Form 5215TE-05, 06-13
Supersedes Form 5215TE-05, 05-12

BMW KDS Wheel Alignment System

WinAlign® Program Version 14.1

HUNTER Engineering Company

Contents

NOTE: Page numbers match PDF page count for improved digital viewing.

Getting Started

1.1 Introduction

This manual provides information and operation instructions required to operate the BMW Computerized Wheel Alignment System.

“References”

This manual assumes that you are already familiar with the basics of wheel alignment. *“Italics”* are used to refer to specific parts of this manual that provide additional information or explanation. For example, *refer to “Recall Specifications.”* These references should be read for additional information to the instructions being presented.

These BMW Operation Instructions are a supplement to the standard WinAlign Operation Manual, Form 3850-T, supplied with this equipment.

Turning Power On

The main power switch is located on the back of the console where the AC power cord is connected to the cabinet. Some cabinet designs will have an additional power switch on the left side of the cabinet. This switch is used to power On/Off the systems computer but leaves power on to the charging stations available for DSP500 sensors and remote indicators.

BMW Account

The BMW logo screen is only displayed when the BMW account is activated. The "WinAlign" logo is shown when the standard account is activated.

The "BMW" account includes specific procedures required by BMW and is intended for use by authorized BMW dealers.

K1 - Exit Aligner K2 (Blank) K3 (Blank) K4 - Begin Alignment

There are two possible selections on the first level of keys that are displayed on this screen:

"Exit Aligner" is activated by selecting the K1 softkey. Always press “Exit Aligner” before turning the power off to shutdown the system.

"Begin Alignment" is activated by pressing the K4 softkey. The green highlight indicates this is the logical next step in the alignment process.

Other softkey selections will appear if multiple account keys are available.

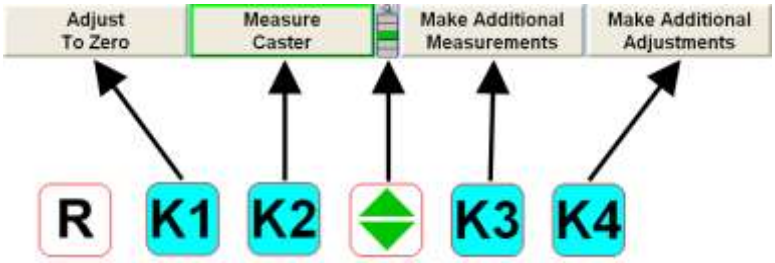
1.2 Operating the Console

Using “Softkeys”

The softkeys, located on the keyboard, provide operator control of the program. These keys are identified as:

- K1 — K1 key
- K2 — K2 key
- K3 — K3 key
- K4 — K4 key
- Menu shift key
- R — Reset key

The four menu labels that appear at the bottom of each screen are referred to as the softkey labels. These labels indicate the action that the program will take when the corresponding K1, K2, K3, or K4 key is pressed.



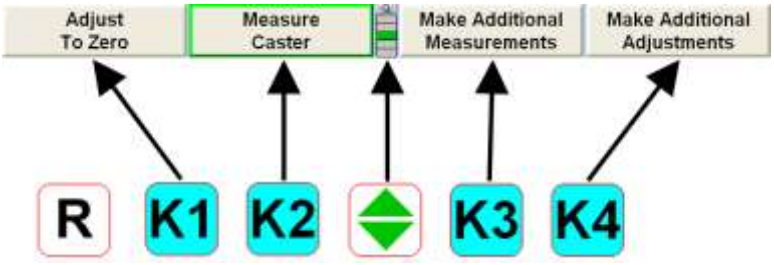
The vertically stacked squares between the K2 and K3 softkeys indicate how many levels of menu labels are available. Six levels of menus are possible. The highlighted box indicates the menu level that is currently displayed.

Pressing the menu shift softkey, , changes the menu level. When this key is pressed, the menu labels will change to the next level “down.” If the last menu level is currently displayed, the next step will be to the first menu level. To go to the next menu level “up,” press Shift and .

Pressing Shift and F6 will enlarge the current softkey menu level. The softkey associated with the label is shown on the left side of the labels and the menu level is indicated on the right side of the labels. Pressing F6 again will cause the menu to return to the normal softkey setting.

Pressing F6, or pressing and holding with a pointing device on the menu level indicator, will cause all of the menus available to appear. The dark green color, displayed behind the entire row of softkeys, indicates the active menu level. Pressing F6 again will cause the menu to return to the normal softkey setting.

Throughout this manual, the statement Press “nnnnnnn” indicates the label of the softkey to press. If the required label is not on the current menu, must be pressed to change menu levels until the desired label is displayed.



Some softkey labels have a green border as depicted around the K4 softkey shown above.

Generally, the softkey with the green border (usually K4) is the appropriate key to press to continue with the procedure being performed.

Using the Handheld Infrared Wireless Remote Control

The remote control provides operation of the WinAlign® program from a distance by duplicating the five softkeys.

The remote control has six softkeys: K1 , K2 , K3 , K4 , , and a zoom key . Pressing will enlarge the current softkey menu level and is equal to pressing Shift and on the main keyboard.

To use the remote control, point the front end of the transmitter toward the front of the wheel aligner console and press the appropriate softkey.

NOTE:	The remote control transmitter is a “line-of-sight” device and will not transmit signals through solid objects.

Resetting the Program

The wheel alignment program may be reset at any time during the measurement process by pressing the R key, located at the upper left-hand corner of the keyboard.

A confirmation screen will appear to verify that the “Reset” button was pressed intentionally.

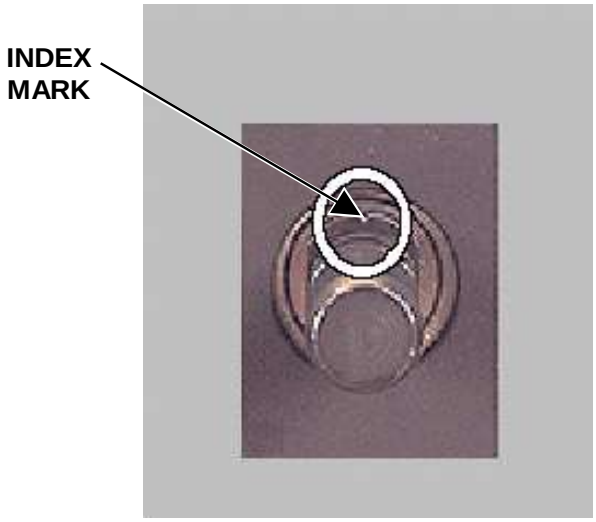
When this screen appears, press “YES” to reset the program or “NO” if the program should not be reset.

When the aligner is reset, the information collected for the measurements in progress will be erased and the display will return to the “BMW Logo” screen.

1.3 Conventional Sensor Setup (DSP508)

Before mounting the sensors on the BMW special adaptors, rotate the index mark on the sensor shaft to the 12 o'clock position with the sensor held vertical and lock it in place using the sensor lock knob. Do not loosen the sensor lock knobs.

When instructed to level the sensors, do so only by loosening the locking lever or lock knob on the adaptor, not the lock knob on the sensor.

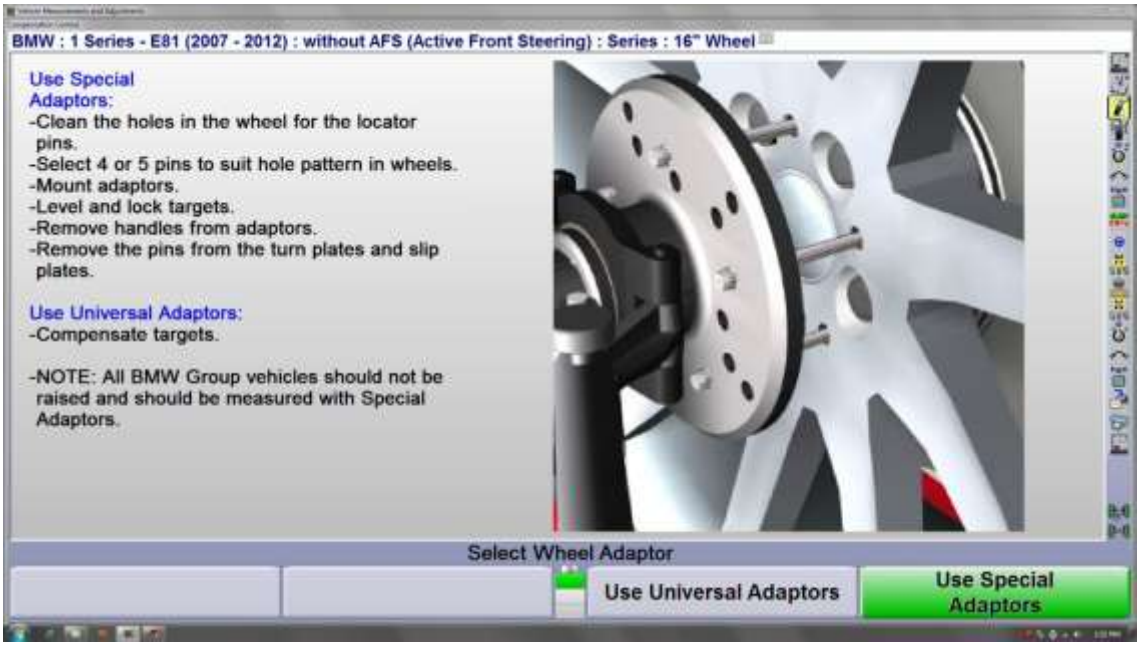


When instructed to level and lock sensors during the BMW software program, the method in which the sensors are leveled and locked when the sensors are mounted to brackets or when mounted to BMW special adaptors is different than the method used when mounting sensors to universal adaptors.

For sensors mounted to the BMW special adaptors, the sensors are secured at the "level" position by tightening the lock knob on the bracket or wheel adaptor, rather than the lock knob on the sensor. Verify that the index mark of the sensor shaft is at the 12:00 o'clock position.

1.4 Camera Sensor Setup (DSP600 or HS4X1 Sensors)

The shaft is not able to rotate on the sensors used with the camera system. Install the sensor to the adaptor. Level and lock the sensor once the adaptor is installed on the vehicle's wheel.



Operation

2.1 Work Order Information

Press “Begin Alignment” to begin the wheel alignment measurement process. The “Work Management” screen will appear. This screen shows the basic work order information.

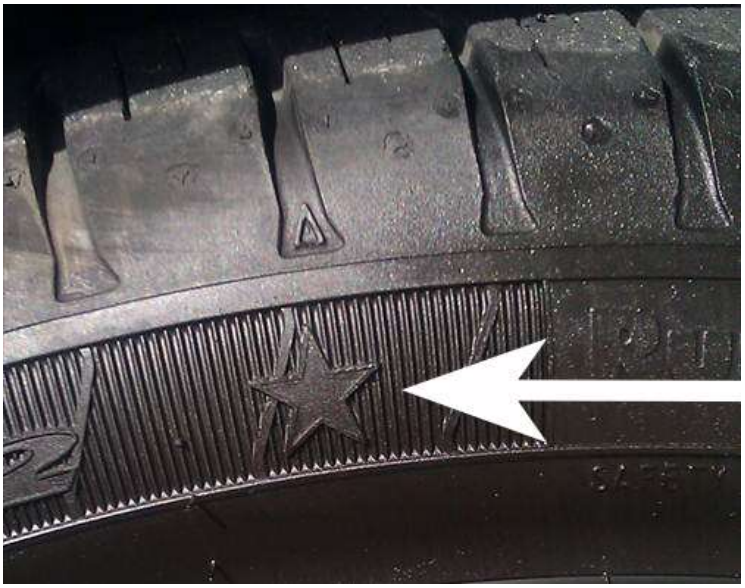
Enter the information. Dark shaded fields must be filled in to continue.

Detailed information regarding this display is available in a later section. Use the TAB key on the keyboard or the mouse to move from field to field on the display.

Optional Tire Information

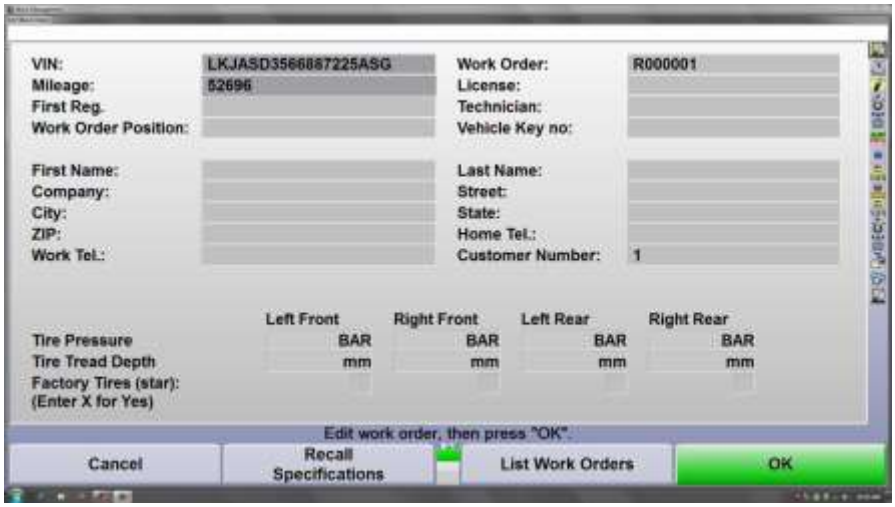
Use the keyboard to enter the appropriate data into the optional “Edit Work Order” screen. This information will appear on the printout summary. Press “OK” to continue.

An "X" should be entered in the Factory Tires (star) field if the tires are Original Equipment Manufacturer (OEM) tires. Factory tires will have a star design imprinted on the tire.



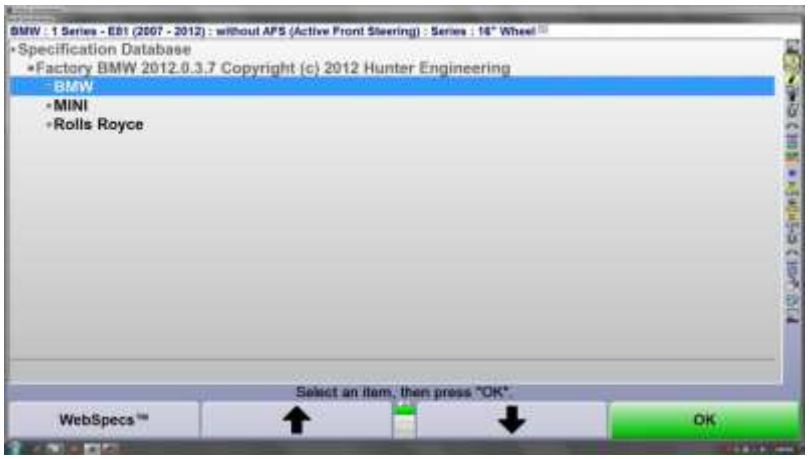
Factory star signifying OEM tires.

When all information is entered select “OK.”

