

BMW's next-gen EVs depend on an unassuming black box called 'Heart of Joy'

Last November, I strapped into the rear passenger seat of an all-electric, four-door sedan with BMW test driver and 24-hour racer Jens Klingmann behind the wheel. It was a cold day at BMW's Performance Driving Center in Greer, SC, and beneath the five-point harnesses, roll cage, and heavily camouflaged body, Klingmann had an unexpected co-pilot: a tiny black box called the "Heart of Joy."

It was an odd name for an interesting suite of tech features powering my brief three-lap stint on the 1.7-mile performance track. The Heart of Joy represents an interesting future for the German brand that still wants to be known as the "Ultimate Driving Machine" in the electrified future.

The vehicle we rode in is called the Vision Driving Experience (VDX), a one-off built specifically for testing this supposedly magic black box, as well as more upcoming features for BMW's Neue Klasse platform. The VDX uses fans to suck it down to the track for better traction at speed. Those fans are loud inside the vehicle, making it nearly impossible to hear much more than a roar while we're hurtling around the track at speeds nearing 90 mph, even though the car itself is a mostly silent EV.

In the skilled hands of Klingmann, the tires whine as they approach the limit of their grip. There's notably less BMW brake squeal as that little black box does a majority of the work as we hurtle around the track.

The Heart of Joy is an ECU that combines both driving dynamics and powertrain control into one computer. Approximately eight-inches by eight-inches, the box will serve as the control module for the upcoming Neue Klasse electrified vehicles that will start rolling out later this year.

It was developed in-house by BMW engineers, which is unique since most manufacturers cobble together hundreds of off-the-shelf components and write software code to make them all communicate seamlessly with one another. That results in a sort of homogeneity of driving experiences across different brands since most brands use the same suppliers. So BMW tasked its engineers with thinking about how to differentiate its EVs from the competition by coming up with a new, single computing system that could power a variety of driving dynamics across BMW's lineup – from SUVs to sports cars.

“The question is, what does driving pleasure look like in an era of electrification?” Christian Thalmeer, BMW's senior driving dynamics engineer, said. “It combines the sheer power and torque of electric motors, with the ability for those motors to slow and brake a vehicle, and the option to have more than one power source.”

On the track, the VDX is a rocketship, and even though we're approaching 90 mph on the straight, Klingmann barely touches the brakes and simply lifts off the accelerator to bring the vehicle to a more sane speed for the sharp hairpins.

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BMW didn't share all the specs of the VDX test vehicle, besides its insane 13,269 lb-ft of torque, and 25 percent increase in efficiency thanks to the integrated brake and energy recuperation. But they did share that the Heart of Joy is ten times faster than the strung-together ECUs on the market.

One of the major features that BMW focused on in the development was braking and stability control. The system can actively use regenerative braking to bring BMW vehicles to a full stop without the driver ever having to touch the pedal. The company says that that feature will lead to more stability at the limit since the system can brake each individual wheel to create better grip resulting in recuperation that is 60 percent more efficient.

Because a single computer system manages everything from driving dynamics to powertrain output to individual wheels, there will be less latency in the vehicle response, and you get less wear and tear on brakes and tires. Thalmeier said that the new ECU system can shift the power and deceleration from front to back and to each wheel to get the maximum recuperation and stability out of the vehicle, an event he calls the “joy of stopping.”

A new way to stand out

Heart of Joy was developed in just three short years and has currently been through more than 7,500 hours of testing, both at the hands of experienced engineers like Thalmeier and race drivers like Klingmann. The aim, of course, is to get future BMWs to drive more like BMWs, and not like, say, Kias, which uses the supplier-to-programming model for their EVs. The single computer also, conveniently, makes over-the-air updates much easier for BMW.

Bringing the development in-house is not new for BMW, but it is relatively unique in an industry that frequently looks to outside suppliers for everything from voice recognition to infotainment. ECUs tend to be outsourced to other companies like Magna Steyr, for example.

BMW CTO Frank Weber explained how the automaker's near failure to launch the 7-series 25 years ago gave the company the ability and confidence to create the new Heart of Joy. "It was a nightmare," Weber told me at CES earlier this year. "We almost didn't make the launch of the car...Today, I can say, maybe this was the best thing that happened to BMW. Because it was so difficult, we had to develop more robust processes for those advanced digital technologies much earlier than the others, and then we just groomed it over time."

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This led the company to believe it could tackle the difficult task of bringing the ECU creation in-house. "Being able to work with the controllers is something that our driving dynamics people did already for a long time, but they did it with suppliers," Weber said. "Here, we had the knowledge, and we developed the algorithms with suppliers... We have to own this, because what we can do with this new controller, when we look at everything, is just incredible."

As Weber noted, there's been an increasing push to regionalize everything from emissions requirements to supplier sources around the world. Auto manufacturer supply chains are deeply integrated across borders, and globalization like that is very difficult and costly to unwind. Look at the incredible amount of damage that President Trump's proposed 25 percent tariffs could have on US automakers alone, with dire estimates that US automakers could shut down within a week should they go into place. As Weber noted, regionalization which is used to put up boundaries between countries, is something that threatens the entire automotive industry. By bringing part of the production of what makes a BMW, a BMW, in-house, the company can, at least in some ways, minimize that risk.

If the brief but thrilling experience I had in the VDX is any indicator, the new Heart of Joy, underlines BMW's "Ultimate

Driving Machine,” roots and promises a truly dynamic, all-electric driving future.

<https://www.theverge.com/cars/613962/bme-heart-of-joy-ecu-ev-powertrain-drive-dynamics>