

# THE POWER OF ELECTRONS

In Wackersdorf we tested the Rotax proposal for the electric kart: it's the Project E20 model that will tour through Europe this year featuring the DEKM (German electric kart championship), certain races of the RMC EuroTrophy as well as special demonstration days and that has us give up nothing in terms of performance

Texts **Maurizio Voltini** Photos **Domenico Paolicelli**

A "special" kart like the Project E20 by Rotax requires specific accessories, such as (on the right) a dedicated data system capable of showing the state of charge of the batteries and particular "push buttons" on the steering wheel, as well as (below) a specific battery charger





**W**ith the progressive loosening of the precautionary health measures due to the coronavirus pandemic, we finally managed to fulfill a test on the track which we especially cared about and that too many times we were forced to postpone. We are talking about the Rotax Project E20, the electric drive proposal of the Austrian manufacturer. This is the competition kart (and certainly not for rental) that animates this year not only the DEKM, which stands for Deutsche Elektro Kart Meisterschaft, the German championship for electric karts, now in its fourth edition but also certain races of the RMC Euro Trophy and last but not least: the Project E20 will for the first time have its own category at the RMC Grand Finals in Bahrain. We believe it should be almost superfluous to underline the importance of an electric karting category in a world of motorsport that in the automotive categories is turning more and more decisively towards “ecological” series, “zero impact” from the environmental point of view, such as the now well-known Formula E, but also a specific class in Rallycross (and others are coming in the various automotive specialties).

But let's get back to focussing on our test, which took place on the challenging track of Wackersdorf, the Pro Kart Raceland circuit in south-eastern Germany that has already hosted several CIK/FIA races thanks to a well-organized structure and an interesting track of almost 1.2 km. Here we are welcomed by Steven Chapman, BRP manager, who offers us the first explanations about the kart and how to use it.

### ELECTRIC BRIEFING

Honestly, we thought that this briefing to understand the peculiarities of the electric kart by Rotax would be more complex. After all, this is a system that operates at 350 Volts, so a certain care (and a certain fear) we think is inevitable. Instead, we don't need to take too many precautions, except for the usual ones we already take with a normal kart: for example, paying attention to where you put your feet when getting in or out. If with traditional karts we have to avoid stepping on the cables of the controls, the fuel lines and, where applicable, the wiring of the electric starter, here we have to pay attention to the orange cables that “carry” the electric current. There is moreover an emergency button to “disconnect”



the power supply completely, as well as a plug that we use as the main switch, but the real precaution to keep in mind is really only one: if a malfunction happens (“but it would be the first time”, we are told) and the red LEDs on the specific dashboard come on, then we must stop at the side of the track and do nothing until the Rotax technicians arrive. At the most, if we really have/want to get out of the kart, let's remember to do it with the now famous “jump or hop” to avoid making or becoming an “electrical bridge” between the kart and the ground with our feet.

