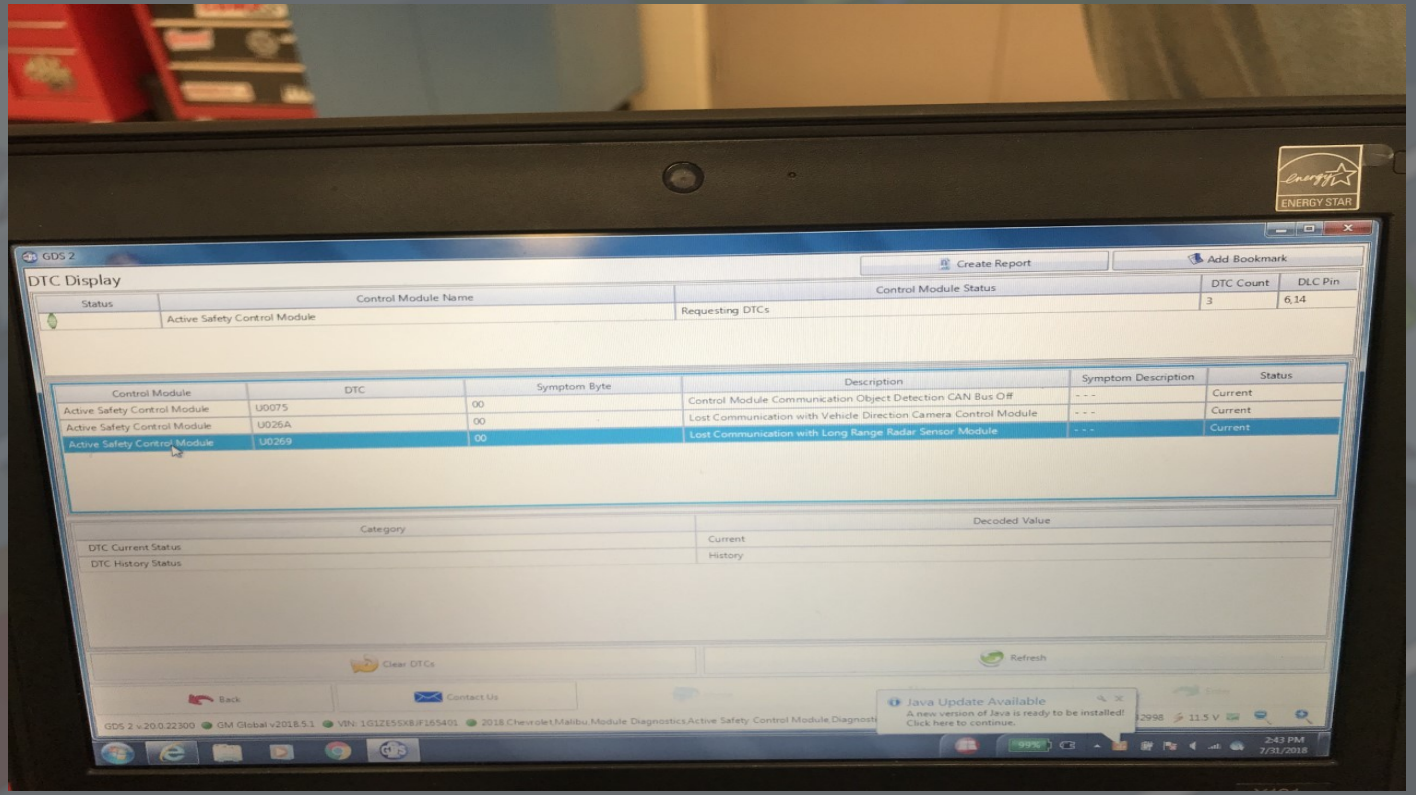
Static Calibration Complete



Diagnosis and Service



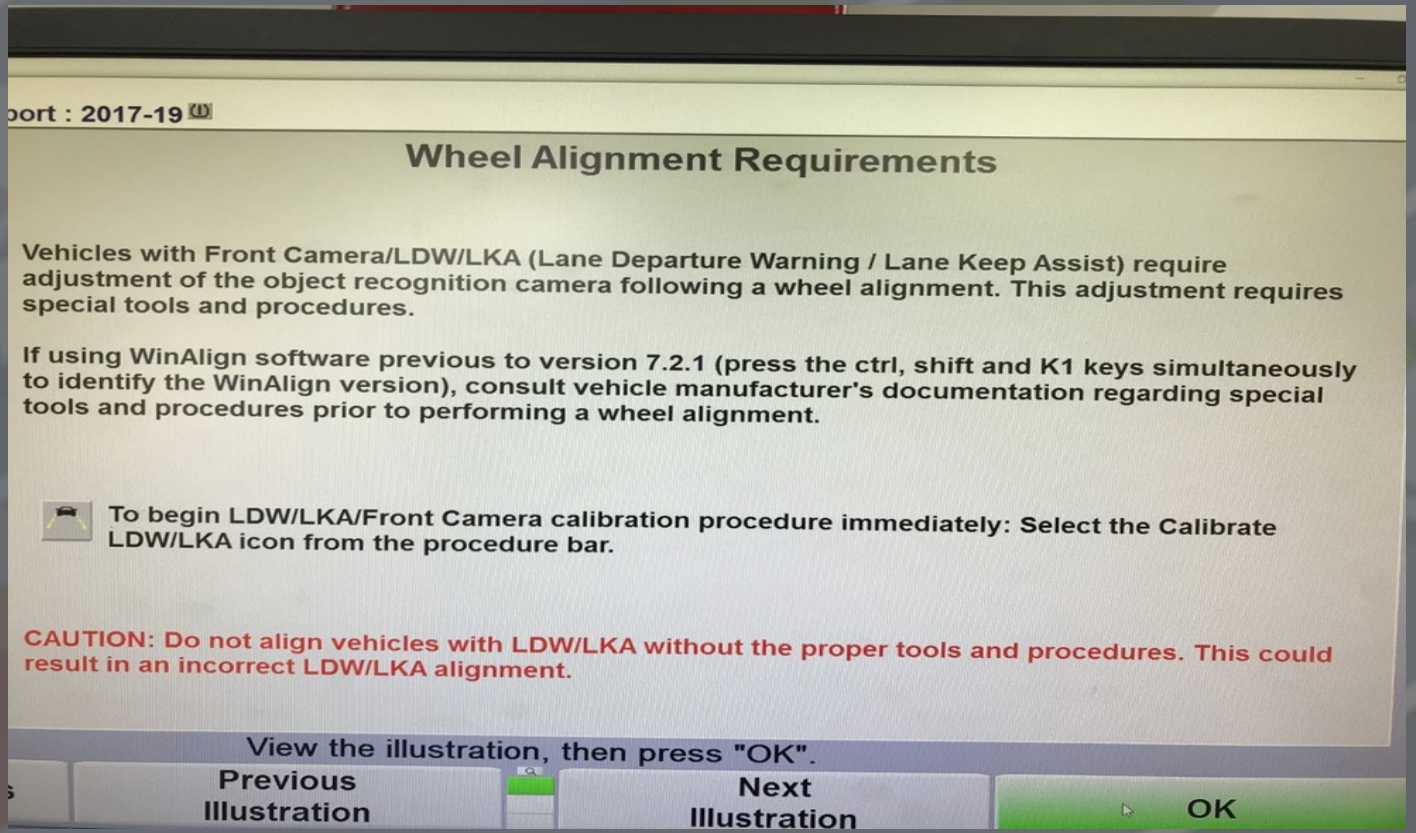
Begin Diagnosis by Reading DTCs



