Owner's Manual

Welcome!

Thank you for purchasing our SmartStrings alignment kit. You are now the owner of what we believe to be the best and most universal way to quickly perform four-wheel alignments on virtually any vehicle anywhere.

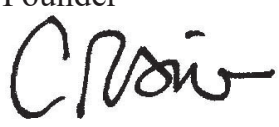
Why SmartStrings? The number one design premise was to allow all four wheels to be aligned with one accurate, portable and affordable tool. Some of the fastest cars in the world - including Indy Cars, Prototypes and NASCARs are aligned with strings.

As with our SmartCamber gauge, SmartStrings were designed to be used on as wide a variety of cars as possible; its telescoping design in all three planes assures that. The attaching "hook leg" features have also been carefully thought out to be as versatile as possible.

Unlike nearly all other toe measuring gauges on the market today, our SmartStrings allow you to simultaneously align and “square” the car, that is, insuring that the rear axle is running true and parallel to the front axle. Also, since our strings attach to the car, they move with the car so when adjustments are made, the vehicle can be rolled to settle the suspension without the worry or bother of the gauge having to be re-calibrated. Since you can adjust all four wheels relative to one another, you can set the car up however you like, or however track conditions require. Properly installed, the parallel strings form a perfect parallelogram around the car’s own centerline.

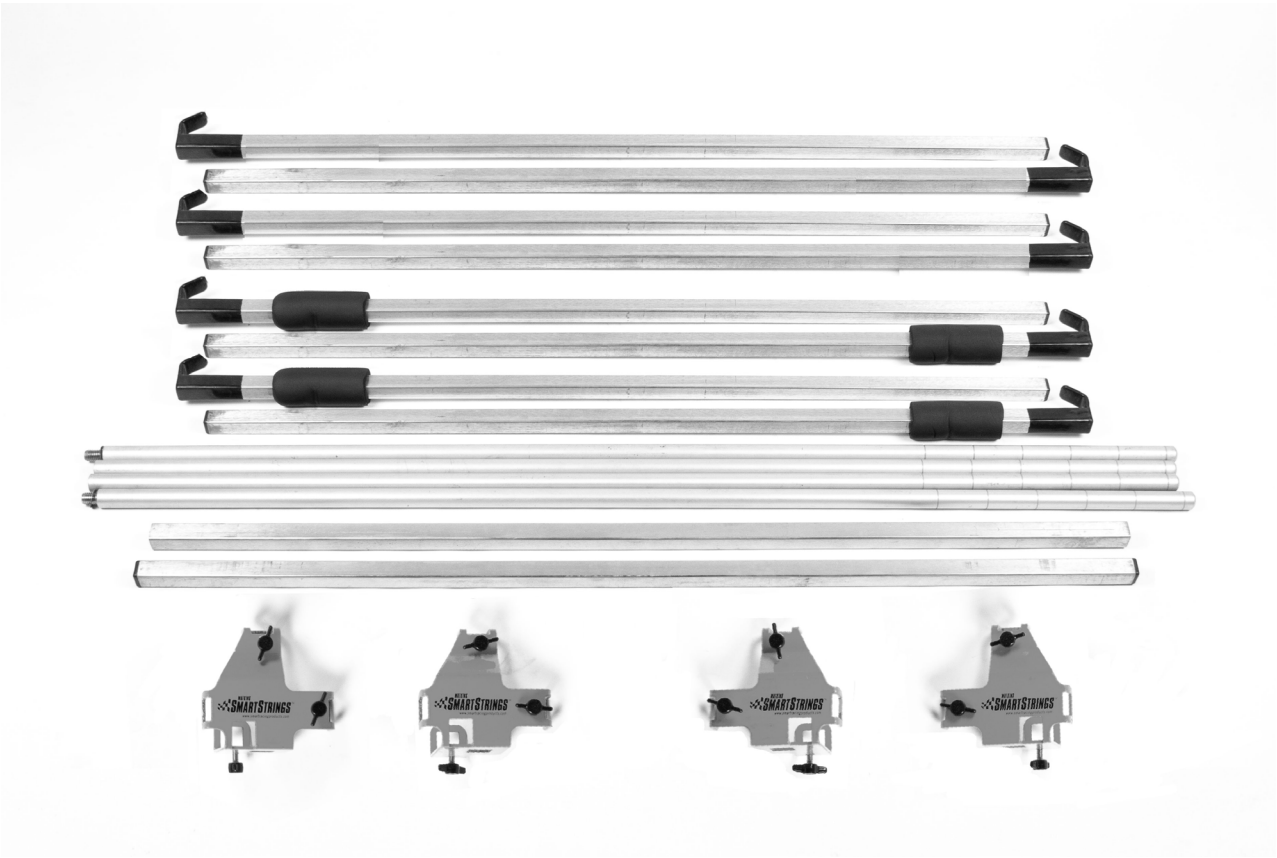
When combined with our SmartCamber camber/caster tool, you can perform a full four-wheel alignment and know for yourself that the numbers are correct and to your individual needs. If you have any questions or concerns at any time, please do not hesitate to contact us by any of the means listed on the back cover. The team here at Smart Racing Products are all here to help you in any way we can.