### TWO RECHARGING TIMES

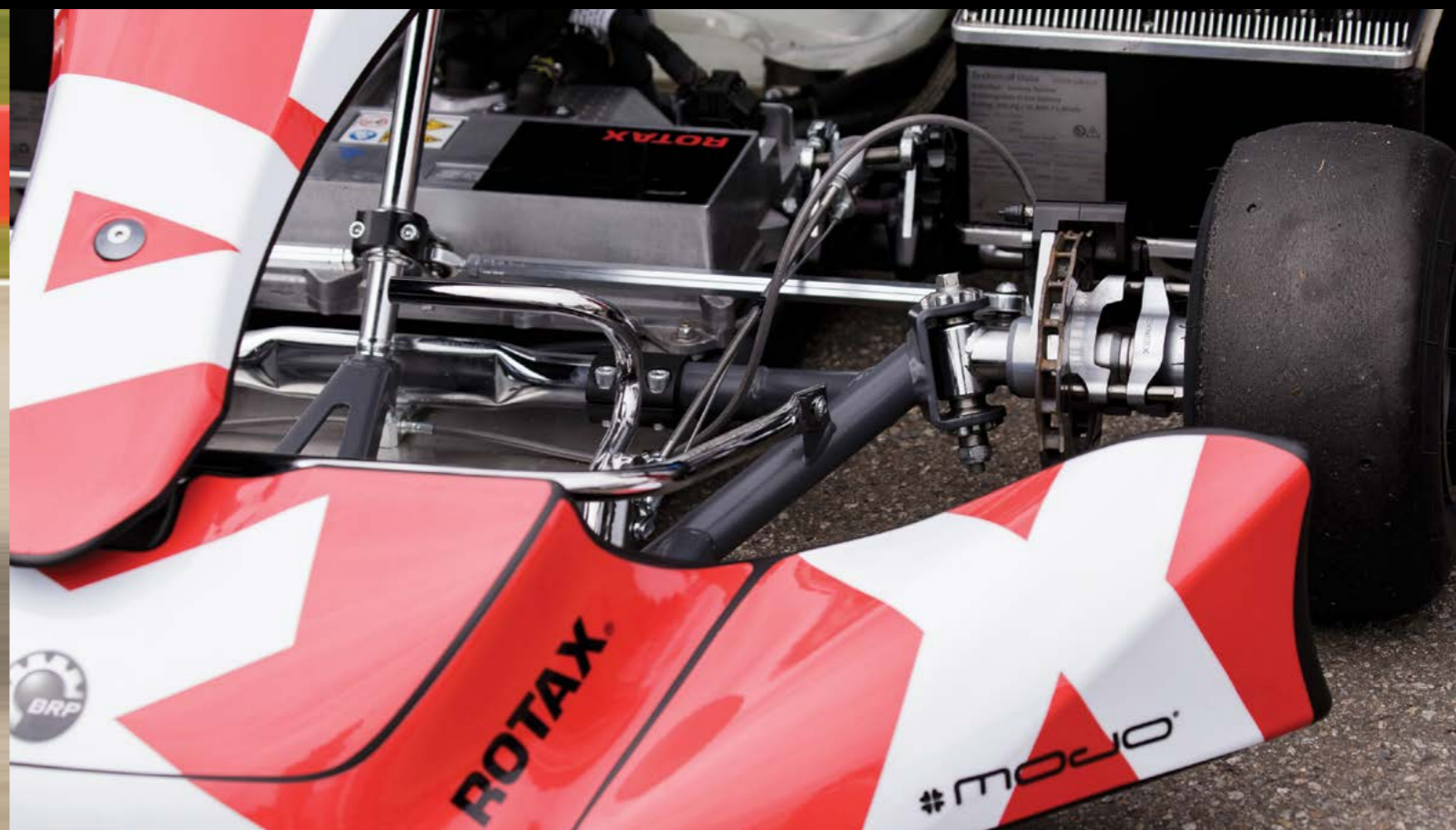
On this occasion, we also learn something about charging batteries, which are lithium-ion. Simply connect them to the specific charger with its quick charger cable and place two covers with fans on the batteries to cool them down during charging. There are two charging modes available: one is the fast mode, which takes about 45 minutes and is suitable for normal testing days when we want to get on track as often as possible. Otherwise, the normal recharge mode, the one we use during race days (there is, after all, enough time between one heat and the next)

The Sodi Sigma frame is the same manufactured for the Rotax DD2 because the electric motor maintains the same type of mounting (ride) that incorporates the axle support, in this case 50 mm. Similarly, there are also brakes on the front (below)



requires about an hour and a half if we really have zero batteries. A situation, the latter, that actually should not occur in normal operating conditions of the race. In fact, engine, batteries and software have been optimized so as not to have to manage, hold back or “save” anything during a race. In fact, assuming that a race is normally about 15 laps, a full recharge would allow the kart to run 18-20 laps, so at least 3 more

than necessary. Therefore, you can race to the max, thinking always and only about giving your best. It should be added that the management software has been designed so that, should the charge reach zero percent (the quantity is always shown on the display panel on the steering wheel), the Rotax electric kart does not stop on the spot but allows you to return to the pits, albeit with limited power, in any case.





## LOTS OF TORQUE AND SPEED

After these preliminaries (actually longer to write than to acquire on the track while preparing), and however indispensable for those who get in an E20 for the first time, it is finally time to get on track and really drive this kart. Just plug it in and push the two buttons on the steering wheel at the same time, and the kart is operational. Initially, we try to be cautious with the right pedal, perhaps even exaggeratingly so, but this care is not completely pointless: the responsiveness of the electric motor is really remarkable; it furthermore unloads a lot of torque on the rear wheels, so it is not really the case to create any chaos while we are still leaving the pits... Even once on the track, however, it is better to be careful with still cold tires, because the sudden power oversteers come extremely easily.