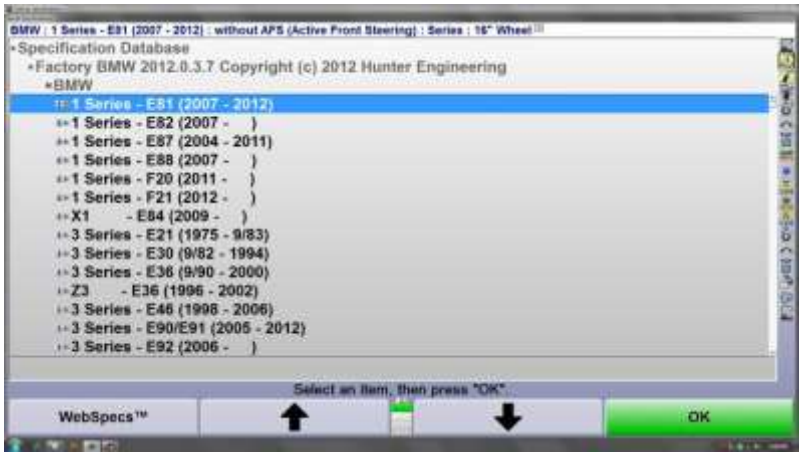


2.2 Specifications

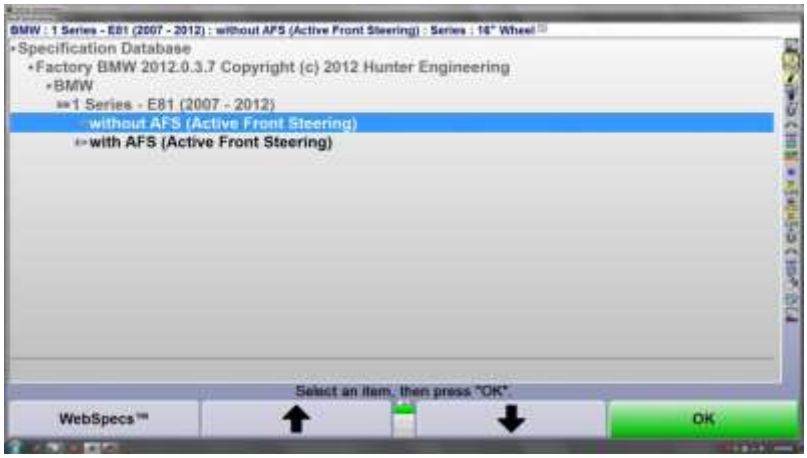
Use the K2 and K3 softkeys or the mouse to select the desired model from the Factory BMW Specification database. It is crucial to select the exact vehicle with the exact options, such as wheel diameter, sport suspension, etc..



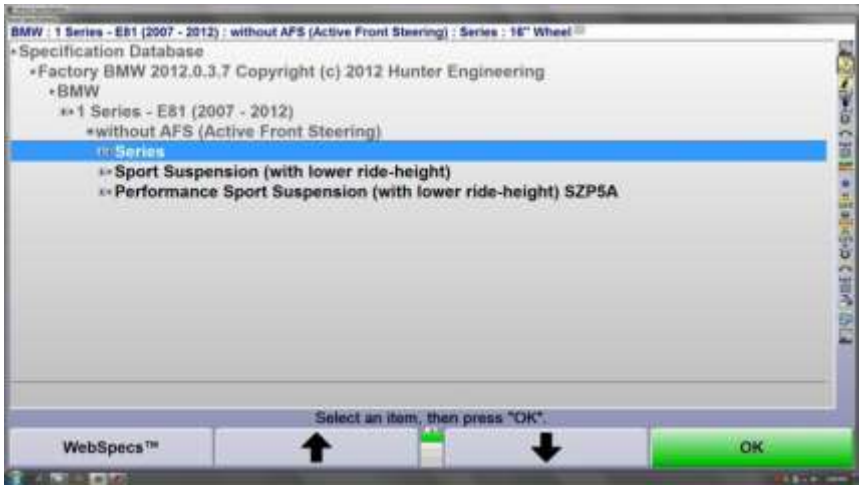
Select the Series.



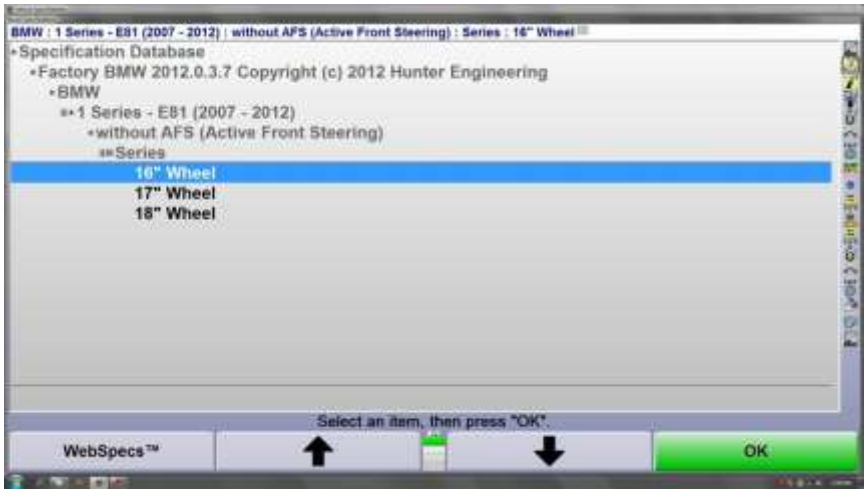
Select with or without Active Front Steering (AFS) Steering system.



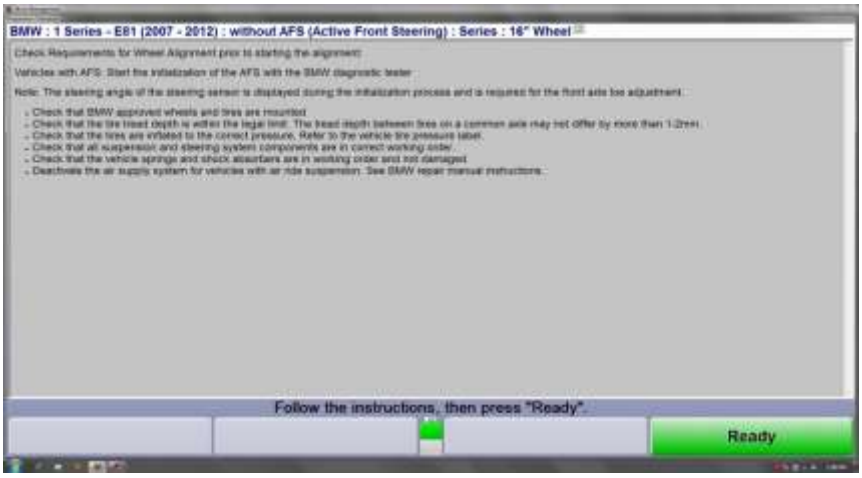
Select the next suspension related option.



Select the wheel size.



This completes the vehicle specification selection. Additional Information screens may be presented throughout the procedure. These screens are specific to the vehicle selected from the specification database and designed to remind the technician of procedures or processes required for the vehicle selected. The following example contains information pertaining to vehicles without AFS.



2.3 Supplemental Information on Specifications and Tolerances

After the BMW specification data has been recalled, "measurement" tolerances are applied and displayed everywhere in the software flow and on the printout except on the adjustment bar graphs. "Adjustment" tolerances are applied to adjustment bar graphs. "Adjustment" tolerances are tighter than "Measurement" tolerances.

The "Measurement" tolerances are presented everywhere accept the adjustment bar graph. "Adjustment" tolerances are tighter and applied to the adjustment bar graphs only.

The following is an example of a 2007-2012 BMW 1 Series (E81) with AFS: 16" Wheel.

BMW - Kinematics Diagnosis System
Loading measurement
Date: 28.12.12 9:57

WinAlign Version	Specification Version	Version Hx421	Cal Date
14.0 Beta 1	BMW/Univ 112.0.3.7	0.0	????

Customer:	Work Order Position:
Vehicle Key no:	Mileage:
Customer number:1	First Reg.:
License:	Technician:

Vehicle: BMW : 1 Series - E81 (2007 - 2012) : with AFS (Active Front Steering) : Series : 16" Wheel

Tire Inspection	Front left	Front right	Rear left	Rear right
Tire Air Pressure				
Tire Tread Depth				
Tire Marking	Star			

Rear Axle		Initial Measurement	Target Data	Final Measurement
Ride Height	left right		-20mm[557mm]+40mm	

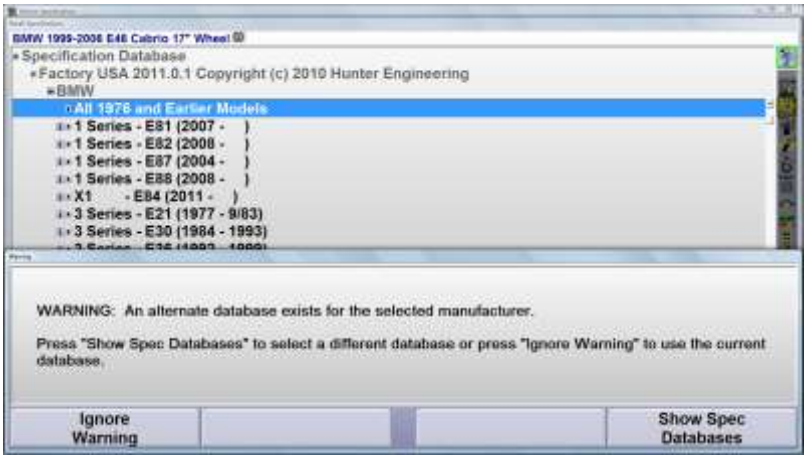
Front Axle		Initial Measurement	Target Data	Final Measurement
Ride Height	left right		-20mm[579mm]+40mm	

Rear Axle		Initial Measurement	Target Data	Final Measurement	Target Data
Camber	left right		-0°25'[-1°30']+0°25'		-0°25'[-1°30']+0°25'
Toe	left right total		-0°12'[0°18']+0°12'		-0°12'[0°18']+0°12'
Thrust Angle	total		-0°02'[0°09']+0°02'		-0°02'[0°09']+0°02'

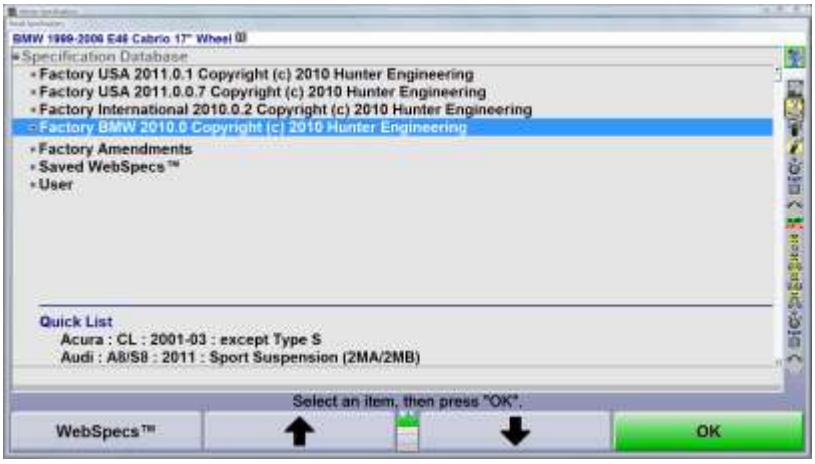
Front Axle		Initial Measurement	Target Data	Final Measurement	Target Data
Camber	left right cross		-0°30'[-0°12']+0°30' -0°30'[0°00']+0°30'		-0°30'[-0°12']+0°30' -0°30'[0°00']+0°30'
Toe	left right cross total		-0°12'[0°16']+0°12' -0°12'[0°16']+0°12'		-0°12'[0°16']+0°12' -0°12'[0°16']+0°12'
Track differential angle	left right				
Max steering lock on curve inside wheel	left right		[-41°22'] [33°29']		[-41°22'] [33°29']
Caster	left right				
SAI	left right				
Setback	total		-0°15'[0°00']+0°15'		

<> = Measured value is outside of tolerance

NOTE: If a BMW specification is recalled from a database other than the “Factory BMW” database, the following warning message will appear.



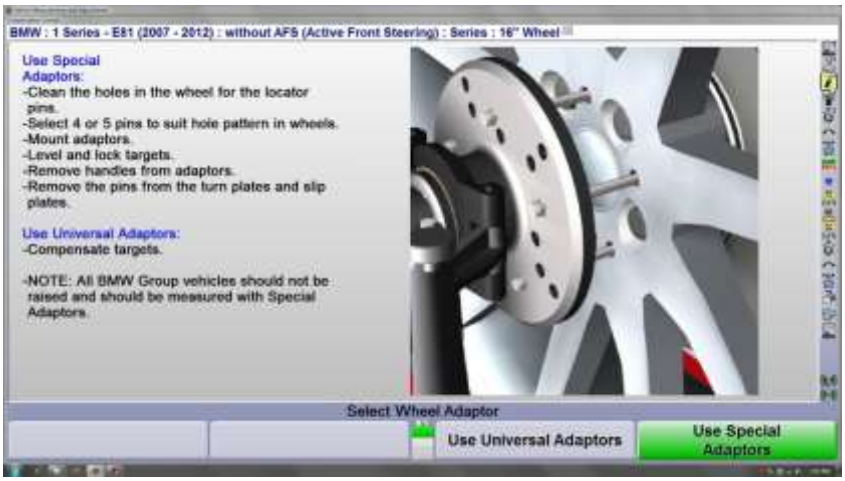
Press “Show Spec Databases” and a list of installed specification databases will appear. Select the “Factory BMW” database, press “OK,” and then select the model.



2.4 Measurements

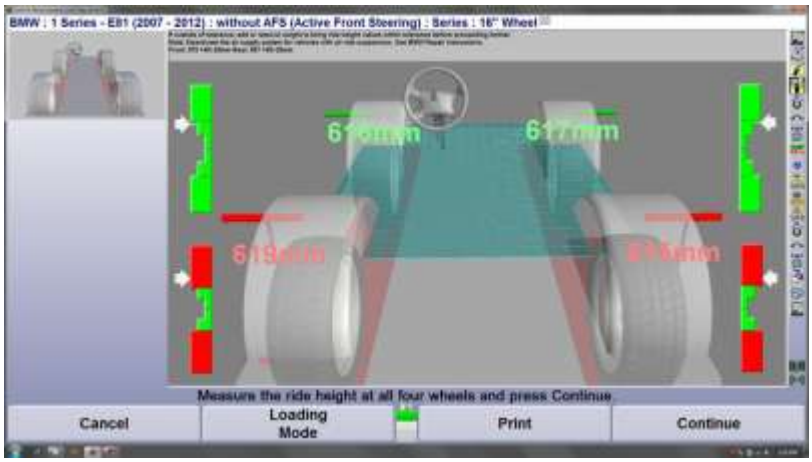
Special and Universal Adaptors Screen

All BMW Group vehicles should be measured with the Special Adaptors. Compensation is not needed when using the special adaptor designed for BMW. Information on using the Universal Adaptors can be found in Appendix A section 5.1.