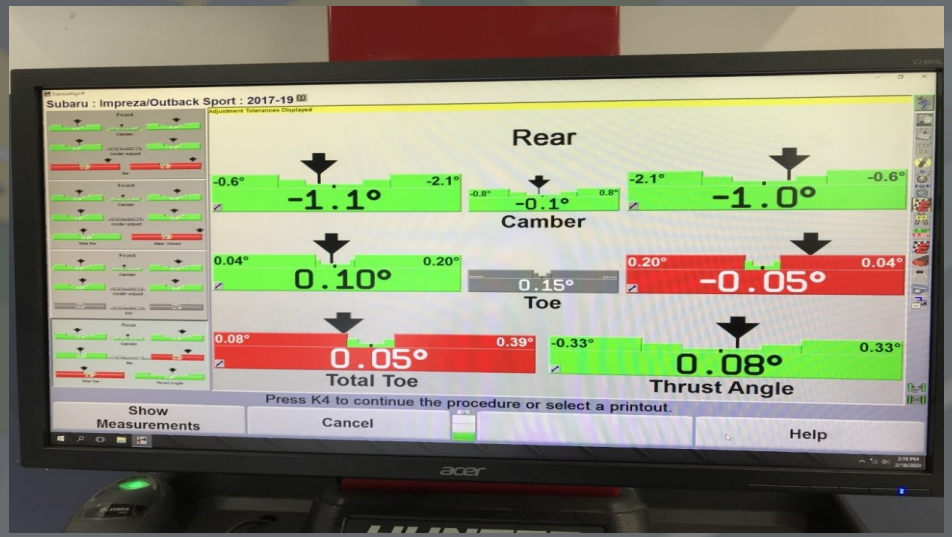
Diagnosis and Service

- Module Replacement?
  - Programming required
- Repairs may require static and/or dynamic calibration

