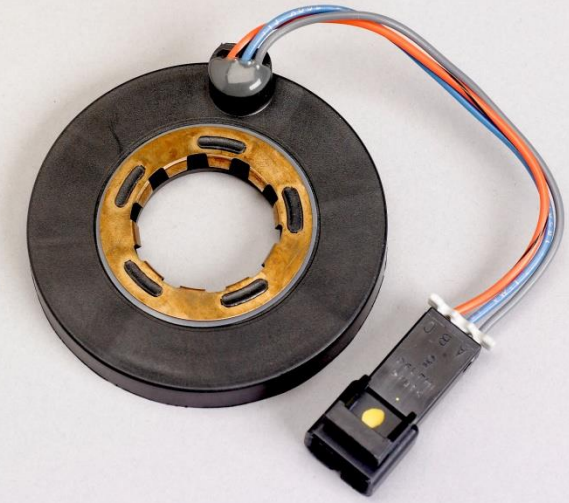
Steering Angle Sensor Resets

- Tim Janello
- Department of Automotive Technology
- Southern Illinois University Carbondale
- E-mail: tjanello@siu.edu

- Showpower 2011

SAS
(Steering Angle Sensors)

There Is A Lot More To It Than Just Resetting Them



Please don’t think you can ignore resetting a SAS system if it’s required.

ESC
The Real Basis of SAS

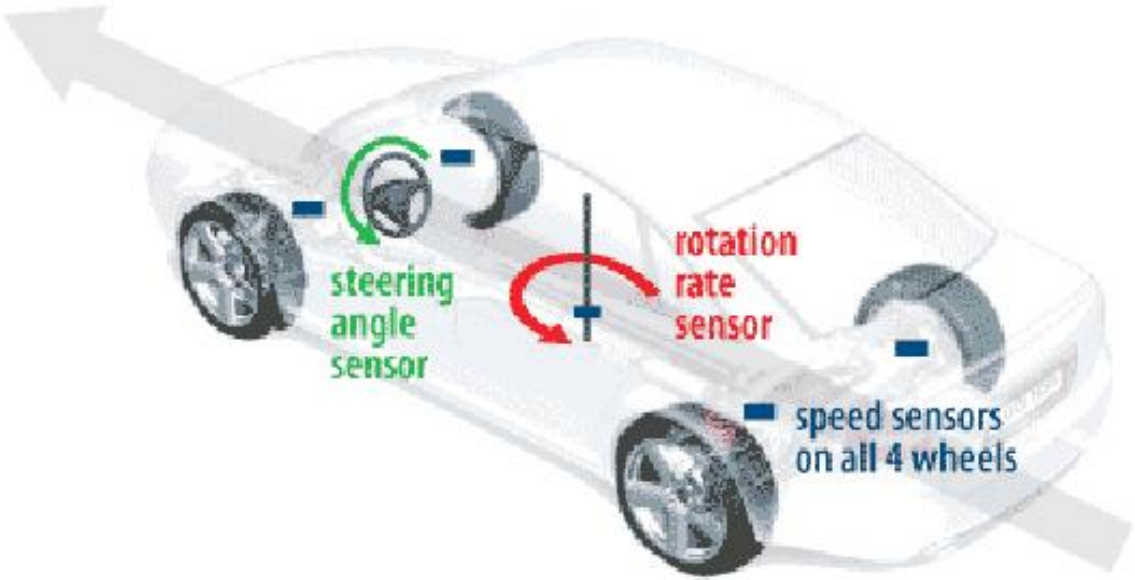


Illustration courtsey of Snap-On Tools

ESC
(Electronic Stability Control)

- Has Inputs From:
  - WSS (Wheel Speed Sensors)
  - SAS (Steering Angle Sensor(s))
  - Yaw Rate Sensor (YRS)
  - Other inputs …….

Such AS

- Other Inputs into the ESC System:
  - ESC (Electronic Stability Control) systems
  - EPS (Electronic Power Steering)
  - AS (Active Steering)
  - VRS (Variable Rate Steering)
  - LD (Lane Departure)
  - LA (Lane Assist)
  - PA (Parking Assist)

ESC
(Electronic Stability Control)

- Inputs From:
  - WSS (Wheel Speed Sensors)
  - SAS (Steering Angle Sensor(s))
  - Yaw Rate Sensor (YRS)
- These inputs can be influenced by:
  - Thrust angle
  - Front alignment
  - Tire issues
  - Braking

Understanding How Over steer and Under Steer are Controlled is Critical

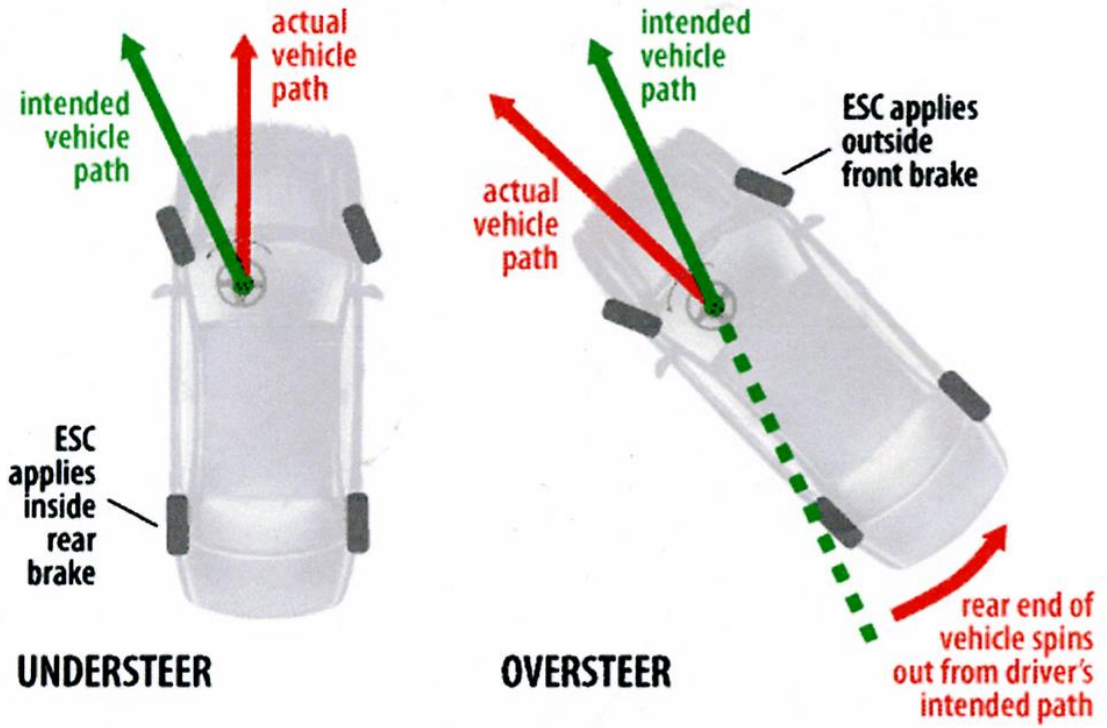


Illustration courtesy of Snap On

Under Steer and Over Steer Happens When

- A driver tries to turn very hard (swerve)
- Turn on a slippery road.

Information courtesy of Snap On

When A Vehicle Under Steers

- It turns less than intended
- Continues in a forward directic
- Front wheels have insufficient

