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Position sensor helps make *waves of fun*

» Design Notes

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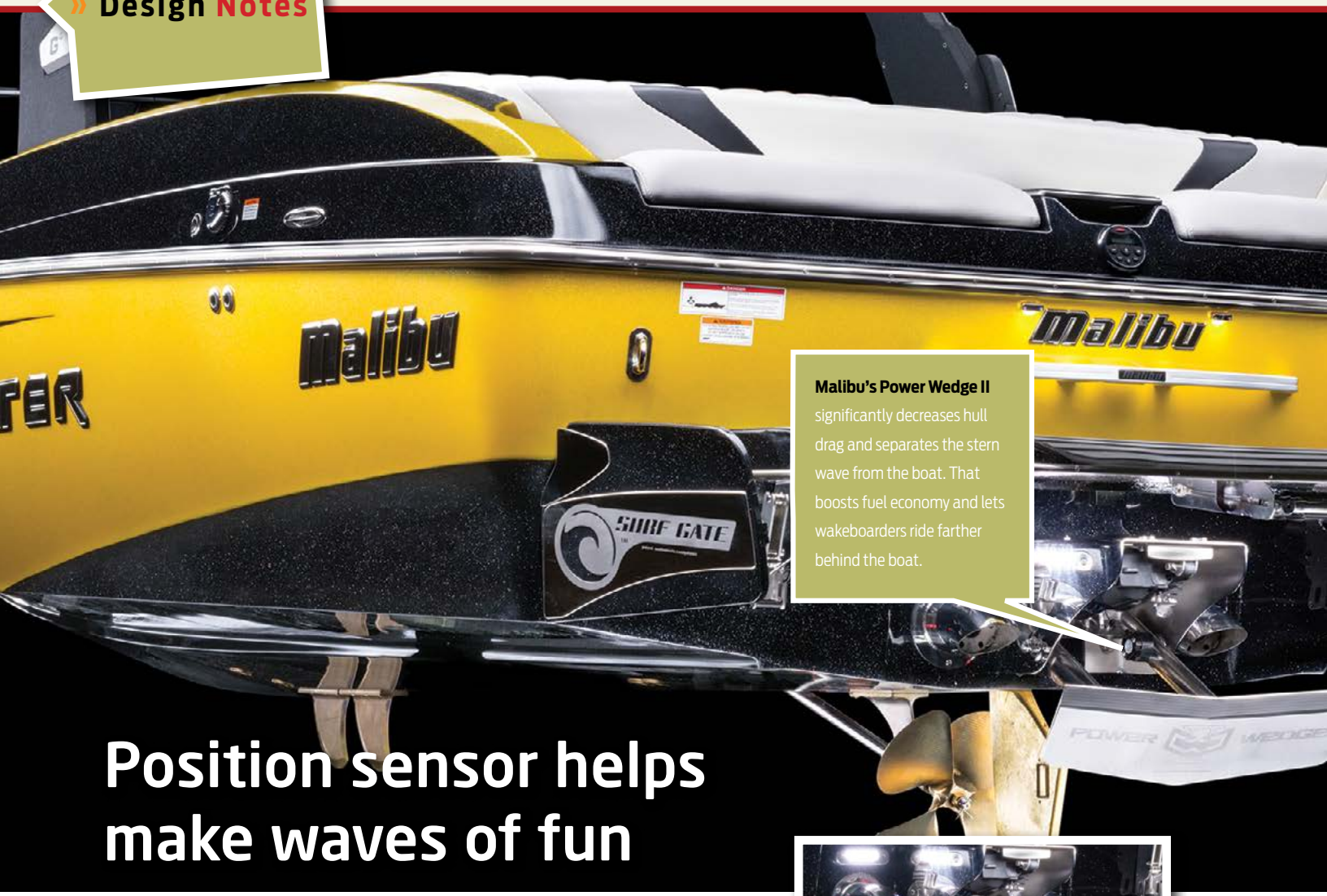


Malibu's Power Wedge II significantly decreases hull drag and separates the stern wave from the boat. That boosts fuel economy and lets wakeboarders ride farther behind the boat.

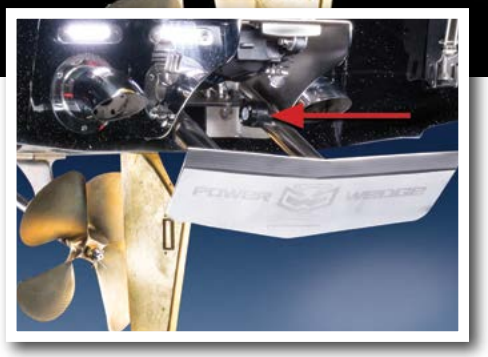
Position sensor helps make waves of fun

Engineers at watercraft maker Malibu Boats have designed a boat that makes custom waves for water-skimming riders to surf without a towrope and wakeboard. Two hydraulic Surf Gate paddles flank the stern and make the waves. Riders use shorter boards and surf 5 to 10 ft behind while the boat moves at about 10 mph.

