

Deep Breathing

The ultimate technology for the ultimate 911: The Porsche Active Aerodynamics (PAA) system moves the rear wing and now too the front spoiler on the new 911 Turbo/911 Turbo S.

By Michael Pappel
Photos by Christoph Bauer

Every series sports car from Porsche is a wanderer between two worlds, combining exceptional day-to-day usability with ever-ready performance of the highest caliber. And yet the requirements of these two poles in terms of design and technology could hardly be more different.

In the new 911 Turbo, the engineers have pulled off an elegant balancing act: Porsche Active Aerodynamics (PAA) perfectly adjusts the rear wing and—for the first time—the front spoiler for all situations and speeds. That's racetrack-ready performance paired with effortless handling of garage and parking ramp entrances, as well as low aerodynamic drag resulting in improved mileage.

To fulfill this complex requirements profile, the engineers at the Weissach Development Center redesigned the affected

components—and particularly with the variable front spoiler, introduced an entirely novel technical solution. As was previously the case exclusively with the rear wing, the front spoiler now also offers multiple positions to achieve the perfect mix of aerodynamics and ground clearance in any situation. The motion of the spoiler is achieved through multiple air chambers which are filled as necessary, thus extending the spoiler lip into the headwind.



The Start position is designed for low speeds. In this position, the spoiler is retracted and all but invisible under the front apron, affixed to the underbody of the front end with holding magnets. This enables the Turbo to master steep descents, such as the ramps in parking garages. Scraping the ground is so yesterday. At 120 km/h, the

At a standstill, the 911 Turbo S is a sculpture of power that discreetly hides its technical endowments: front spoiler and rear wing repose in their retracted positions.



system automatically switches to the Speed position. A segment on both the left and right sides is inflated by means of a compressed air supply, enabling aerodynamics to support optimized fuel consumption at higher speeds. At the same time, the extremely light rear wing, weighing in at just 2.1 kilograms, kicks into action and extends 25 millimeters to create greater downforce.

The precise height is stored in the control unit and is determined on the basis of not only the speed but also the vehicle variant, having different positions for the Coupé and the Cabriolet, with or without the Sport rearview mirror. In the overall aerodynamics setup, drag and downforce are perfectly balanced. If the driver lets up on the gas pedal, the systems automatically switch back into the starting position at speeds below 80 km/h.

So much for the day-to-day. To really unleash its potential, the PAA needs the open road. The third stage in the system is called Performance, and that's exactly what it means. In this position, the aerodynamics are optimized for maximum downforce. The Turbo is practically glued to the asphalt. An additional air chamber in the middle is activated in the front spoiler, wedging its full surface and con-

In the Performance position, the front spoiler displays the Turbo logo at its center.

tour into the wind. At the same time, the rear wing of the Coupé extends to a height of 75 millimeters and faces the wind at a 7-degree angle.

Performance mode is a part of the Sport Plus program for the entire vehicle and is activated by means of the corresponding button. Performance mode can also be activated by means of the functionally enhanced spoiler button in the center console.



To enable ultimate performance while ensuring day-to-day usability, the engineers drew deep from their well of ideas. The lip of the front spoiler is constructed of EPDM (ethylene propylene diene monomer), an elastomer that is stable, robust, and yet flexible, to provide the desired spoiler contour depending on the stage of development. The material is resistant to environmental factors such as extreme cold or saltwater, within a broad tolerance range.

The compact and, at just 3 kilograms, extremely light pneumatic system module is located in the luggage compartment, which is nevertheless slightly larger than before. The entire front spoiler unit is designed as a closed system to ensure a constant humidity. The precisely conditioned air for the chambers comes from a reservoir—so every new Turbo has some Swabian air in its lungs. Only under extreme conditions does the system discharge a minimal amount of air into the luggage compartment or draw air from it.



Another detail of Porsche Active Aerodynamics underscores the developers' meticulousness: in the Performance position, the front spoiler displays the Turbo logo at its center. What looks simple required complicated calculations, because the logo looks perfect on the flexible material only when the middle air chamber is activated. The shapes of the spoiler, air volume, and graphic are so finely balanced that not even the aesthetics had to be compromised for the sake of performance.

The flag drops: the wanderer between two worlds reaches every goal at once.



Start position

Front spoiler and rear wing are retracted

Speed position

Over 120 km/h, the spoiler (side segments) and wing extend

Performance position

Optimal downforce thanks to maximum spoiler surface and extended wing

The Steering

For better handling, the rear wheels also get in on the steering—for the first time as a standard function.

