

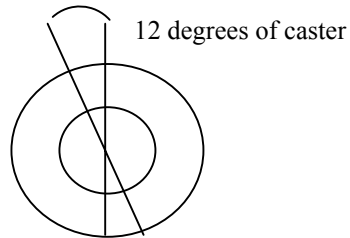
DIGITAL FRONT END ALIGNMENT

To discuss caster and camber tool we must begin with the basics to be sure that we all understand the basics of front-end geometry.

Basic term definition is the best place to begin. The three most basic terms are caster, camber and toe in or toe out. These are the elements you must learn to adjust as a competitive racer.

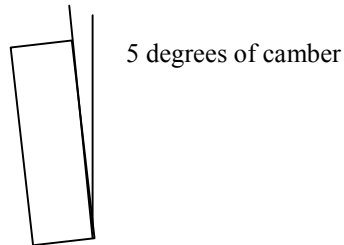
Simple drawings best explain the principles.

Caster



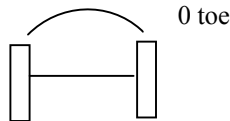
Caster is simply the angle of tilt of the of the kingpin. Tipped toward the center of the kart is positive and toward the front of the kart is negative.

Camber



Camber is the tip of the tire and wheel. Tip to the center of the kart is negative and to the outside is positive. Zero is straight up and down.

Toe



Toe is the alignment of the outside edges of the tires. If the outside front edge of the tire and the rear edge of The tire are aligned the toe is said to be static zero.

With the basis understood it is time to go to work. Begin by understanding how you use your chassis in competition. Inflate the tires to the inflation level used for racing. We now need a flat surface so that we can determine if the chassis is level. We always strive to maintain the chassis in a level position. Our technique involves a flat plate in the shop where we do all of the setups and a set of portable stands which we have had constructed to support the kart in a level manner.

It is highly recommended that you find a way to get your setup to a level base. You may spend a lot of time and not achieve the desired result if you do not get yourself to a level and repeatable base line. If you have access to a flat plate we recommend a complete set of chassis measurements. We take the chassis measurements as a precaution and then in the event that anything ever occurs we can return to the baseline measurements and determine if there is any bend or twists in the chassis.

Our alignment process involves very simple to use tools. Once we have determined that we are completely level from front to rear and side to side we can begin. Our stands being specially built make our work easy as there is only a long center support upon which the kart is balanced. The first tool we engage is an Exact Toe from RLV. This tool serves two purposes. The Exact Toe is attached to the front spindles and the left and right side is connected with a solid steel rod. With the Exact Toe in place we adjust the tie rods for the desired static toe.

Toe-out and handling:

Toe out can be used to a racers benefit if the racer is very careful in the application. The object of using a little toe out in a kart is to increase the turning force generated in the kart. With a kart understeering or pushing in the middle of a turn, some amount of toe out may be a cure.

Be cautious as applying too much toe out can have a negative impact on the front tires and may cause a further loss of grip. Excessive toe out may cause added heat to accumulate causing the tires to loose most and sometimes all of their intended grip.

Toe out can be accomplished in a host of ways. We run ackerman steering in our All Kart chassis. Many oval racers change the toe out characteristics by running the tie rod ends in different holes at the steering arms on the front spindles. The oval racers put the tie rod ends in the holes closest to the spindle on the left side and in the furthest hole from the spindle on the right side. The net impact is that when the wheel is turned to the left the wheel is toed out as left spindle is turning more than the right side. End of sidebar.

After attaching the Exact Toe and inserting the steel alignment bar then measure the distance from the end of the spindle to your rear axle. Place the end of your tape measure against the rear axle and read the measurement at the center of the front spindle. These readings should be the same if the kart is square. If there is a difference determine the cause. Some specialty chassis actually make the wheelbase shorter on the left side of the kart for oval racing. The Exact Toe is not the proper tool if this is your chassis design.

For a very fast check at the track of your camber set up raise the Exact Toe to a vertical position and place the steel alignment bar to its position. You can get a quick reading as to the amount of camber that is dialed into the kart. We always do this measurement before we leave the shop so that we can do quick checks especially of there is any contact with the wall or another kart. It only takes moments to check the toe and to verify the camber. If they are both where you left the shop the chances are very good that the balance of the front-end settings are as desired.

We like a zero static toe setup. You may set the static toe to any setting that you feel fits the needs of your chassis.

With the toe set to the desired position it is now time to turn the Exact Toe into a set of turning plates for our front-end alignment. Take a protractor, like the one you always had in your school box and never used. Position the zero at the point of rotation on the movable portion of the Exact Toe (not the segment containing the steel bar). Now on the fixed segment (the segment which is containing the steel bar) find and mark 20 degrees on each side of the zero position. Do not forget that the protractor will show you the center point as 90 degrees. To get the desired measurement you have to subtract 20 degrees on the forward motion making the reading on the protractor 70 degrees and when you turn toward the rear the setting you are targeting is 20 degrees greater than 90 degrees or 110 degrees. Repeat this on the other side of the kart, being sure that you have carefully mark the Exact Toe accurately. The Exact Toe has just become your turning plates for doing a front-end alignment. Take your time making these measurements and be sure that the measurements are accurate. We always take a square and mark the alignment points, before we tape the protractor to the Exact Toe. After we get the desired measurements we use a carbide scribe to mark the Exact Toe so that we do not have to repeat the measurements.

We do not mean to imply that there is absolutely no need for turning plates when performing a front-end alignment. We have a set of turning plates which are mechanical and we can achieve an accuracy of plus or minus one half degree. With the digital turning plates from Intercomp Model 100340 you can achieve accuracy of one tenth of one degree. There is greater accuracy with the turning plates as we have the driver in the kart and the kart at race weight so any chassis squat or flex is established while performing the alignment.

