

2011 KAWASAKI ZX-10R

S-KTRC, MOTOGP-INSPIRED TRACTION CONTROL FOR THE MASSES

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The guiding physics principle behind the S-KTRC is that of the Delta, a term used to denote “rate of change” or the speed at which a variable changes over a specific period of time. Put another way, two objects may increase in velocity the same amount, but one may do it much more quickly. The velocity amount is a given quantity, but the rate at which the two objects change in speed may not be. In the case of the S-KTRC, these rates of change are observed by the ZX-10R’s host of speed sensors, which include a throttle position sensor (TPS), crank position sensor (CPS, which measures rpm), gear position sensor (which measures transmission load) and either or both of the 10R’s front- and rear-wheel speed sensors. Under acceleration, the ZX-10R’s ECU analyzes these changes at 200 times per second and then intervenes by plotting an ignition map that manages this rate of change according to what the program predicts the rider is trying to achieve on the road or the track. While Kawasaki admits that the amount of available maps in the program is finite, they number in the millions and are delivered to the engine often before the rider is even aware that the system has been activated.

In fact, at Road Atlanta, the S-KTRC’s intervention was so subtle that I hardly realized it was working. The only way of knowing for sure was by observing the S-KTRC bar graph located at the bottom of the LCD display on the ZX-10R’s instrument panel—not something you can spend a lot of time studying when the speedometer above it is flashing an indicated 150+ mph on certain sections of the track. In fact, on the few occasions that I did detect an intervention by the S-KTRC, it was more a matter of hearing rather than feeling it work. In those instances, the system did its job by alternately cutting spark energy to the inline four’s cylinders. The engine emitted a slight stutter with a frequency on the order of an angry swarm of bees, but the loss of power to the rear wheel was undetectable, at least by me.

The S-KTRC’s abilities are illustrated even more profoundly in the way it reckons powerslides and wheelies. While other systems are designed to halt wheelspin, the S-KTRC will allow the rider to power out of a turn with the rear wheel spinning as long as the system predicts that effective traction can be maintained. Using the TPS, it can discern if the rider is staying hard on the gas out of a corner despite spinning the wheel, and it will allow that spin to continue until it detects an unfavorable rate of change, such as if the rider rolls off the throttle or if the crank and/or wheel sensors begin to spin up too quickly. And since the system does not rely on a gyroscope, it can distinguish between torque lift and excessive lift, so when the front end is aloft, the program monitors the rate of change between the front and rear wheel sensors and disregards the front wheel sensor’s input until the difference in front and rear wheel speed exceeds the program’s prediction. Full wheelie protection only comes into play as the system determines that the rate of change between the rear wheel speed sensor, CPS and TPS is exceeding the predicted safety zone. Viewing the system in action, the nose of the ZX-10R comes up like any normal machine starting into a wheelie, but the system allows it to only reach a height that is consistent with the program prediction—and this height may vary. Rather than force the nose down like the BMW, the S-KTRC allows the ZX-10R to keep driving forward while the bike lofts the front end. At the maximum established lift height, either the system decides to intervene or gravity takes over. In this regard, the S-KTRC differs from the BMW DTC, which alters power to effectively force the front wheel to return to earth. The struggle between the electronics and the rider’s right wrist

ROAD ATLANTA IS a rollercoaster of a place, with more elevation changes than the Swiss Alps, and blind rises that require intense concentration and precise calculation to negotiate properly. It’s also fast, mixed with slow bus-stop style corners waiting at more than one of its steep downhill slopes. Add in the odd off-camber curve and you end up with a racetrack that isn’t for the faint of heart—even less if the plan is to attack it aboard what may be the 1000cc Superbike class’ most advanced sportbike yet, the 2011 Kawasaki Ninja ZX-10R.

