

Safety and higher-efficiency solutions for motorcycles



Bosch has introduced its motorcycle stability control (MSC) for sub-400cc motorcycle models. It is implemented first on TVS's flagship motorcycle, the TVS Apache RTR 310. The devices inside the MSC are networked via CAN CC (classic). At the EICMA 2023 motorcycle show in Milan, the company has shown further solutions for safety and higher efficiency of two-wheelers.

Bosch MSC for smaller motorcycle models is fitted on the new TVS Apache RTR 310 (Source: Bosch)

Out on the road, the best way to feel an unparalleled sense of freedom is to ride a motorcycle. Braking or accelerating in bends can be critical to safety when riding a motorcycle. The motorcycle stability control (MSC) helps bikers maintain control in various situations. The system combines a motorcycle ABS (anti-lock braking system) with a 3D or 6D inertial measurement unit (IMU) and is a type of ESP (electronic stability program) for motorized two-wheelers.

MSC for smaller motorbike segments

Bosch has introduced the motorcycle ABS over 25 years ago, ensuring greater safety on the roads. Ten years ago, the MSC followed up. It was introduced on the KTM 1190 Adventure (2014 models). By monitoring two-wheeler parameters such as lean angle, the system can instantaneously adjust its electronic braking and acceleration interventions to suit the current riding situation. In this way, the system can prevent the bike from low-siding or righting itself suddenly and uncontrollably when braking in bends, which is where many motorcycle accidents occur.



Figure 1: Bosch Motorcycle Stability Control (Source: Bosch)

The system is now available not only in the medium to large motorcycles, but also covers smaller sub-400cc motorcycle models, which are common in emerging markets e.g. in India, China, and ASEAN. India's TVS Motor Company, a global manufacturer of two-wheelers and three-wheelers, has fitted its new TVS Apache RTR 310 with the Bosch MSC. It utilizes the Bosch IMU and the ABS 10 base unit, which has a smaller and lighter housing thus suited to smaller motorcycles.



Figure 2: The introduced MSC utilizes the Bosch IMU (right) and the ABS 10 base unit (left) with a smaller and lighter housing thus suited to smaller motorcycles (Source: Bosch)

"TVS Motor Company has always transformed and redefined technology, with the TVS Apache series at the helm. The TVS Apache is one of the best loved and most iconic two-wheeler brands, with over five million customers across the globe. Backed by 40 years of TVS Racing heritage, every Apache brings to life our "Track to Road" philosophy, where learnings and technologies from our race machines are passed on to the production motorcycles. With a core focus on race-derived performance, it is very important for us to push the limits of race-inspired safety. Continuing our long-standing tradition of introducing segment-first technologies, we are proud to introduce Bosch MSC within the Race Tuned Dynamic Stability Control (RTDSC) in our new flagship motorcycle, the TVS ▶

Apache RTR 310, which marks a global first introduction of a 6D IMU-backed motorcycle stability control system on a sub-400cc motorcycle. We are set to deliver an unparalleled motorcycling experience by instilling in our customers a sense of confidence, comfort, and excitement,” says Vimal Sumbly, Head Business – Premium, TVS Motor Company.

MSC functions and variants

MSC kicks in where things can get critical for motorcyclists: when leaning and in bends. According to a study by Bosch Accident Research, motorcycle stability control in combination with ABS could prevent or mitigate one in three motorcycle accidents involving personal injury in

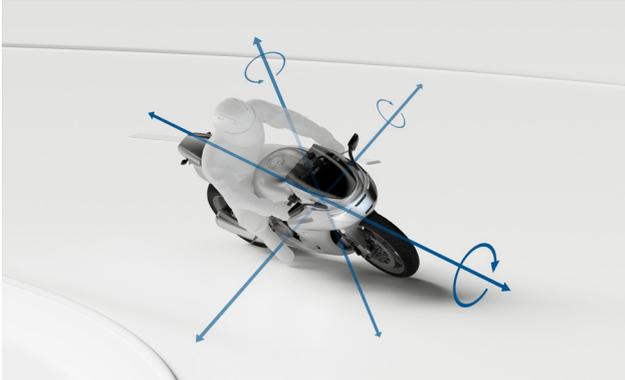


Figure 3: The IMU determines the bike's acceleration and angular rate 100 times per second (Source: Bosch)

Germany if every motorcycle were equipped with MSC. MSC uses a series of sensors to detect the two-wheeler's vehicle dynamics. While the wheel speed sensors measure the speed of the front and rear wheels, the IMU determines the bike's acceleration and angular rate 100 times per second. MSC also manages braking control in bends. By analyzing the bike's pitch and roll angle, the system can optimize stability and braking effect even in dynamic riding situations.

Bosch has a range of modular MSC solutions that offer different combinations of ABS and IMU depending on the application needs. The recently upgraded KTM RC 390 uses a 3D inertial measurement unit (IMU), which integrates various functions into the vehicle via MSC, including braking and traction control in bends. In the case of the KTM, these are supported by a more performant ABS variant including an additional pressure sensor for more accurate brake pressure control. As another example, an MSC solution can be offered with an ABS 10 base and 3D IMU specifically for realizing basic MSC functions in emerging markets such as cornering brake control, corner traction control, and cornering drag torque control.

EICMA 2023 motorcycle show

At EICMA 2023 in Milan (Italy), Bosch has showcased individual solutions for the motorcycles of today and tomorrow. The solutions providing CAN CC (classic) or CAN FD connectivity include engine components and ▶

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the electric powertrain as well as safety, displaying, and connectivity devices.