Live Ride Height

If ride height measurements are required, WinAlign® will display a ride height measurement screen. This screen provides an initial unladen ride height measurement compared against a tolerance of +40 / -20mm. The specification and tolerance information is listed at the top of the screen for easy reference. Passing measurements are displayed in green and failing measurements are displayed in red.



If the vehicle is within tolerances, the screen will advance to the Caster, S.A.I. included angle and turning angle measurements screen when "Continue" is pressed and you may proceed with the alignment.

If the vehicle is out of specification the operator is presented with two options to bring the vehicle ride height into acceptable tolerances. Both options are listed at the bottom of the screen presented in tabs.

The preferred method for obtaining acceptable ride height measurements is through use of the Loading Mode.

- This mode continues to measure the ride height against the +40 / -20mm tolerance used in the initial unladen measurement.
- Load or unload the vehicle as needed and select Loading Mode to view the actual Ride Height Measurement.
- Continue the procedure until the vehicle ride height is within tolerance. Once the program records measurements that are within tolerance, the program will advance to the Caster, S.A.I. included angle and toe-out-on-turns measurements screen.

The Construction Mode is a method of setting Ride Height to an **EXACT** factory specification. This method is primarily used when a vehicle has had major service that will affect its alignment and or ride height.

- The Construction Mode uses a two tiered tolerance threshold for ride height.
- The first tier has a specification tolerance of +/- 10mm.
- Load or unload the vehicle as needed to obtain another Ride Height Measurement.
- Once that tolerance has been met, weight must be added or removed until the measured ride height is within +/- 2mm tolerance.
- Some sport tuned suspensions will require a second tier tolerance of +/-1mm.

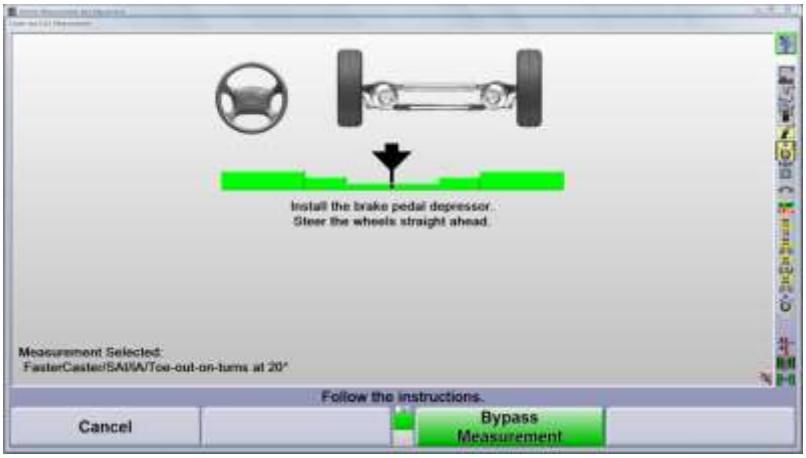
Complete instructions on the Construction Mode are found in Appendix A section 5.2.

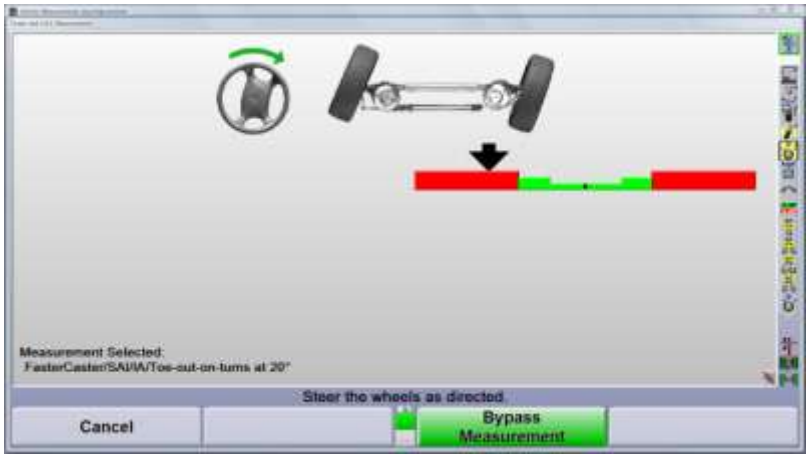
NOTE	The Manual Ride Height data entry screen can be reached by using a second row softkey.

Caster, S.A.I., Included Angle and Toe-out-on-turns Measurements

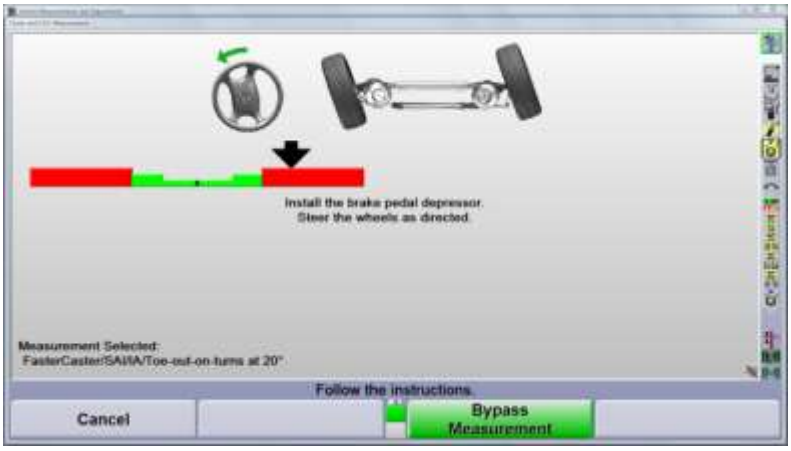
BMW's process requires Caster, SAI/IA and toe-out-on-turns at 20 degrees to be measured using a single 20 degree steering sequence.

Follow the instructions given on the screen. The program will wait until all measurements are stable before automatically moving to the next screen. This is necessary because all “Before” measurements for the sensors are saved at this time.

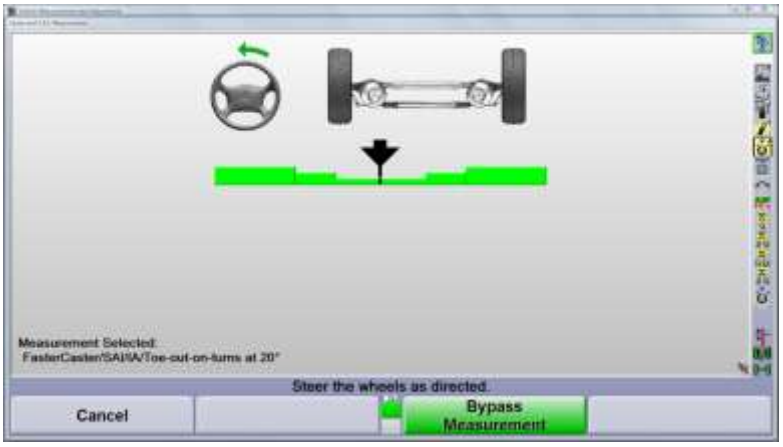




Steer to the left as directed until the arrow is in the lower valley of the graph. Hold the wheels still until the bar graph changes to the screen shown below.



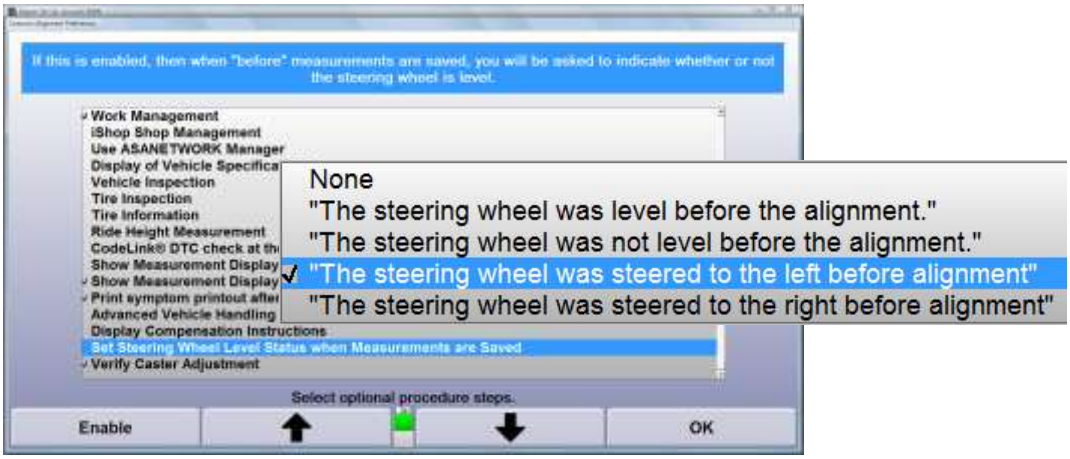
Steer to the right as directed until the arrow is in the lower valley of the graph. Hold the wheels still until the bar graph changes to the screen shown below.



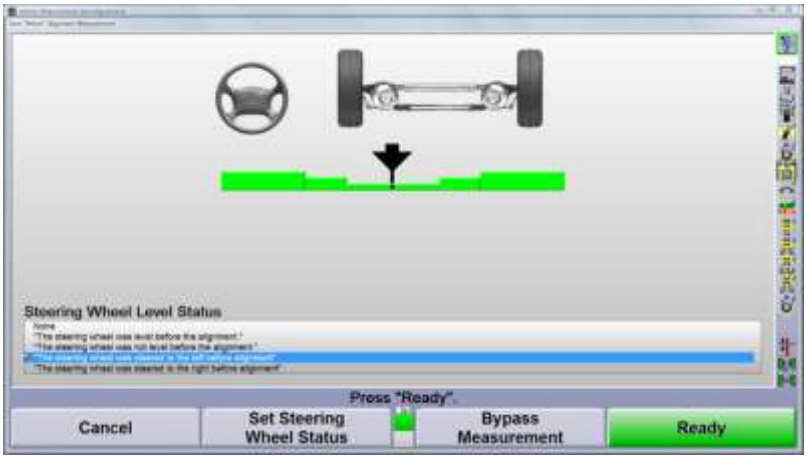
Steer back to the left until the arrow is centered in the bar graph. Hold steady until the screen changes to the next step of the operation.

Steering Wheel Status

A steering wheel status indicator may be used during the alignment if the option is turned on through the "Common Files" portion of WinAlign®'s setup program.



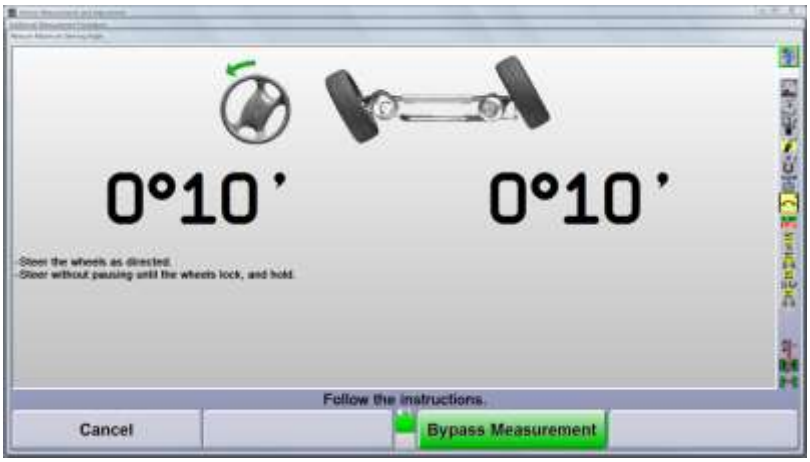
Initial steering wheel position may be recorded when the initial primary angles have been measured.



"Before" Measure Maximum Steering Angle

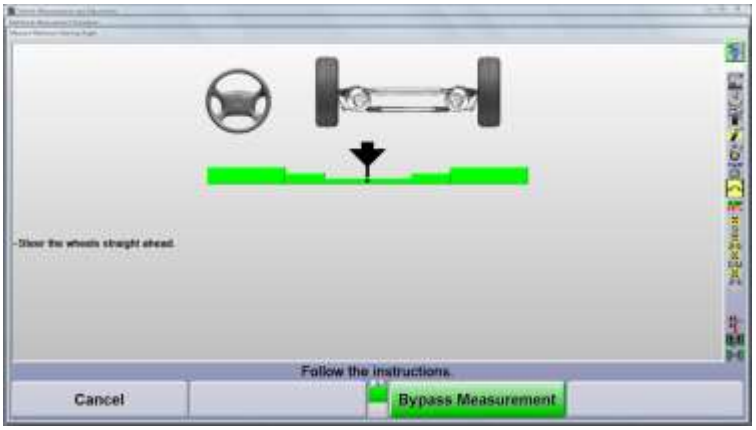
Maximum Steering Angle will be measured if the specification for the vehicle selected contains maximum steer angle value. The program will automatically bypass this procedure if the vehicle's specification does not contain a maximum steer angle value. Follow the instructions and then steer the wheels as directed.

Conventional sensors should be unlocked for this measurement.



Steer the wheels as directed with a steady motion until maximum steer angle is achieved to the left. Hold the wheels until the display indicates to steer right.

Repeat this process when steering to the right.



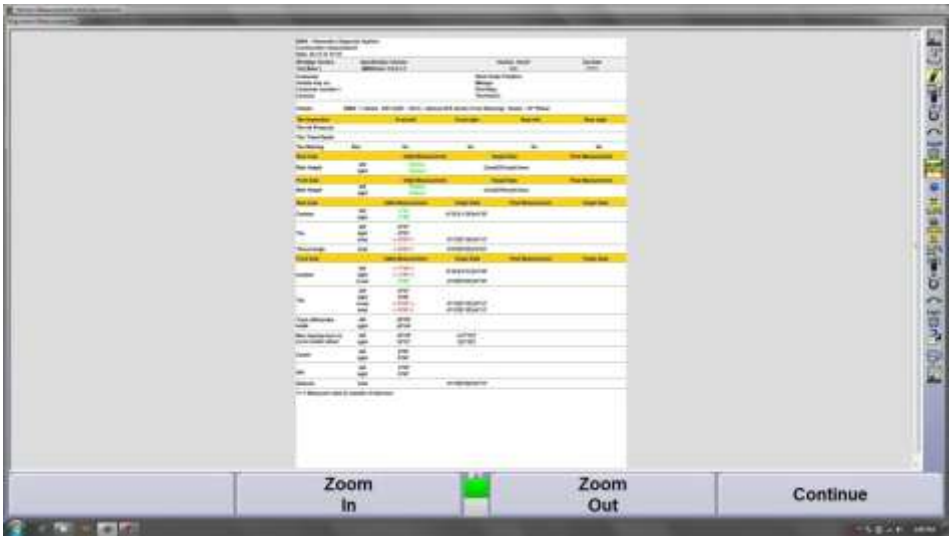
Return the wheels to the straight ahead position.

