

PROTEAN 360+

Fact Sheet

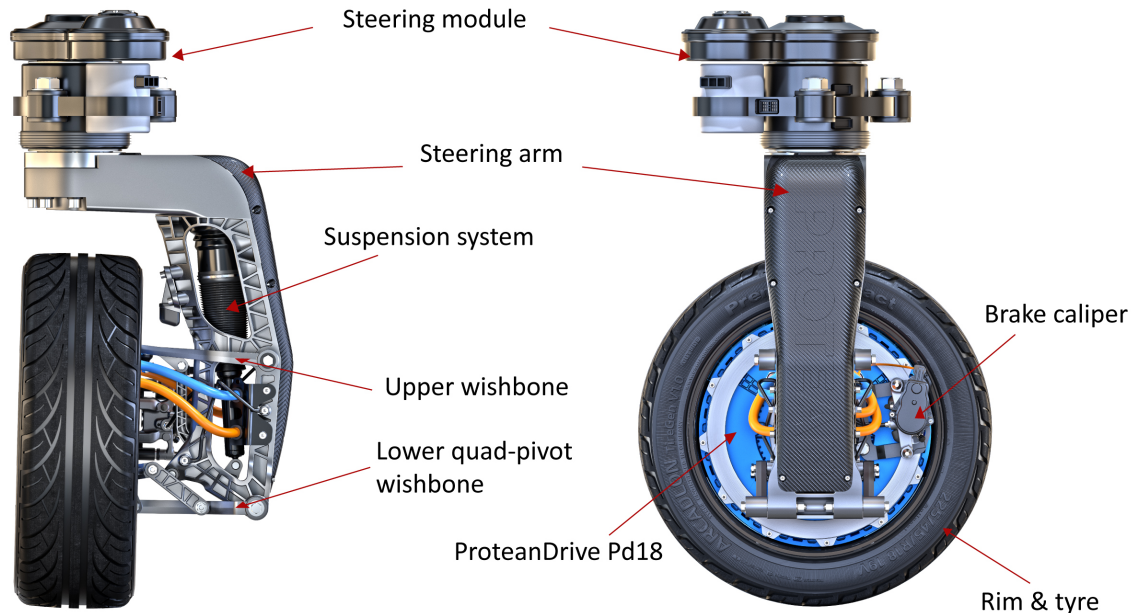
Advanced electric-drive corner module designed for next-generation mobility pods.

Area	Protean Approach
Limitless 360-degree steering	<p>The capability for each wheel to be steered through and beyond 360 degrees without limitation gives the vehicle an unprecedented level of manoeuvrability. It means that the vehicle doesn't need to stop-steer-move when performing complex manoeuvres, helping ensure smooth, uninterrupted progress for passengers. It also means the vehicle can spin through 360 degrees within its own footprint, helping it negotiate environments such as extremely tight urban streets, parking lots and loading bays. It allows ultimate precision in manoeuvrability for the final metre when approaching the kerb to park up.</p> <p>The 360-degree steering capability is made possible by a patent-pending rotating interface that sits above the corner module's main arm. The top of the rotating interface is fixed to the vehicle and the lower interface is fixed to the module arm.</p>
Novel twin-knuckle suspension for compactness	<p>The primary challenge for the suspension system was the compact packaging required to ensure that the system takes up the minimum internal space, facilitating improved access for people with reduced mobility or greater cargo capacity. To achieve this compactness, the development team conceived a novel multi-link design with an additional lower wishbone pivot.</p> <p>The patent-pending quad-pivot double-wishbone 'spider' movement enables high-strength force-transfer with both compact packaging and full-range suspension travel.</p> <p>This novel suspension packaging allows optimum geometry and additional articulation in the lower suspension arm in order to achieve the desired kinematics, while retaining the all-important package compactness. It also allows the suspension system to exhibit identical behaviour and performance in all directions of travel.</p> <p>As a result, a single common module design is optimised for all four corners of the vehicle, negating the need for left and right or front and rear versions, thereby reducing development and production costs.</p>
Pneumatic ride height enables vehicle 'kneeling'	<p>A critical target for the development team was to provide the capability for vehicles to 'kneel', in order that stepless kerb-to-vehicle access eases entry and egress for passengers with reduced mobility, wheelchair users, pushchairs, and for loading goods.</p> <p>A pneumatic ride-height system enables the vehicle height to be raised or lowered. The pneumatic reservoir and compressor are shared with other systems in the vehicle, and provide independent control of suspension air at each corner to precisely control the level of the vehicle floor.</p>

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Super-efficient, fully integrated in-wheel motor	<p>Electric propulsion is provided by the ProteanDrive in-wheel motor, a highly integrated patented design that provides maximum efficiency and flexibility and that includes all the core technology of an electric driveline within a single unit. It is estimated to be significantly more efficient than alternatives, such as e-axle solutions, thanks to the elimination of driveline losses.</p> <p>In-wheel motors also offer greater dynamic control of the overall power and torque delivery. They can apply positive or negative torque within milliseconds, meaning improved performance of ESC, ABS and traction control systems, which benefit safety, stability and stopping distances (typically 7% shorter, according to an independent study*). Furthermore, there is a greater level of redundancy, especially in four-motor setups, as torque load can be transferred if problems occur in any one motor.</p> <p>*Satoshi Murata, "Innovation by in-wheel-motor drive unit". International Journal of Vehicle Mechanics and Mobility, Volume 50, Issue 6, pp 807-830, 2012.</p>



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