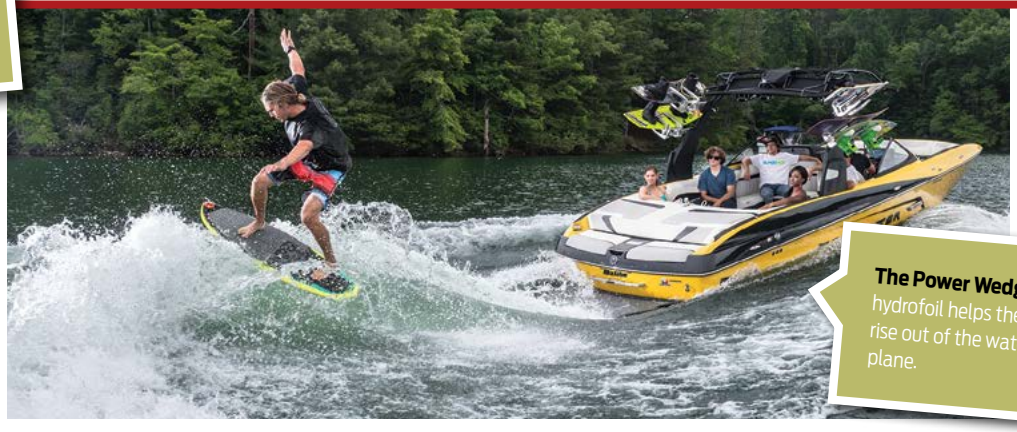
Called Malibu's Power Wedge II, the 24-x-7-in. hydrofoil simulates ballast between 500 and 2,000 lb. How? It precisely redirects water flow behind the boat to make drag and water displacement that generate large wakes. Raising and lowering the Power Wedge II lets enthusiasts customize the wake size and shape for riders of various skill levels.

The hydrofoil technology behind Malibu's Power Wedge II also gets the boat—with an engine of 330 to 555 hp—to plane faster.

A boat pushes water aside as it travels and makes a bow wave in front and a stern wave in back. But boats with planing hulls can move with enough speed to overtake the bow wave. The Power Wedge II hydrofoil reduces the time and energy for this, so the boat quickly rises out of the water to ride on its bow wave, leaving its stern wave trailing behind.



Here's where the Novotechnik magnetic sensor measures angle. Before testing its boats on the water, Malibu performs dynamic simulations with CAD models to predict and prepare for all conditions and variables. To make the Power Wedge II safe, controls make the driver get the boat to a certain speed before the hydrofoil will go up or down.



The Power Wedge II hydrofoil helps the boat rise out of the water and plane.

Once the operator determines that conditions are good for wakeboarding, he or she uses a touchscreen control panel to pump water into ballast tanks and lower the boat deeper into the water. This extra ballast works in conjunction with the Power Wedge II, creating a steep wake up to 5 ft high. Orders happen at the helm from Malibu's multi-touchscreen Command Center, a Windows-based CPU. A hydraulic actuator moves two stainless-steel arms on the Power Wedge II hydrofoil, taking it from a stowed position (90° to the water surface) through parallel to a position of 10° in lift mode.

An RFC 4800 touchless magnetic angle sensor from Novotechnik reads the hydrofoil's position and sends it as a feedback signal to the controls. Malibu's Command Center uses a proprietary algorithm to accept user input and actual arm position from the RFC 4800 to determine how far to move the arms. Controls get the hydrofoil to 10° (±1°) and get the boat on plane 25 to 75% faster, depending on hydrofoil position, how the boat is weighted, and engine and propeller size. Once the boat is planing, the operator uses the touchscreen control panel to move the hydrofoil into wakeboarding position, with -10° delivering maximum wake height. The operator can adjust the hydrofoil from -10 to 10° to suit any wakeboarder's skill level.

The angle sensor is dependable, even immersed in fresh or saltwater and subject to harsh marine environments. The sensor reports myriad position values within a small 20° range to give the user total control over wake size. What's more, the sensor is touchless—helpful in an application where there's no way to attach the sensor shaft to a moving part.

The Novotechnik RFC 4800 is sealed against ingress of water to IP69K. The magnetic marker and sensor are both immune to the corrosive effects of saltwater. Its mounting-bolt head contains the magnet and attaches to the pivot point of one arm of the hydrofoil. The sensor goes between the mounting bracket and arm. The arm pivots on a bracket, and the sensor moves with it. The RFC 4800's shock and vibration specs (50 *g* and 20 *g*, respectively) also help the sensor and magnet withstand considerable forces while moving through water.

The RFC 4800 is custom-programmable, so Malibu gets a custom nonlinear transfer curve that maximizes available values within the 20° range. That way, Power Wedge II operators get fine control over wakes and waves for riding.

Malibu also chose Novotechnik for quick turnaround time and prototyping quantities of custom product-development parts in a few days. This kept the project on schedule and gave Malibu more time for validation. Once Malibu was satisfied with programmed values, Novotechnik manufactured custom RFC 4800 units as standard stock parts.