Vehicles without AFS will display the screen with the steering wheel level pictured to demonstrate how to set the steering wheel to level position.

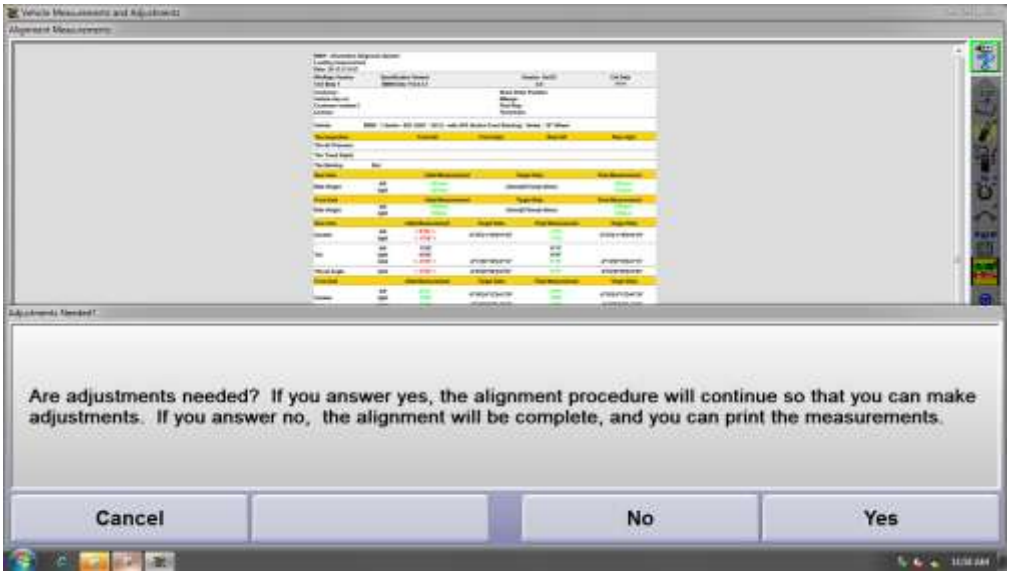
AFS equipped vehicles will display a screen that shows the BMW diagnostic computer. The BMW diagnostic computer must be used to view steering angle sensor value. The steering wheel must be steered until the BMW diagnostic computer displays 0 degrees +/- 0.2 degrees.

Alignment Measurements Printout

The 'Before" measurements screen will appear after all measurements are obtained. Screen scroll up or down, zoom in or out to see all the alignment data. Numbers shown in red are out of specifications, number in green are within acceptable limits. Click on "Print" to create a printout of what is displayed on the screen.

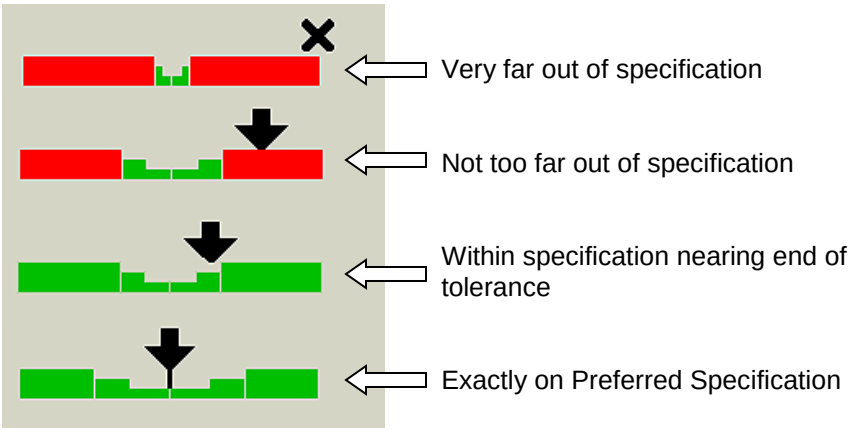


The next screen asks the operator if adjustments are needed. If the answer is "Yes" the program will proceed to the initial alignment screen. If the answer is "No" the system will skip directly to the end.



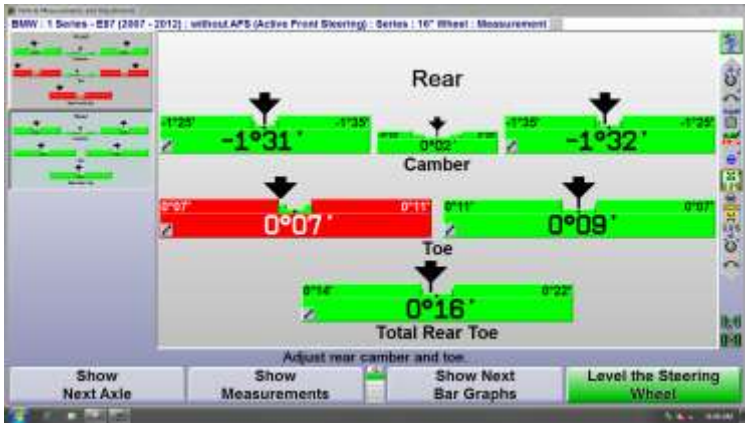
2.5 Adjustments

Bar graphs quickly indicate the position of the angle compared to specification.



Rear Camber and Toe Adjustment

The Rear Camber screen indicates the current measurement of Camber, Toe and Total Toe. BMW vehicle specification data, which is displayed at the top of each bar graph, may change if the measured ride height changes while camber or toe adjustments are performed if ride height is being measured with live ride height targets.



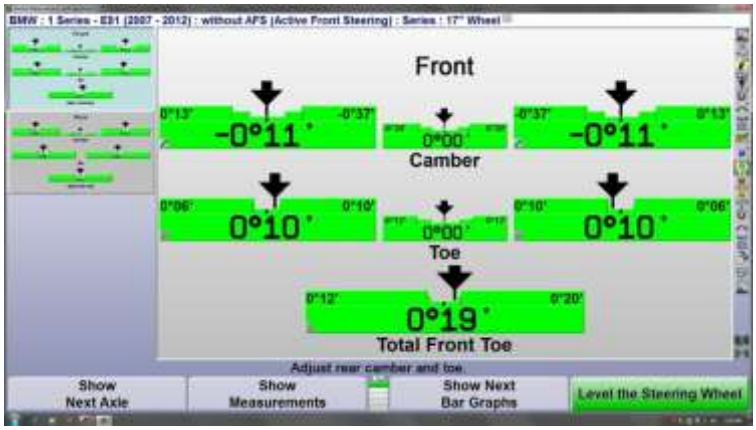
Note:	If ride height was brought into specification via "Loading Mode", then the spec value shown on the bar graphs may change as any adjustments affect the ride height. It is required for the ride height targets to still be unobstructed to perform this procedure. This does not apply to the "Construction Mode" procedure.

Steering Wheel Adjustment

Once Rear Camber adjustments have been completed the program will return to the "Level Steering Wheel" screen.

Front Camber Adjustment

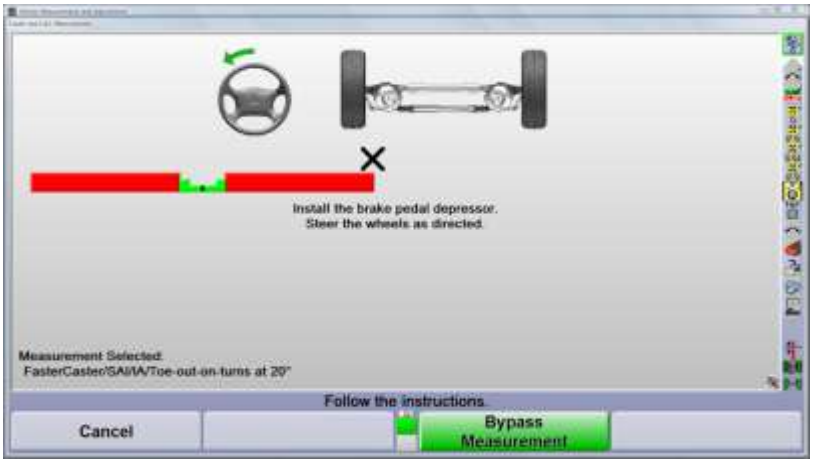
Adjustments may be made to front camber at this screen. Do not re-level conventional front sensors before adjusting front camber.



Note:	If ride height was brought into specification via "Loading Mode", then the spec value shown on the bar graphs may change as any adjustments affect the ride height. It is required for the ride height targets to still be unobstructed to perform this procedure. This does not apply to the "Construction Mode" procedure.

2.6 Completing the Alignment Process

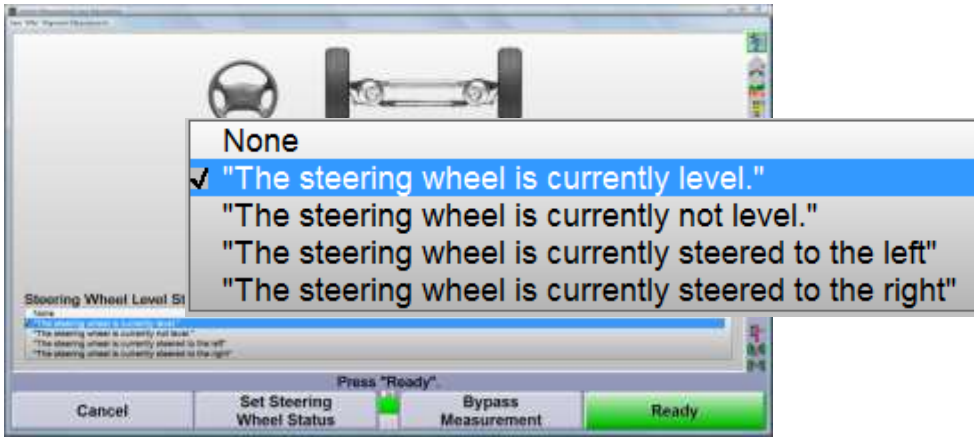
Verify Caster Measurement



Measure caster/SAI/IA/Toe-out-on-turns at °20 again. This step should not be bypassed. Adjustments made to front camber and toe influence the SAI/IA and Toe-out-on-turn values.

Steering Wheel Status

Select the steering wheel status now that all adjustments have been finished.



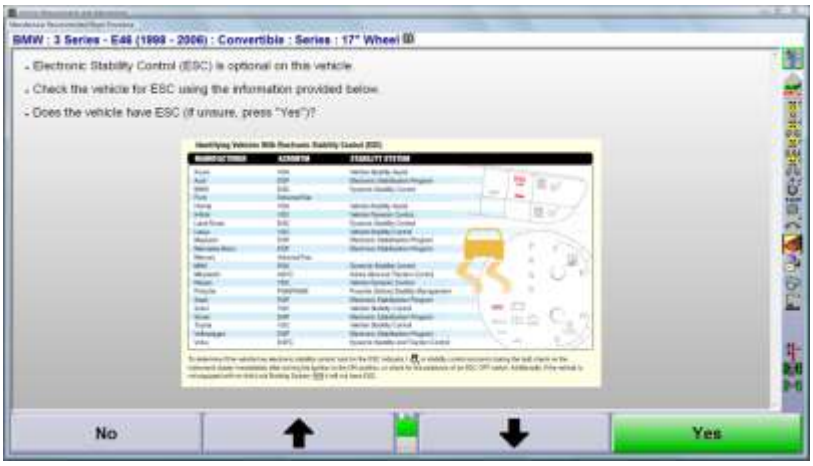
A note will be added to the printout the position the steering wheel was in before and after the alignment adjustments were made. Select K4 “Ready” to continue with the procedure.

Measure Maximum Steer Angle (Re-measure)

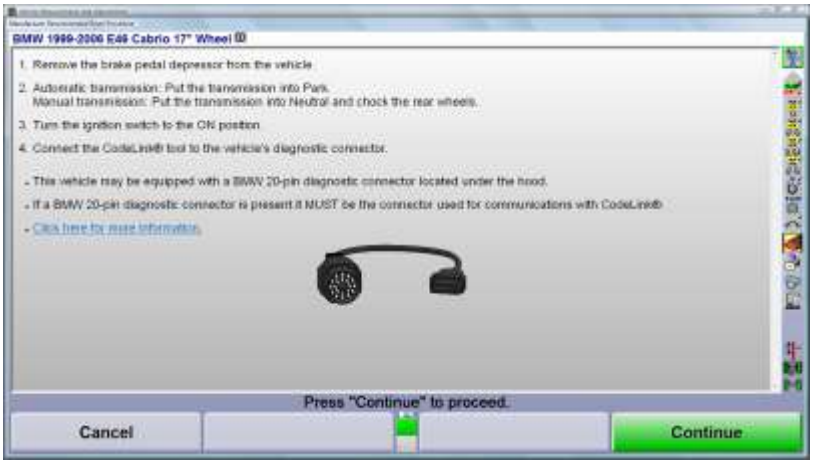
The maximum steer angle measurement is also affected by adjustments to front toe angles. If a maximum steering angle specification is available, the program will automatically offer a maximum steer angle measurement. Proceed as instructed on the screen.

The final maximum steer measurement is made at this screen.

Does the vehicle have ESC (if unsure, press "Yes")?

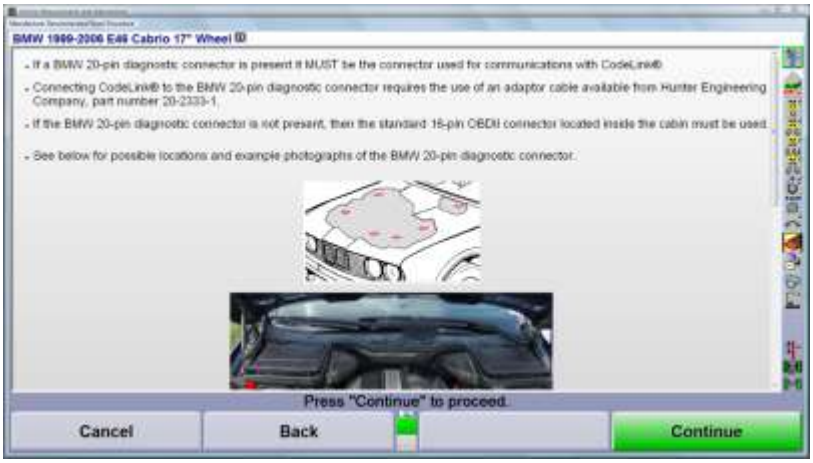


Selecting "Yes" will instruct the WinAlign® system to use Hunter's CodeLink tool.



