The next step to highly automated driving

Continental has combined its MK C1 electronic brake with the MK 100-based hydraulic brake extension (HBE). The units are connected via CAN or CAN FD.

The MK C1 electronic provides CAN (FD) connectivity and is in production since 2016 (Photo: Continental)

By combing the MK C1 with the MK 100-based hydraulic brake extension, redundant braking systems can be realized (Photo: Continental)

While automated driving is a big step into the future of safe and comfortable individual mobility, one thing will not change: In conjunction with the steering, the brakes will remain the most important element of active safety. Once the driver hands over the full driving responsibility to the vehicle, the electronic brake system (EBS) must be capable to perform the braking function, even in a rare case of a possible failure of the primary electronic brake system. That is why Continental has improved its MK C1 electronic brake system, targeted to the additional requirements of highly automated driving.

Fallback option for the brake system is a must have when it comes to highly automated driving (HAD). “HAD poses tough requirements to the braking system“, said Felix Bietenbeck, Head of Continentals’s Vehicle Dynamics business unit. “We have used our broad braking technology expertise to design an enabling solution for the next practical step towards automated driving for several of our customers. The MK C1 for highly automated driving makes cutting-edge brake technology available to a new application with new challenges.”

However, the MK C1 has another benefit to offer. Currently, Continental develops a cooperative brake mode. This plies, if the electromechanical actuation and pumping function of the primary braking systems should fail without affecting the unit’s control valves. In this case, the MK 100 HBE unit goes into the cooperative brake mode. A part of its hydraulic pressure is fed to the still functional MK C1 valves to activate the rear brakes as well. This split of functions ensures a full autopilot braking function with slip-controlled deceleration on both axles even in a situation of partial-failure in one system. “The principle of networking two EBS units is a complex and challenging task. It requires an outstanding system know-how, which Continental has“, Bietenbeck concluded.

The supplier will exhibit the MK C1 braking system at the IAA in Frankfurt/Main in Hall 5.1, Booth A07/A08 (Photo: Continental)

The MK C1 for highly automated driving has a redundant fallback-level by combining it with the HEB. As the MK C1 is a by-wire system, it is suited for automated driving. To achieve the requirements of braking redundancy, the Tier1 has combined the brake unit with a derivative of the MK 100 ESC. In normal operation mode, the brake unit provides all braking, stability, and comfort functions. The hydraulic pressure simply passes through the HBE. In order to ensure 100-percent availability at all time the HBE performs frequent self-tests.

In very unlikely case the primary EBS fails, the secondary EBS steps in and provide the required braking function. Depending on the type of potential failure in the primary EBS, two things can happen: Should the primary EBS fail completely – a highly unlikely scenario – the HBE brakes the vehicle with the front wheels and provide an ABS function. The entire system can be integrated to other ECUs by means of CAN, CAN FD, and Flexray networks (or a combination of them). The internal communication is done via CAN or CAN FD (in the near future).

The MK C1 unit enables 100-percent recuperation of braking energy, due to the “brake-by-wire“ design. Further benefits include an approximate 30 percent weight reduction of the system and efficient braking dynamics in a compact unit. The innovative electronic brake system integrates the tandem master cylinder (TMC), brake booster and control systems (ABS and ESC) into a compact, weight-saving one box design module. The braking solution can build up braking pressure in 150 ms (time-to-lock), which is twice as fast as conventional systems today.