Thank you,
Craig Watkins
Founder

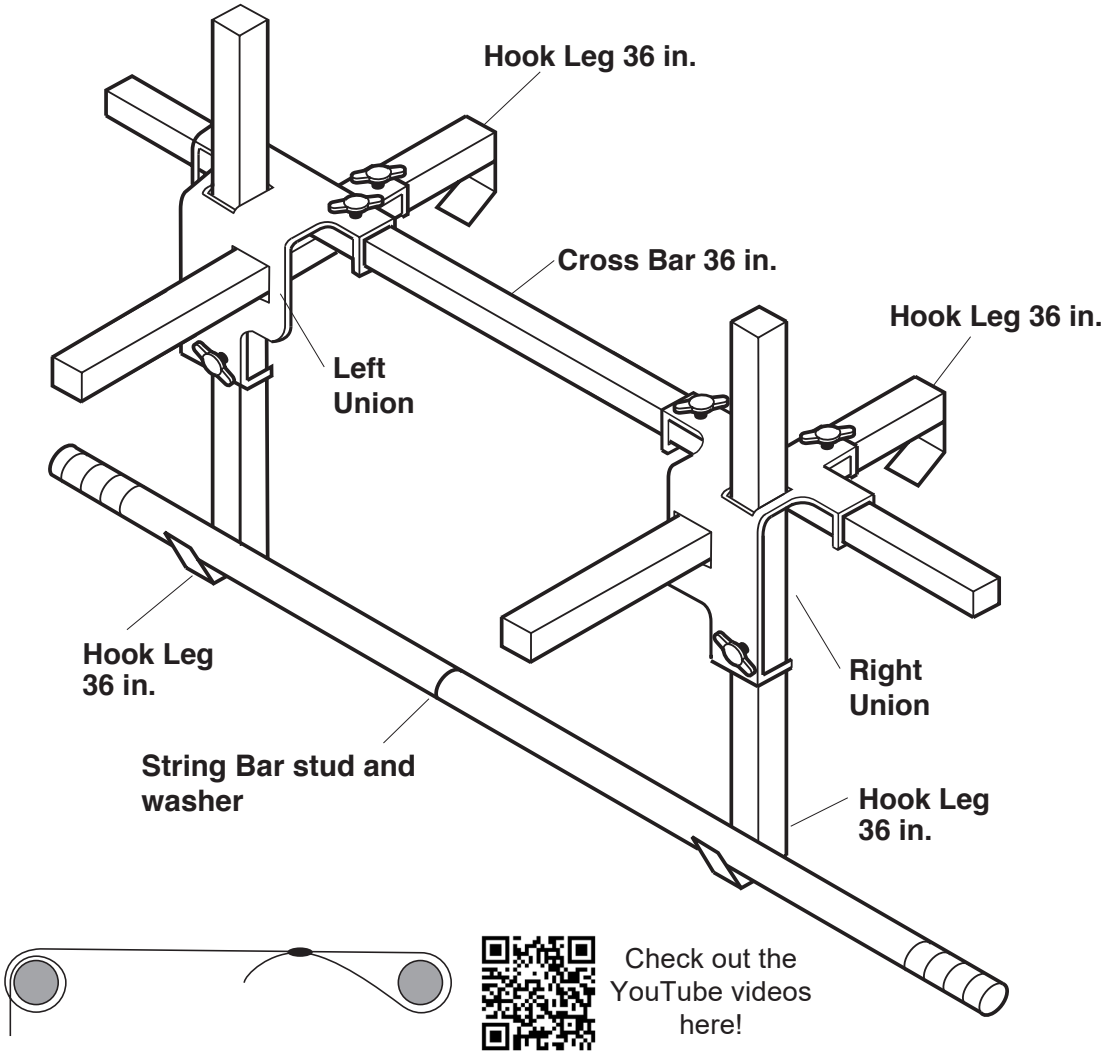


John Slater
Owner

SmartStrings
Parts List



PART NAME	QUANTITY
Union Right Side	2
Union Left Side	2
Hook Leg 36”	8
Cross Bar	2
String Bar	4
Hook Leg Pad	4
Stud	2
Washer	2
String Line	1



Check out the YouTube videos here!

Assemble the tool:

1. Slide the yellow unions onto the cross bars. The design of these unions allows for them to be positioned any way that help fit your vehicle.
2. Slide the hook legs into the unions as shown. The thumb screws only need to be tightened using your fingers. Over tightening will damage the tubes.
3. Hang the front and rear assemblies on the vehicle. Get them as square as possible, and the hooks of the vertical legs positioned close to the height of the center of the wheels. This can take time, patients pays dividends.
4. Assemble the string bars, the red washer helps them from being over tightened.
5. Place the string bars into the legs. use the split in the center of the bar to align with the center of the vehicle to get you close.
6. Using the provided Dacron line place the pre-tied loop around the front bar. Use the machined groove that gets you apprx. 2"-4" off the edge of the wheel. It is critical that the same groove be used front and rear, remember we are creating a perfect parallelogram around the car.
7. The other end of the string will be held in place by cinching the string in the groove of the bar with tension from the taught string. Pull the string between the bars taught. Take up the slack around the bar with the loose end and release the top string. The string will now be held tight.