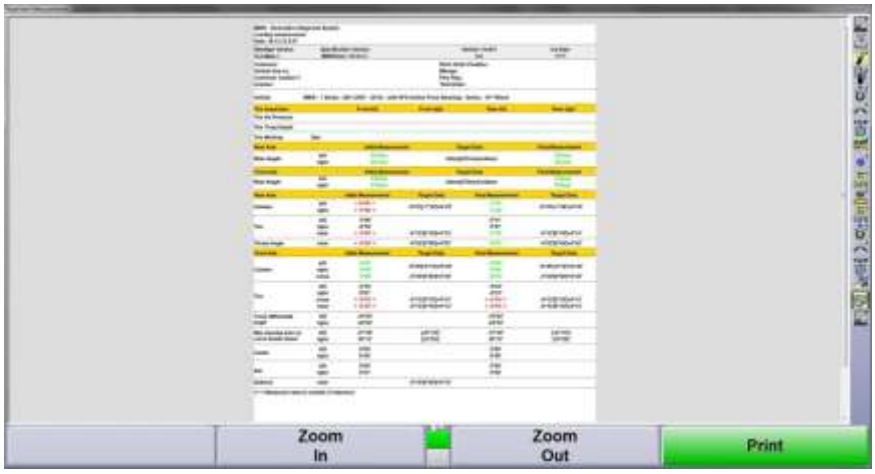
It is vital to follow the sequence of events exactly as the display indicates.

The "Click here for more information" hyperlink will help you find the connector.



Final Measurements Overview

Measurements that have been saved as “After” measurements are shown here. This detailed page illustrates all the measurements and adjustments required, plus any customer and vehicle information entered on the work order.



Saving Final Work Order

Press “Save Current Work Order” to store all data pertaining to this job.

Alignment Printouts

Press “Print “ to generate an alignment summary using the BMW printout format.

BMW-Kinematics Diagnosis System Printout

BMW - Kinematics Diagnosis System
Loading measurement
Date: 28.12.12 9:57

WinAlign Version	Specification Version	Version Hx421	Cal Date
14.0 Beta 1	BMW/Univ 112.0.3.7	0.0	????

Customer:	Work Order Position:
Vehicle Key no:	Mileage:
Customer number:1	First Reg.:
License:	Technician:

Vehicle: BMW : 1 Series - E81 (2007 - 2012) : with AFS (Active Front Steering) : Series : 16" Wheel

Tire Inspection	Front left	Front right	Rear left	Rear right
Tire Air Pressure				
Tire Tread Depth				
Tire Marking	Star			

Rear Axle		Initial Measurement	Target Data	Final Measurement
Ride Height	left	557mm	-20mm[557mm]+40mm	557mm
	right	557mm		557mm

Front Axle		Initial Measurement	Target Data	Final Measurement
Ride Height	left	579mm	-20mm[579mm]+40mm	579mm
	right	579mm		579mm

Rear Axle		Initial Measurement	Target Data	Final Measurement	Target Data
Camber	left	< 0°00' >	-0°25'[-1°30']+0°25'	-1°31'	-0°25'[-1°30']+0°25'
	right	< 0°00' >		-1°34'	
Toe	left	0°00'		0°11'	
	right	-0°05'		0°07'	
	total	< -0°05' >	-0°12'[0°18']+0°12'	0°18'	-0°12'[0°18']+0°12'
Thrust Angle	total	< -0°05' >	-0°02'[0°09']+0°02'	0°07'	-0°02'[0°09']+0°02'

Front Axle		Initial Measurement	Target Data	Final Measurement	Target Data
Camber	left	-0°01'	-0°30'[-0°12']+0°30'	-0°01'	-0°30'[-0°12']+0°30'
	right	0°00'		0°00'	
	cross	0°00'	-0°30'[0°00']+0°30'	-0°01'	-0°30'[0°00']+0°30'
Toe	left	-0°03'		-0°02'	
	right	0°01'		-0°01'	
	cross	< -0°02' >	-0°12'[0°16']+0°12'	< -0°03' >	-0°12'[0°16']+0°12'
	total	< -0°02' >	-0°12'[0°16']+0°12'	< -0°03' >	-0°12'[0°16']+0°12'
Track differential angle	left	-10°02'		-10°02'	
	right	-20°03'		-20°03'	
Max steering lock on curve inside wheel	left	-37°30'	[-41°22']	-37°30'	[-41°22']
	right	39°13'	[33°29']	39°13'	[33°29']
Caster	left	0°00'		0°00'	
	right	0°00'		0°00'	
SAI	left	0°00'		0°00'	
	right	0°01'		0°00'	
Setback	total		-0°15'[0°00']+0°15'		

<> = Measured value is outside of tolerance

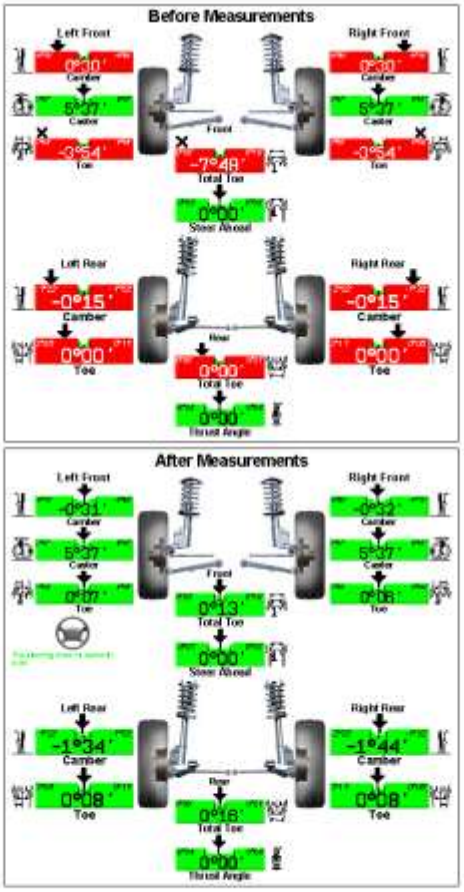
Print Vehicle Printout

Select “Print Vehicle” to print specific measurements shown in the WinAlign® format. The following example shows both “before” and “after” results.

VIN:	WBABS53461JU81878
Work Order:	R000007
Mileage:	89321
License:	ok-fine
First Reg.	1.1.01
Technician:	Bob Jones
First Name:	John
Last Name:	Smith
Company:	HEC
Street:	11250 Hunter Dr
City:	Bridgeton
State:	MO
ZIP:	63044
Home Tel.:	314-504-9037
Work Tel.:	314-716-0482
Customer Number:	
Date	25.7.11 9:28

WBABS53461JU81878

BMW 1999-2006 E46 Cabrio 17" Wheel



- The steering wheel was not level before the alignment. Toe adjustments are required.
- One or more values are not within specification. Tire wear, handling and safety problems may result.

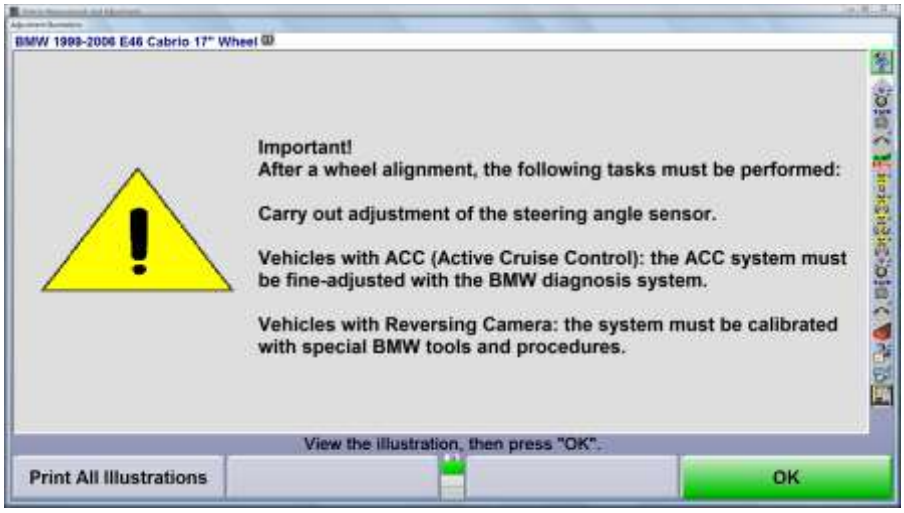
Conclude the alignment process by selecting the “Reset” softkey.

Additional Alignment Steps

During Recall Specifications the info icon will appear next to vehicles requiring special procedures. Click on the icon to display a detailed illustration or description.

3.1 Adaptive Cruise Control

Vehicles with ACC (Active Cruise Control), AFS (Active Front Steering), and DSC (Dynamic Stability Control) may require additional measurements, adjustments, and/or special tools to make the adjustments.

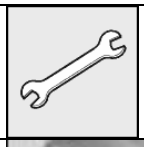
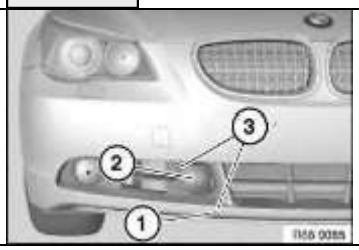
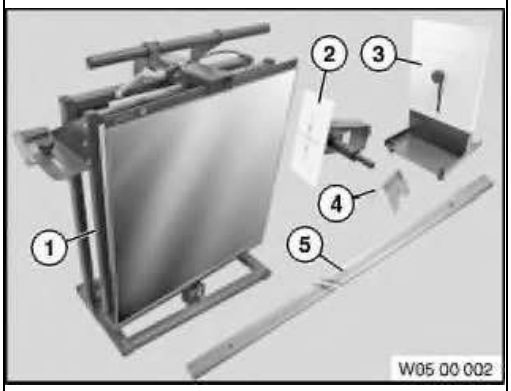


[1]"Radar sensors at the front of the vehicle permanently scan the road ahead. As your BMW approaches a slower vehicle, Active Cruise Control automatically reduces power output from the engine and gently applies the brakes, holding your BMW at a pre-defined distance to the vehicle ahead. This distance is set as a number of seconds, not of meters, so that a safe reaction time is always available, relative to the current speed. When the lane ahead becomes clear, Active Cruise Control automatically increases your vehicle's speed to your preferred cruising speed. Up to four different cruising speeds can be pre-programmed. A touch on the accelerator or brake pedal deactivates the system."

Alignment of the BMW ACC System requires a vehicle specific BMW scan too and special ACC adjustment tool (BMW part# 81-10-0-021-292).

[1] "BMW Insights," BMW website http://www.bmw.com/com/en/insights/technology/technology_guide/articles/active_cruise_control.html

BMW TIS - 66 31 001 Adjusting ACC sensor

66 31 001	Adjusting ACC sensor
	Special tools required: · 36 1 100 · 36 1 130
	Lever out cap ①. Carry out adjustment of ACC sensor ② with special tool 36 1 130 by means of adjusting screws ③.
	Special tool required: Active Cruise Control ACC adjusting device, complete. Order number: 81 10 0 021 292 Consisting of: 1. Mirror, complete 2. Wheel laser 3. Slotted diaphragm 4. Control bracket (for initial installation of rail) 5. Rail 6. Setup and operating instructions (not shown) Note: A holder which is not included in the scope of delivery is required to support the wheel laser. Use either the quick-action clamp from the existing KDS or ACC wheel holder (36 1 100).
	Note: Follow instructions for ACC adjusting device .
	Note: To adjust the ACC sensor, connect the BMW diagnosis system and fit the ACC adjusting device. Select ACC system in diagnosis. Start test module "ACC adjustment" (service functions) and proceed in accordance with instructions. Handle ACC adjusting device in accordance with mounting and operating instructions provided with device.
	Note: Further information on the ACC adjusting device can be found in the BMW Workshop Equipment and Planning Documentation

3.2 Active Front Steering

[2]"When driving at lower speeds - such as in city traffic, when parking or on winding mountain roads, Active Steering increases the size of the steering angle. The front wheels respond immediately to small movements of the steering wheel, enabling the driver to maneuver through tight spaces without needing to make multiple turns of the steering wheel. Parking is easier and agility enhanced.

At medium speeds, steering is also easier. And to ensure smoothness at higher speeds, as of around 120 to 140 km/h (depending on the model) Active Steering becomes more indirect.

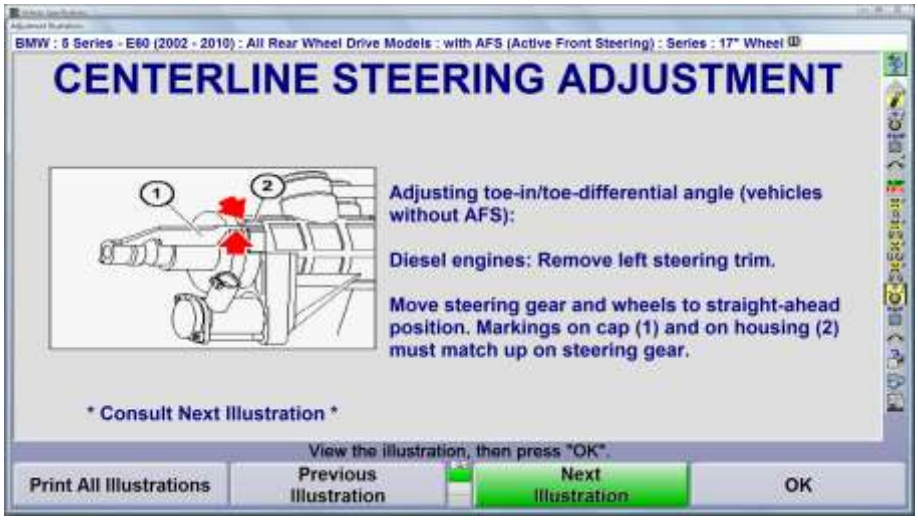
Active Steering therefore reduces the amount of change in the steering angle for every movement of the steering wheel. This gives the driver the advantage of more precise steering at higher speeds, and ensures great stability and more comfort.

If the vehicle is threatened with instability, such as by over steering or braking on a changeable surface, DSC identifies the problem and can use Active Steering to help overcome it. For example, in order to reduce unsafe yaw, Active Steering can increase the angle of steering wheels faster than even the most expert driver.

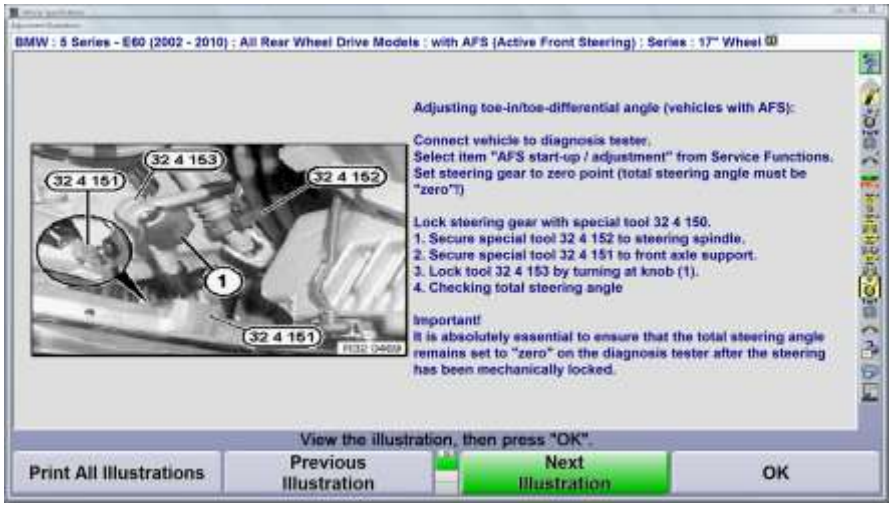
Active Steering does not interrupt the direct connection between steering wheel and front wheels, so that even in the unlikely event of a complete failure of the electronic systems, the BMW remains completely controllable at all times. This is because at the first sign of any problems, an adaptation mechanism blocks the Active Steering immediately using a pivot so that the driver is permanently in control of the situation."