Now mount the Intercomp Digital Caster/Camber Gauge Model 100008 to the front spindle. Intercomp offers various mounting methods. We prefer the direct mount on the spindle. A kart adapter is available from Intercomp, for 5/8 inch spindles. With our chassis coming from Italy we chose to have a local machine shop make some adapters for all of the available metric spindles. Now we can do all American and all foreign chassis.

The Intercomp Digital Caster/Camber Gauge has complete directions on the face of the instrument. It details five easy steps. 1. Mount the instrument and turn on the power. (The units are battery operated and offer extremely long battery life.) 2. Level the instrument using the level that is built into the instrument, set the caster/camber switch to caster and read the caster from the digital display window. Determine your desired caster setting for your chassis.

On the ovals the challenge is to keep full tire contact at all times. You will need to factor in the banking when setting up the caster and camber. We have put in as much as eighteen degrees of camber to help the chassis turn. You will need to set the caster up for each side depending upon how the driver likes the feel of the track and how much help you are trying to dial into the chassis for the turns. On high-banked ovals where the driver wants lost of feedback through the wheel you can put in more than fifteen degrees of caster. Remember on the ovals the camber adjustments are not the same on the right and left side of the kart. You tilt the right side toward the center of the chassis and you tip the left side away from the center of the chassis. To get good handling you will use caster adjustment to assure that the kart tracks appropriately on the straights. For the road racer the set up is entirely different. We like ten to twelve degrees of caster and no less than three degrees and no more than six degrees of positive camber in sprint karts for manufacturers cup racing. For enduro racing the answer is nine to twelve degrees of caster and zero degrees to two degrees negative camber for the large road courses. You may run out of adjustability with the pills. Do not be upset. Most of the chassis companies offer spindles that offer different starting angles. Call your kart manufacturer and ask them for assistance in getting you the correct spindles to begin the alignment process.

We are often asked how do I know if the set up is correct or incorrect and the best way to tell is to look at the tires at the completion of each session and to keep excellent records concerning tire temperatures with a tire pyrometer. If the set up is good the temperatures will not vary more than 10-15 degrees across the surface of a tire. Another sure way to tell is to look for the tire to clean themselves of rubber pickup quickly and evenly. If the driver runs a few quick laps and there is still pickup showing on 1/2 or more of the tire you probable need some attention in the alignment department. End of sidebar.

With the instrument still attached move the spindle forward 20 degrees. The marks you previously made on the Exact Toe at 20 degrees should now align with the zero position on the fixed portion of the Exact Toe. Now reset the level within the instrument to the level position and move the switch to the caster position. Adjust the digital display with the adjustment knob until the display reads exactly zero. Move the instrument now back to the center position and then to the 20 degree to the rear position. This is the other indicator you made earlier on the Exact Toe. Adjust the instrument to the level position using the built in level and read the caster for this spindle.

The process continues by repeating the process on the other side of the kart. At the completion of this process we always put the kart back on the scales and observe the impact of the front-end alignment. Adjustments to caster do have an impact on the weight distribution of the kart. You can add or remove weight from the front wheels with the caster adjustments. Be sure that you have the proper weight distribution for your driver. We have found drivers finding to little or too much grip after a front-end alignment. Another step is to make sure the driver is ready to adjust the brake bias as adjusting the front end alignment often requires a brake bias adjustment to compensate for a change in front grip of the kart.

Adjustments to caster and camber are made by moving the parts known as pills at the top and bottom of the kingpin or spindle bolt. These pills are cam shaped and allow you to move the spindle bolt front and rear and left and right. These motions allow you to change caster and camber. Some kart makers offer a fixed camber and adjustable caster option in their front ends.

I was first introduced to caster adjustments on karts by Coyote Products. Coyote Products told us how to get the most out of their innovation and it made a dramatic improvement in the performance of their chassis. You can accurately adjust the caster with the Intercomp instrument and you can verify your camber settings.

Most kart shops and I believe all of the major retailers offer the caster camber pills as an aftermarket option. We have installed them in several karts and the process took about one hour. The only tool we had to purchase was a drill bit of a size specified by the manufacturer of the pills that we purchased. The rest of the work was the use of basic hand tools. Do not be afraid to attempt this upgrade. It is easy and it really pays off in improved performance and handling. You can reduce your tire bills by getting more out of your tires and get more out of the chassis by being able to use the chassis to the limits of its design. You will definitely help the driver perform in a kart that is giving more consistent performance over a longer duration each race.

The Intercomp Model 100008, Digital Caster and Camber Gauge retails for \$299.00 with the kart adapter and \$279.00 if you choose to supply your own adapters. Intercomp Turning Plates are model 102007 for the Manual Turning Plate at \$595 and model 100340 for the Digital Turning Plates at \$1095. The turning plates are delivered in pairs and you should purchase Turning Plate Rear Spacers, to level the kart using model number, Intercomp 100339, priced at \$195.

The Exact Toe from RLV retails for \$134.00 from most of the karting suppliers.

Intercomp can be reached at:

Intercomp Company, 14465 23rd Avenue North, Minneapolis, MN 55447 U.S.A.

Toll free 800-328-3336, Worldwide 763-476-2531, Fax 763-476-2613

E-mail: highperf@intercompco.com

Web site: www.intercomp-racing.com

RLV Tuned Exhaust Products

Phone 805-925-5461 Fax 805-922-3321

Coyote Products

Phone 716-352-0806 Fax 716-352-3294

Writer: Bob Chiras

©NKN