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Photo: Achim Hartmann

G-FORCE

Force of Persuasion

The Sport Chrono Package for the 911 and the Boxster includes a g-force display, which shows acceleration forces in graphic form.

Earth scientists calculate acceleration in gals, engineers do it in meters per second squared, and drivers generally in the number of seconds it takes to reach 100 km/h (60 mph) from a standstill. With its new generation of the 911 and the Boxster, Porsche has introduced a further value into the cockpit of its sports cars, namely, *g*. This *g* stands for the acceleration of a free-falling object due to the earth's gravitational pull. Expressed as a numerical formula, $g = 9.80665\ m/s^2$.

The new g-force display shows drivers the acceleration values in real time, and also saves maximum values, which can be accessed afterwards both individually and in combination. Drivers can choose to have this function, which comes as part of the Sport Chrono Package, included in the right-hand field of the multifunction display. Acceleration is shown by a yellow dot that moves within a circle. The dot is in the middle of the circle when the car is at a standstill. It shoots up when the car is braked, and down when it is accelerated. Left curves send it to the right, and right curves to the left. These fields overlap, and in theory the dot can reach every point in the circle.

Acceleration values are precisely registered by an inconspicuous small sensor module located underneath the central console, directly behind the gear lever. It operates on the basis of capacitors with movable elements, which change position in the course of acceleration and thus also the capacitor capacity, which in turn is measured as an electrical signal. Not only do the sensors register the dynamic values achieved by the new sports cars, they also lay an essential foundation for the performance of Porsche cars. They form the basis of Porsche Stability Management (PSM), Porsche Active Suspension Management (PASM), Porsche Torque Vectoring (PTV), and Porsche Dynamic Chassis Control (PDCC). Without these driver assistance systems, the cars' outstanding stability in curves—or in other words, the lateral acceleration they can attain—would not be possible. ●

911 (TYPE 991) **CO_2 emissions:** 236 g/km to 194 g/km, **Fuel consumption (combined):** 10.0 l/100 km to 8.2 l/100 km
BOXSTER (TYPE 981) **CO_2 emissions:** 206 g/km to 180 g/km, **Fuel consumption (combined):** 8.8 l/100 km to 7.7 l/100 km

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Full Speed Ahead

We want to feel pure acceleration, and there's no better place for that than the test course in Leipzig. A study of curves.

By Peter Weidenhammer **Photos by** Achim Hartmann

Fuji Speedway: Suntory Corner

The left-left-right combination of the Fuji Speedway in Shizuoka, Japan. Full braking maneuver and downshifting, followed by a sensitive load change to take the car from a wide curve into a tight one.