The markings on the steering shaft cap and housing must be aligned before front toe adjustments are performed.

[2] "BMW Insights," BMW website http://www.bmw.com/com/en/insights/technology/technology_guide/articles/mm_active_steering.html (May 8, 2013)



These marks must stay aligned during the toe adjustment process.

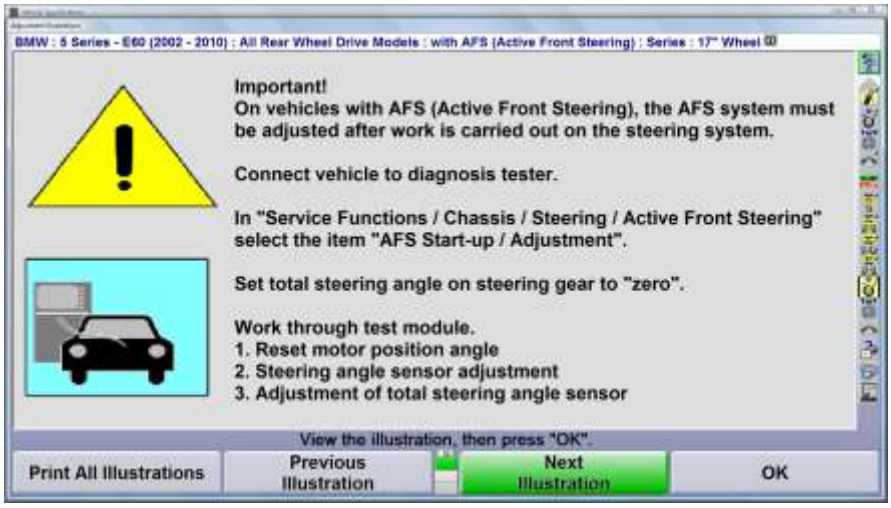


A special tool assembly (32-4-150) is used to hold the marks together.

"IMPORTANT: It is absolutely essential to ensure that the total steering angle remains set to zero on the diagnostic tester after the steering has been mechanically locked".

Proceed with the alignment process. The alignment procedure will inform the technician when the tool should be removed.

If further instructions are required, such as resetting the steering gear, these instructions will also be displayed at the appropriate point in the procedure.



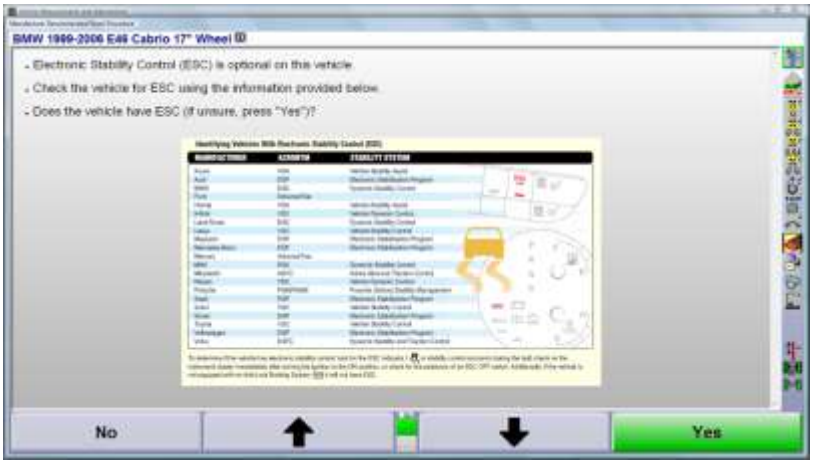
Final measurements will display after all special procedures are completed.

3.3 Dynamic Stability Control (DSC)

BMW's Dynamic Stability Control is a system designed to help keep the vehicle in control. The system gathers information from sensors monitoring wheel rotation, steering angle, lateral forces, pressure and yaw (spin).

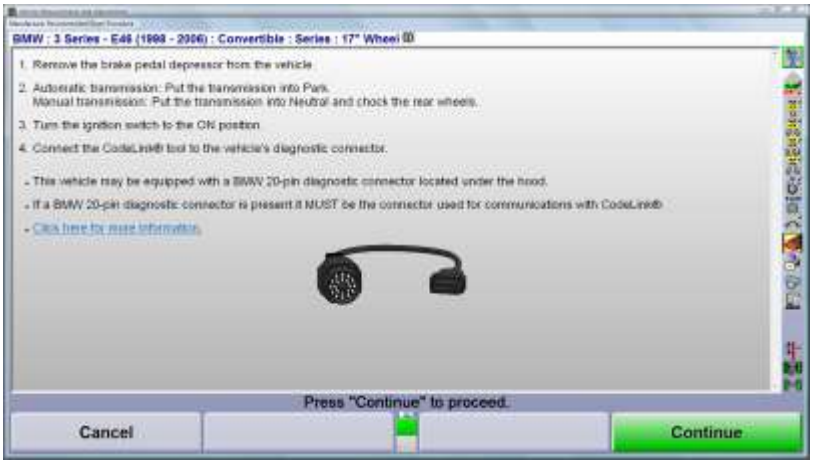
Wheel alignment may affect the calibration of the steering angle sensor. The only way to know that the DSC system is working with properly calibrated sensors is to connect the vehicle's computer system and check.

WinAlign® will display a message screen indicating that the vehicle may be equipped with DSC and in need of a verification procedure at the end of the alignment process.



The icon for Hunter's CodeLink device will appear in the procedure bar if CodeLink is part of the alignment system.

The following display will appear at the correct place in the alignment procedure if CodeLink is available.



Follow the instructions line-by-line and the procedure will be complete in a short period of time.

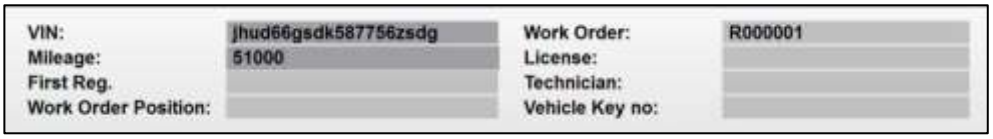
Program Details

4.1 Work Management

Using the Work Management program provides the following advantages:

1. Storage of customer information for later recall
2. Storage of customer's vehicle information for later recall
3. The ability to store more than one vehicle per customer
4. Storage of "Before" and "After" wheel alignment measurements
5. Record of customers tire pressure and tread depth
6. Record of factory or non-factory tire
7. Ability to recall work orders electronically

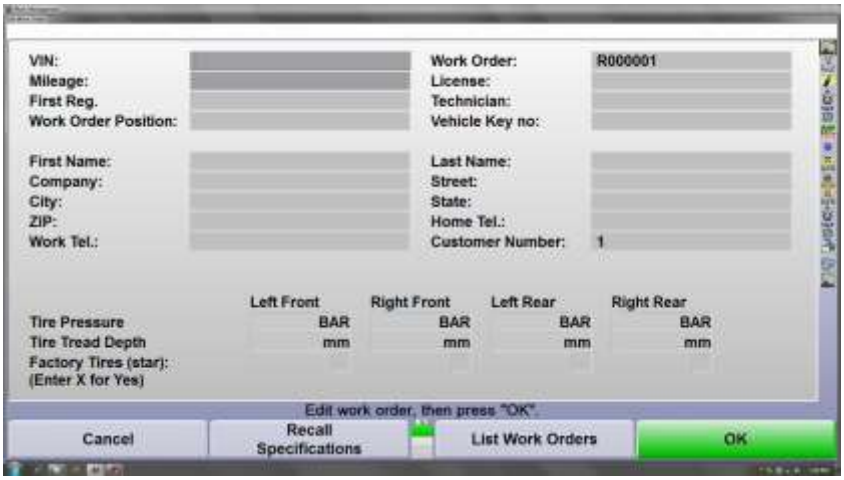
Vehicle identification includes the following:



The Edit Work Order screen also contains tire pressure, tread depth, and whether or not the tires are factory equipment.

The dark grey areas indicate mandatory information. This usually includes:

- VIN #, Work order number, Mileage



The cursor indicates the position where a letter or number will appear.

Press **Enter** or **Tab** to advance to the next field. Press **Shift** and **Tab** to back up to the previous field. The mouse may be used to move between fields.

Press the **Backspace** key to delete the last character entered.

Press the right or left cursor arrow key to move the cursor.

Press **Del** to remove the character to the right of the cursor.

To insert a character in the middle of a word, move the cursor to the character before the position and press the character to be inserted.

The following error will appear, if a mandatory field is left blank.

Saving Current Work Order

Press “Work Management” on any primary screen to display the “Work Management” primary screen.

Press “Save Current Work Order.” The work order with its associated customer and vehicle identification will be stored on the hard drive.

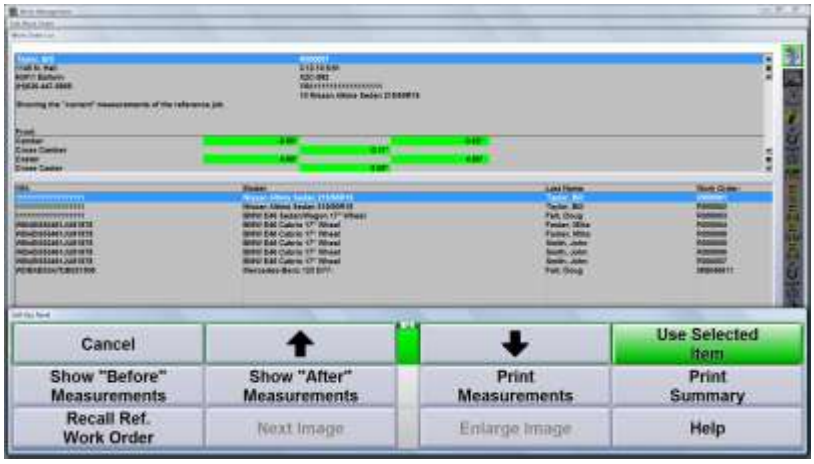
The “Save Current Work Order” softkey will also appear at the end of the alignment measurement procedure and on the “Print” screen.

Recalling a Work Order for Review or Print

Start on the Edit Work Order screen.

1. Select the "List Work Orders" softkey

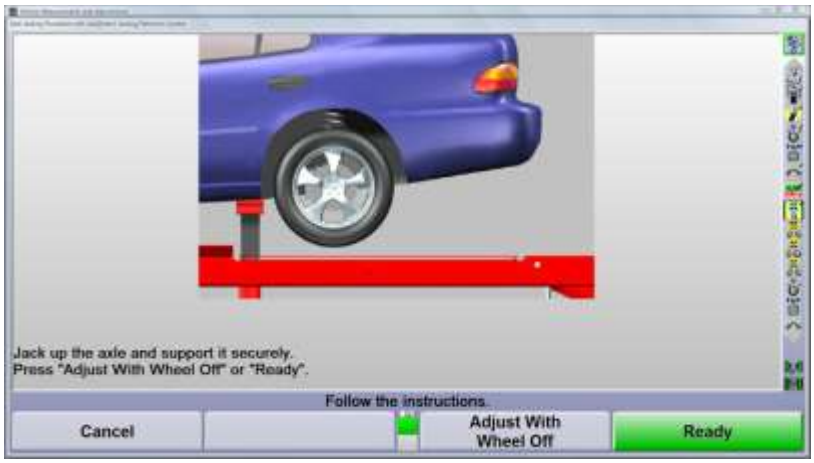
2. Use the search function to find the correct work order / customer
3. Highlight the correct work order / customer
4. Expose all the softkeys by clicking on the magnifying glass between the K2 and K3 keys
5. Select "Show **"Before"** Measurements", "Show **"After"** Measurements", "Print Measurements" or Print Summary".



4.2 Raise Selected Axle

Front camber, front caster and rear camber may be adjusted with the tires lifted off the runway using the "Jack Up Selected Axle" softkey available on the fourth row.

Jack up the vehicle as indicated and press K4 "Ready".



Adjust the camber or caster angle as needed.

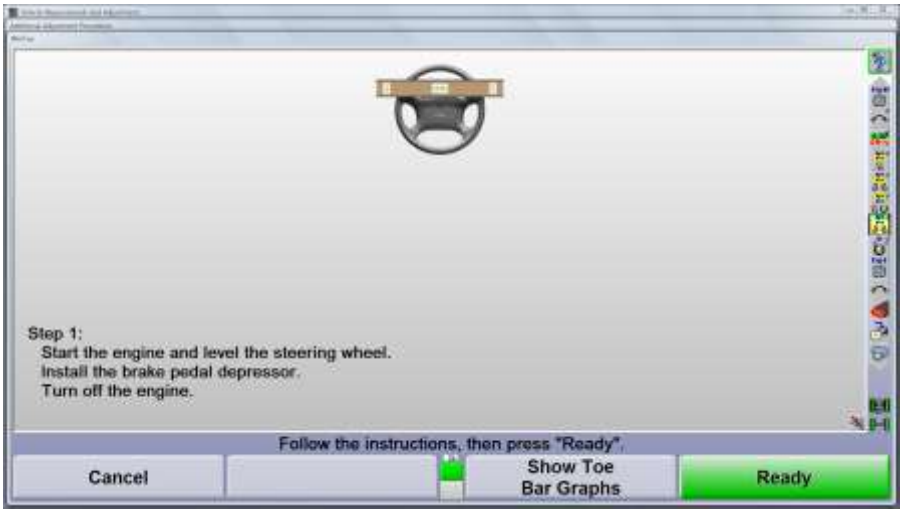
Press K1 "Lower Selected Axle" when adjustment is finished.

4.3 WinToe®

WinAlign®'s patented WinToe® program has been enhanced with the addition of WayUp and WayOut Wintoe®, which were introduced with WinAlign® 10.0.

WayUp WinToe® is a seamless software program which extends the vertical range of the cameras. This allows the alignment lift to be raised higher without moving the cameras or losing front toe measurements.

WayOut WinToe® allows the front wheels to be turned during a front toe adjustment while maintaining accurate toe values.



Enter WinToe® from the "Make Additional Adjustment" softkey or through the context sensitive drop-menu obtained by clicking on the steering wheel icon on the front toe bar graphs.

NOTE: Vehicles requiring the steering gear to be centered during the front toe adjustment should not use the WayOut WinToe® feature.

Select K2 "Steer Before Adjusting" to use the WayOut WinToe® program.

