Glossary: Technical terms about steering

From A as in all-wheel steering to Y as in yaw moment – steering systems bring a host of technical terms with them. In the glossary for TechTalk Steering, we will explain the most important terms.

A for

all-wheel steering:
Instead of only steering the front wheels, as is customary, vehicles with all-wheel steering can steer the back wheels. For that reason, this is also sometimes called rear-axle steering. At low speeds, the back wheels turn up to five degrees in the opposite direction to the front wheels. This reduces the turning radius significantly and increases manageability. At the same time, the driver feels more comfort and stability at higher speeds because the back wheels turn up to two degrees in the same direction as the front wheels. The signal to turn is electrically transmitted to actuators and the suspension arms in the rear suspension. Dynamic all-wheel steering, which can also vary the steering ratio by using superimposition gearing on the front axle, is an expansion of the system.

D for

dynamic steering:
Dynamic steering varies its degree of implementation up to 100 percent, depending on driving speed, steering angle, and the mode selected in the Audi drive select dynamic handling system. The central component is the superimposition gearing in the steering column. It conveys the driver's steering commands just as directly as in a vehicle with a conventional steering column. There is also a direct mechanical link to the actual steering gear on the front axle and the associated feedback to the forces on the wheels. When the superimposition gearing is controlled by the electric motor, it increases or decreases the steering angle, which constantly adjusts the steering ratio according to the given driving situation. That improves steering comfort and tracking behavior in accordance with speed and driving situation. At low driving speeds – in city traffic and while maneuvering – dynamic steering operates very directly; all it takes is two full turns to go from end stop to end stop. The power steering boost is also high, which makes parking and maneuvering easier. On country roads, the directness of the steering response and electric assistance are progressively reduced. Indirect gear ratios and low power assist are used to smooth out unsteady steering movements and enable straight tracking at fast expressway speeds.

directional stability:
Directional stability is the vehicle's ability to drive straight without extensive steering corrections. Directional stability depends not only on the steering mechanism, but also on the chassis, tires, aerodynamics, and wind conditions.

O for

oversteering:
Oversteering is when the car tends to swivel or swing outward, with the rear toward the outer edge of the curve. It is caused by a combination of speeds that are too high and a sudden load shift or change maneuver. In that situation, the possible buildup of lateral force on the rear wheels is no longer sufficient for safe tracking and more slippage occurs. Oversteering can be compensated for by controlled countersteering and decelerating. The Electronic Stabilization Control system (ESC) counteracts oversteering: It slows the front wheel on the outside of the curve and reduces the torque on the wheels in order to bring the vehicle back on the desired course.

P for

progressive steering:
Electromechanical progressive steering increases driving dynamics and driving comfort. Its specially interlocked steering rack varies the gear ratio depending on the steering angle. With an increasing steering angle, the steering becomes more direct. In city traffic and in maneuvering, this reduces steering effort and the car is more agile on sharp curves. Moreover, progressive steering adjusts its power steering boost to the driving speed. At low speeds, this increases for easier maneuverability.

power steering:
Purely mechanical steering is moved solely by the driver's muscle power. By contrast, power steering offers electro-mechanical, electro-hydraulic, or purely hydraulic assistance, which makes steering while stopped, parking, or driving at low speeds significantly easier. It is one of the most significant evolutionary steps in steering systems. Without power steering, cars with the front axle load that is common today and wide tires could only be steered with difficulty, particularly at low speeds. Electro-mechanical power steering is state of the art and it makes all assistance systems with steering intervention technically possible. Consequently, it is also a key technology for automatically driven cars.

S for

steering return:
When the steering wheel automatically resets to the middle position, it not only improves comfort with directional stability, but also the feeling of safety while driving. A feeling of balanced centeredness even at the smallest steering angles ensures optimal precision.

steering column:
The steering column is a central component of the steering system. It forms the mechanical link between the steering wheel and the steering gear. The steering column conveys the rotational motion of the steering wheel to the steering gear, which in turn pushes the tie rods in the

corresponding direction. Likewise, the torque emanating from the steering gear is transferred via the steering column to the steering wheel. The height-adjustable steering column enables drivers of different body sizes to find an individually appropriate and therefore optimal sitting position.

steering moment:
Steering moment, also known as hand moment, is the steering force that the driver applies. It is one of the most important influence variables for steering feel.

steer-by-wire:
With steer-by-wire technology, digital steering technology takes over the processes of driving the front and rear axles – unlike with conventional systems, where the steering wheel and steering gear are mechanically linked. There is no longer a steering shaft in vehicles with steer-by-wire systems. Instead, all steering commands are transmitted electrically via a control unit on a motor that ultimately executes the steering movement and transfers it to the wheels.

T for

threshold range:
Drifting, emergency braking on various surfaces, slalom driving, or extremely sharp turns at high speeds – the threshold range is at the edge of driving physics.

U for

understeering:
Understeering occurs when the front wheels lose their grip on the road and, while driving through a curve, the car shifts over the front axle to the curve's outer edge. If the longitudinal and lateral forces become too great, the vehicle is in danger of going off the road. The Electronic Stabilization Control system (ESC) likewise counteracts understeering: It slows the rear wheel on the inside of the curve and can also use engine management to reduce engine output and bring the car back on track.

Y for

yaw moment:
Yaw moment is produced when the vehicle drives into a curve. It is a measure of the rotation around the vertical axis. The higher the speed or the sharp the curve, the greater the yaw moment. If there is too much of it, the vehicle can swerve and veer out of control and skid. That movement is also called "yawing."

Product and Technology Communications
Tobias Söllner
Phone: +49 841 89 36188
Email: tobias.soellner@audi.de
www.audi-mediacenter.com

Product and Technology Communications
Julia Winkler
Phone: +49 841 89 44904
Email: julia.winkler@audi.de
www.audi-mediacenter.com

The Audi Group, with its brands Audi, Ducati and Lamborghini, is one of the most successful manufacturers of automobiles and motorcycles in the premium segment. It is present in more than 100 markets worldwide and produces at 19 locations in 12 countries. 100 percent subsidiaries of AUDI AG include Audi Sport GmbH (Neckarsulm, Germany), Automobili Lamborghini S.p.A. (Sant'Agata Bolognese, Italy), and Ducati Motor Holding S.p.A. (Bologna/Italy).

In 2020, the Audi Group delivered to customers about 1.693 million automobiles of the Audi brand, 7,430 sports cars of the Lamborghini brand and 48,042 motorcycles of the Ducati brand. In the 2020 fiscal year, AUDI AG achieved total revenue of €50.0 billion and an operating profit before special items of €2.7 billion. At present, 87,000 people work for the company all over the world, 60,000 of them in Germany. With new models, innovative mobility offerings and other attractive services, Audi is becoming a provider of sustainable, individual premium mobility.