  Traction

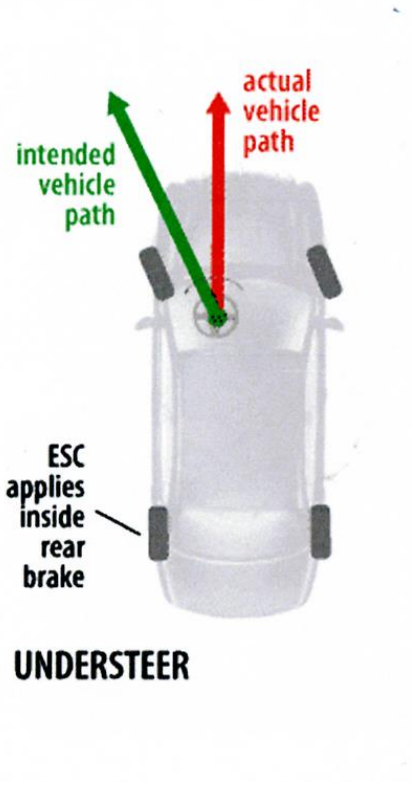


Illustration courtesy of Snap On

When A Vehicle Over Steers

- It turns more than intended
- The rear end is spinning or sliding out

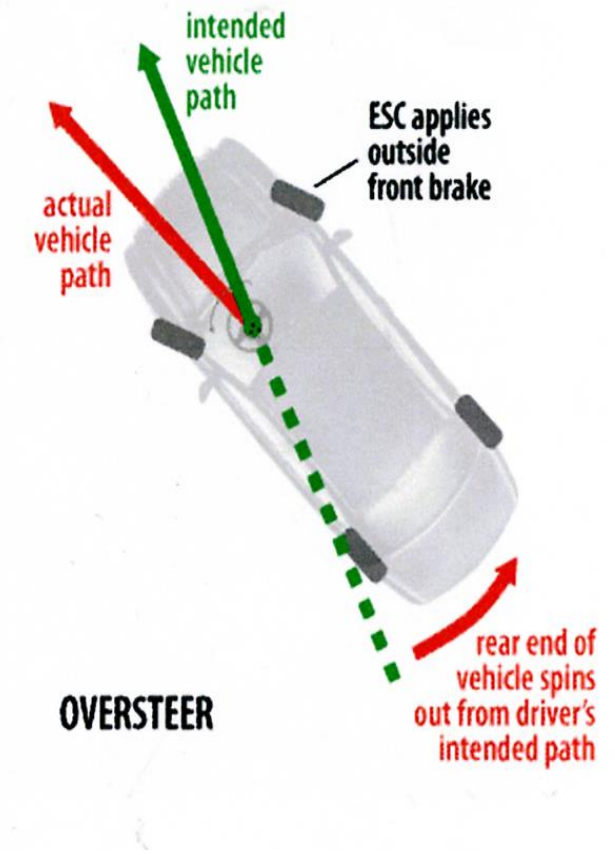


Illustration courtesy of Snap On

Wheel Alignment & Vehicle Service Rules Have Changed

- Again

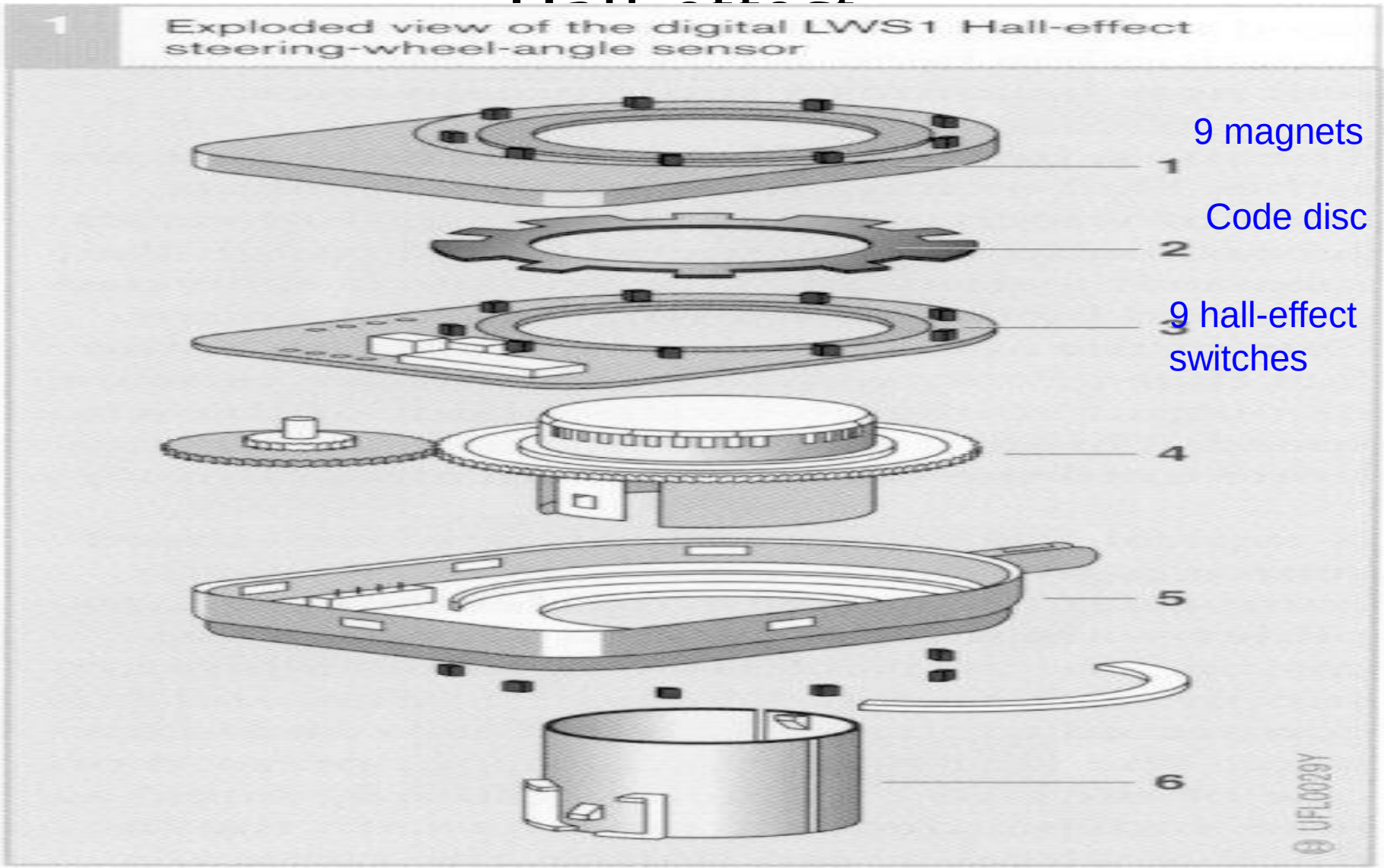
If you are performing or selling any vehicle that affects the steering, chassis, tire or alignment system you must…

Understand the Why's and What's of SAS

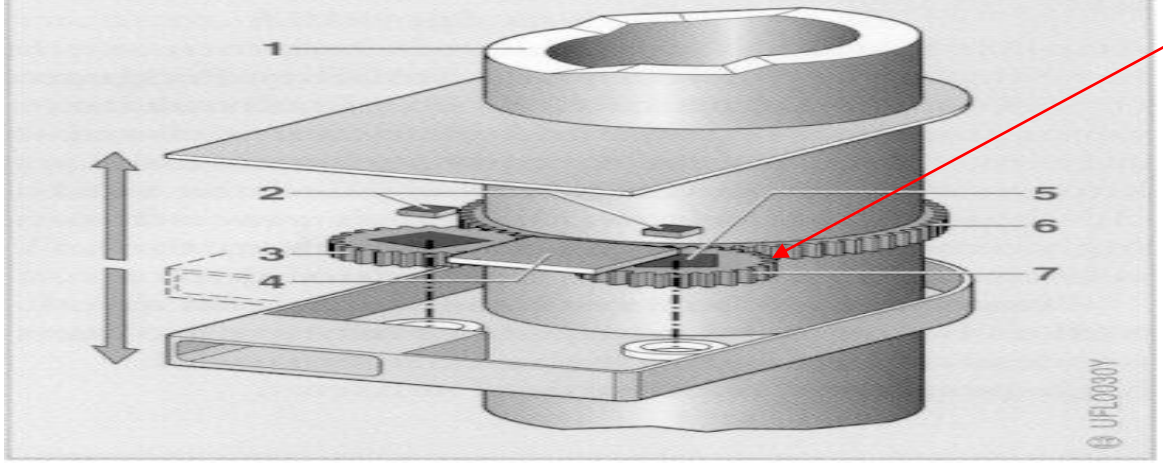
- Before you do anything else you must know
- Why SAS are used?
- What do they do or control?

Steering Wheel Angle

Hall-effect



2 AMR steering-wheel-angle sensor LWS3 (principle)



1 tooth off to get a definite pair of angular variables

Fig. 2

1	Steering-column shaft
2	AMR sensor elements
3	Gearwheel with m teeth
4	Evaluation electronics
5	Magnets
6	Gearwheel with n > m teeth
7	Gearwheel with m + 1 teeth

3 AMR steering-wheel-angle sensor LWS3

Magneto-resistive

4 AMR steering-wheel-angle sensor LWS4 for attachment to the end of the steering-column shaft

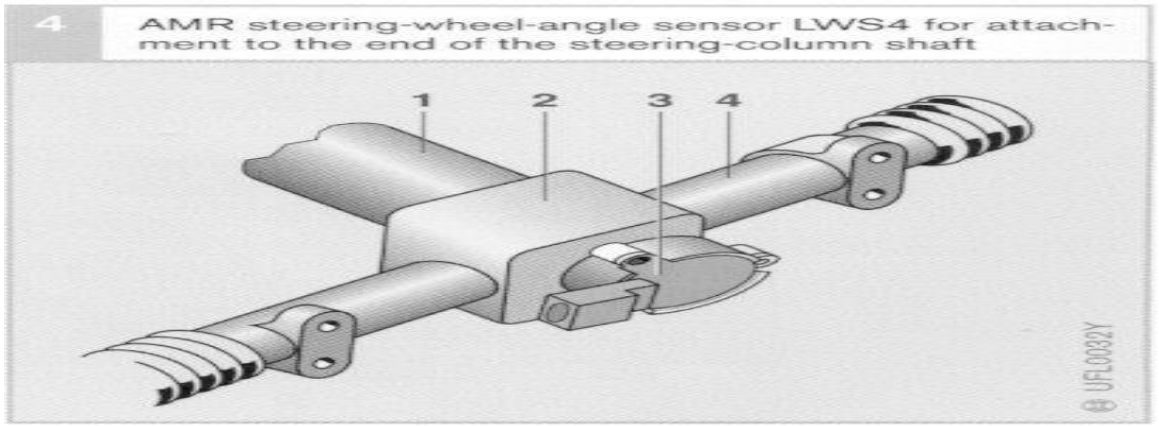
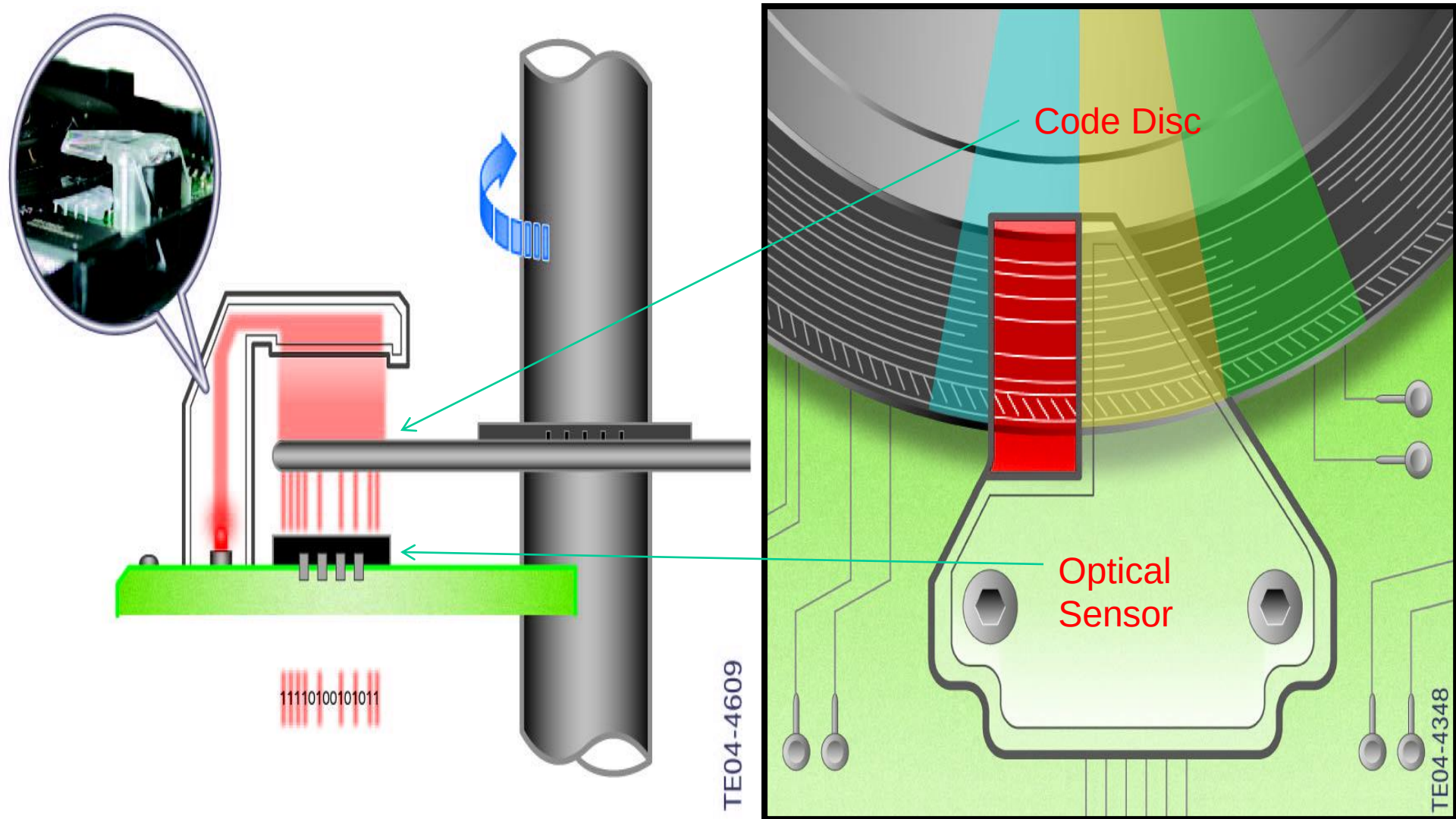
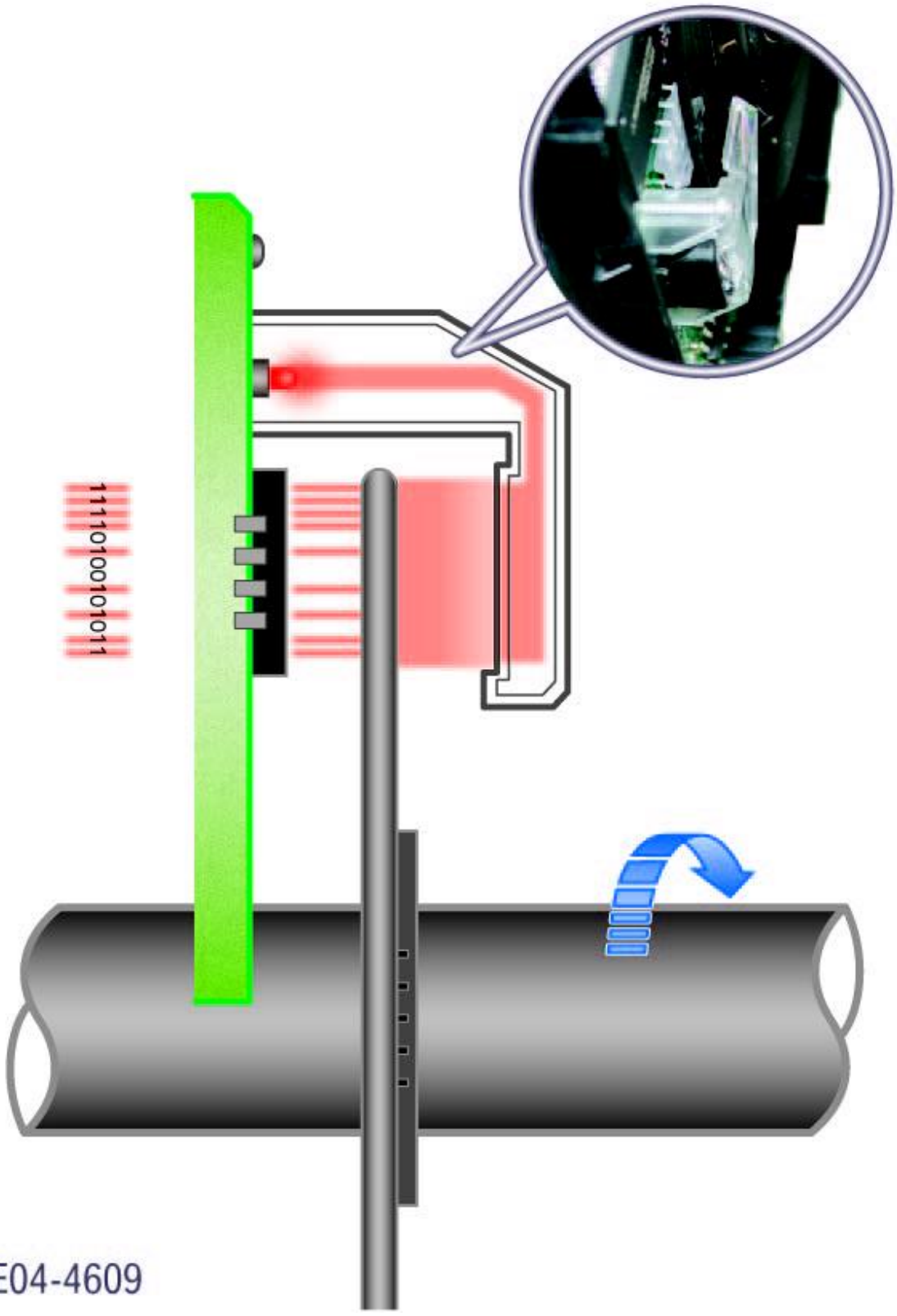