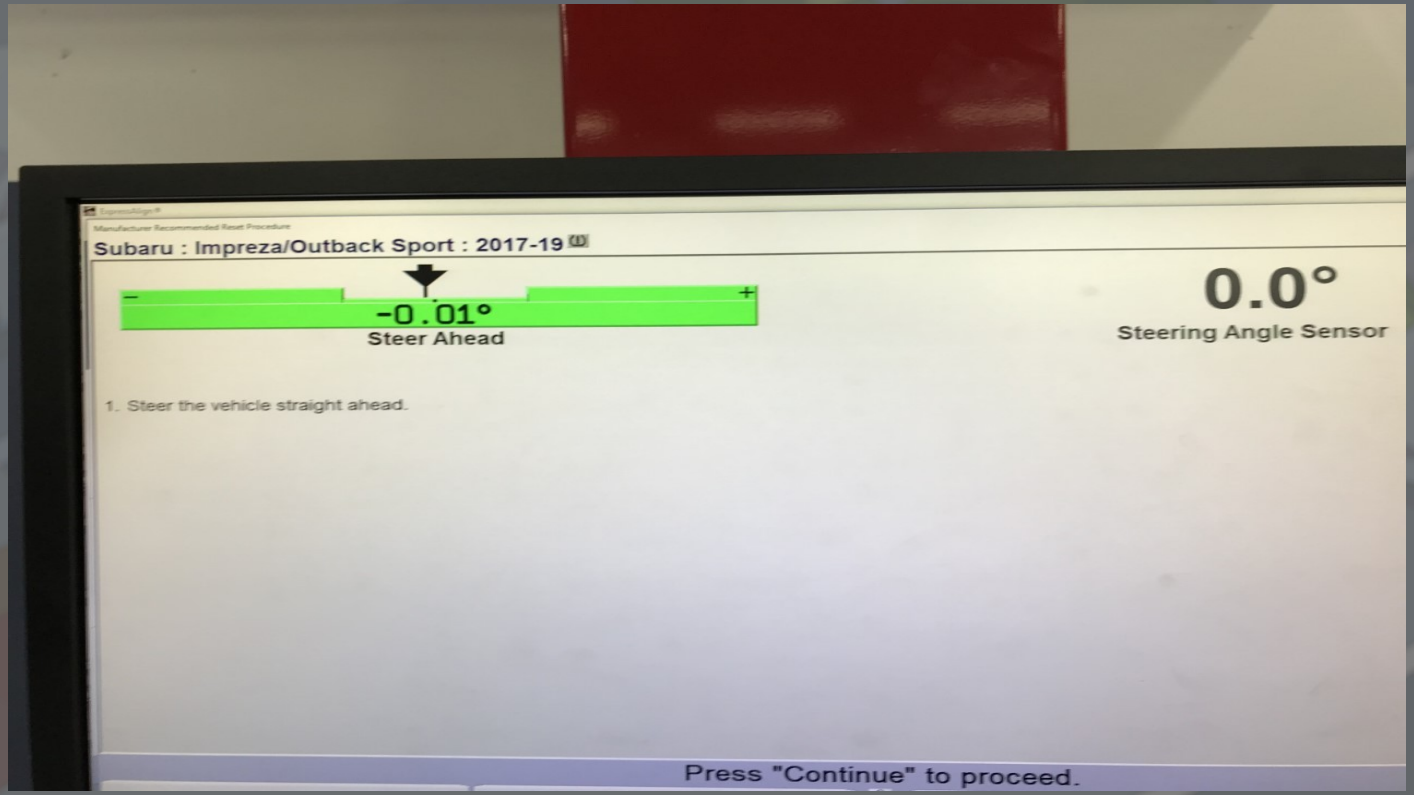
2019 Subaru Impreza Alignment



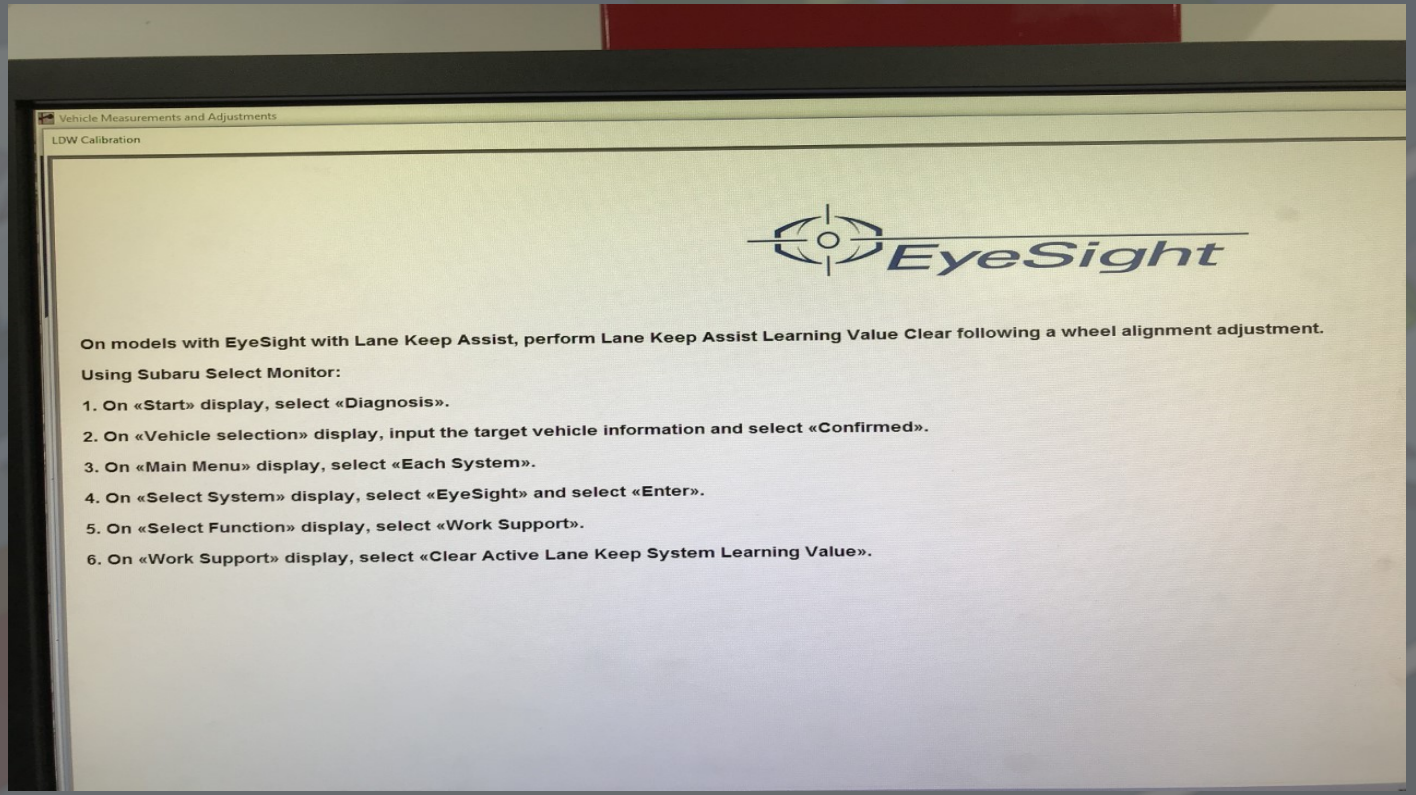
Set Rear and Front Toe



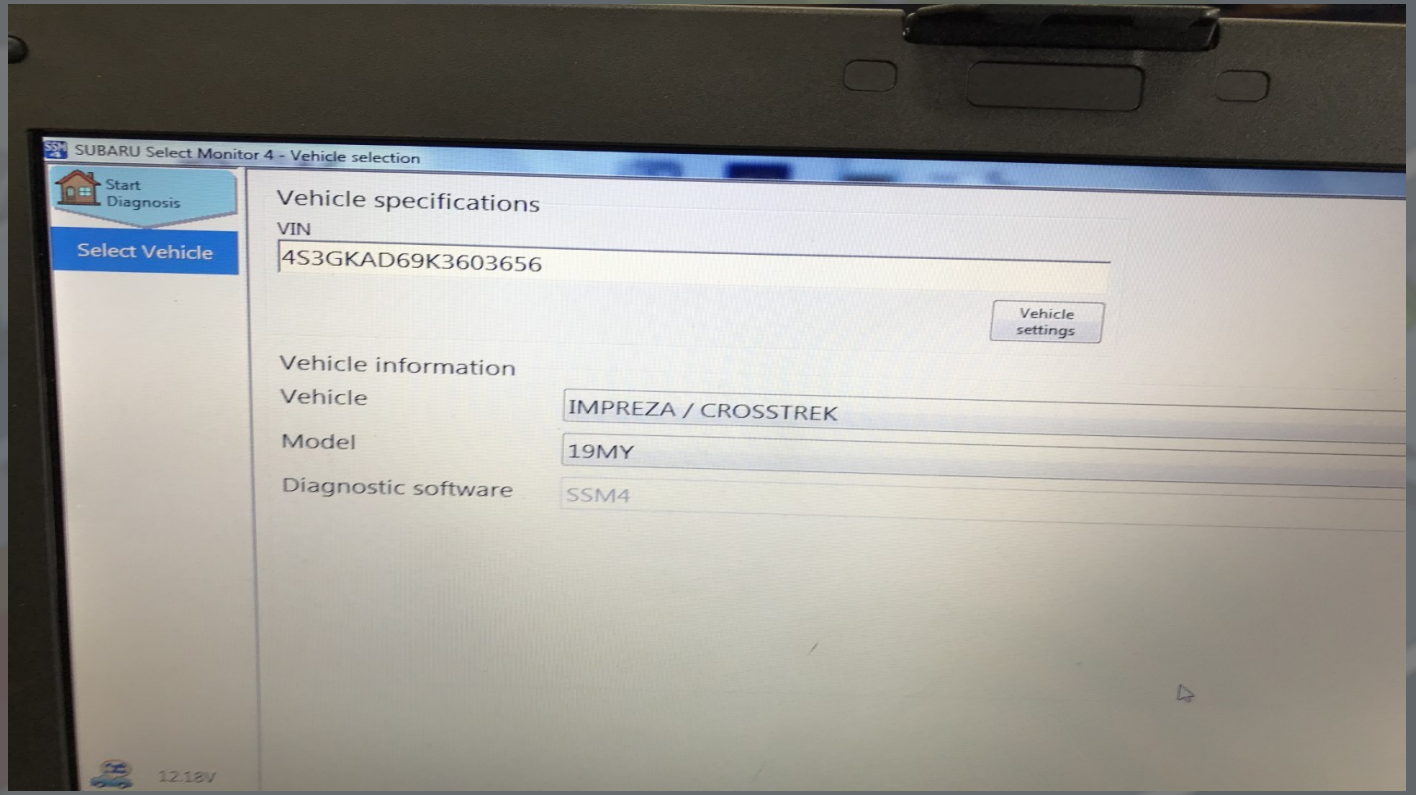
