

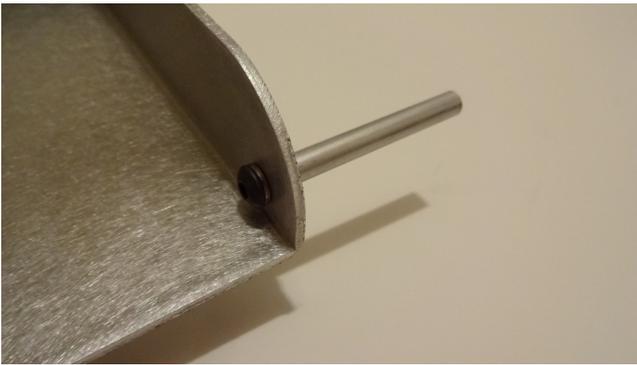
# Tenhulzen Automotive 2-Wheel Alignment System Assembly Instructions

**Included hardware:** 10 plastic ends, 1 button head bolt, 2 flat washers, 1 lock washer, 1 threaded backing plate, 4 short threaded shafts, 1 long shaft, and 1 long shaft with a stud.

## Camber Gauge Assembly

### Step 1: Bolt on the lower contact point.

Using the lock washer, bolt the plain shaft to to the hole in the toe plate with the integrated camber gauge, placing one of the flat washers between the shaft and the frame. Now included is a philips head bolt so the bolt can be tightened with a screw driver.



### Step 2: Bolt on the upper contact point.

One washer sits between the chassis of the gauge and the threaded shaft. The small backing plate threads on the backside . To adjust the position of the contact point only the threaded shaft needs to be turned, the chassis of the gauge will prevent the backing plate from turning.



### Step 3: Screw on the plastic ends.

Thread 2 of the included plastic ends into the ends of the threaded shafts.

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## **Stand-offs Assembly**

### **Step 1: Thread the black thumb screws**

Thread 1 of the black thumb screws into the each of the short stand-offs



### **Step 2: Assemble as desired**

The stand-offs are attached on the outside of the toe plate for storage (so everything will clip together), and on the inside for measurement (so that they extend to contact the wheel). Use the 4 remaining thumb screws to attach them to the plates as desired.



### **Step 4: Attach the degree conversion chart**

Peel off the adhesive backing on the velcro and stick the degree conversion onto the plate with the integrated camber gauge

## **BONUS!**

Now included are 4 rubber grippers and a tube of superglue. These rubber pieces can give the toe plates more grip on smoothed concrete or epoxy coated floors.

Glue one on each side of the bottom edge of the plates



Assembly should now be complete.

If you have any questions or issues, please contact us at [info@TenhulzenAutomotive.com](mailto:info@TenhulzenAutomotive.com)

# Caster Instructions - Tenhulzen Automotive 2-Wheel System

There are two methods that can be used to measure caster. The first method measures the actual caster value. The second method does not find the actual caster value but provides a side-to-side comparison. This is useful for example, to quickly investigate if caster is to blame for a vehicle pulling to one side (if caster is not equal the vehicle will pull to one side, but there are also other reasons for why a vehicle may be pulling).

## Method 1: True Value Caster Measurement

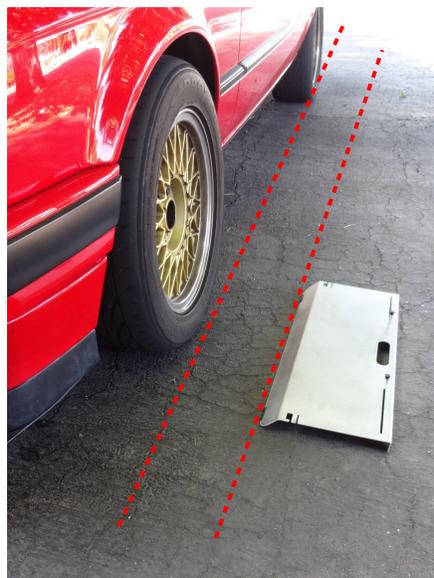
### Step 1: Create Reference Line



Center the steering wheel. Lay the plain toe plate (plate without the integrated camber gauge) down on the ground approximately 8" from the tire. The bottom of the plate should be pointing toward the vehicle.

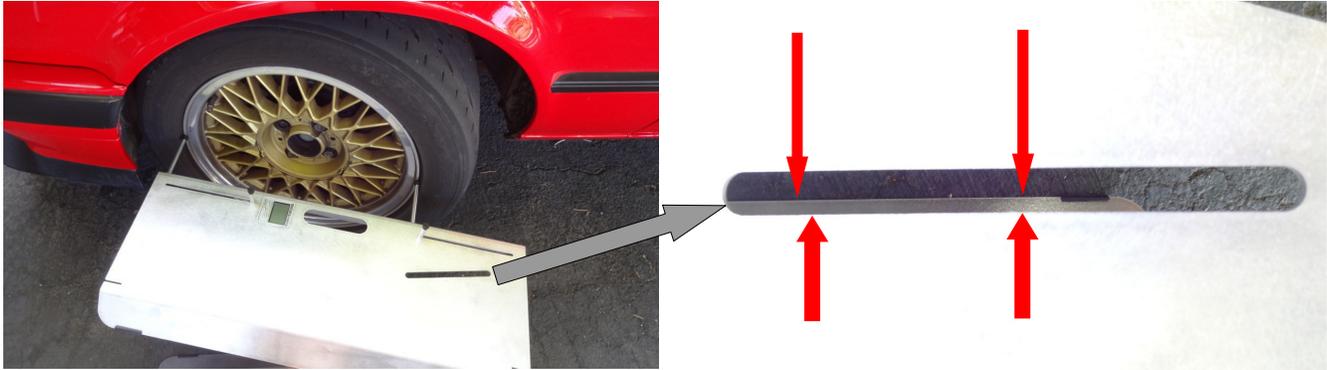
### Step 1b: Align the angle of the reference plate