But Kawasaki claims that the all-new ZX-10R’s crowning technological feature, Sport Kawasaki Traction Control (S-KTRC), is so sophisticated that it will lower your lap times by allowing you to push the bike harder, even around racetracks you’ve never seen before. To an even greater degree than the BMW S1000RR’s sensational Dynamic Traction Control, the S-KTRC rewrites the rules of how 200-hp open-class superbike power is managed.

S-KTRC Explained

BMW’s gyroscopically controlled DTC broke new ground in improving racetrack grip levels on liter-class production superbikes, but Kawasaki’s S-KTRC takes the art of managing traction a quantum leap further. Perhaps it should come as no surprise that the system was developed on Kawasaki’s ZX-RR MotoGP bike, which first debuted in 2002.

We still think the BMW system is pretty darn good, as it represents arguably the best reactive traction control system on the market. BMW’s DTC detects lean angle via its dual gyroscopes, compares it with the S1000RR’s array of speed sensors and cuts power after it detects that the motorcycle is exceeding the fixed slip rates that are programmed into the system. In other words, spin up the back tire and the DTC will save you by adjusting fuel and ignition timing to reduce power until the system detects that the rear wheel is no longer sliding and/or the lean angle returns to within the DTC’s preset parameters. Kawasaki’s S-KTRC, on the other hand, is a *proactive* system with more unlimited parameters. It differs by actually predicting when traction conditions are about to become unfavorable and adjusting power to optimize traction regardless of lean angle or wheel speed.

can cause the S1000RR's front end to porpoise as the DTC intervenes and then releases when the front wheel touches the ground.

Similar to other systems, the S-KTRC also features multiple performance modes, although Kawasaki claims that because the system is adaptive, the modes overlap depending on rider skill. Level 1 provides the least intervention, with Levels 2 and 3 progressively more intrusive. The system can also be turned off, which is something that Kawasaki officials encouraged us to try at Road Atlanta. Gathering up enough courage to do so, I made one or two laps with the system turned off before coming to my senses. High-siding the ZX-10R to the moon may have been ample proof that the system is effective, but I didn't need to go there to be convinced. Besides, I'd already witnessed the system's proficiency.

The Bigger Picture

The S-KTRC was the showcase technology on the ZX-10R that Kawasaki provided at Road Atlanta. Unfortunately, our test bike was not equipped with the equally intriguing Kawasaki Intelligent Anti-lock Braking System (KIBS), which is manufactured by Bosch to Kawasaki's design specs. Using CAN-bus wiring, the KIBS compares information from the front wheel speed sensors, clutch (on/off signal) gear position sensor, engine speed and throttle position to adjust brake pressure. The system is designed to reduce front brake pressure in the event of panic braking or if the rear wheel slows too fast for traction or starts to hop. It is also designed to reduce rear wheel lift under heavy front braking.

The ZX-10R's new 998cc inline four was designed specifically to work with the S-KTRC and not merely to shoot for the class horsepower record; Kawasaki claims 200 crankshaft horsepower from the Euro-spec machine, but US-spec versions are limited by sound compliance. Three power modes allow the rider to choose the level of engine performance: Low, Medium and Full. The Low setting noticeably decreases power but does not affect throttle response. Medium and Full are similar in their character, although Medium does reduce power at throttle openings below 50%. Above 50% throttle, Medium feels a lot like Full and unleashes almost all the power that the 10R motor has to offer.

The design goal with the new engine, say Kawasaki engineers, was to manage airflow throughout the system and also to reduce mechanical losses and parasitic drag. The former is accomplished via a new, larger airbox with redesigned intake ducts that emphasize mid- and high-rpm performance. The 10R's new 47mm Keihin throttle bodies also feature larger oval sub-throttle valves designed to increase airflow and improve throttle control. The system features dual 12-port injectors with a 5°-wider spray pattern for better fuel atomization. The intake ports retain the same ceiling height as before but are wider at the valve guides to increase the amount of the incoming air/fuel mix, and both the intake and exhaust ports are polished. The intake valves are increased by 1mm to 31mm, while the exhaust valves remain at 24.5mm.