From 2019 to 2023, Bosch Two-Wheeler & Power-sports sales grew by an average of 8 percent. The manufacturer has a total of some 500 associates worldwide working on ideas and solutions for the motorcycles, quads, and snowmobiles – a threefold increase since 2016. The company offers its customers the required solutions from individual devices to complete systems.



Figure 4: The 10-inch TFT Cluster display offers a split screen to show e.g. vehicle information and navigation content simultaneously (Source: Bosch)

Displays: The display solutions (e.g. the exhibited 5-inch TFT Cluster) enable riders to keep an eye on their speed and other vehicle information while on the road. Bosch's Integrated Connectivity Cluster (ICC), which is available in various sizes, adds connectivity functions to the displays. In the past, motorcyclists often had to use a second display – and attach it to the vehicle using a separate mount – so that they could look ahead and use navigation information. Bosch provides a remedy here: by connecting their smartphone to

the ICC, riders can access functions such as navigation, music, and telephony. The 10-inch display version also offers a split screen, which allows information and navigation content, for example, to be displayed simultaneously.

Headlight control unit for motorcycles

I.C.M., a Taiwanese CiA member, has developed a headlight control unit (HCU), which can be connected to CAN CC networks. The company founded in 1995 is specialized in customized hardware and software developments for OEMs (original equipment manufacturers). The HCU has been designed in co-operation with TYC for KTM, an Austrian motorcycle manufacturer. These units are intended for the aftermarket. The product is on the market since 2020. The 38-employees company, which has heavily supported the CiA Technical Day 2023 in Taiwan, has also developed lighting control units for Ducati and Navistar motorcycles available since the end of 2023. The advanced HCUs feature yaw sensors calculating the motorcycle's angle in real-time. The yaw sensor comprises a 3D acceleration meter and a 3D gyroscope. The adaptive LED control unit is able to cornering dynamically the dark area while turning.

Additionally, the company, which is also a member of the nonprofit Asam association, provides customized designs and manufacturing for calibration tools. A related app for Kawasaki motorcycles is available since the end of 2023. The calibration tool and app is suitable to optimize engine settings for different conditions. By means of data logging, it can also be used to review and analyze the driver behavior.

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Drive and vehicle control:

Bosch develops drive solutions aiming to help vehicle manufacturers to reduce emissions. The Bosch Drive Control Unit combines the inverter, engine management system, and vehicle control. In conjunction with the recent weight-reduced electric wheel hub motor, the control unit can be used to implement different comfort functions. The latter include a smoother starting mode or cruise control to maintain speed. Controlled by the electric motor, the electric traction control prevents the rear wheel from slipping when starting off and increases riding safety. One-throttle ride, meanwhile, is an additional function that increases powertrain efficiency by allowing the motorcycle to recuperate braking energy when the rider rolls off on the throttle. This helps extend the battery-electric range by up to 8 percent.

In addition, Bosch also showcased its Vehicle Controller, which enables implementation of further functions for the electric powertrain. For instance, in addition to pump control for water cooling, it meets various charging standards (such as CCS-AC or 2W Chademo). The controller providing more than 110 connections, can be combined with various vehicle architectures and meets also future requirements for electric two-wheelers.

Electric 6-kW drive: Bosch has introduced the integrated 6-kW electric drive suited for vehicle architectures such as large scooters or classic motorcycles both in urban environments and for cross-country trips. The focus so far has been on the smaller performance classes of electric drive systems up to 3 kW. With production starting in 2025, the 6-kW motor should enable manufacturers to electrify two-wheeler segments that have so far tended to feature combustion-engine technology. The one-box solution offers an integrated motor management including the vehicle controller and inverter. Its compact design frees up storage space in the vehicle for the battery. In addition, the motor has a passive cooling concept. Hereby, the drive is cooled by the airstream instead of a complex water-cooling system. Manufacturers who opt for the new



Figure 5: The Bosch Drive Control Unit combines the inverter, engine management system, and vehicle control (Source: Bosch)



Figure 6: Geoff Liersch at EICMA 2023 in Milan (Source: Bosch)



Figure 7: Bosch solutions enable updates over-the-air and functions on demand (Source: Bosch)

electric motor can thus save on system costs, informs the producer.

The company is focusing on new developments for efficient engine management for internal combustion engines and for electric powertrains. By 2026, Bosch aims to generate group-wide electromobility sales of 6 billion Euro – a trend that is also gaining momentum in the Two-Wheeler & Powersports business unit. “Especially in Asian countries, where the two-wheeler is often the backbone of mobility, electrification can help bring about huge improvements in local air quality and quality of life,” said Geoff Liersch, head of Two-Wheeler & Powersports at Bosch.

On-demand functions increase riding enjoyment

Increasingly standard in the automotive sector, functions on demand are also gaining ground in two-wheelers. Bosch software solutions mean that motorcyclists can install and update functions even after purchasing their vehicle. Special or advanced riding modes for the racetrack or off-road use, as well as convenience functions for the next long trip, can thus be added on demand. This is done via the rider’s own smartphone. The new functions are downloaded over the vehicle manufacturer’s app and then applied to the motorcycle.

For manufacturers, this solution also lends itself to electric two-wheelers. For example, the throttle for different speeds can be set or removed, depending on country requirements or driver’s license class. With the same functional architecture, Bosch enables software updates over-the-air. These can be downloaded from the cloud via an app on the rider’s own smartphone and uploaded to the motorcycle or powersports vehicle to perform relevant updates or improve vehicle functions.

For updates-over-the-air or functions on demand, the implementation in the vehicle depends also from the OEMs (original equipment manufacturers). Connectivity via CAN CC and CAN FD is supported. ◀

of (based on information from [Bosch](#))

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