Fig. 4

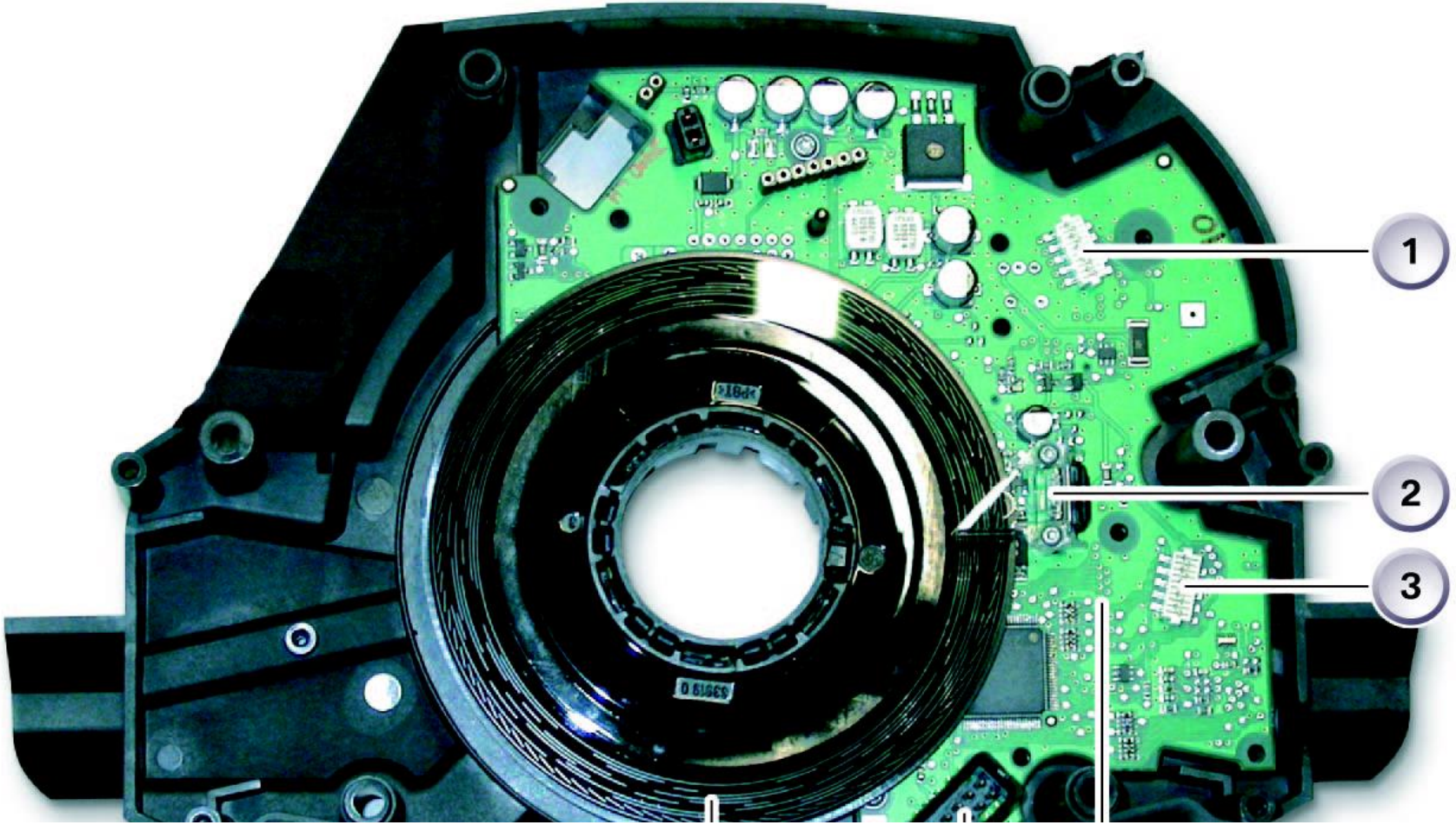
1	Steering column
2	Steering box
3	Steering-wheel-angle sensor
4	Steering rack

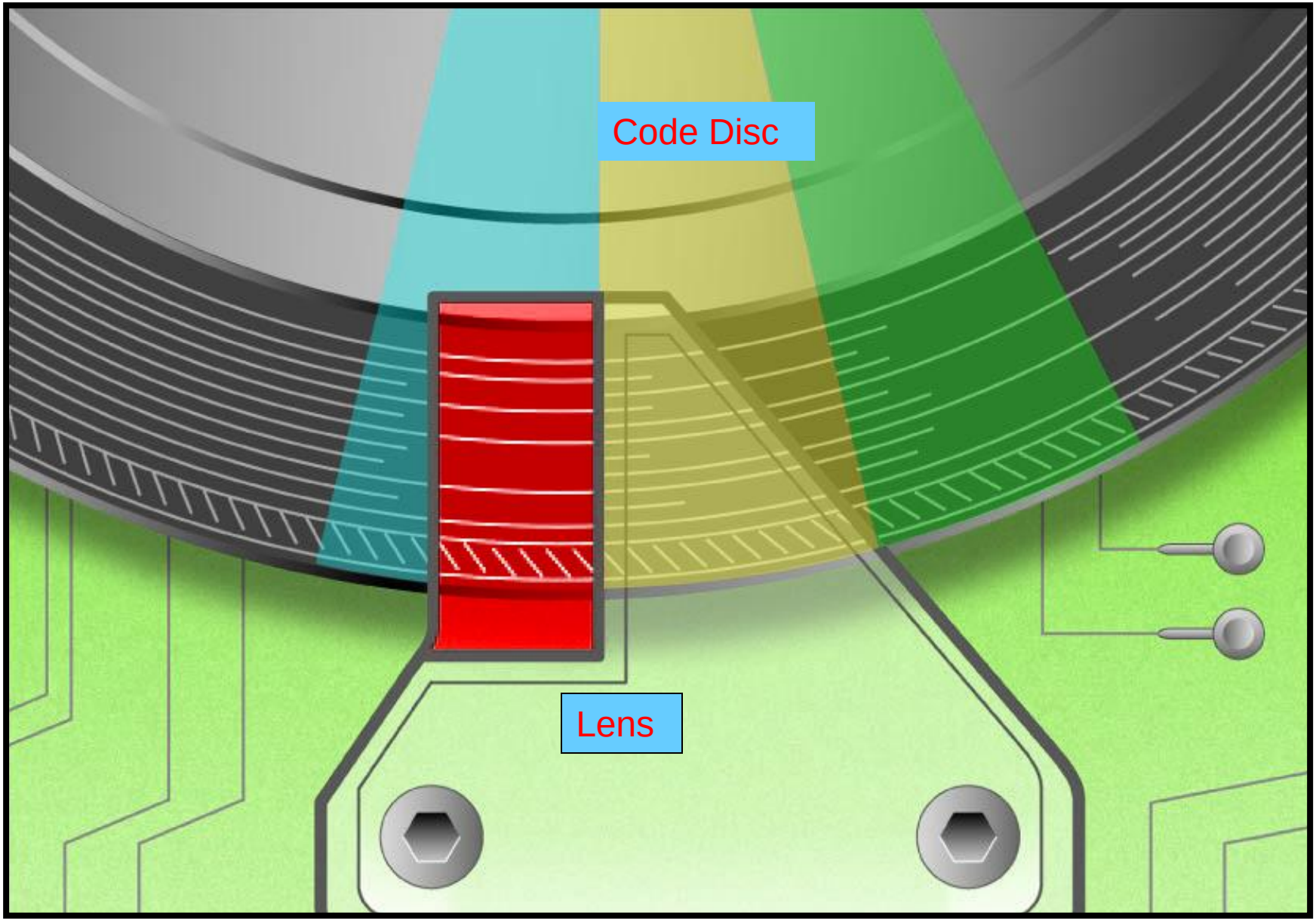
Optical Steering Angle Sensor




11110100101011
TE04-4609

The Steering angle sensor is a contact less optical measuring system




Code Disc
Lens

Understand How Systems Interact

- How can chassis service affect SAS?
- How can steering service affect SAS?
- How can tire service affect SAS?
- How can alignment service affect SAS?

What Do SAS Do

- Monitor the drivers steering input from straight ahead
- Monitor the drivers turning rate (how fast the driver is turning the wheel)
- Reports the above information to the vehicle on board systems.
- The above is based on a few assumptions

The Vehicles On Board Systems Assume That

- The steering wheel is straight ahead when the vehicle is driven on a flat level road
- Toe is equally divided between the two front wheels
- There is no directional influence caused by tires or chassis
- There is no rear thrust influence causing a driver to counter steer

Why Are SAS Used

- To provide steering data information to:
  - ESC (Electronic Stability Control) systems
  - EPS (Electronic Power Steering)
  - AS (Active Steering)
  - VRS (Variable Rate Steering)
  - ABS (Anti-Lock Brake System)
  - LD (Lane Departure)
  - LA (Lane Assist)
  - PA (Parking Assist)

In the Past SAS Systems Were Previously Calibrated When….