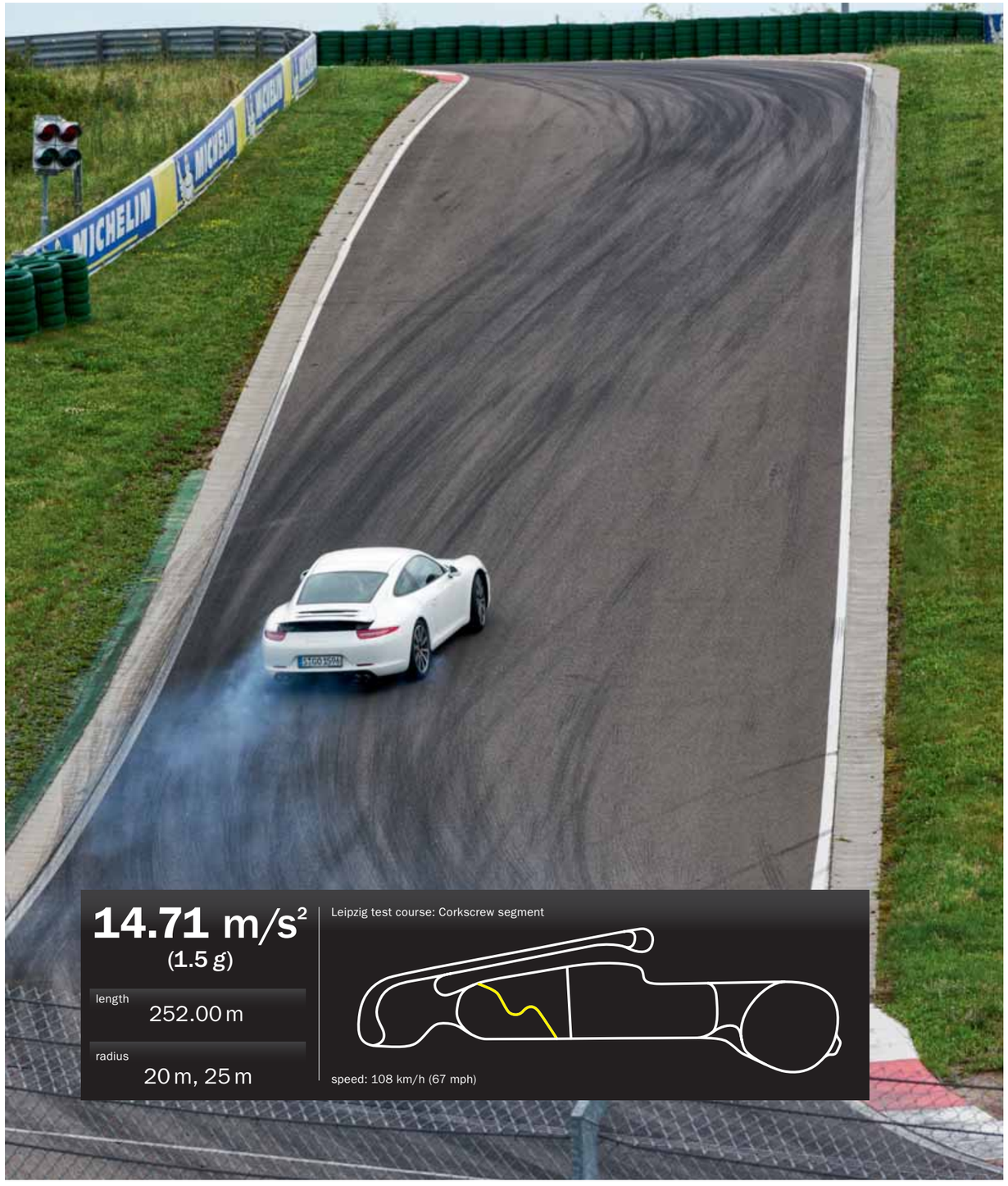
12.85 m/s²
(1.31 g)

length
177.19 m

radius
38 m, 66 m, 189 m

Leipzig test course: Suntory Corner segment

speed: 101 km/h (63 mph)



Laguna Seca: Corkscrew

Spectacular right-left-right combination from Laguna Seca in the United States. A 12-percent incline with no view of the upcoming curve, including constant shifts between under- and over-steering.

A small yellow dot. No more is needed. More than any other display, it shows what the car can do—and what drivers can make of it. There will be a showdown on four of the world's most famous curves, taken from four racecourses on three different continents. Four of ten curves reproduced on a single circuit, the racetrack at Porsche's site in Leipzig. It is familiar ground for Gunther Ofenmacher. A retired race-car driver, Ofenmacher heads the team of Porsche instructors whose classroom consists of the site's own racing course. The tool of his trade is the latest 911 Carrera S. No one knows better how to manipulate the little yellow dot on its console. "The g-force display is an unerring reflection of how well you can really accelerate, take curves, and brake," Ofenmacher says.

The weather is ideal, and the 911 is superbly prepared. The active PTV plus limited-slip differential enhances stability in curves and turn-in performance, the Porsche Ceramic Composite Brake (PCCB) improves braking performance, and PDCC compensates for rolling movements. And of course there's also the Sport Chrono Package with launch control, dynamic engine mounts—and the g-force display.

We first drive straight ahead to gather momentum for the curves. We're using a different way to measure acceleration—this time not the number of seconds it takes to go from zero to 100 km/h (60 mph) and thus the average value that includes all the shifting processes and power and torque points. Instead, we're interested in the real development of force, measured in m/s². We start with the launch control. The brake lights go on; the engine revs up to the limiter and slips into a husky cough. The rear spoiler extends almost teasingly slowly. Ofenmacher takes his foot off the brake, and the 911 Carrera S lowers its rear to the track nearly imperceptibly and sprints off—which means with maximum traction. One is well advised to hold the steering wheel firmly and straight right now, because the launch control would otherwise suspect a lack of seriousness and immediately interrupt this power play—after all, one wouldn't want a fast start with swinging hips. The 911 pushes up to 10 m/s² (1.02 *g*), as displayed on the g-force circle. If the car could generate that power continuously, it would reach 100 km/h in fewer than three seconds.