SmartString set-up tips :

1. When attaching the frames to the vehicle, try to keep the hook legs that hold the string bar as vertical as possible.
2. Make sure to place the string in the same groove position on all four corners of the string bars so the strings will be roughly 2" to 4" away from the wheel/tire.
3. Adjust the hook legs to set the string heights to be even with the axle centers.
4. Center the steering – very important! Double check the number of rotations it takes to turn from full left to full right, then go back half way. You may need to reset the steering wheel to a straight-ahead position. Do not guess this, if you do, then all sorts of things can be thrown off, for example, bump and roll steer
   (even if you don't know what they are, you don't want to unintentionally create problems). Also, excessive play in the steering system (loose or worn tie rod ends, etc) will affect getting repeatable results.
5. Set in following sequence:
   1. Ride height
   2. Caster
   3. Camber
   4. Toe
6. It is important to take the measurements on as large a diameter as you can. (See Figure 3 on page 10) for the variations in toe angles taken at different diameters.

Calibration:

1. Lock the steering wheel or rack and pinion to the center-steer position. Use a ratchet strap or a steering wheel lock to hold the steering wheel in the center-steer position. If the steering wheel moves while you are making adjustments, all of your work and effort will be lost and you get to do the front all over again.
2. Position the front and rear string bars so that the visual distance from the tires to the string are equal from side to side (see Figure 2).
3. Slide the front string bar so that the measured distance from the center of the wheel to the string is equal side to side (see Figure 2, A measurement).
4. Slide the rear string bar so that the measured distance from the center of the wheel to the string is equal side to side (see Figure 2, B measurement).
5. Repeat steps 3 and 4 until they are perfect. Note on a piece of paper what the final measurements are (front and rear) so if someone accidentally bumps or trips on the strings, it is easy to reset them – after you've chased "your friend" around the shop.

6. Remember that the front axle's measurement – side to side – will not be the same as the rear axle, because front and rear track widths are rarely the same. The important thing is that the front measurements (left & right) are equal and the rear measurements are equal. By doing this, you have "squared" the strings around the car. Again, see Figure 2.

Measuring:

1. Use the included 6" steel ruler. We also offer other rulers (longer and different units) if you require.
2. To determine toe on a given wheel we need two measurements per wheel. One on the leading edge and one on the trailing edge (see Figure 2). First measure the leading edge of the wheel then measure the trailing edge. Compare your measurements and determine the amount of toe you have. At first, you may get a little confused – just try to establish your own measuring style and stick to it. In other words, always measure to the inside of the string or to the outside of the string. If you are not consistent, it can get confusing and frustrating. **Toe-in:** the measurement is longer on the leading edge of the wheel than the trailing edge of the wheel.
   Toe-out: the measurement is shorter on the leading edge of the wheel than the trailing edge of the wheel.

3. Adjust the toe links/control arms as necessary until you are satisfied with your settings.

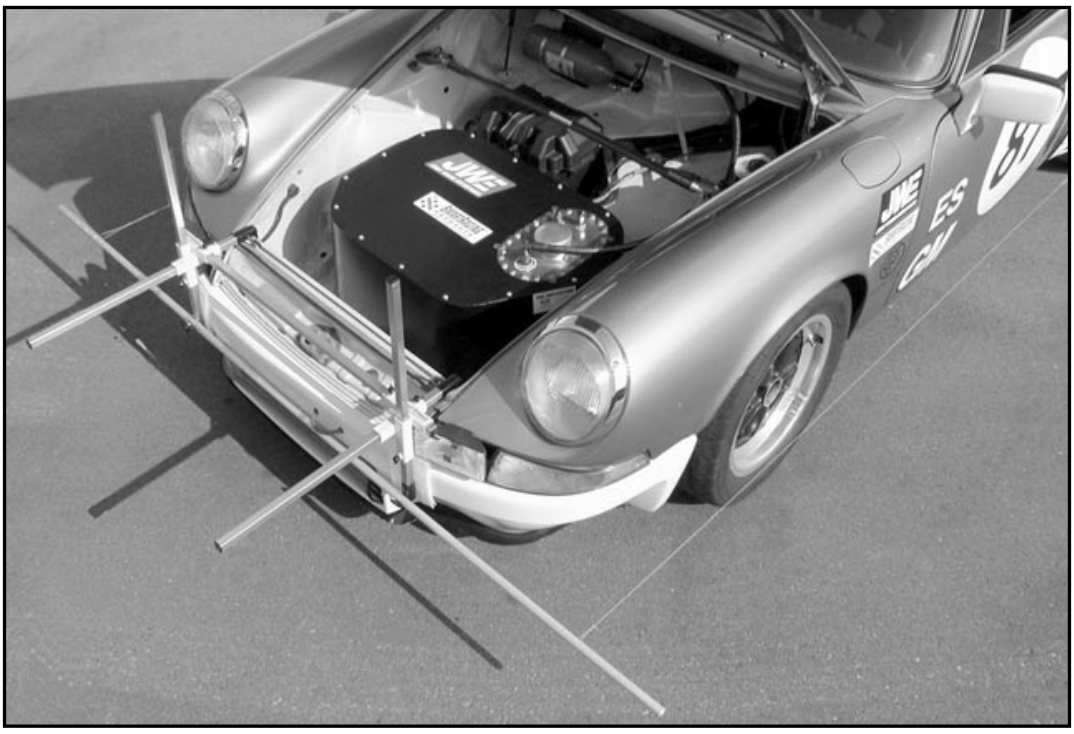
Toe Setting Factoids:

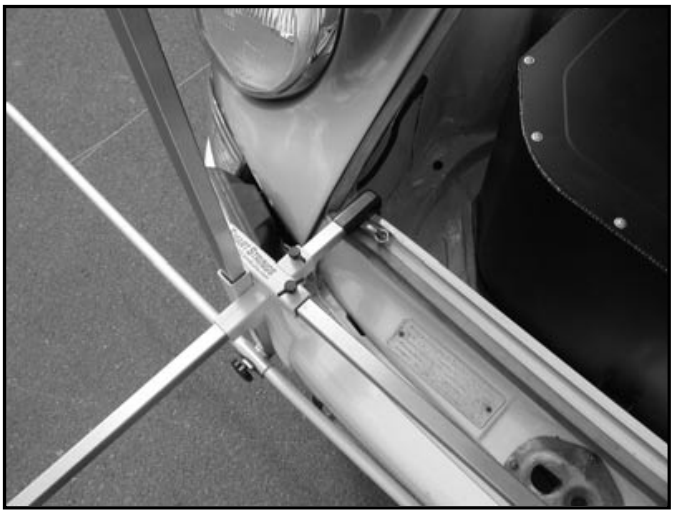
The following are included to give you additional information of the many toe specification types and how you can convert from one unit type to another. This is important to know because there are many variations and subtleties that many people are not aware of. Here are a few:

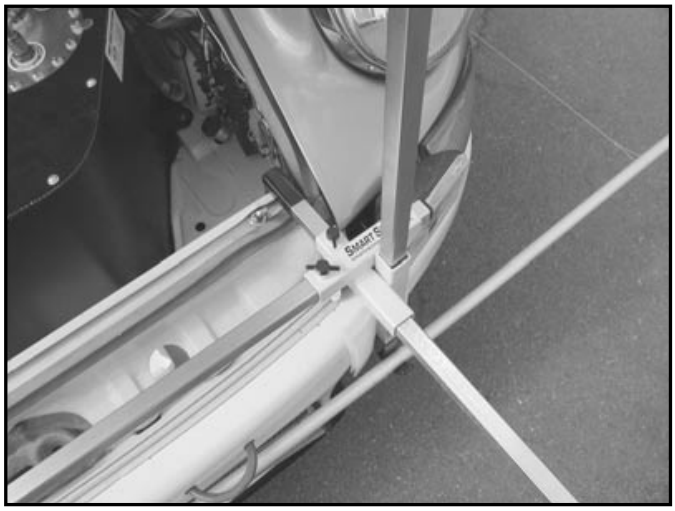
1. Set in following sequence:
   1. Ride height
   2. Caster
   3. Camber
   4. Toe
2. **Look at Figure 3**, it shows the variation in toe for different diameters - both in decimal and degrees. Note the toe angle (in degrees) does not change with diameter, but it does change with decimal settings/ fractional settings. This is why measuring from the same position each time on each wheel is crucial - and looking to see what your measuring points diameter is because you may not have the toe setting you think you do!