- The SAS sensor was replaced
- After certain collision repair procedures
- Generally they were not reset after a wheel alignment

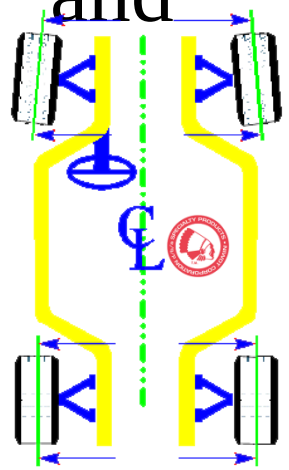
Today Many Manufactures Require The SAS To Be Reset After a Wheel Alignment

- 25 Different Vehicle Manufactures
- 120 plus different models

Toe Facts

- Front toe will <u>always</u> equally divide itself when a vehicle is driven.

- On some vehicles toe changes dramatically as the outer tie rod swings forward and backwards (articulates).

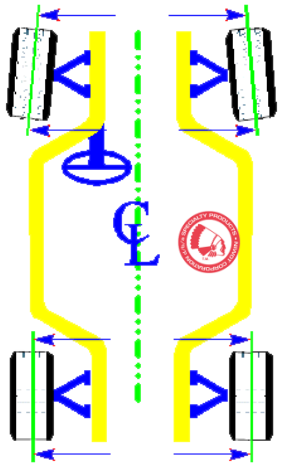


Toe Facts

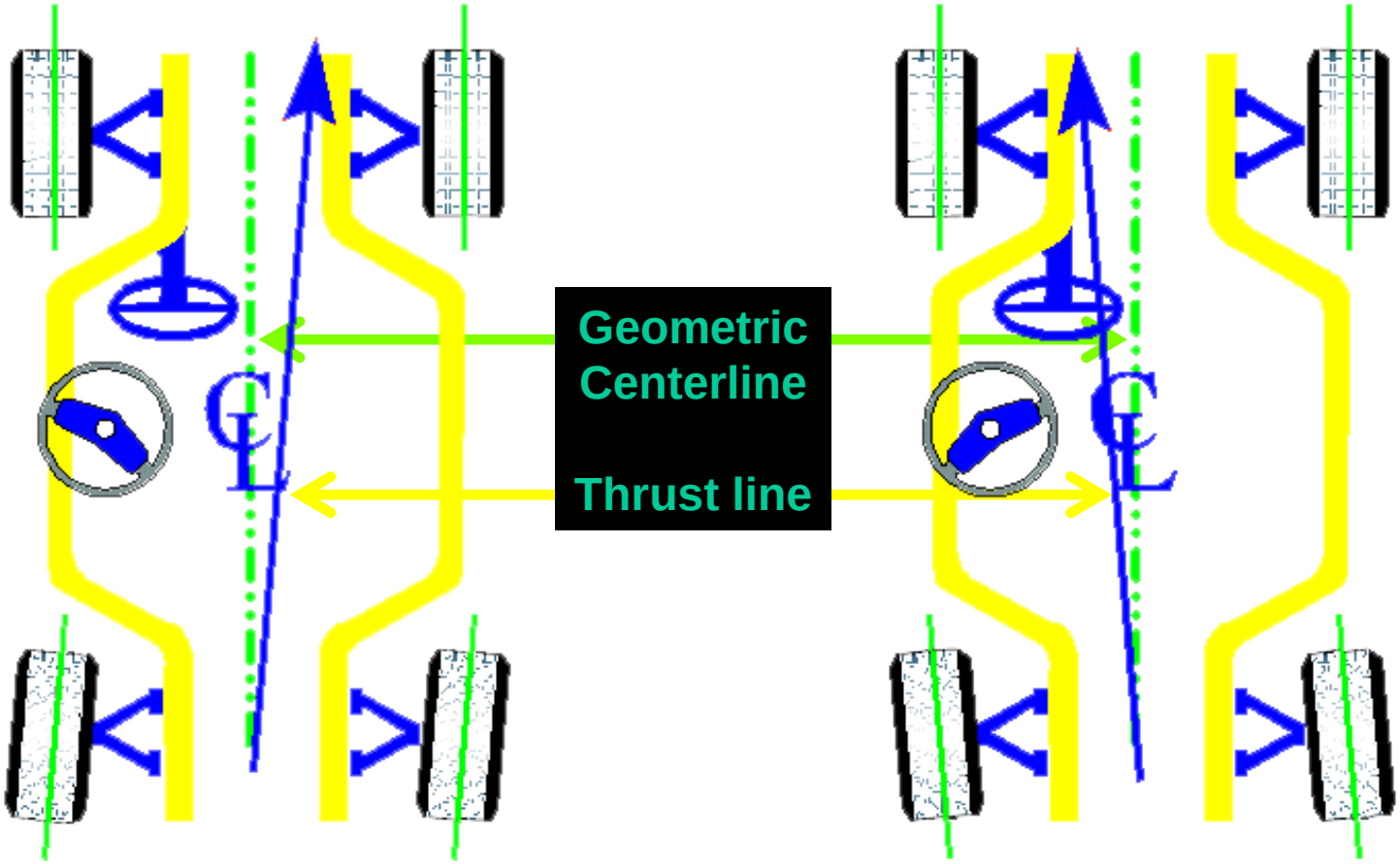
- Rear toe is more critical to vehicle handling than front toe.

- Rear toe when not equally adjusted on both wheels will create a thrust angle.

- When you turn the wheels from a straight ahead position the individual toe changes on each wheel are not equal.



Thrust Angle



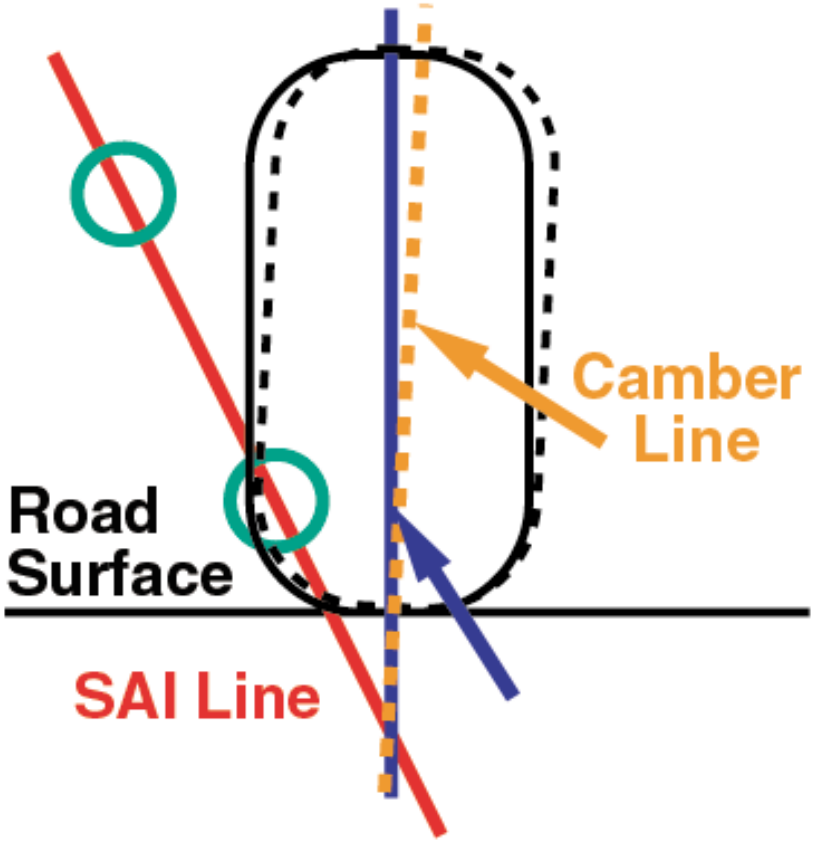
Thrust Specifications

- It is generally accepted that the maximum allowable thrust angle for FWD vehicles is .125
  - For a average vehicle .125 thrust means that the rear tires will move sideways ¼” for every vehicle length it moves forward.
  - Assumes a average vehicle length of 10’.

A Statement About Thrust

- Someone once said:
  - "The front wheels, of a vehicle, steer a vehicle from straight ahead. The rear wheels determine what straight ahead is"!

Scrub Radius



The dotted lines represent movement of the tire outward at the top because of positive camber. This movement does not affect scrub.

This shows the effect of positive scrub combined with positive camber and how the two will affect the vehicle.

How Can A SAS Input Be Accurate If

- The steering wheel is not straight ahead when the vehicle is driven on a flat level road
- Dynamic toe is different than static on the two front wheels
- There is a directional influence caused by tires or chassis
- There is a rear thrust influence causing a driver to counter steer from a static straight ahead setting

Two Ways To Reset/Zero A SRS
1. A Scan Tool

Note the fine print

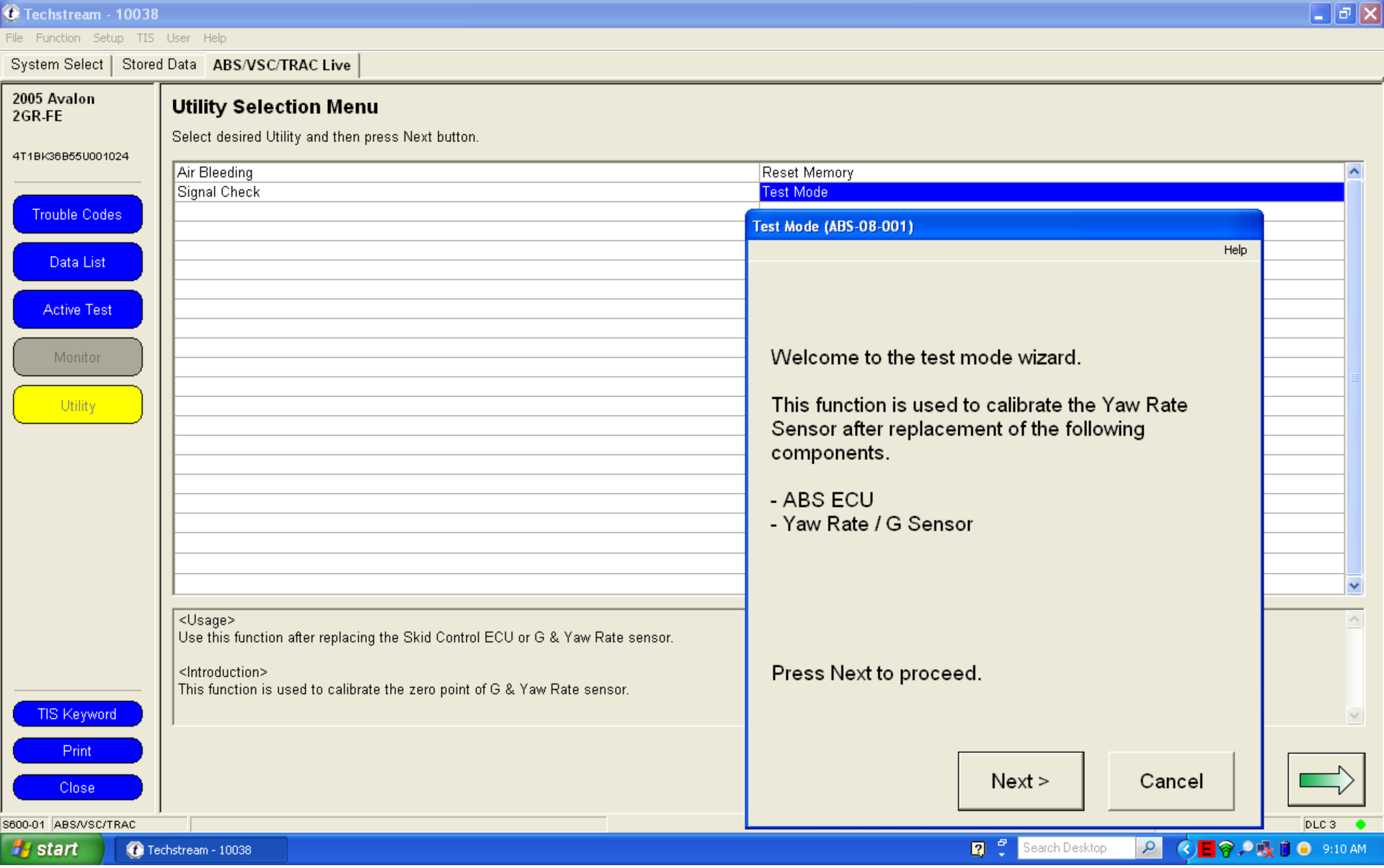
It says "..steering Angle (sensor)