Reset Steering Angle Sensor



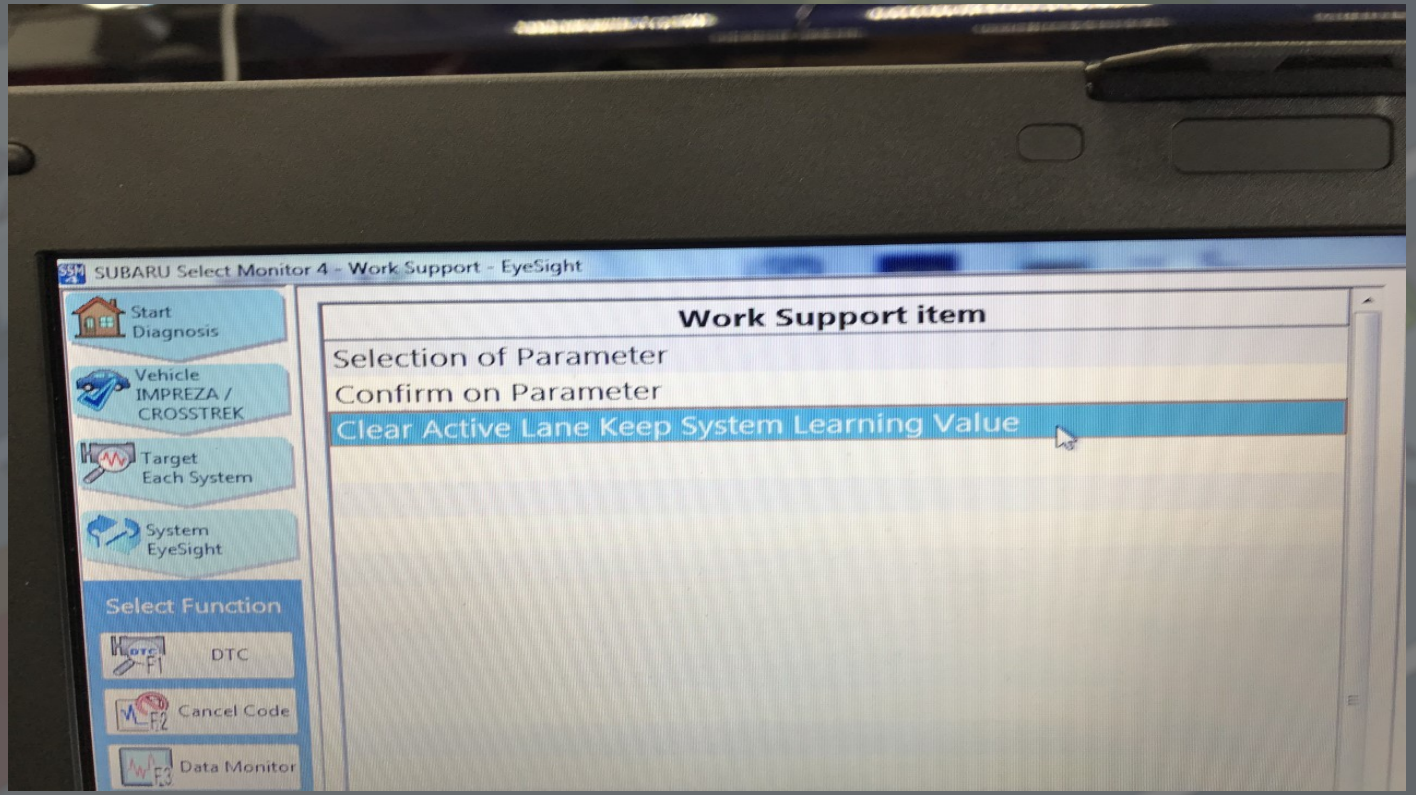
EyeSight Specific Screen



Subaru Scan Tool



Clear Old Data



Service Information