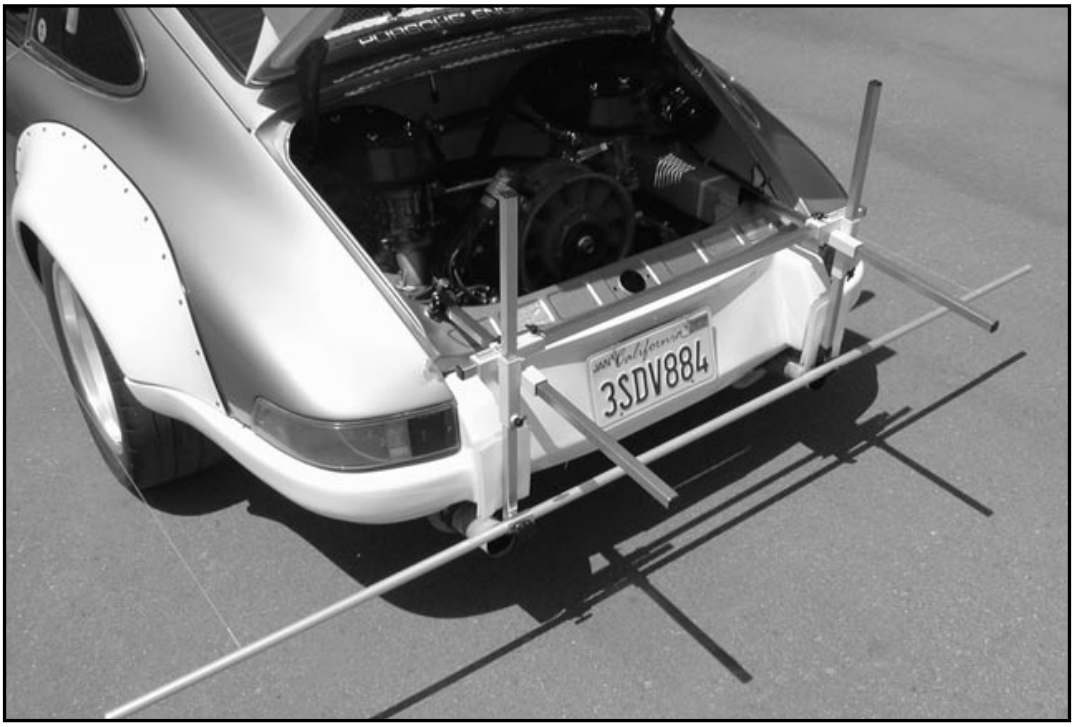
3. **Tire Diameter Changes:** Figure 4 is a simple mathematical formula converting wheel measurements to the equivalent as if measured at the outside diameter of the tire.
4. **Toe measuring assumptions and toe machine averages (old machines vs. new):** Years ago, if you had your car aligned and asked for 1/8th" of total toe-in in the front for example, they based the 1/16th" per side on an old industry tire diameter standard of 29.5". In the 1970s, that was changed to 28". In the age of computer alignment machines, they enter lots of data into the system, including tire diameters to get more accurate or true settings.
5. **Thrust angles created by toe:** Let's say that the front of the car is set to perfect zero toe, the rear is set to 1/16th" per side or 1/8th" total toe-in. If the front is perfectly centered on and the rears do not have precisely the same amount of toe-in, then the point somewhere way out in front of the car where the rear tire's centerlines theoretically intersect, would not be on the same centerline as the car itself. This deviation from the true centerline is called the thrust angle. Some race cars use this thrust angle to help them to be faster around certain corners.
6. **Measuring from the true centerline:** You can measure using your SmartStrings to measure from the true centerline of the car as opposed to the theoretical centerline, which is the way I have explained it in the procedures above. In order to measure for the true centerline, you must first find a point under the car in the front and rear that is measured to be the true centerline. Then the strings are set equal distance from that line. For 99% of the world's applications, the theoretical centerline (measuring off the center of the wheels) method works very well. However, for Indy cars and others that are extremely powerful and only make left hand turns, measuring from the true centerline is crucial because each wheel's toe angle is set individually. Also note that modern computer alignment machines also say they measure toe angles from the true centerline, but they really do not (at least the ones I have seen don't). Rather, they optically surround the car with laser beams and estimate where the centerline is based on reflection averages. It's pretty neat how they work, but if you took the time to check their accuracy, it would be off a bit. There are many variables, including operator competency, machine calibration methods, condition of the machine etc. At least you are now aware of the two and can act accordingly for your particular application.
7. Downloadable copies of these instructions are available by going to **www.smartracingproducts.com**, click on Instructions, then on SmartStrings Instructions.

Figure 1. Photos of Installation Front & Rear





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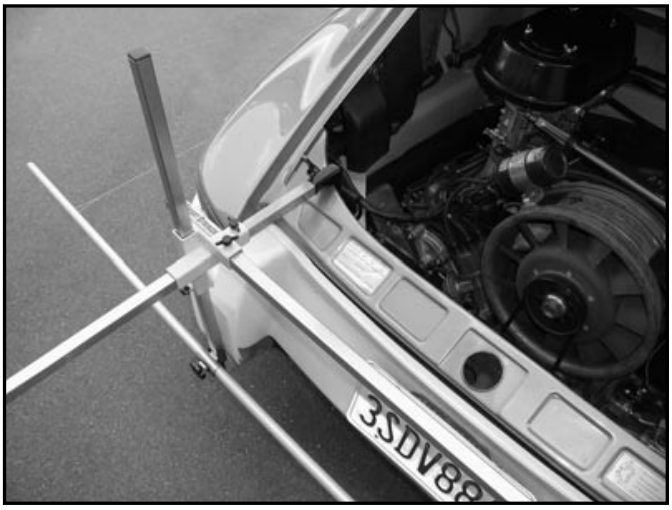