Once you get into the rhythm, you appreciate the good general balance (the weights are well distributed) but above all, and we'll never get tired of repeating it simply because it's the thing that impresses you the most when driving, the great torque coming out of corners. A powerful thrust (we are still talking about almost 33 hp of power and 190 Nm of torque!) that is also reflected in speed. In fact, at the end of the Wackerdorf start

straight it is possible to exceed 132 km/h (as you can see also from the telemetry graphs) that is over 10 km/h more than the Rotax DD2. And even compared to other OK karts that took advantage of the reopening of the track to be present, the differences in pure engine performance are definitely limited.

## MORE SIMILAR TO A KZ

To tell the truth, we found that the driving of the Project E20 has more similarities with those of the KZ class karts with gearbox than with the single-speed ones, and not only for the presence of brakes in front, necessary to better slow down the great mass of the electric kart. In fact, it is easy to notice that, compared to the rounded trajectories that other direct drive karts have to make on the track, especially in slow turns, the E20 can afford narrower or more "straightened" lines coming out of bends, just to better exploit its acceleration and thrust qualities. A kind of driving that with another single speed kart would have

**In addition to the two testers of the day on the track (Darrell Smith official Rotax test driver and the author of the article) in the photo we have, from the left, Dorijan Cargonja (technician), Steven Chapman (manager), Siegfried Wilhelmstaetter (electrical engineer), Philip Walsdorf (technician)**

made us "slow down" irremediably, but not with this one. Soon, however, we realize that, yes, this remarkable torque helps you in an incredible way to "extract" yourself from the bends, but it is always better not to exaggerate in relying completely on this boost. The weight, however, can be felt and therefore