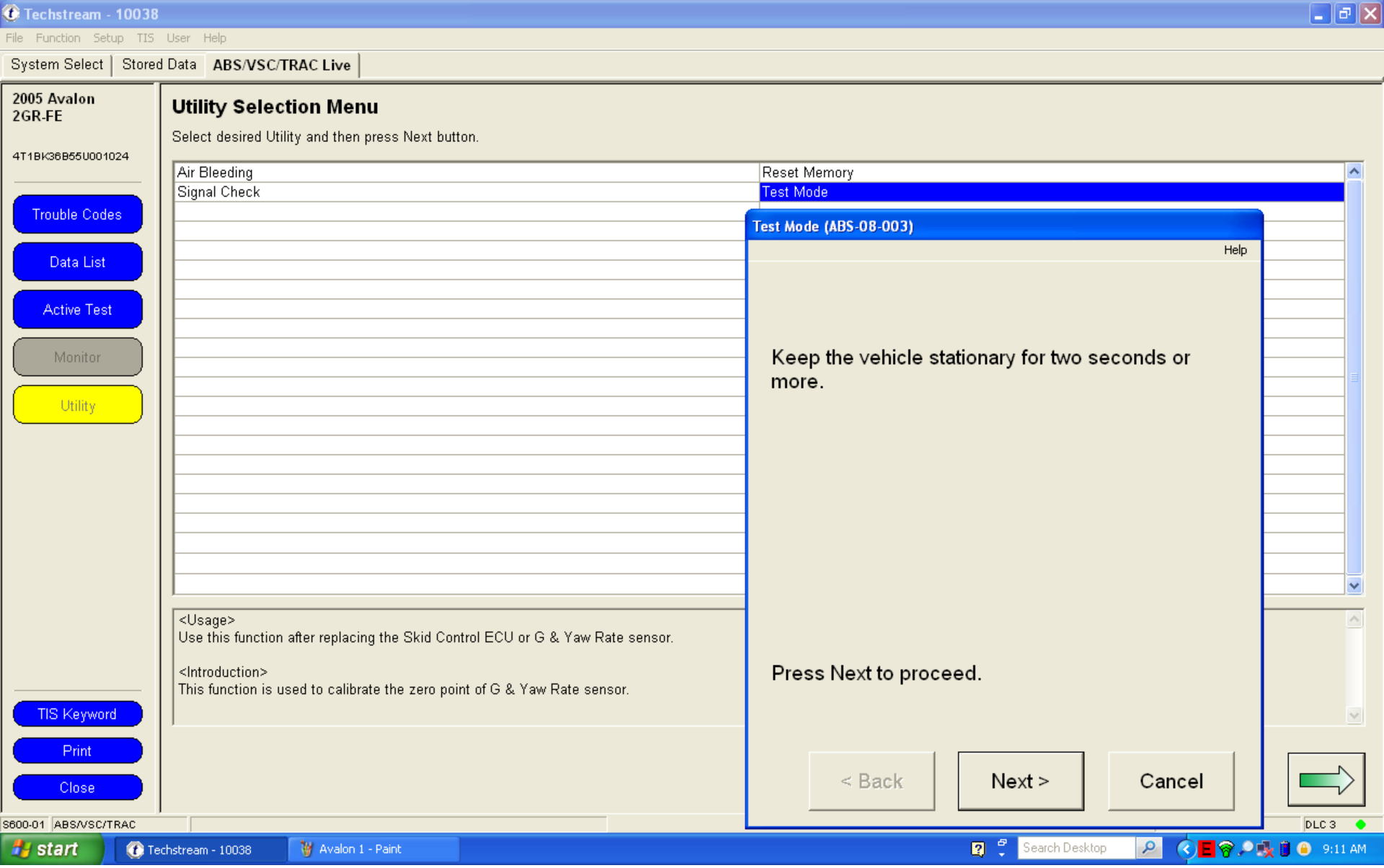
Many aftermarket scan tools can reset late model steering angle sensors.

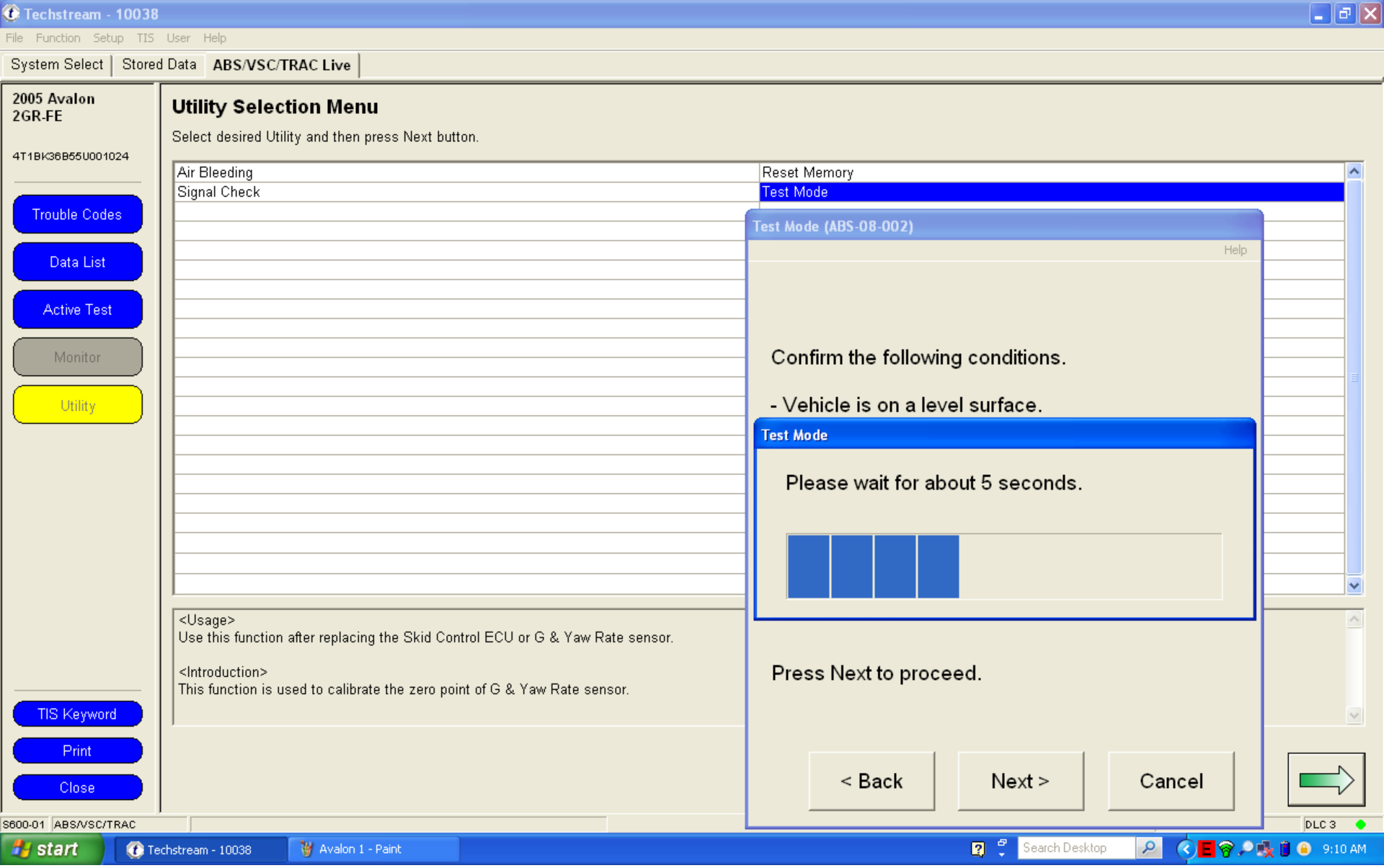
Scan Tool SRS Reset

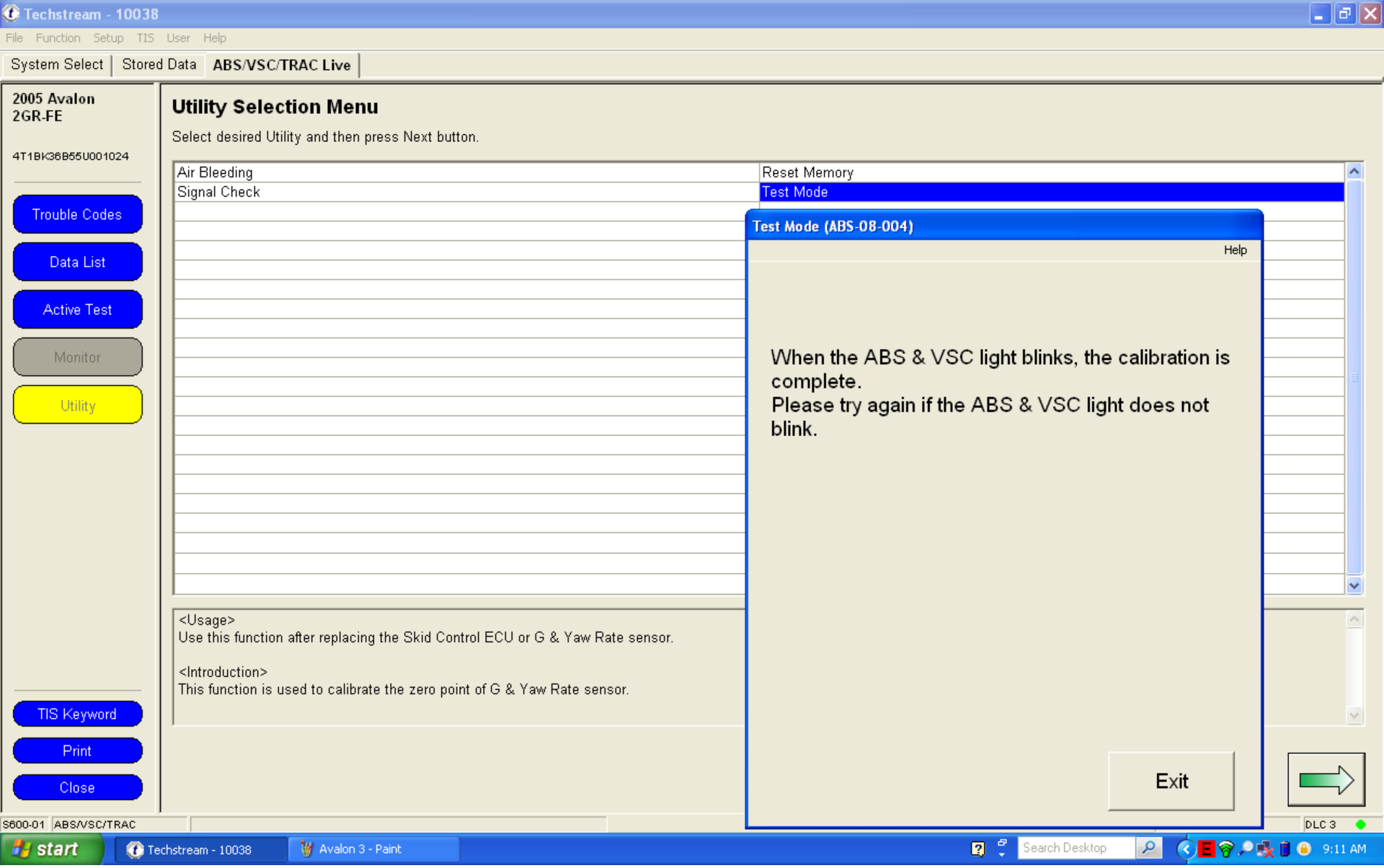
- Aftermarket scan tools only work on a portion of vehicles requiring resetting.
- OE scan tools are needed on the rest.