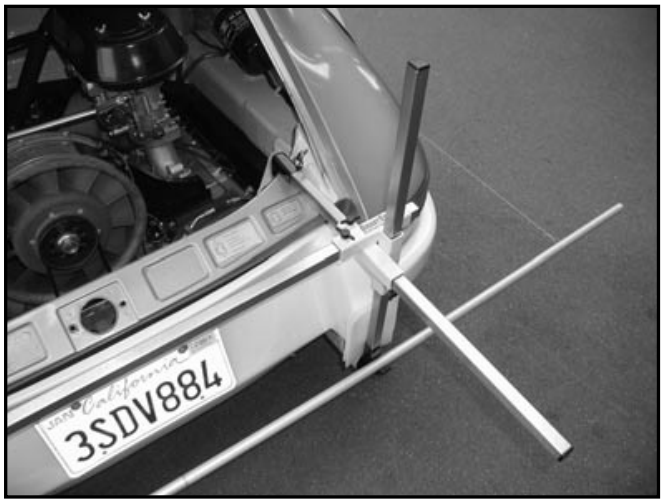
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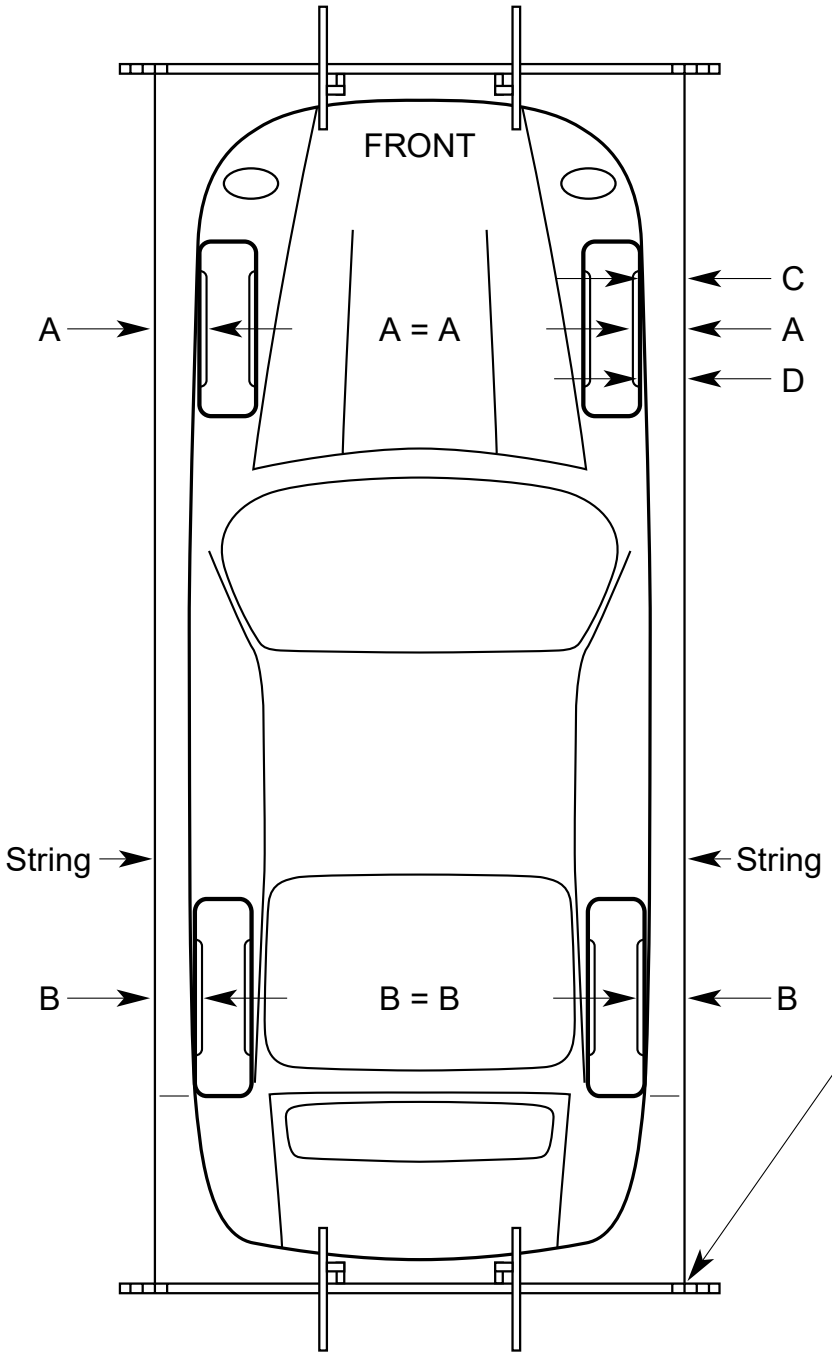
Figure 2. String Layout and Measurements



Toe-in:
The measurement is **longer** on the leading edge of the wheel than the trailing edge of the wheel.
Example:
Measurement **C** is **longer** than measurement **D.**

Toe-out:
The measurement is **shorter** on the leading edge of the wheel than the trailing edge of the wheel.
Example:
Measurement **C** is **shorter** than measurement **D.**

Note:
This is true for both the front and rear axles.