Drag in the new engine is decreased by new 13.0:1 compression pistons with 3.5mm shorter skirts and narrower piston rings that now ride in bores honed with the use of torque plates for more perfectly cylindrical dimensions. Even greater drag reduction was accomplished by offsetting the cylinder 2mm toward the exhaust side from the crankshaft centerline, resulting in a claimed 21% reduced piston load and 1.4% less drag at 10,000 rpm. Beefier connecting rods and a new crank with additional stabilizing alloy provide added strength to withstand its 13,600 rpm redline.

The ZX-10R's 6-speed cassette-style transmission has also been revised with a steeper primary drive ratio (1.681:1 vs. 1.611:1 for the 2010 model) to optimize the swingarm-pivot-to-chain-pull relationship. Because swapping final drive sprockets to change gearing can alter this relationship, creating excessive squat/lift, Kawasaki is offering no less than seven different 6-speed gears through its parts and accessories division. While expensive, the alternative ratios should make it easier to tailor the ZX-10R's handling to just about any racetrack without changing sprockets. And although the stock transmission lacks the greasy-slick action of the S1000RR's electronic Gear Shift Assistant, both upshifting and downshifting are acceptably smooth.

On the track, the new ZX-10R's power delivery is brawny and perfectly linear, and while it may not possess the aggressive mid-range and top-end punch of previous 10Rs, its character is deceiving. It is extremely responsive, yet it isn't abrupt, thanks to its

excellent fuel injection. On the track, we appreciated that its slipper clutch exhibited a linear feel, but one thing that was extremely noticeable was a decided lack of compression braking. The ZX-10R feels almost as if it "freewheels" into corners. No worries, though. The 10R's twin 310mm front petal-style rotors with two-pad, 4 x 30mm piston Tokico radial calipers haul the bike down smoothly from speed.

An all-new, more rigid cast-aluminum twin-spar chassis repositions the engine for better mass centralization. Rake has been slightly reduced, while the wheel-

base has been increased by 10mm to 56.1". Other changes include a 10mm lower seat height, a slightly more downward angle for the handlebars and footpegs that have been lowered 5mm and moved 2mm forward. The pegs can also be lowered by another 15mm for more comfortable street use. The rear suspension incorporates the same Horizontal Back-link shock mount as the Z1000 and the Ninja 1000, but the 10R's shock is, of course, fully adjustable. The 43mm fork features Showa's Big Piston technology, which enhances damping control and reduces chassis pitching.

An array of weight-saving changes include going from 6-spoke to 3-spoke wheels with less material in the hubs, resulting in an overall weight decrease of 22 lbs., to a curb weight of 436.6 lbs.

The ZX-10R handles like a razor. Its lighter weight and better mass centralization promote a feathery, flickable feel that is more 600cc supersport than 1000cc superbike, but the 10R's geometry doesn't make it nervous at speed. The longer wheelbase certainly enhances its stability, but the ZX-10R is also fitted with an adjustable Öhlins steering damper to keep its front end under control. Furthermore, the 10R's suspension is firm and controlled, but its initial stroke offers a plush feel that allowed it to tame the bumps and ruts left in the Road Atlanta circuit by all of the sports cars that regularly pound the track.

Final Thoughts

Shelling out \$13,799 (add \$1000 for the ABS) may seem like a lot of dough, but it's a bargain for a bike that may contend for Superbike of the Year honors. We never doubted that Kawasaki could produce a faster ZX-10R, but the confidence-inspiring ability of the S-KTRC traction control system takes it to an entirely different level. For all its complexity, the 10R is simply ready, willing and able to charge with authority from anywhere in the rev range without a hint of vibration, even above 10,000 rpm.

Advanced street riders looking for a manageable 1000 with the potential to win WSBK races should check it out. 🏍️