- Remember on many/most 2010 and later vehicles this is a mandatory post alignment procedure.


Techstream - 10038
File Function Setup TIS User Help
System Select Stored Data ABS/VSC/TRAC Live
2005 Avalon
2GR-FE
4T1BK36B55U001024
Trouble Codes
Data List
Active Test
Monitor
Utility
TIS Keyword
Print
Close
Utility Selection Menu
Select desired Utility and then press Next button.
Air Bleeding
Signal Check
Reset Memory
Test Mode
<Usage>
Use this function after replacing the Skid Control ECU or G & Yaw Rate sensor.
<Introduction>
This function is used to calibrate the zero point of G & Yaw Rate sensor.
Test Mode (ABS-08-001)
Help
Welcome to the test mode wizard.
This function is used to calibrate the Yaw Rate Sensor after replacement of the following components.
- ABS ECU
- Yaw Rate / G Sensor
Press Next to proceed.
Next >
Cancel
S600-01 ABS/VSC/TRAC
DLC 3
start
Techstream - 10038
Search Desktop
9:10 AM

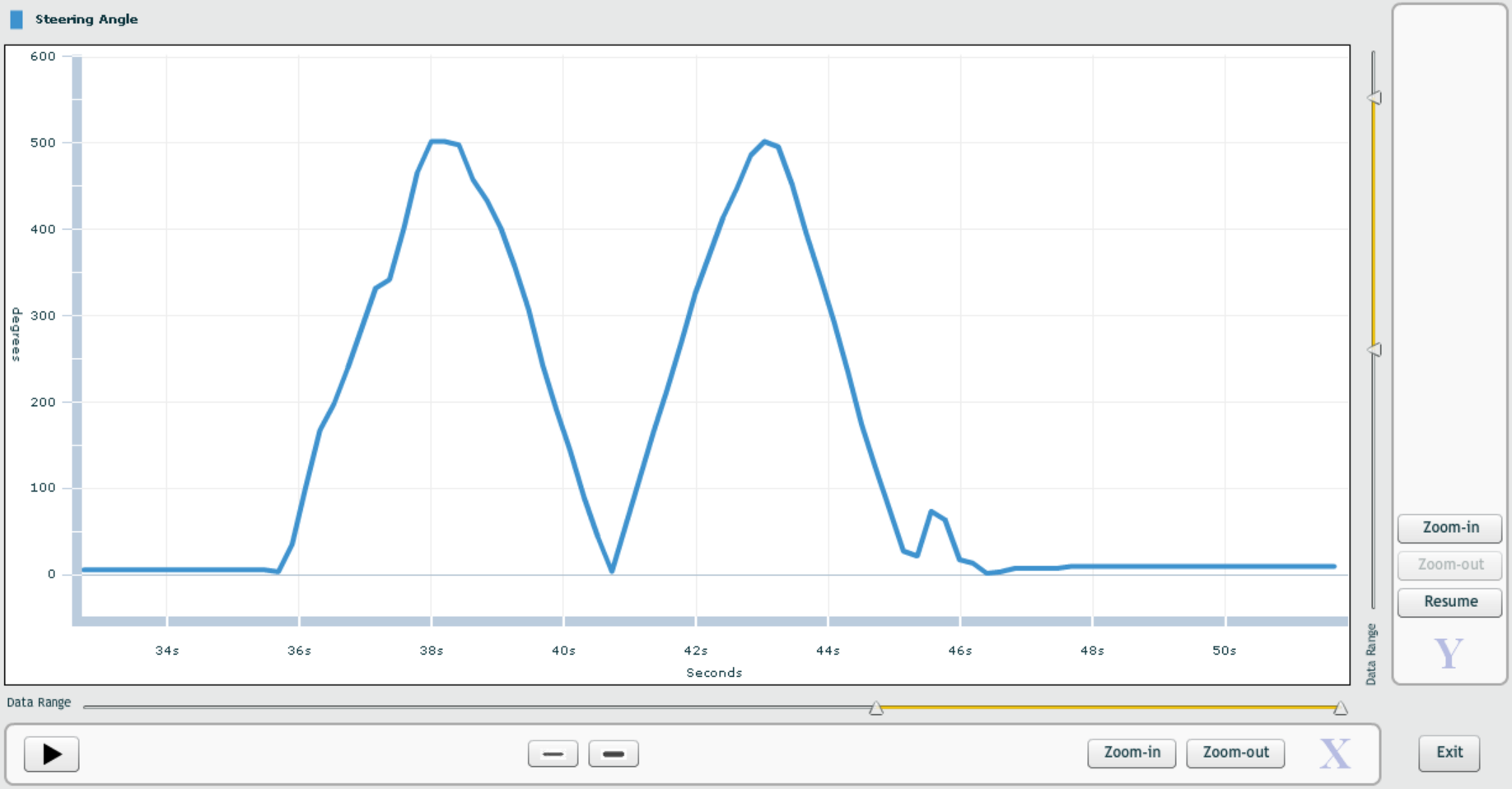

Techstream - 10038
File Function Setup TIS User Help
System Select Stored Data ABS/VSC/TRAC Live
2005 Avalon
2GR-FE
4T1BK36B55U001024
Trouble Codes
Data List
Active Test
Monitor
Utility
TIS Keyword
Print
Close
Utility Selection Menu
Select desired Utility and then press Next button.
Air Bleeding
Signal Check
Reset Memory
Test Mode
<Usage>
Use this function after replacing the Skid Control ECU or G & Yaw Rate sensor.
<Introduction>
This function is used to calibrate the zero point of G & Yaw Rate sensor.
Test Mode (ABS-08-003)
Help
Keep the vehicle stationary for two seconds or more.
Press Next to proceed.
< Back
Next >
Cancel
S600-01 ABS/VSC/TRAC
DLC 3
start
Techstream - 10038
Avalon 1 - Paint
Search Desktop
9:11 AM


Techstream - 10038
File Function Setup TIS User Help
System Select Stored Data ABS/VSC/TRAC Live
2005 Avalon
2GR-FE
4T1BK36B55U001024
Trouble Codes
Data List
Active Test
Monitor
Utility
TIS Keyword
Print
Close
Utility Selection Menu
Select desired Utility and then press Next button.
Air Bleeding
Signal Check
Reset Memory
Test Mode
<Usage>
Use this function after replacing the Skid Control ECU or G & Yaw Rate sensor.
<Introduction>
This function is used to calibrate the zero point of G & Yaw Rate sensor.
Test Mode (ABS-08-002)
Help
Confirm the following conditions.
- Vehicle is on a level surface.
Test Mode
Please wait for about 5 seconds.
Press Next to proceed.
< Back
Next >
Cancel
S600-01 ABS/VSC/TRAC
DLC 3
start
Techstream - 10038
Avalon 1 - Paint
Search Desktop
9:10 AM


Techstream - 10038
File Function Setup TIS User Help
System Select Stored Data ABS/VSC/TRAC Live
2005 Avalon
2GR-FE
4T1BK36B55U001024
Trouble Codes
Data List
Active Test
Monitor
Utility
TIS Keyword
Print
Close
Utility Selection Menu
Select desired Utility and then press Next button.
Air Bleeding
Signal Check
Reset Memory
Test Mode
<Usage>
Use this function after replacing the Skid Control ECU or G & Yaw Rate sensor.
<Introduction>
This function is used to calibrate the zero point of G & Yaw Rate sensor.
Test Mode (ABS-08-004)
Help
When the ABS & VSC light blinks, the calibration is complete.
Please try again if the ABS & VSC light does not blink.
Exit
S600-01 ABS/VSC/TRAC
DLC 3
start
Techstream - 10038
Avalon 3 - Paint
Search Desktop
9:11 AM

wiTECH Diagnostic Application - 11.02.43

Single Graph Display



start | wiTECH Diagnostic Ap... | Search Desktop | 11:25 AM

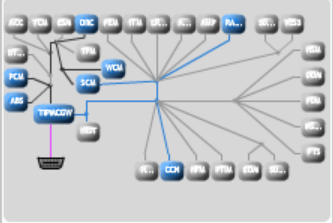
wiTECH Diagnostic Application - 11.02.43

Utilities | Reports | Monitors | Preferences | About | Help

Search Service Information: You must login to search

SCM View

Click on tabs to access various ECU operations and information for the selected ECU.



SCM Overview

Name:	Steering Column
Flash Part Number:	1EQ80XXXAI
Bus Type:	CAN B
Hardware Version:	18.08
Software Version:	12.13.00
DTC Count:	0

Flash | Data | DTCs | Actuators | System Tests | Misc Functions | ECU Details

Click on the buttons to view the desired information. Click on column heading to sort table.