Visually align the edge of the plate so it's approximately parallel to the side of the vehicle, as indicated by the red line. This can be approximated as the precision of this will not affect the accuracy of the caster measurement.



### **Step 2: Turn the wheel being measured inwards**

Turn the steering wheel so the front of the wheel being measured is pointing inwards. Hold the camber plate sideways to the wheel, with the caster sight hole toward the rear of the vehicle. Use the caster hole to check the angle of the wheel. Adjust the angle of the wheel as needed until the edge of the caster sight is parallel to the reference plate.



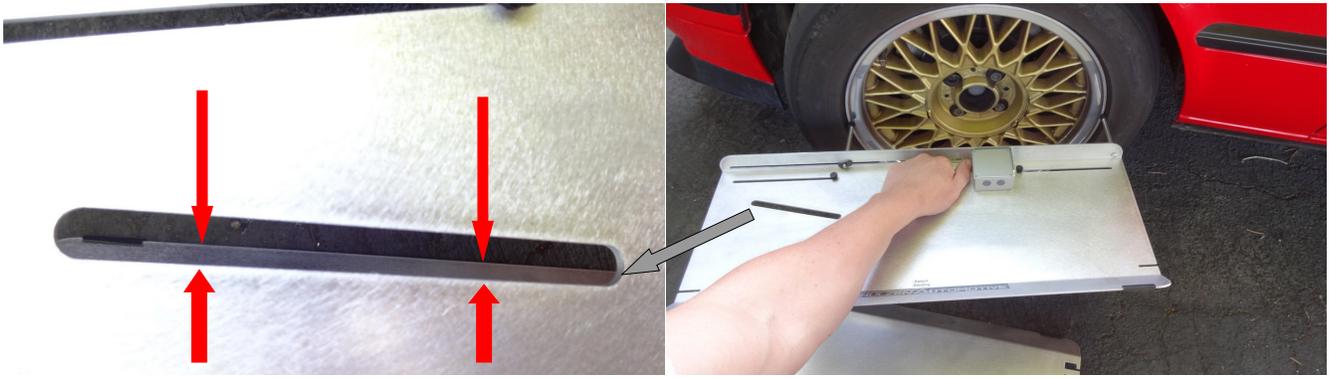
### **Step 3: Zero the digital readout**

When the angle has been set, hold the camber plate to the wheel in the camber measuring orientation, then power on the digital readout and zero it. Do not turn off the digital readout.



### **Step 4: Turn the wheel outwards**

Turn the steering wheel so the front of the wheel being measured is pointing outwards. Hold the camber plate to the wheel, with the caster sight hole toward the front of the vehicle. Use the caster sight to check the angle of the wheel. Adjust the angle of the wheel as needed until the edge of the caster sight is parallel to the reference plate.



### **Step 5: Calculate Caster**

Place the camber plate on the wheel as you would to measure camber, and note the value. To calculate caster multiply the camber value displayed by 2. The result is the caster measurement.

Below the digital readout is displaying 4.25, so the caster is  $4.25 * 2 = 8.5$  degrees



Repeat the process on the other front wheel as desired.

## **Method 2: Caster Comparison**

### **Step 1:**

Turn the steering wheel 1 turn from center. Place the camber gauge on the wheel as you would to measure camber and zero the digital readout.

### **Step 2:**

Turn the steering wheel 1 turn from center the opposite direction. Place the the camber gauge on the wheel and note the value displayed on the digital readout. Repeat on the other front wheel.

### **Step 3:**

Compare the two measurements. Again this is not the real caster reading itself, but quick and easy way to compare the side to side caster values. The two values should be approximately equal.

If you have any questions or issues, please contact us at [info@TenhulzenAutomotive.com](mailto:info@TenhulzenAutomotive.com)

# Tenhulzen Automotive Camber Measurement Instructions

## Calibration

The digital readout auto-levels when it is powered on. If the working surface is not level the readout can be calibrated.

**IMPORTANT!!!:** The digital readout must always face the same direction it was facing when calibrated. If the readout is forward (toward the front of the car) when it is calibrated the readout should be facing forward when camber is measured on both sides of the vehicle. This will keep the calibration.

## Step 1: Calibration (if necessary)

Adjust the sliding contact point to the end of the gauge, and orient it so the two contact points are sitting on the ground (as shown below). Rotate the digital readout so it is upright, power it on, and press the zero button on the gauge to calibrate.