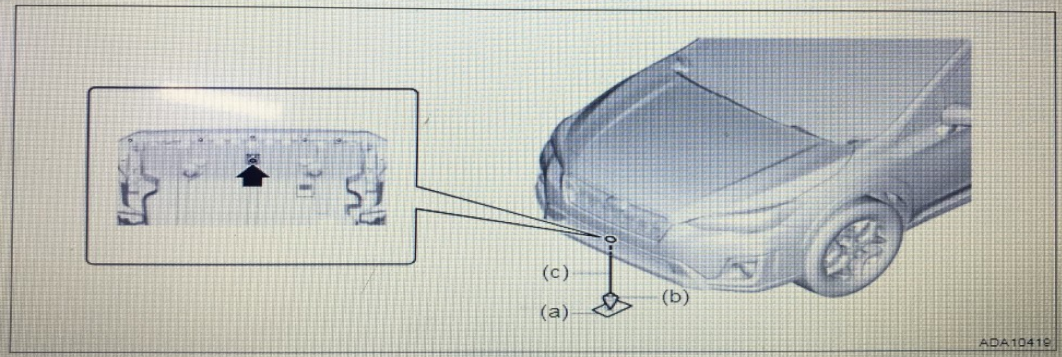
(3) The inflation pressure of tires is correct.
(4) The vehicle does not have load.
(5) The front wheels are directed to the straight ahead position, when the steering wheel is set to the center position.

参考:

When the front wheels are not directed to the straight ahead position, adjust the alignment. FRONT SUSPENSION