Note:
By using the same groove in the bar both front and rear, the strings are now parallel to each other. Measurement A and B will most likely not be the same.

Figure 3. Toe Settings at Various Tire Diameters Per Wheel

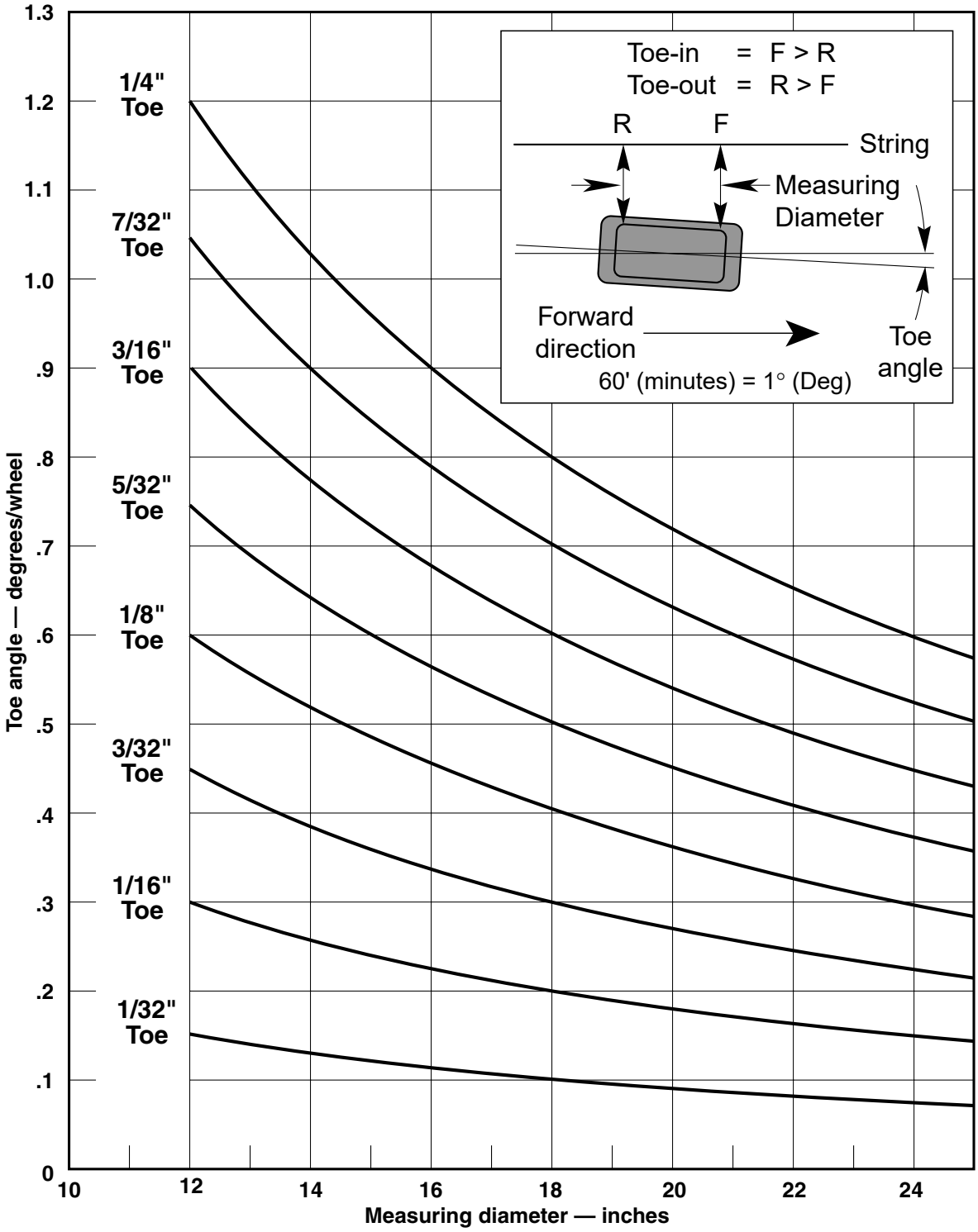


Figure 4. Mathematical Conversion

To convert a known toe setting (call it Ta) and a known tire diameter (call it Da), use this equation to convert to a different tire diameter but using the same toe. For those who hate the math, just use the graph. For those who want the exact number and not interpolate from a graph use this equation:

$$\frac{T_a}{D_a} = \frac{T_b}{D_b}$$

Where Ta = known toe setting
Da = known tire diameter

If you want the same toe angle with different tire diameters call those Tb and Db. If you do the algebra, you end up with:

$$T_b = T_a \times \frac{D_b}{D_a}$$

You can see that measuring toe accurately is not something that you can take for granted.