If the surface is very wavy or bumpy the calibration may still not be perfect. In this case a long, straight piece of metal or similar can be laid down and used to calibrate the digital readout.



**Tip:** If it is desired to simply add a certain amount of camber, the gauge can also be calibrated on the wheel itself. For example if you are out at the track and decide you want to add 1 degree more negative camber, the gauge can be placed on the wheel and zeroed. Now camber can be adjusted until the gauge reads 1 degrees negative camber.

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## Step 2: Measure Camber

Adjust the upper contact point so that both contact points touch the wheel rim. The camber value will instantly be displayed on the digital readout. Remember that the readout must always face the same direction it was facing when calibrated (meaning it will have to be turned around when measuring the other side of the vehicle).

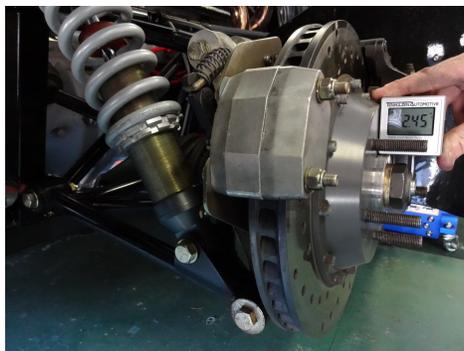


**NOTE:** The digital readout is very sensitive, so sensitive that you may make yourself crazy trying to adjust to the exact desired value. Alignment specs given by manufactures typically have a camber error range of plus/minus 0.5 degrees, meaning if the camber is within 0.5 degrees of the desired value the car is considered to be within spec. Keep this in mind while adjusting camber, if camber is a couple tenths off the exact desired value, there will be no perceivable difference in handling or tire wear.

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**Tip:** If the suspension the vehicle must be disassembled to adjust camber (threaded ball-joints, rod ends, etc.), it is possible to speed up the process using the digital readout on the wheel hub or brake disk..

First measure the camber as normal, and determine how much you want to add or subtract. Then after jacking up the vehicle use the digital readout on the hub. This will NOT provide an accurate camber measurement because the suspension is unloaded, but it can provide an accurate camber CHANGE measurement. Meaning if you change the angle of the hub by one degree, the camber should also change by about 1 degree. This will eliminate having to repeatedly disassemble/reassemble the suspension to guess and check. Do not zero the digital readout on the hub unless you want to loose your calibration.



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## Toe Measurement Instructions - 2-Wheel Alignment System

- The rim stand-offs work on nearly all stock cars and SUV's, however it is possible that the sidewall on some trucks and SUV's may be too tall for the stand-offs to properly contact the wheel rim. In this case either the stand-offs can be removed and the plates can be used as standard toe plates (placed flat against the tire), or a 2x4, 4x4, or similar can be placed under the plates to raise them up higher.
- If the tire bulges too much for the standoffs to contact the wheel rim, contact us for longer standoffs.

### Step 1: Adjust Plate

Center the vehicle's steering wheel. If the vehicle is equipped with hub caps they should be removed. Place plate with in integrated camber gauge close to the wheel of the axle being measured, so that when the stand-offs are resting against the rim, the plate will be sitting vertical or tilted slightly inwards. Use the notch cut into the top edge of the plate to center the plate in relation to the wheel.

Use the thumb screws to adjust the stand-offs to contact the rim of the wheel. When tightening it is not necessary to use two hands, simply apply some pressure to the plate while the stand-off is against the rim and the friction will allow the thumb screw to be tightened.



### Step 2: Extend tape measures

Run the tape measures underneath the car as shown, 80 inches should be enough



### **Step 3: Adjust stand-offs**

Use the same procedure as shown in step 1 to fit the other toe plate on the opposite side of the vehicle, and place the ends of the tape measures into the tape holder slots.



### **Step 4: Measure Toe**

**Check that the stand-offs on both plates are properly seated against the rim of the wheels.**

Unlock the tape measures and slide them into the straight slots. When taking measurements, pull on both tape measures slightly to tension them.



The rear tape measurement (side towards the rear of the vehicle) minus the front tape measurement (side closest to the front of the vehicle) is the total toe of the axle. A larger measurement on the front side indicates toe out, and a larger measurement on the rear side indicates toe in.

For example, if the front measurement is 66" and the rear measurement is 66 3/32" the axle has a total toe in of 3/32" .

**Note:** When using alignment specs, note that the toe plates measure the TOTAL toe, not the toe of each wheel. Thus if your specs are given for each wheel you will need to add those values together. For example, if the toe in of each wheel is suppose to be 0.15 degrees, then the total toe should be  $0.15+0.15= 0.3$  degrees. The optional alignment specs CD gives total toe so these specs do not need modification, however you should use the degree specifications, NOT the inch specifications.

**Tip:** if the toe is correct but the steering wheel is crooked, turn the tire rod on one side in, and the tie rod on the other side out an equal number of turns. This will keep the toe measurement but adjust the position of the steering wheel. Make sure to adjust it the right direction!

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