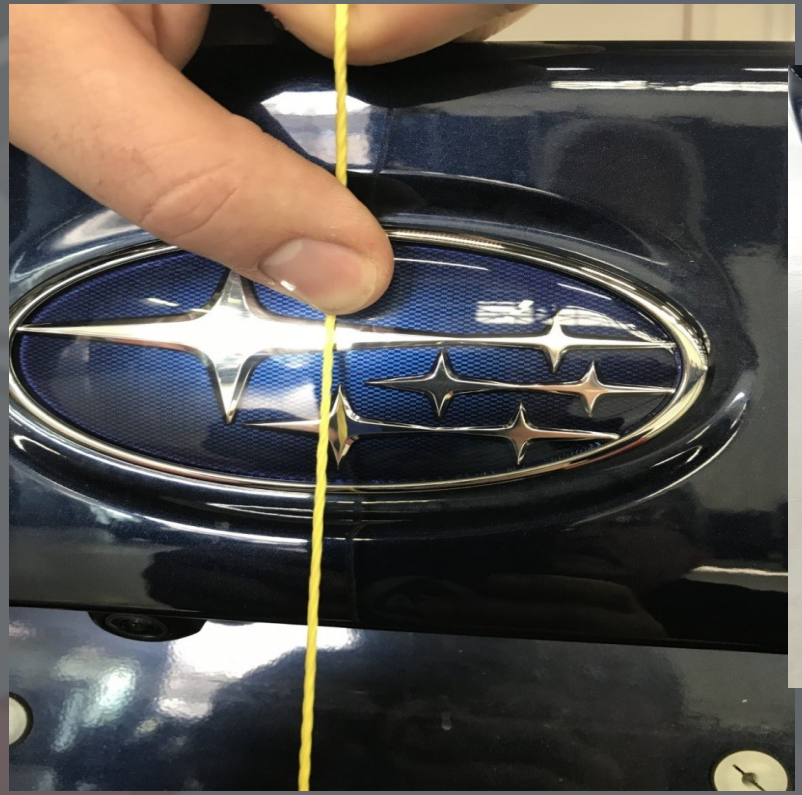
参照のこと。

2. Prepare the Subaru Select Monitor, measure, plumb bob, leveling line and RANDOM CHART (ST).
   Preparation tool:
   ST: RANDOM CHART (87599VA000)
3. Place the vehicle on a level surface, where approximately 5 m (16.41 ft) space can be secured in front of the vehicle.
4. Suspend the plumb bob with leveling line from front center position of vehicle (center clip of under cover), and mark the position where t
   (Point A)



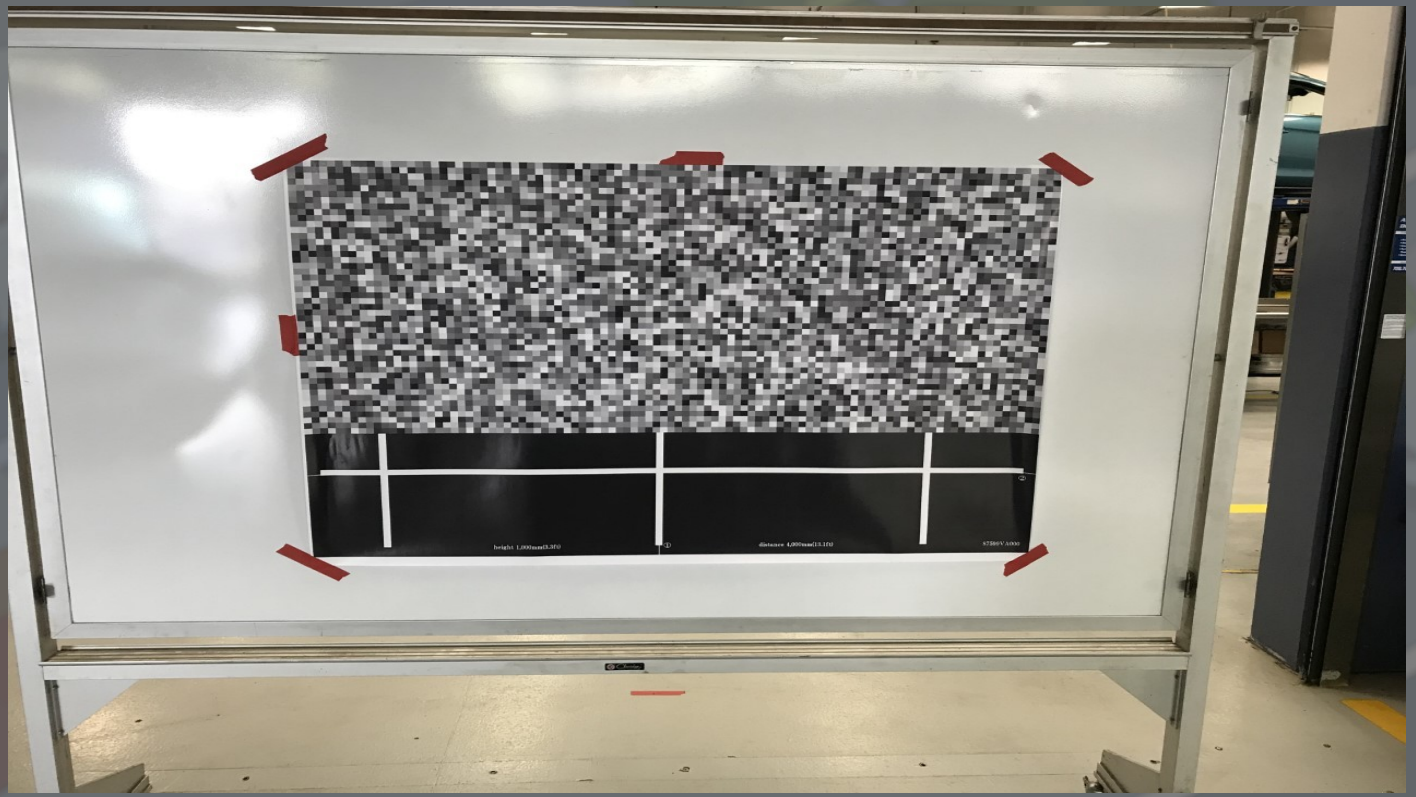
(a) Point A (b) Plumb bob (c) Leveling line