By Thorsten Schönfeld

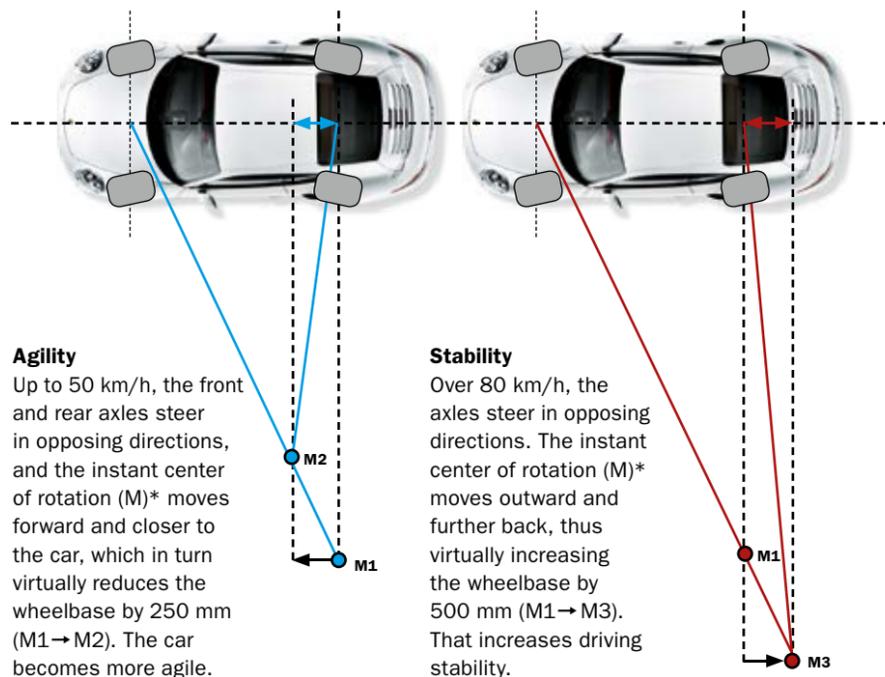
The astonishing ease with which the latest generation of the 911 Turbo can be controlled even at the top end of its considerable performance range inspires deep respect even in test-driving champ Walter Röhrl: “It really is amazing how calmly and safely even normal drivers can now drive around with 560 hp at their disposal.” Porsche traditionally improves the handling with each new 911 Turbo, but the introduction of rear-axle steering represents more of a quantum leap than a mere enhancement.

Thanks to the steering rear wheels, Porsche engineers have managed the trick of improving handling at low speeds while improving driving stability at higher speeds.

It works because instead of the conventional toe links, integrated electromechanical actuators steer the rear axle in the opposing or same direction as the front axle depending on the speed. Up to 50 km/h, the rear wheels are turned up to 2.8 degrees in the opposite steering direction as the front wheels, thus enabling the Turbo to steer into and through corners with greater agility. This advance also reduces the turning circle by about 0.6 meters, making parking and maneuvering easier.

Above 80 km/h, the rear axle steers in the same direction as the front axle (angle: maximum +/-1.5 degrees), enabling the rear wheels to develop cornering forces significantly sooner than with un-steered axles. As a result, the car reacts more spontaneously and with greater stability to changes of direction—also at high speeds. Röhrl: “Rear-wheel steering yields the greatest benefits in S-curves.” Measurably. In terms of lap times, it amounts to a good three seconds on the Nordschleife.

In summary: more performance, more safety, and more fun behind the wheel—and if you want to drift, you can naturally do so even with rear-axle steering. ●



Agility
Up to 50 km/h, the front and rear axles steer in opposing directions, and the instant center of rotation (M)* moves forward and closer to the car, which in turn virtually reduces the wheelbase by 250 mm (M1 → M2). The car becomes more agile.

Stability
Over 80 km/h, the axles steer in opposing directions. The instant center of rotation (M)* moves outward and further back, thus virtually increasing the wheelbase by 500 mm (M1 → M3). That increases driving stability.

* The instant center of rotation is the point around which the vehicle rotates. It is determined by drawing perpendicular lines from the wheels on the front and rear axles at their current steering angles. Where the two lines intersect, that is the instant center of rotation.



Even more direct
The steering is 10 percent more direct than in the current Carrera because rear-axle steering develops additional lateral support. The advantages of optimized steering are most apparent in S-curves. A practical side-effect: the turning circle shrinks from 11.2 to 10.6 meters.