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Curve di Lesmo from Monza in Italy. Ofenmacher approaches it at a good 200 km/h (125 mph), turning into the right curve at 130 km/h (80 mph). The 911 remains stoically horizontal, a perfect demonstration of roll control. What appears so effortlessly elegant has enormous advantages when it comes to driving dynamics. If the car's body doesn't lean to the side, the contact areas of all four tires can develop the best possible grip—or what the chassis engineers call "low wheel-load shift." At the vertex the rear drifts slightly outward, and the yellow dot moves synchronously toward the boundary region. On the display it has the form of a circle, but actually it is shooting out somewhere into the run-out zone. When the dot moves

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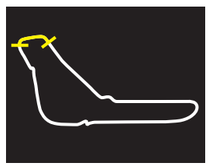

Monza: Curve di Lesmo

Right curves from Monza in Italy, combined into an extremely long single curve in Leipzig, which can be taken at high speed thanks to the slight banking.

911 CARRERA S (TYPE 991)
Engine: Six-cylinder boxer
Displacement: 3,800 cc
Power: 400 hp (294 kW)
Maximum torque: 440 Nm at 5,600 rpm
0–100 km/h: 4.5 (4.3*) sec.
Top track speed: 304 (302*) km/h (189/188* mph)
CO_2 emissions: 224 (205*) g/km
Fuel consumption
City: 13.8 (12.2*) l/100 km
Highway: 7.1 (6.7*) l/100 km
Combined: 9.5 (8.7*) l/100 km
* with Porsche double-clutch transmission (PDK)

back toward the center, the maximum value of 12.75 m/s² (1.3 *g*) remains visible to the left of the circle. We glance at Ofenmacher for his assessment—is that high? Yes. "It's higher than slamming on the brakes," confirms the expert.

We compare this now with Spa-Francorchamps in Belgium. The straight-out emergency exit next to the Bus Stop chicane is accustomed to hard braking maneuvers. A cone-lined stretch marks the braking point. At 110 km/h (68 mph), the approach is comparatively laid-back this time. In a flash, Ofenmacher shifts from the accelerator to the brake. The braking assistant registers an emergency situation and enters full deceleration mode. The 911 bends down almost imperceptibly, the brake lights start to flicker, and the warning light signals "Look out!" The PDK transmission double-clutches down, and our eyes jump instinctively to the anticipated end of our trip on the track. But the coupe never reaches the critical point. It stands well before it. Our g-force instructor has forecast correctly: 11.77 m/s² (1.2 *g*) is above the circle. "It has never been greater," confirms Ofenmacher. He tries a few more times, but the result always remains in this region, sometimes a little lower. The ceramic brakes would keep going at it for hours, but then the tires would get too hot.