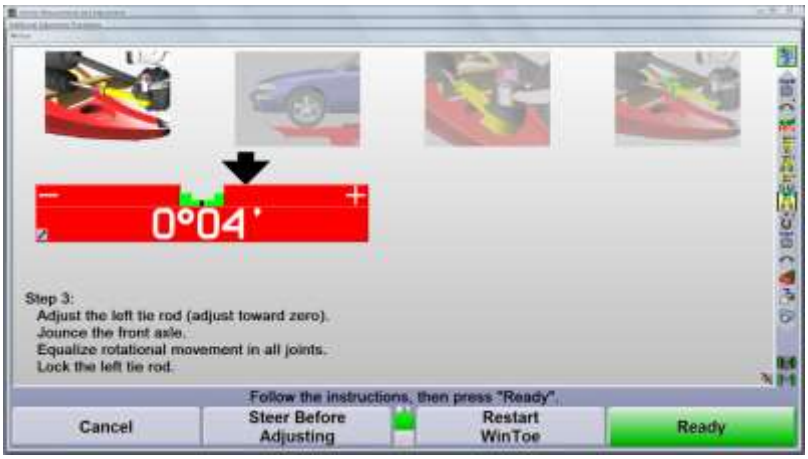
Follow the instructions on the display. Securely lock the front wheels in place after steering to the desired position. This may require using the ignition lock.

Press K4 "Ready" when the front wheels are secure.

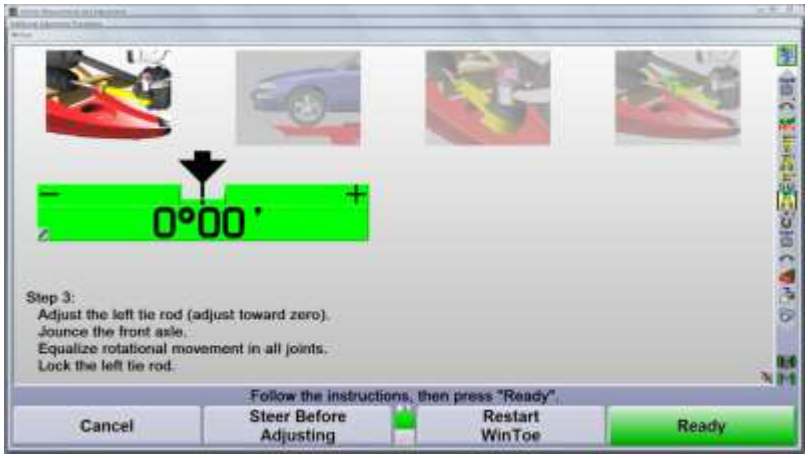
The toe adjustment display is shown with the same required change displayed before the front wheels were steered. Adjust toe and follow the instructions. Press K4 "Ready" when ready to adjust the left tie rod.

Steer the wheels to the position desired to access the left tie rod adjuster.

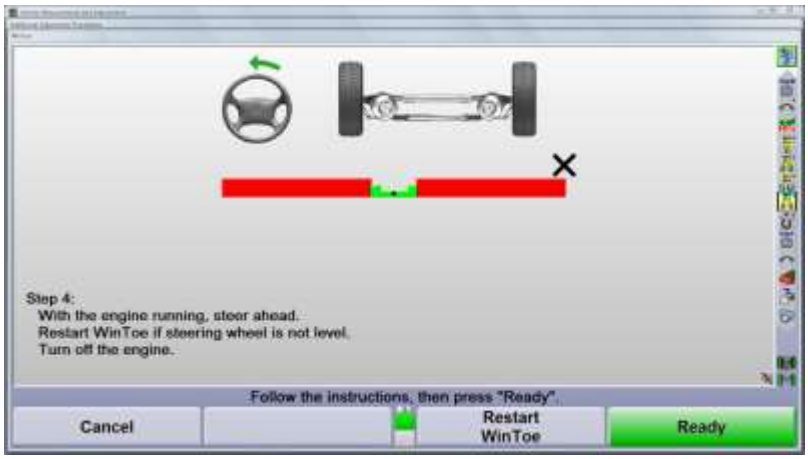
Lock the front wheels in place and press K4 "Ready".



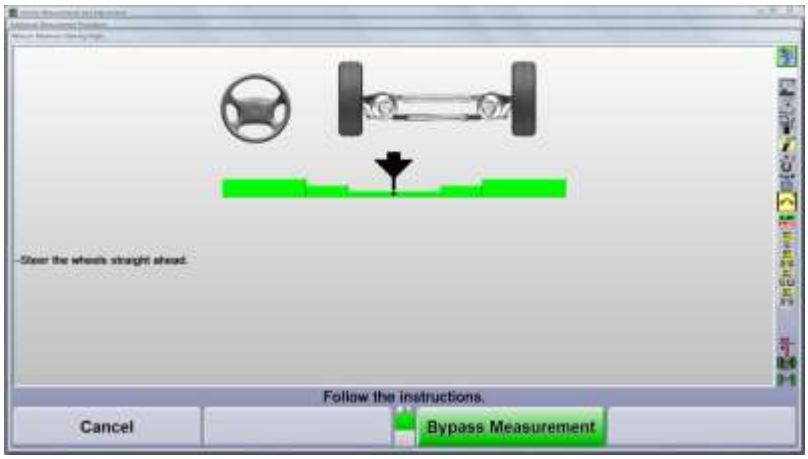
Adjust the left tie rod and follow the instructions displayed on the screen.



Press K4 "Ready" when the adjustment is complete and the instructions on the screen have been followed.



Verify the steering wheel is centered when the arrow is in the center of the bar graph.



Camera Based
BMW KDS II and KDS II Plus Aligners

Standard accessories for DSP600 and HS4X1 Camera Based Sensor systems

 175-348-1	BMW Adaptor w/120mm pins and large tire hooks.	BMW special adaptors with large tire hooks (with 120mm pins). For use with all DSP and HS4x1 sensors
 20-2050-1	HS4X1 and DSP600 Live Ride Height Targets *Intended for ride height measurements from center of wheel to wheel opening lower edge.*	For use with all HS4X1 and DSP600 sensors. Includes 4 Live Ride Height Targets and 20 adhesive strips. Included with new KDS II-Plus systems. *(Requires WinAlign® 9.0 or greater)*
 20-1885-1	Ride Height Handheld Wireless Remote Control	Ride Height Handheld Wireless Remote Control Kit 20-1885-1, ships standard with BMW DSP600 and HS4X1 Series Sensors and DSP508XF-B Sensors.

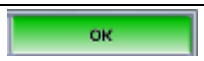
Optional accessories DSP600 and HS4X1 Camera Based Sensor systems

 30-419-1-X	Icon Remote Indicator	New style remote indicator
 30-421-1-X-XF	Icon Cordless Remote Indicator	New style cordless remote indicator
 30-418-1-X-XF	Plus Cordless Remote Indicator	New style cordless remote indicator. Records tire pressure, tread depth, ride height and measures tire temperature and frame angle. Includes Tire Temperature Probe.

 20-2072-1	XF2 Pod Kit	XF communication for use with Plus Cordless Remote Indicator, 30-418-1-1 and Icon Cordless Remote Indicator, 30-421-1.
 20-1978-1	Wheel-Off Adaptor	Wheel-Off adaptor may be used to make adjustments to camber and caster with wheel removed. Magnetic version also 20-1979-1
 20-2389-1	Storage Tray for Bar Code Reader	Bar Code Reader must be purchased from outside vendor. Recommended scanner is the Symbol LS4278
The following accessories are available for older wheel adaptor configurations		
 20-1222-1	 Pin 135-302-1 BMW 100mm Pins One kit required per adaptor.	Use with older BMW special adaptors (175-214-1) for some specialty wheels with deeper offsets. The current BMW special adaptor performs well without the 100mm pins
 175-214-1	(Older design) BMW Special Adaptor with 100mm pins	Available to replace broken or damaged BMW Special adaptors purchased prior to the availability of BMW Special Adaptor 175-348-1 (April 2004)
 20-1789-1	External tire clamp adaptor	Compatible only DSP600 and HS4X1 self-centering adaptors 175-321-1 or 175-325-1.
 20-1792-1	Extensions for self-centering 175-321-1 or 175-325-1 adaptor	Compatible only with DSP600 self-centering adaptors 175-321-1 or 175-325-1. (set of sixteen, covers 4 wheel adaptors)

Glossary

"Adjustment" Tolerance	An alignment specification intended for use when a BMW vehicle has one or more alignment angles that are not with the "Measurement" specification
Alignment	The process of measuring and positioning all wheels attached to a common chassis
Angle	Two intersecting lines
Camber:	The inward or outward tilt of the top of the wheel as viewed from the front
Camber roll:	The change in front camber in a turn due to caster
Caster:	The forward or rearward tilt of the steering axis as viewed from the side
Degree:	A unit of measurement used to describe an angle.
Directional stability:	The tendency for a vehicle to maintain a directed path.
Dog tracking:	The appearance given when the thrustline is not parallel with the centerline of the vehicle.
Drift (lead):	The tendency of a vehicle to steer away from a directed course. Less severe than a pull, constant pressure at the steering wheel is not needed to maintain straight ahead.
Geometric centerline:	A line drawn through the midpoint of both front wheels and both rear wheels.
Included angle:	S.A.I. plus camber
Individual toe:	The angle formed by the intersection of an individual line drawn through the plane of one wheel and the centerline.
Max Steer Angle	The maximum steer angle left and right of center for both front wheels
"Measurement" Specification	An alignment specification intended to assess the wheel alignment condition of a vehicle manufactured by BMW
O.E.M.	An acronym used instead of Original Equipment Manufacturer.
Pivot point:	A component used to permit the steering knuckle to turn i.e. ball joint, strut bearing, king pin
Pull:	The tendency of a vehicle to steer away from a directed course. A constant pressure is maintained by the driver at the steering wheel to travel straight ahead.
Rack and pinion steering:	A steering system design that utilizes a pinion gear meshed with a rack gear to transmit steering forces to the spindle.

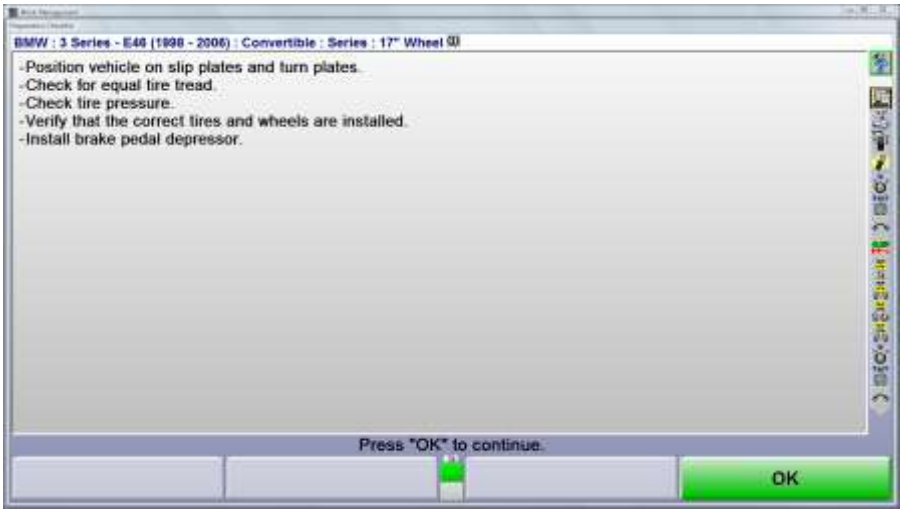
Returnability:	The tendency of the front wheels to return to the straight ahead position from a steered position.
Road isolation	The ability of the vehicle to absorb or dissipate road vibrations.
Sensor compensation	A process which measures lateral and axial runout to determine the location of the center of the hub/axle
Setback	The angle formed by the geometric centerline and a line drawn perpendicular to the front axle.
Softkey	A graphic menu icon used to operate WinAlign® software 
Steering Angle Sensor	An electro-mechanical device designed to measure steering wheel angle and rate of turn
Steering axis	A line drawn between the upper and lower pivot points of the spindle.
Steering arm	A steering component that connects the outer tie rod to the spindle. The angle of the steering arm to the wheel's axis determines turning angle.
Steering Axis Inclination	An angle formed by a line drawn through the upper and lower pivot points of the steering knuckle and a vertical
S.A.I.	An angle formed by a line drawn through the upper and lower pivot points of the steering knuckle and a vertical line drawn through the lower pivot point, as viewed from the front.
Slip plates	A free floating surface designed to allow a rear suspension to relax
Suspension:	An assembly used to support weight, dampen shock, and maintain tire contact and proper wheel to chassis position.
Thrust angle:	The angle formed between thrustline and geometric centerline.
Thrust line:	The bisector of rear toe, also described as a line drawn in the direction the rear wheels are pointed.
Total toe (angular):	The angle formed by the intersection of lines drawn through both wheels of a given axle.
Total toe (linear):	The difference in measurements taken across the front of the tires versus a measurement taken across the rear of the same tires.
Tracking:	The interrelated paths taken by the front and rear wheels.
Turn plate	A free floating surface designed to allow front wheels to remain free of binding during a wheel alignment
Turning angle:	The angle of a wheel during a turn when the opposing front wheel is steered to a specific reference angle
Wander:	The tendency of a vehicle to drift to either side of a directed course.
WinToe®	A procedure used to adjust front toe patented by Hunter Engineering Co.

Appendix A:

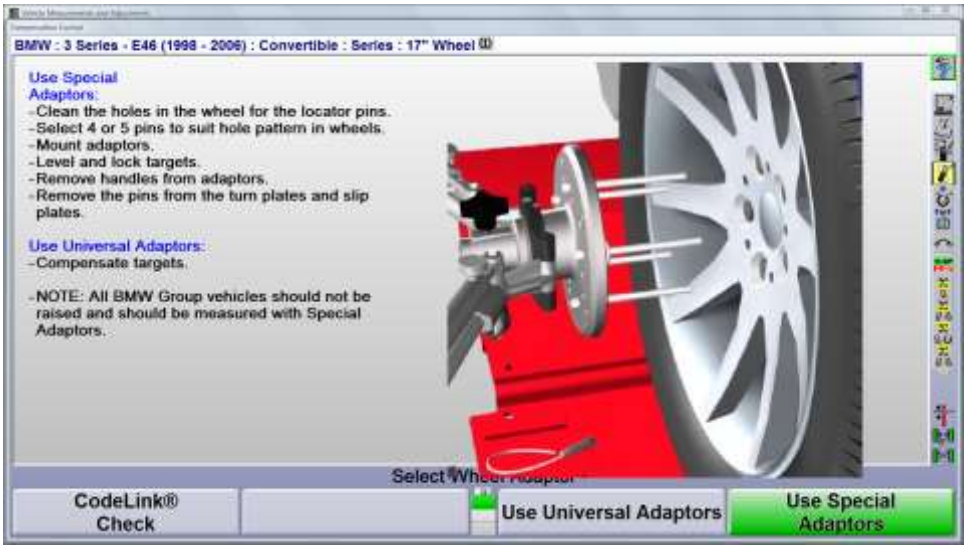
5.1 Universal Adaptors

Sensor Operation

Place the vehicle in position for compensation by following the instructions.



The operator must choose a wheel adaptor type before proceeding with the alignment.