Overview | Configuration

Name	Units	Value
Tilt and Telescope		False
Steering angle sensor not intitializec		False
Steering Angle Sensor		True
SAS not initialized		False
Optical Sensor #7		Not Set
Optical Sensor #6		Not Set
Optical Sensor #5		Set
Optical Sensor #4		Set
Optical Sensor #3		Set
Optical Sensor #2		Not Set
Optical Sensor #1		Set
Current intiializing carried out by E!		True
Current initializing carried out by st		False

A A

Knowledge Base Articles | Login | Off-line | Disconnect | Warnings: 0 Errors: 0

start | wiTECH Diagnostic Ap... | Search Desktop | 11:29 AM

Techstream - 10564

File Function Setup TIS User Help

System Select | Stored Data | ABS/VSC/TRAC Live

2006 IS350
2GR-FSE

JTHBE262762001849

2006_IS350_2GF
File Notes
Health Checl
Data 1-3/1
ABS/VSC/TR
Data List
Data 2
Data 3

Expand>>

TIS Search
Print
Back

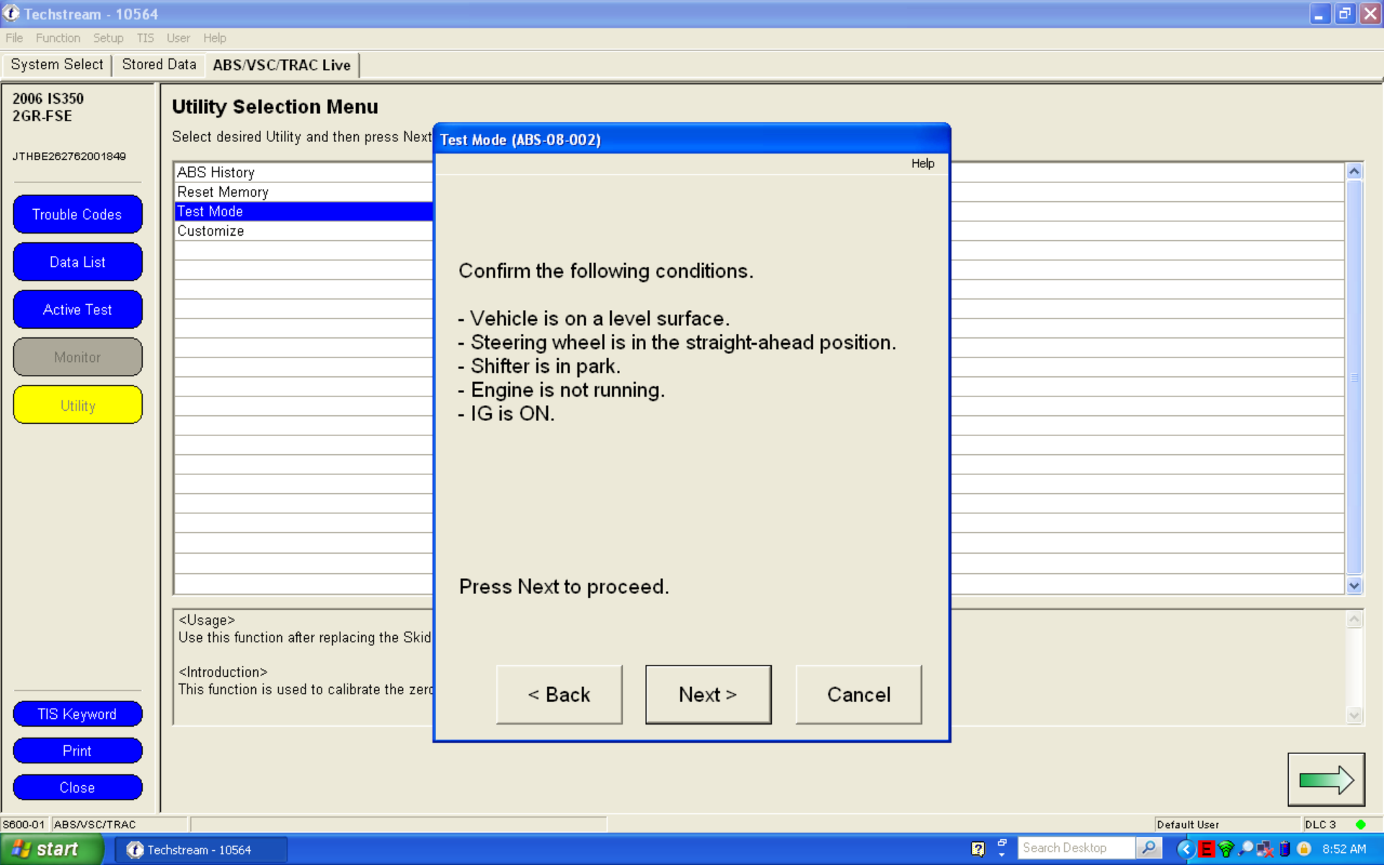
Parameter	Value	Unit	Parameter	Value	Unit
ABS Warning Light	OFF		Lateral G	-0.19	m/s2
VSC Warning Light	ON		Forward and Rearward G	-0.39	m/s2
Brake Warning Light	OFF		Yaw Rate Value	0	degrees/s
Slip Indicator Light	ON		Steering Angle Value	-4.5	degrees
Buzzer	OFF		FR Wheel Speed	0	MPH
Stop Light SW	OFF		FL Wheel Speed	0	MPH
Parking Brake SW	OFF		RR Wheel Speed	0	MPH
TRC(TRAC)/VSC OFF SW	OFF		RL Wheel Speed	0	MPH
Main Idle SW	ON		Vehicle Speed	0	MPH
Brake Pedal Load Sensing SW	OFF		FR Wheel Acceleration	0.00	m/s2
Gear Position	P,N		FL Wheel Acceleration	0.00	m/s2
Shift Lever Position	P,N		RR Wheel Acceleration	0.00	m/s2
Shift Information	OFF		RL Wheel Acceleration	0.00	m/s2
Inspection Mode	Other		FR Wheel Direction	Forward	
Number of IG ON(Inspection)	254		FL Wheel Direction	Forward	
Master Cylinder Sensor	0.47	V	RR Wheel Direction	Forward	
Zero Point of M/C	0.00	Mpa	RL Wheel Direction	Forward	
Deceleration Sensor	-0.430	m/s2	FR Wheel ABS Ctrl Status	OFF	
Zero Point of Decele	-0.58	m/s2	FL Wheel ABS Ctrl Status	OFF	
Deceleration Sensor2	0.143	m/s2	RR Wheel ABS Ctrl Status	OFF	
Zero Point of Decele2	0.39	m/s2	RL Wheel ABS Ctrl Status	OFF	
Yaw Rate Sensor	0	degrees/s	BA Ctrl Status	OFF	
Zero Point of Yaw Rate	0	degrees /sec	PBA Ctrl Status	OFF	
			TRC(TRAC) Ctrl Status	OFF	
Yaw Rate Sensor2	0	degrees/s	TRC(TRAC) Engine Ctrl Status	OFF	
Zero Point of Yaw Rate2	0	degrees/s	TRC(TRAC) Brake Ctrl Status	OFF	
Steering Angle Sensor	-4.5	degrees	FR Wheel VSC Ctrl Status	OFF	
Zero Point of Steering Angle	0.0	degrees	FL Wheel VSC Ctrl Status	OFF	

1

All Data

S400-04 | Time/Frame : 00.09.396 - 00.11.000 - 00.12.604 / 6 - 7 - 9 | Default User | DLC 3

start | Techstream - 10564 | Search Desktop | 8:39 AM


Techstream - 10564
File Function Setup TIS User Help
System Select Stored Data ABS/VSC/TRAC Live
2006 IS350
2GR-FSE
JTHBE262762001849
Trouble Codes
Data List
Active Test
Monitor
Utility
TIS Keyword
Print
Close
Utility Selection Menu
Select desired Utility and then press Next
ABS History
Reset Memory
Test Mode
Customize
<Usage>
Use this function after replacing the Skid
<Introduction>
This function is used to calibrate the zero
Test Mode (ABS-08-002)
Help
Confirm the following conditions.
- Vehicle is on a level surface.
- Steering wheel is in the straight-ahead position.
- Shifter is in park.
- Engine is not running.
- IG is ON.
Press Next to proceed.
< Back
Next >
Cancel
S600-01 ABS/VSC/TRAC
Default User
DLC 3
start
Techstream - 10564
Search Desktop
8:52 AM

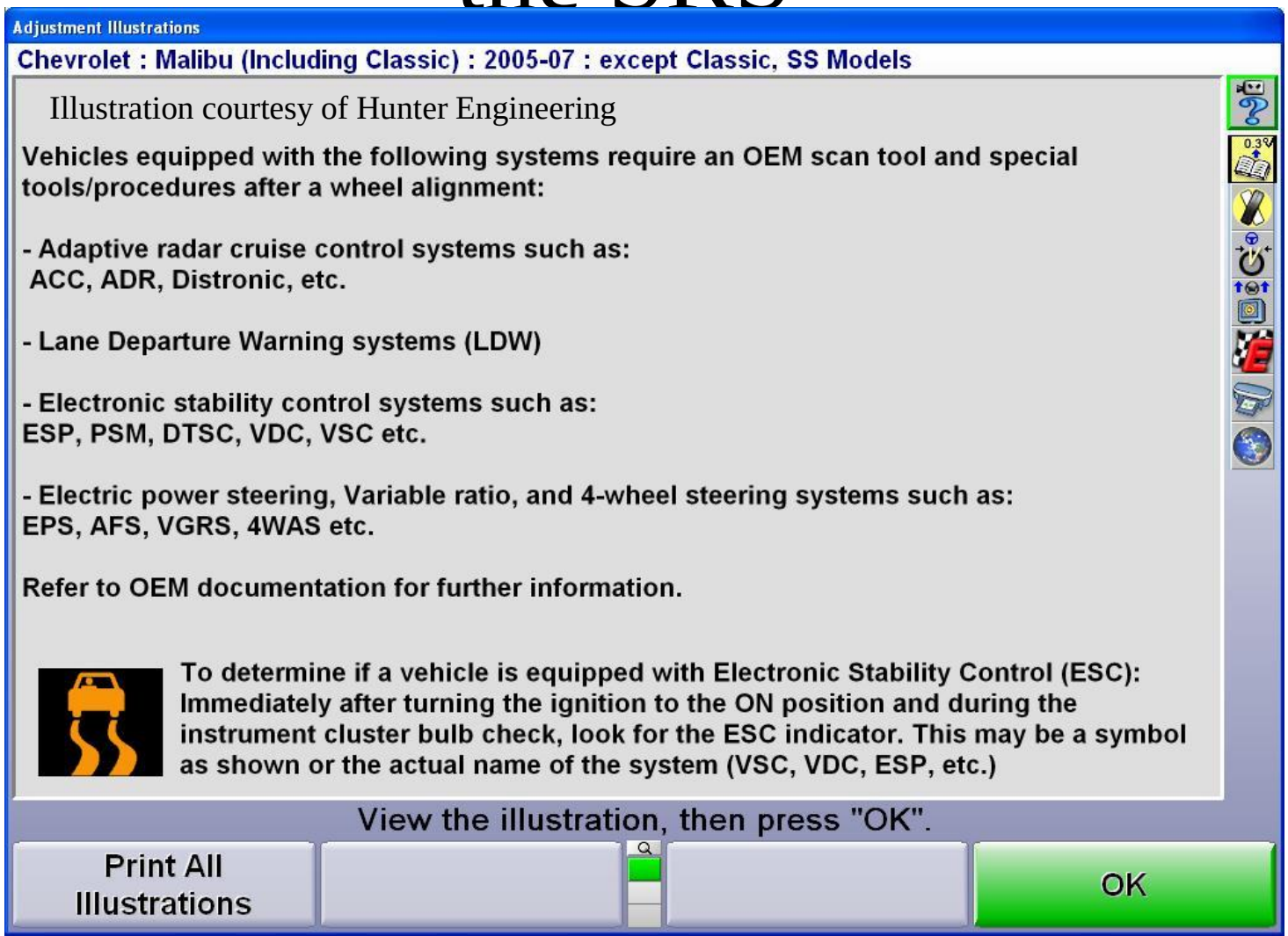
Two Ways To Reset/Zero A SRS 2. Alignment equipment interface

- The alignment equipment interface will reset about 80-90% of the needed vehicles