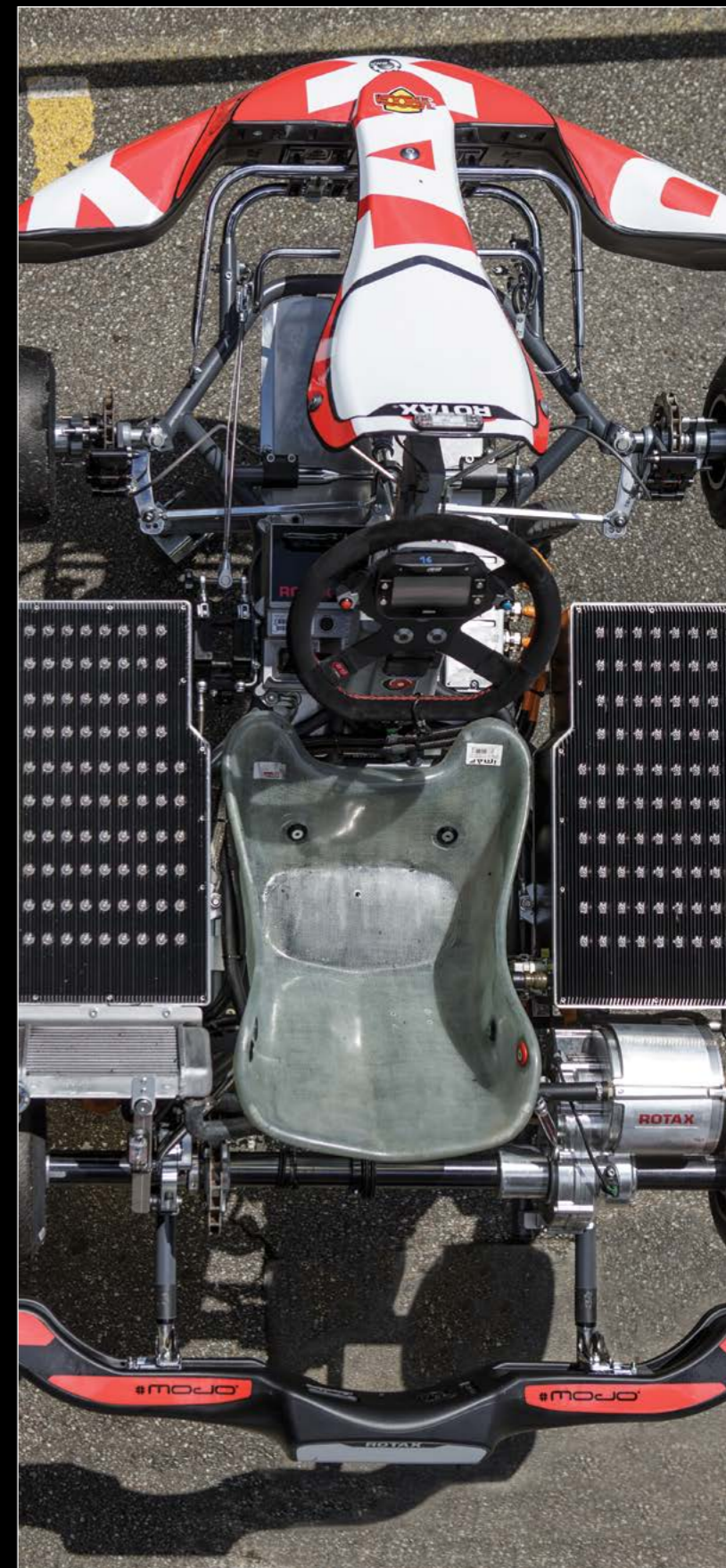
## LIKE A ROTAX DD2, MINUS GEARBOX

Let's see how the Rotax Project E20 is materially made more in detail. Even if the main peculiarity is the electric propulsion, we prefer to immediately highlight the chassis specificities, also as it is linked to the constructive philosophy of the engine itself. In fact, the adopted chassis is the Sodi Sigma, already used for the Rotax DD2 class, with brakes also in front, because the assembly of the engine is completely similar: in fact, the engine incorporates in both cases the support structure of the axle on the right side, giving up the chain drive. The only difference is that on DD2s the axle is 40 mm in diameter, while on E20s it is 50 mm. As far as the transmission is concerned, the difference is also that the DD2 has a 2-speed gearbox, while the E20 is single-speed. Also: the ratio is fixed and not replaceable, a factor that does not represent a limitation as the adopted ratio allows a maximum speed of 135 km/h and at the same time the typically electric torque, that is available from low speed, allows the vehicle to exit from even the slowest curves without problems. To be precise, the electric motor adopted is a permanent synchronous type magnet and provides something like 33 hp together with 190 Nm of torque: a value that no 125 kart can match. To power it with an operating voltage of 350 volts are two lithium-ion batteries and a control unit, also liquid-cooled and further optimized in the management software. It should be noted that among the updates made to the electric kart for this racing season is also the reduction of the radiator, a modification that makes the aesthetics of these karts even more balanced and fluid and that was possible because in practice it was seen that the cooling requirements were less stringent than feared. But, at least initially, it is always better to be on the safe side... and this is what Rotax technicians have done and are doing.

## DATA SHEET SET-UP E20 - TEST IN WACKERSDORF

KART	ROTAX Project E20
Chassis maker	Sodi Kart
Chassis model	Sigma 1040mm
CIK homologation	Yes
Front width	1215mm
Rear width	1398mm
Chassis height (front)	Standard - Middle
Chassis height (rear)	Fixed
Additional bars (front/rear)	Front torsion bar - upright position / no
Toe-in	Out 2mm each side
Camber	-0.2mm
Caster	Full castor
Rear axle	50mm Spec - no adjustment
Front hubs	TEKNEEX 90mm Alu
Rear hubs	TEKNEEX 75mm Alu (optional 90mm Alu "wet")
Brake system	Front and Rear disks with adjustable bias TEKNEEX - CIK FIA 96/FR/20
Wheels	Magnesium low volume, 130mm - 212mm
Pneus	Mojo D5 - 0.60bar (cold pressure)
Engine	Rotax permanent magnet synchronous motor (PMSM) with integrated transmission
Control Unit	Specifically developed VCU, combined air and liquid cooling system
CIK homologation	DMSB - DEKRA - IP66 rated water and dust proof
Batteries	Lithium-ion with battery management system (BMS) and isolation monitoring device (IMD)
Transmission ratio	Fixed
Configuration	24KW - 190Nm - 5 seconds boost per lap
OTHER	12.5 Minutes races with full power (no drop off in power during the race). Boost is available every 30 seconds. Integrated Isolation monitoring system built into the custom AIM Mxm display / Data logger. Reverse function E-Braking - recuperation possible

Among the updates for the 2021 version of the E20, in addition to those of the control unit we have a smaller radiator for cooling the engine and VCU. The led lights are used to show the security status of the entire system





it is better not to give up the speed in the middle of the curve. Similarly, the powerful three-disc braking system ensures powerful slowdowns when we attack the left pedal, but even at this stage it is better not to overdo it when we enter the curve, not to slow down too much and “block”. Also because if we insist too much on relying on the engine torque to get out of the curve as best as possible, the kart tends to start “pumping” on the rear wheels. In short, even the electric kart requires shrewd driving to get the best out of it in chronometric terms, no exception here.