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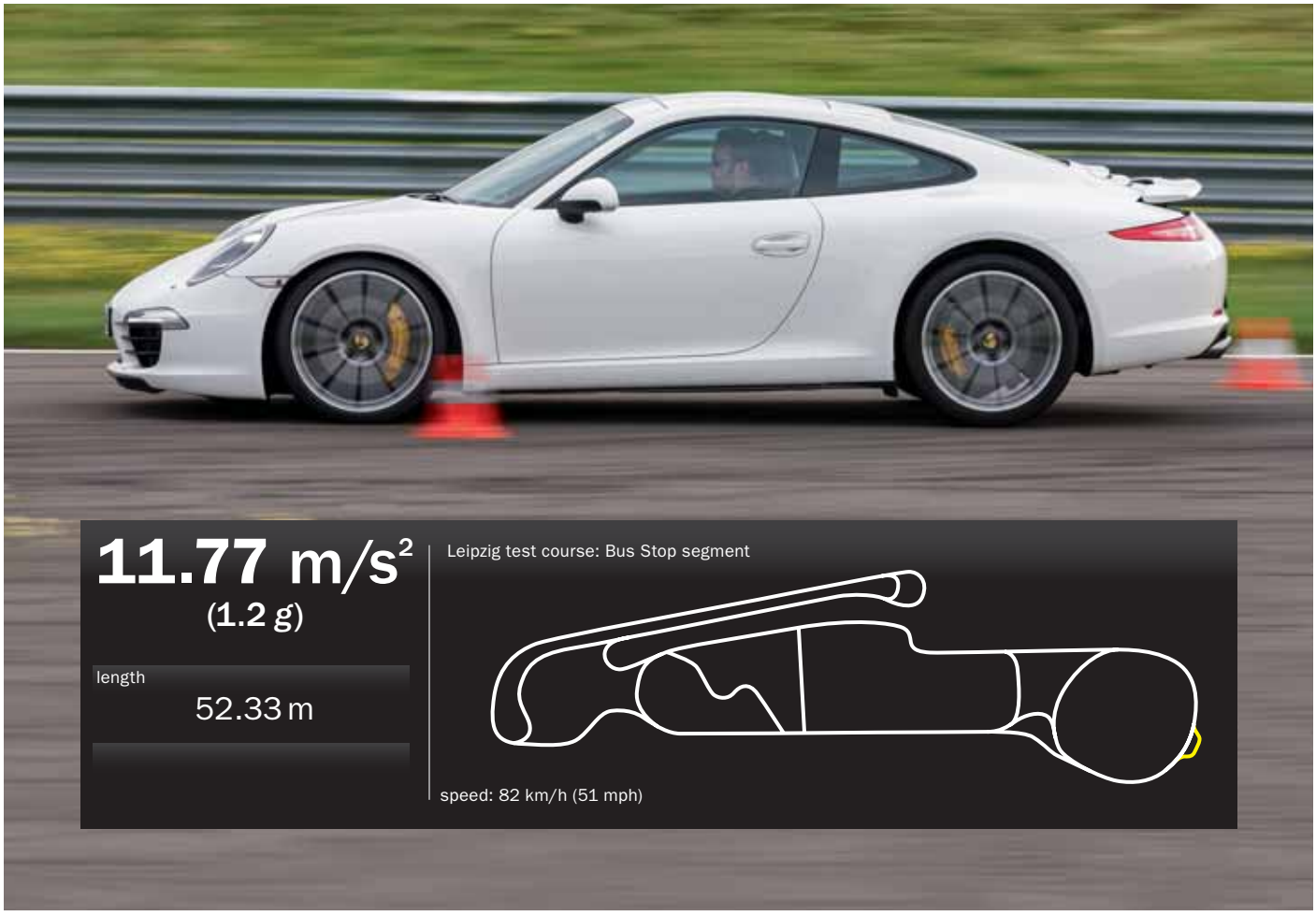
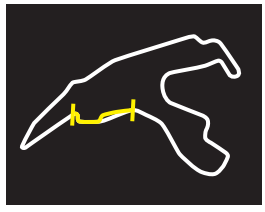
We approach Suntory Corner from Shizuoka in Japan (Fuji Speedway). The tires need full grip for this legendary left-left-right combination. "We can hit top lateral acceleration values here," says the chief instructor. He shoots the 911 into the right curve at a good 130 km/h (80 mph), and takes the vertex at around 80 km/h (50 mph). The dynamic engine mounts have long since switched to maximum damping. The six-cylinder engine sits in the car body as if welded on, with no impulse from its mass able to impair the wheels' directional control.

Precisely circling the limit, Ofenmacher takes the 911 through the left curve. The tires hold. The yellow dot coils from left to right, pulling a tail behind it like a comet. The display shows 11.87 m/s² (1.21 *g*) in the



right curve, 12.85 m/s² (1.31 *g*) in the left curve. This is quite close to the edge of the circle, which is not an arbitrary boundary. In large part it also reflects the "friction circle," that is, the graphic representation of forces that a tire can transfer. This is always just the sum of all the forces, longitudinal and lateral. When the dot shoots to the front for a full braking action, for example, this means that all potential has been exhausted and no further lateral forces can come—or the tires will lose their grip and the car will take off.

Finally, we reach the Corkscrew from Laguna Seca in the United States. Acceleration in three dimensions: longitudinal, lateral, and vertical. The approach to the famous S curve on the hill leads into a robust incline from a right curve on the flat. Ofenmacher turns the 911 in at 100 km/h. Compression pushes the coupe down onto the track, which gives the wheels additional grip. In a drift the 911 shoots up the hill and breaks the record: 14.71 m/s² (1.5 *g*) lateral acceleration to the left. "The top value for the whole track," says Ofenmacher. But it's not the top value for the Porsche 911, as there's still more leeway for the yellow dot. ●



Spa: Bus Stop

Left-right-right-left chicane from Spa-Francorchamps in Belgium. Here drivers have to brake straight as an arrow, turn the car, and accelerate over the curbs at full load.