A Story Board View of Using Alignment Equipment to Reset the SRS

A Story Board View of Using Alignment Equipment to Reset the SRS

A Story Board View of Using Alignment Equipment to Reset the SRS



A Story Board View of Using Alignment Equipment to Reset the SRS

A Story Board View of Using Alignment Equipment to Reset the SRS

A Story Board View of Using Alignment Equipment to Reset the SRS

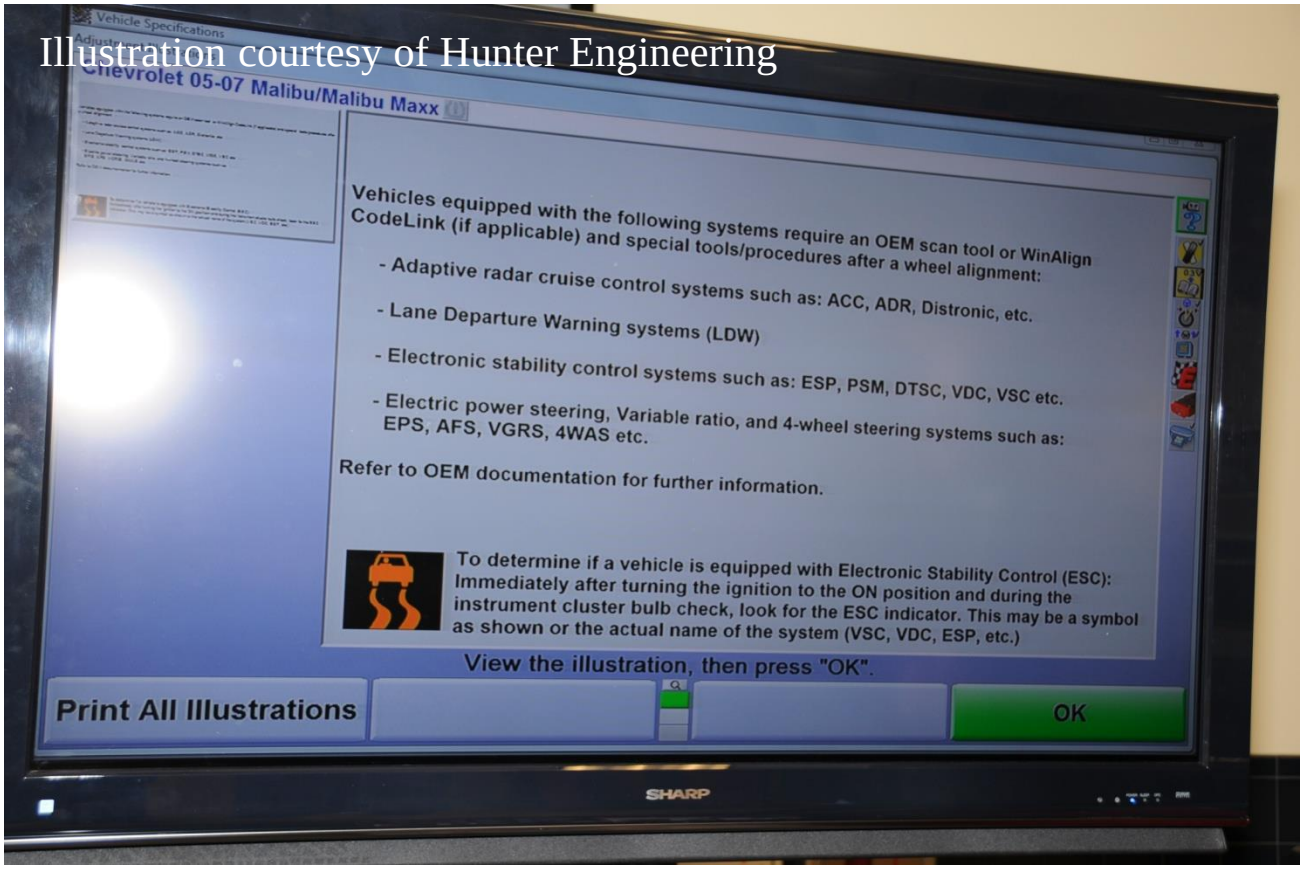


Illustration courtesy of Hunter Engineering

A Story Board View of Using Alignment Equipment to Reset the SRS

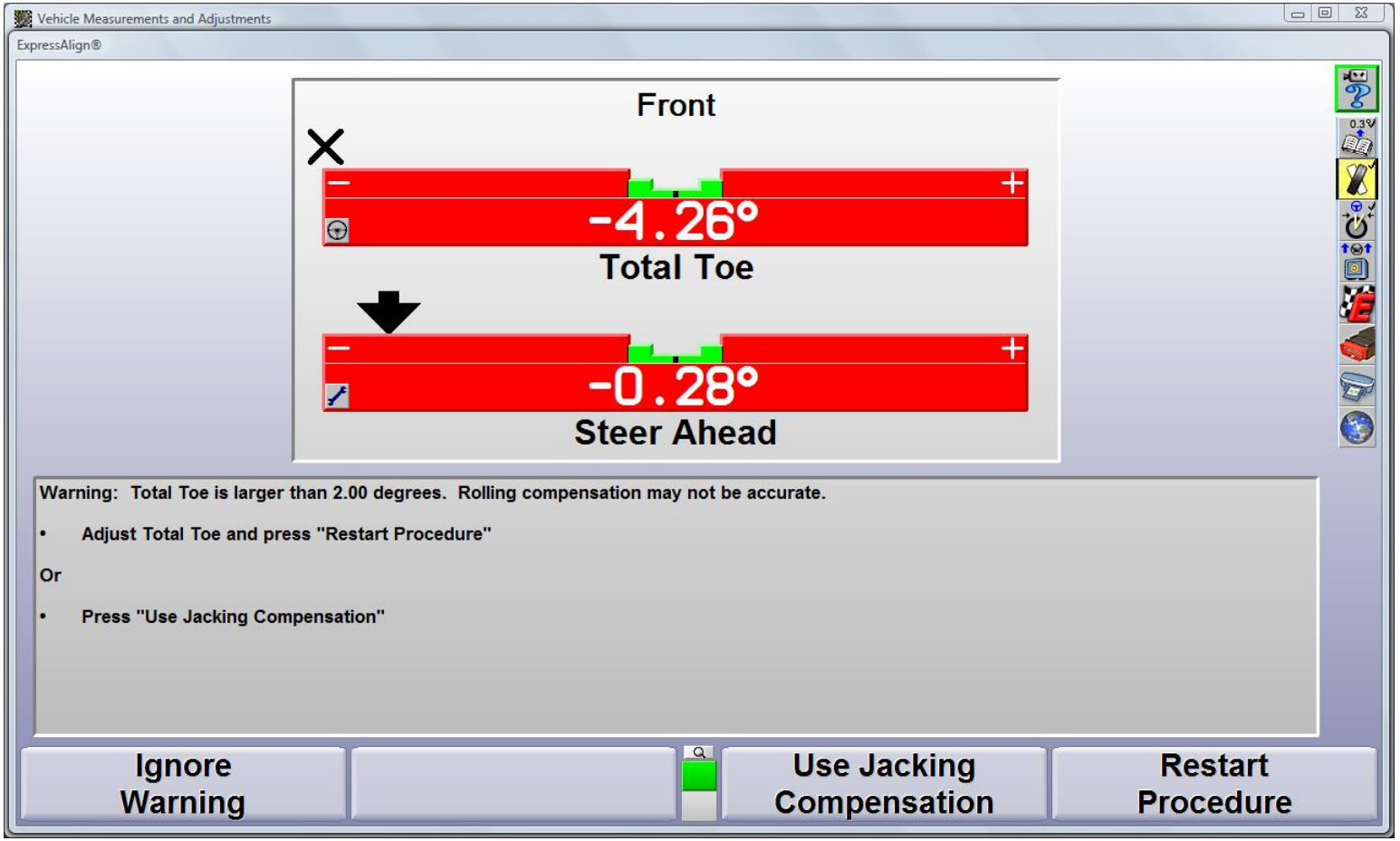


Illustration courtesy of Hunter Engineering

7 Malibu/Malibu Maxx

Illustration courtesy of Hunter Engineering

Steer the wheels as directed.

ncel

Select Measurement

Bypass Measurement

A Story Board View of Using Alignment Equipment to Reset the SRS

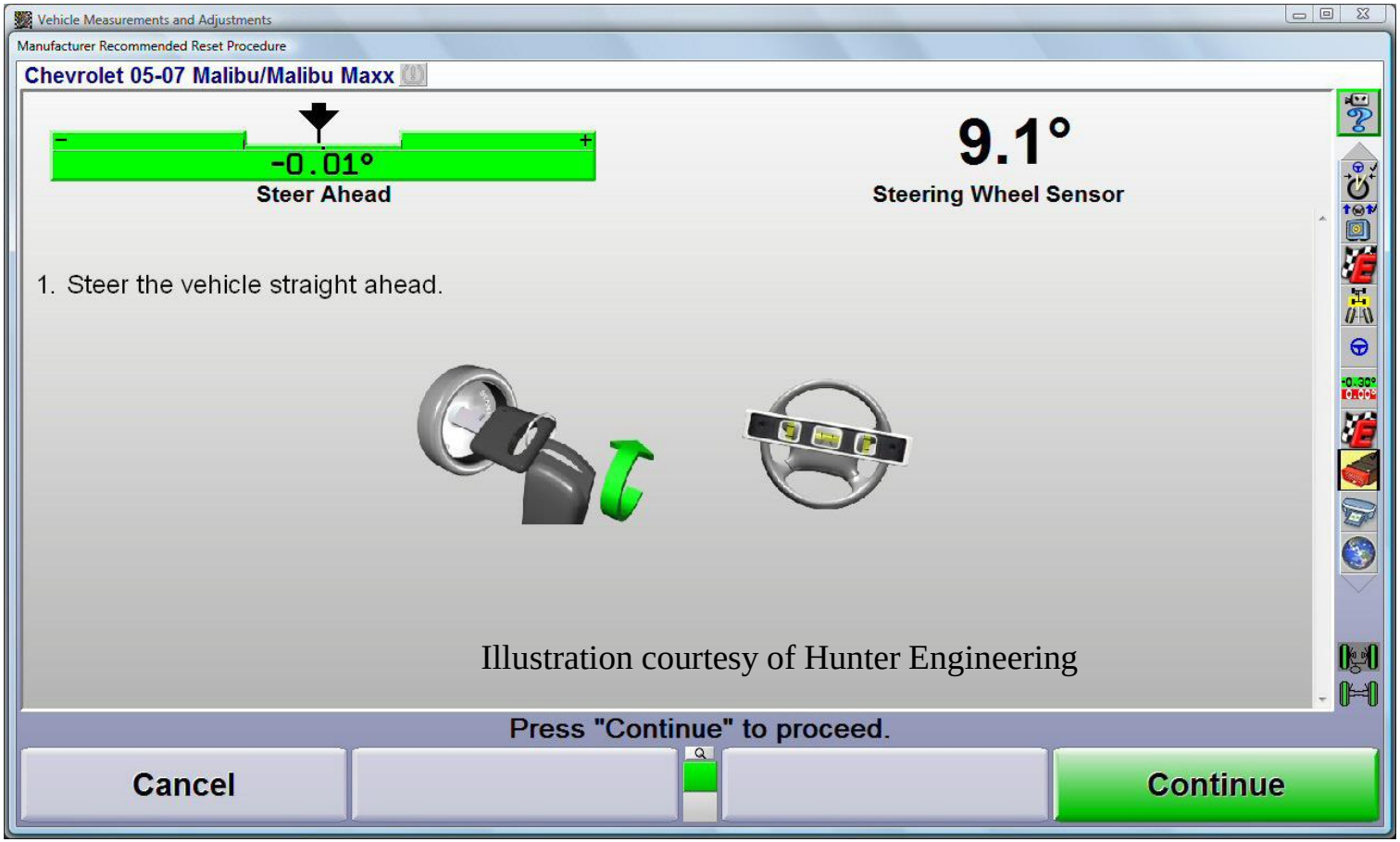


Illustration courtesy of Hunter Engineering

A Story Board View of Using Alignment Equipment to Reset the SRS

A Story Board View of Using Alignment Equipment to Reset the SRS

A Story Board View of Using Alignment Equipment to Reset the SRS

A Story Board View of Using Alignment Equipment to Reset the SRS