**BOOST AND... LAXITY**

In addition to everything described above, the Project E20 offers other interesting features, such as the possibility of using the reverse gear but, above all, the boost function that temporarily increases the power to facilitate overtaking. This can be used every 30 seconds at its minimum, and therefore essentially once a lap, although then obviously each driver can manage it differently depending on the situation: it is not said that the best point of attack is always the



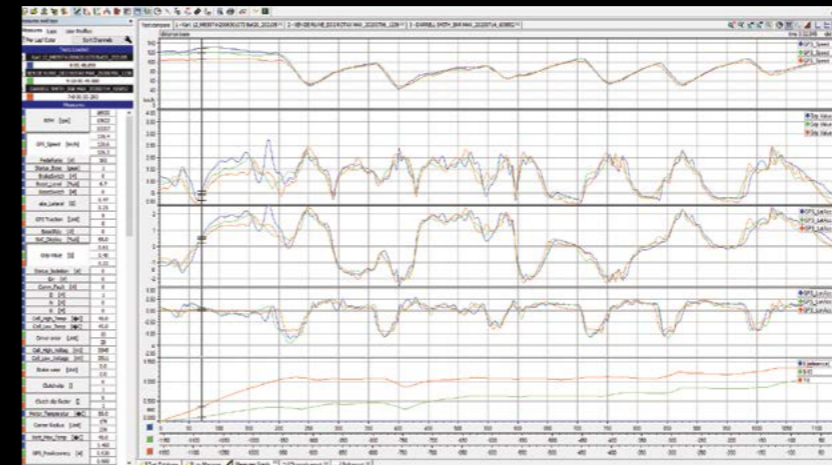
When getting on and off the kart, it is better to avoid stepping on the orange high voltage cables (350 Volt) which are connected to the control unit and are in any case in a fairly protected position

main straight, after all. Also, this function helps to make the races more strategically interesting and to prepare the drivers for what may happen in the future in the bigger categories. In short, the test was certainly interesting, but one of the most interesting things was pointed out to us by our photographer Domenico, who was waiting to take a shot with

the technicians at work on the kart: in fact, once the kart was brought back to the pits and connected to the recharge, there was no one forced to work on the vehicle as we saw others doing in the rest of the paddock. There was no need to grease the chain, fix the carburetion, change the engine, the sprocket or anything else as we used to see in the rest of the pits with the OKs: if there is no need to make any change in the set-up or to touch up the tire pressure, the E20 is simply left still to recharge and the mechanics can take care of something else. Again, this really is another way of approaching racing. After all, it is now a well-known and “intrinsic” factor that electric vehicles have a higher initial (purchase) cost, but then an almost zero operating cost: practically only the tires. Even the fear of battery wear is disappearing: the karts used by Rotax have not shown any decline in this respect even after two years of intensive use.

**WHAT FUTURE PROSPECTS**

So we have seen that from the driving point of view, Rotax electric karts are



**PROVEN PERFORMANCE**

For fans of telemetry data and to provide evidence of the increased performance offered on the track, here are the comparisons between Rotax E20 (blue line), Rotax DD2 (green line) and Rotax Max (red line). The electric kart is faster both on the straight and on the lap, and its data acquisition provides further parameters on the engine and batteries

Run	Kart	Time	Max Speed	Avg Speed	Max Accel	Avg Accel	Max Decel	Avg Decel
1	Rotax E20	0:48.173	130	85	1.2	0.8	-1.5	-1.0
2	Rotax DD2	0:49.010	125	80	1.1	0.7	-1.4	-0.9
3	Rotax Max	0:49.270	120	75	1.0	0.6	-1.3	-0.8