Malibu tries to make the special capabilities easy to use, so drivers spend minimal time managing the boat and more time enjoying it. Before accelerating to plane speed, a single tap on one of the Command Center's touchscreens triggers the ballast tanks to fill with water, which takes three to four minutes. Once the day's wakeboarding and surfing is done, a tap of a Home button stows the Power Wedge II and pumps the water out of the ballast tanks for an efficient ride back to the dock. DW

Novotechnik
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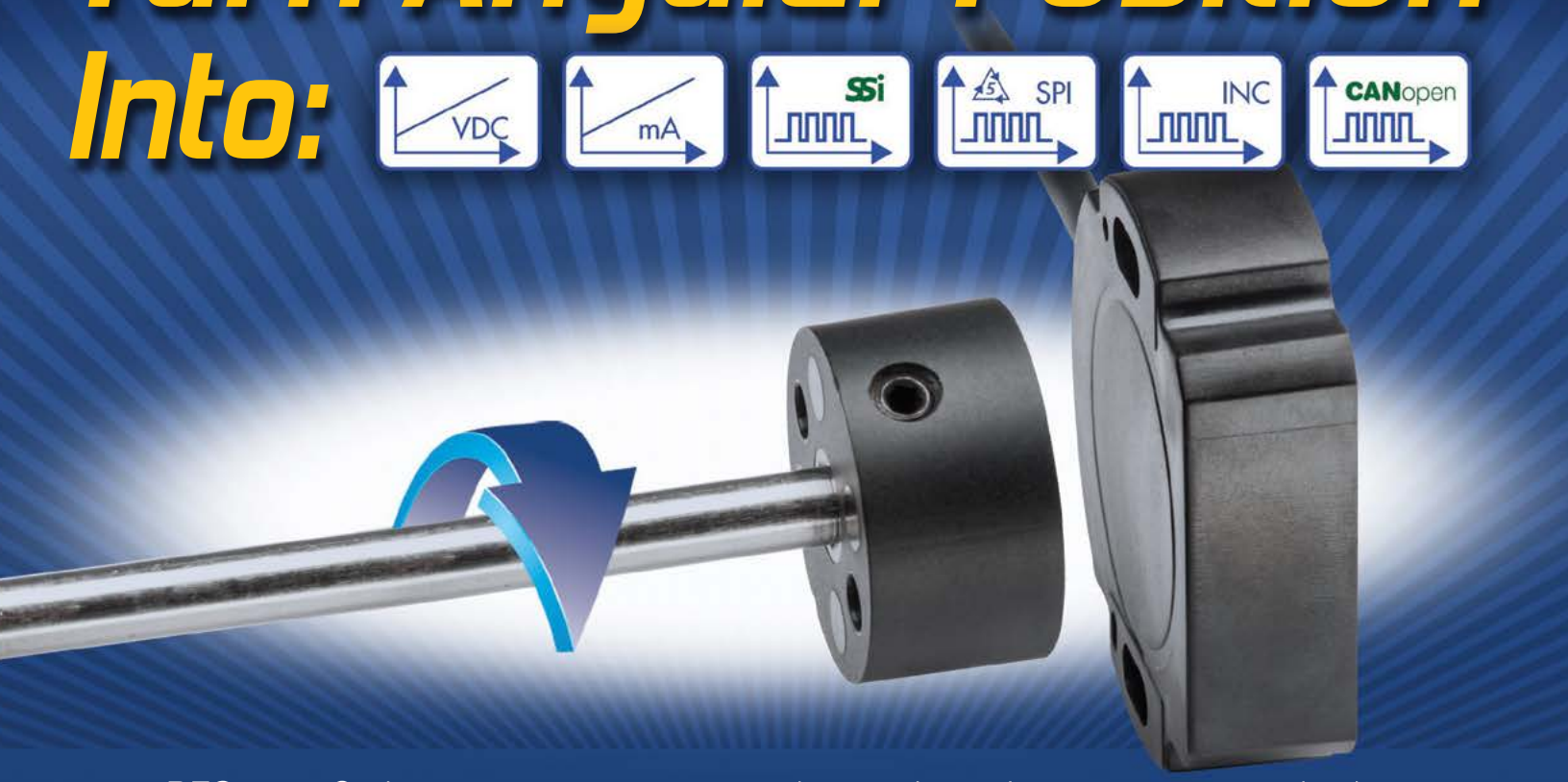
Turn Angular Position Into:



RFC 4800 Series sensors measure angular rotation using a magnet attached to your application's shaft. Since they're absolute sensors, they keep measuring even if you lose power and report the correct position when power is restored. Voltage, current and digital output options provide design flexibility to choose the interface that works best for you.

Other key specifications include:

- Repeatability - 0.1°
- Measurement range - 0 to 360°
- Resolution - versions to 14 bit
- Linearity - ≤ ±0.5 % of F. S.

For more information visit www.novotechnik.com/rfc48

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To see Malibu's Power Wedge II in action, view these resources:

Video: ***http://www.novotechnik.com/news/videopage.html***

Slideshow: ***http://www.novotechnik.com/Applications/applications.html***
(click on the Malibu application photo)