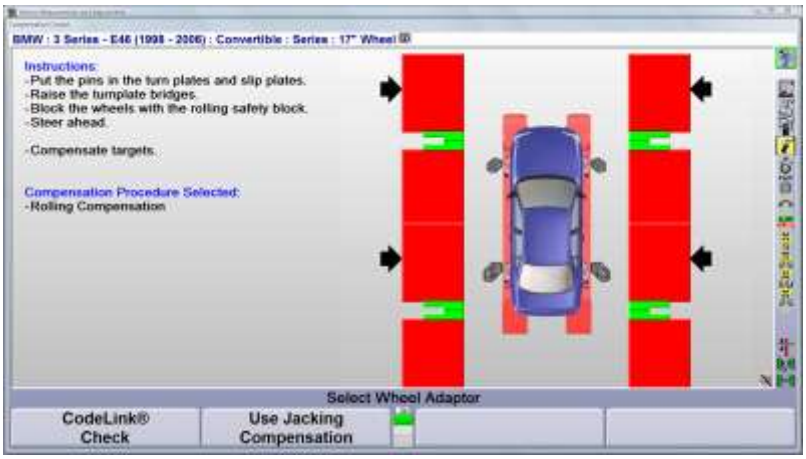
Universal Adaptors

If the universal adaptor is selected, then instructions pertaining to this adaptor are provided. The compensation option is displayed along with the vehicle plan view showing the status of the sensors.

Run-out compensation must be performed when using universal adaptors. Press “Continue” to proceed with the measurement process.

The lift rack should be level on the leveling legs or locks during the compensation process. The lock pins must be in place on the turnplates and rear slip plates.

Place the vehicle's transmission in neutral with the engine off.



Roll the vehicle rearward using the left rear tire until the bar graphs are green and the arrows are well within the green area of the bar graph. Hold the vehicle until the bar graphs change.

Roll the vehicle forward until the bar graphs are green and the front tires are centered on the front turnplates. Chock the rear wheels.

Install the brake pedal depressor.

Remove the pins from the front turnplate and rear slip plates.

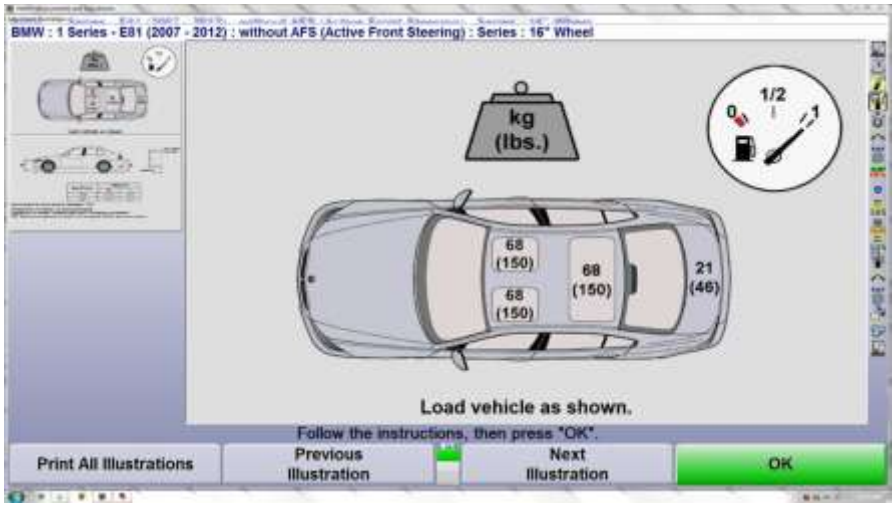
The vehicle's transmission may be placed in Park at this time.

Do not disturb the level condition of the sensors. The sensors will remain locked the remainder of the alignment process or until unlock instructions are displayed

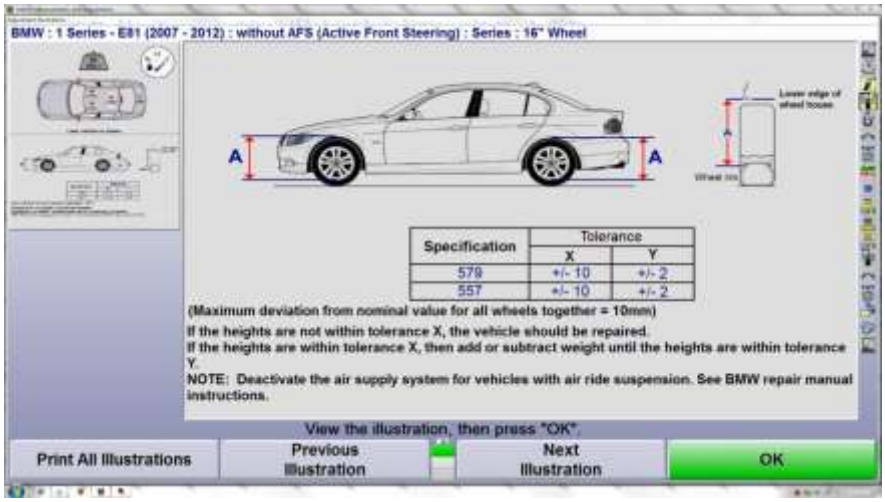
5.2 Construction Mode

The Construction Mode is a method of setting Ride Height to an EXACT factory specification. This method is primarily used when a vehicle has had major service that will affect its alignment and or ride height. The Construction Mode uses a two tiered tolerance threshold for ride height. The first tier has a specification tolerance of +/- 10mm and once that tolerance has been met, weight must be added or removed until the measured ride height is within +/- 2mm tolerance. Some sport tuned suspensions will require a second tier tolerance of +/-1mm.

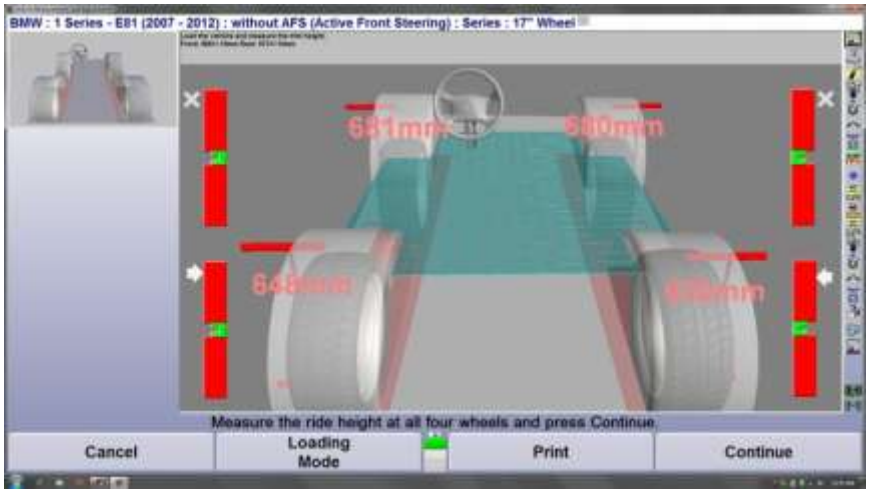
Once the Construction Mode is selected two informational screens are presented. The first screen is the Loading screen. This screen provides a guide for adding weight to the correct areas of the vehicle. Once the "OK" tab is clicked you advance to the Specifications screen.



This screen provides the desired ride height specification for both axels. A table also provides an "X" and a "Y" tolerance. Once the "x" tolerance is achieved it will be necessary to continue adding and removing weight until the "Y" tolerance is met. The "X" tolerance is a fixed value with a +/- 10mm range. The "Y" tolerance is +/- 2mm



Once the vehicle has had weight added or removed as needed, the Ride Height entry screen will appear again. The specifications and tolerances to be me are listed at the top of the screen.



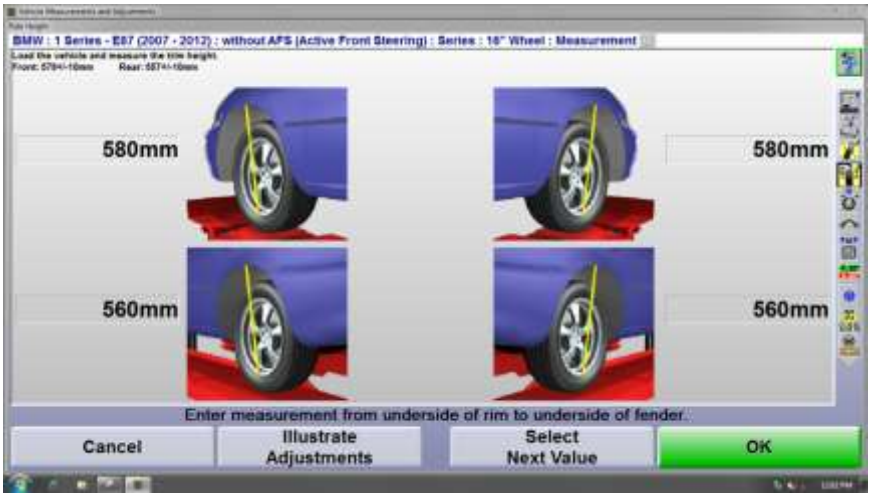
Ride height measurements that are obtained by using live ride height targets will continuously be measured and displayed as changes in ride height occur. Ride height dependent BMW vehicle specification data will be recalled and will change as the ride height measurement changes.

5.3 Manually Entered Ride Height

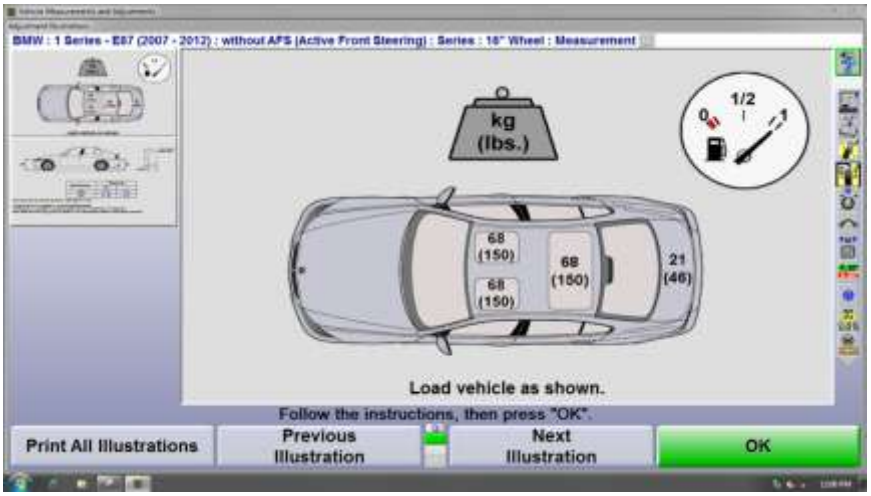
Ride height measurements can also be entered manually. Ride height measurements that are measured and entered manually will be used to recall ride height dependent BMW vehicle specification data but specification data will not change if ride height changes occur.

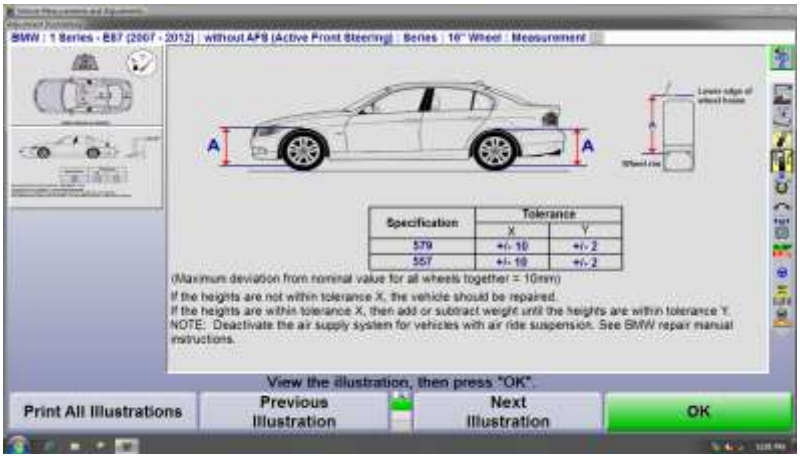
Values may be manually entered via the keyboard or electronically entered using Hunter's Electronic ride height tool.

Enter the ride height values and press K4 "OK" to continue the alignment process.

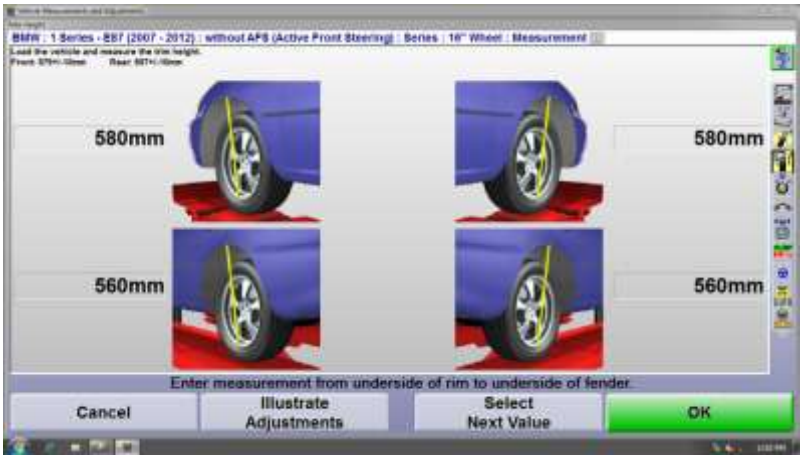


The next screen is the loading diagram screen.

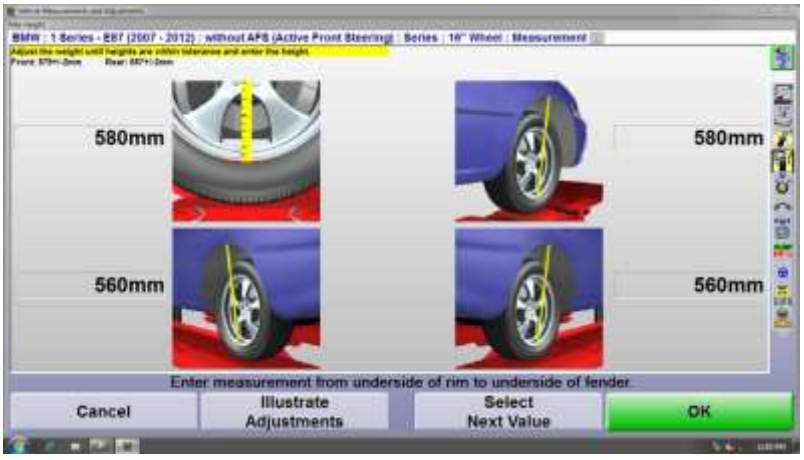




Add weight to the vehicle as illustrated and enter measured ride height.



If the ride height is within the limits of Tolerance "X", Add or remove weight to get within the Tolerance "Y" value.



If the ride height is not with the limits of Tolerance "X", repair the vehicle.

Press K4 "OK" to continue