Driver	Kart	Run	Time	Max Speed	Avg Speed	Max Accel	Avg Accel	Max Decel	Avg Decel
DARRELL SMITH	E20	1	0:48.173	130	85	1.2	0.8	-1.5	-1.0
XEN DE RIJN	DD2	1	0:49.010	125	80	1.1	0.7	-1.4	-0.9
DARRELL SMITH	Max	1	0:49.270	120	75	1.0	0.6	-1.3	-0.8

**THE “ARRIVE & DRIVE” SERIES**

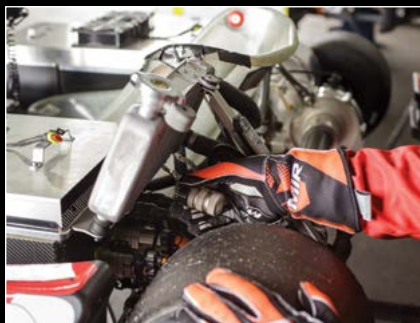
For the 2021 season BRP-Rotax is offering several possibilities to boost your perspective, driving the Rotax Project E20 E-Kart on an Arrive&Drive tour throughout Europe. Beginning with the DEKM, the German e-karting championship, which starts this month of June with a series of four events (plus official collective tests) on the tracks of Wackersdorf, Mülsen (twice) and Genk, you’ll additionally have the chance to drive the Rotax Project E20 E-Kart during the RMC EuroTrophy in Mülsen from 16th to 18th of July and in Wackersdorf from 3rd to 5th September, 2021. AND: the Rotax Project E20 will be introduced as a new category for the RMC Grand Finals 2021 which will be held from 11th to 18th December 2021 in Bahrain. Moreover, there will be demonstration days of the Rotax Project E20 on different locations in Europe – check out the website [www.rotax-kart.com](http://www.rotax-kart.com) and the social media channels for updates and more information. The interesting aspect is that the races are offered as an “arrive and drive” formula for drivers who want to participate. In other words, the karts are managed and brought to the track by Rotax, so drivers just have to go there with their overalls and a helmet. We repeat that at the moment these electric karts are not available for sale. For more information about the fee and the prizes, please visit the official websites of the organizers: [www.dekm.de](http://www.dekm.de), [www.rotax-kart.com](http://www.rotax-kart.com), [www.rotaxmaxchallenge-eurotrophy.com](http://www.rotaxmaxchallenge-eurotrophy.com)

**Dates:**

Event	Dates	Location
DEKM	04. - 06. 06.	Wackersdorf (DKM)
	09. - 11. 07.	Mülsen (RMC Germany)
	30.7. - 01.08.	Genk (DKM)
	10. - 12. 09.	Mülsen
RMC EURO TROPHY	16. - 18.07.	Mülsen
	03. - 05.09.	Wackerdorf
RMC GRAND FINALS	11. - 18.12.	Sakhir, Bahrain



not disappointing; on the contrary. And we're just at the beginning; some updates have already been made for this 2021 (we write about them in more detail aside), but that's not all. Keep in mind we are talking about karts that are basically still at the prototype stage (which is also why they are not sold but only rented) and thus still have room for development. For example, we saw the official test driver Darrell Smith try out a depowered variant on the track watching this space as next year Rotax may have something exciting for their younger drivers. This is an evolution that would be exponentially positive, because lowering weights would not only improve lap performance, but also energy consumption. Consequently, it would become possible to adopt less powerful engines and smaller batteries without reducing performance and range; these motors and batteries are also lighter, further lowering weights. In short, all this



Above, we show the position where you connect the charging cable or the "cap" that goes in its place after charging is finished. Below you can see the cover with the fans to cool the batteries while charging

starts a virtuous circle in which even apparently small improvements can be amplified considerably.

### THE NOISE PROBLEM

This is as far as future development possibilities are concerned. However,

without taking away from the fact that already now the perspectives seem very good: Project E20 has shown that electric karts already have their *raison d'être*, and this even without thinking about the concrete problems that some tracks (and motorsport in general) have with noise. That when it leads you to close certain facilities because of complaints from the neighborhood, it is not a small problem or one that can be ignored/postponed indefinitely.

On a related note, it's fair to point out that when driving, there you feel aerodynamic sound and tire squeal (not covered by the exhaust noise), and when we watched the other E20s running, the rustling noise as the electric karts passed by didn't detract from the feeling of speed at all. In fact, at one point we found ourselves thinking if one day we will be forced to change the name of our magazine from "Vroom" to "Swoosh"...