Locating Vehicle Centerline

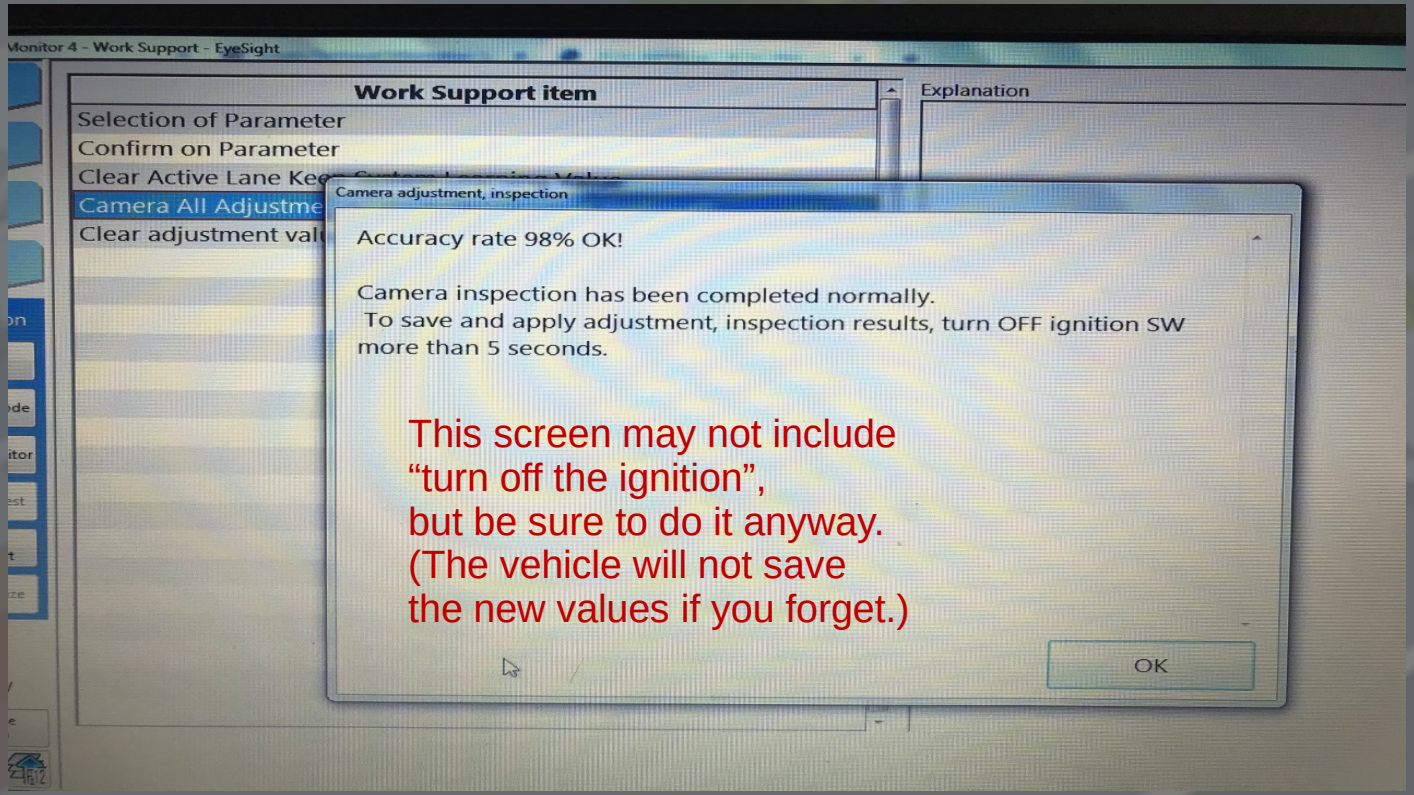


Transferring Wheel Centerline Measurements

Place Target



Static Calibration Success



Dynamic Calibration Test Drive

- Drive the vehicle on street that has lane markings. Make sure the calibration completed with no errors.

Calibration Summary

- Follow instructions!!!
- Take your time.
- Be careful with your measurements

What is likely to occur

- Two different ADAS Technicians
  - Diagnostician (“A” Tech)
  - Calibration Specialist (Apprentice)

The End.

- There is a home work on Brightspace.
  - Introduction to ADAS.
    - Please refer to Brightspace for when due.