SMARTCAMBER™
SMARTRACINGPRODUCTS.COM

The **SmartCamber** tool was designed to maximize its measuring potential over a wide variety of wheel/tire combinations. Utilizing repeatable digital technology, the tool allows accurate measuring regardless of where the vehicle is or what angle surface it is on.

There is no misinterpretation with this tool because there are no bubbles or lines to subjectively read. The SmartCamber tool takes all of the guess work out of camber and caster measuring.

Since there are nearly an infinite number of wheel and tire combinations, it was necessary to design a tool that would be quick and easy to use.

The number one design premise was to allow camber and caster to be measured almost anywhere without removing hub caps, lug nuts or jacking the car off of the ground.

Though it is basic in concept, the results are excellent. One fixed and one adjustable standoff allows the owner to use the tool on almost any vehicle.

Check smartracingproducts.com for pricing.

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Cross Weight	Ride height	Camber	Caster	Toe	Springs	Tire Pressure

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Notes

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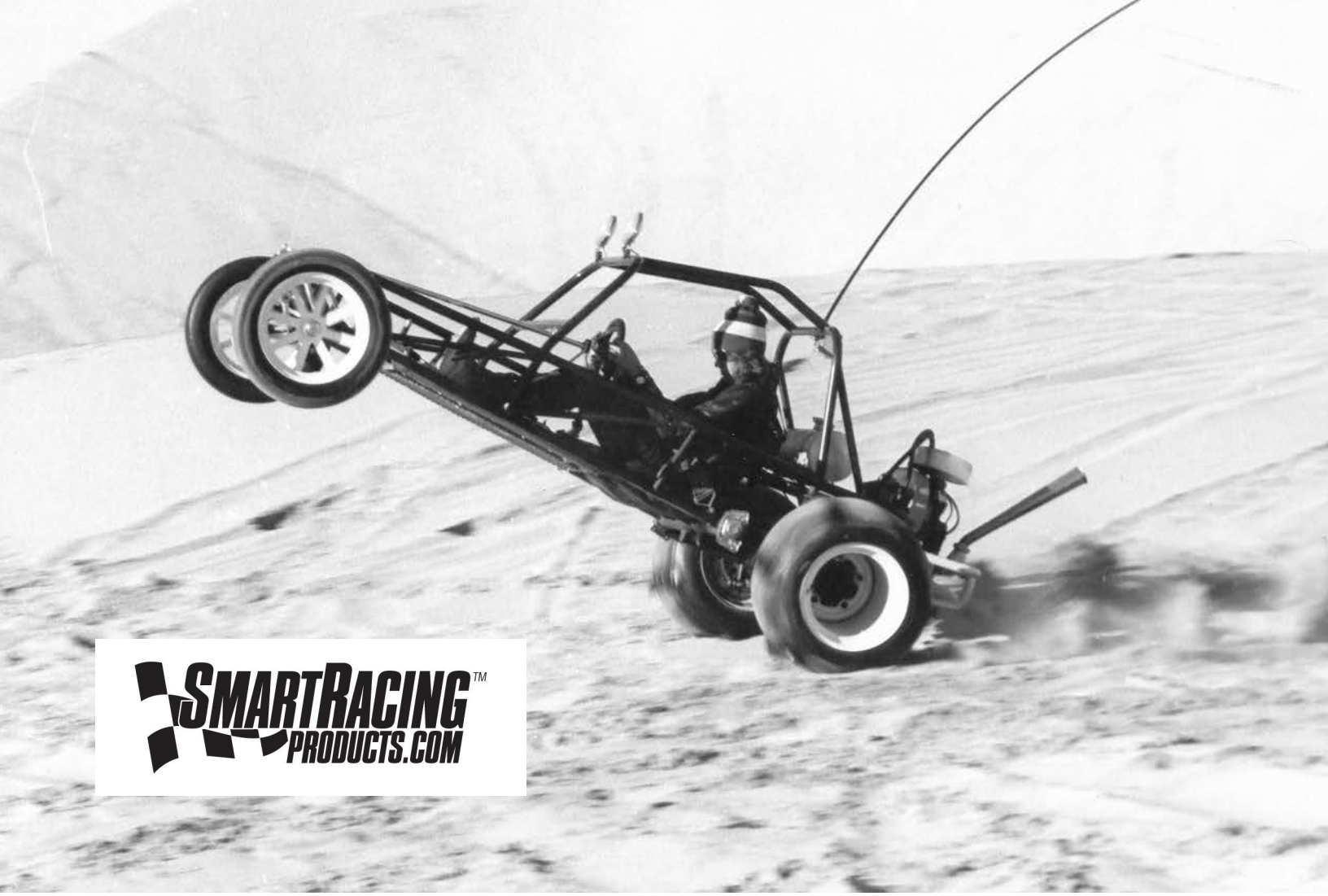

Smart Racing Products have been providing high quality tools and performance parts for over 25 years. With our roots in California and our new headquarters in Michigan, we are a true "Made in the USA" small business.

Our family based team is committed to offering useful products and a high level of customer support. Please feel free to call or email with any questions or comments.

Sales and Technical Support

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