EMRAX
INNOVATIVE E-DRIVES

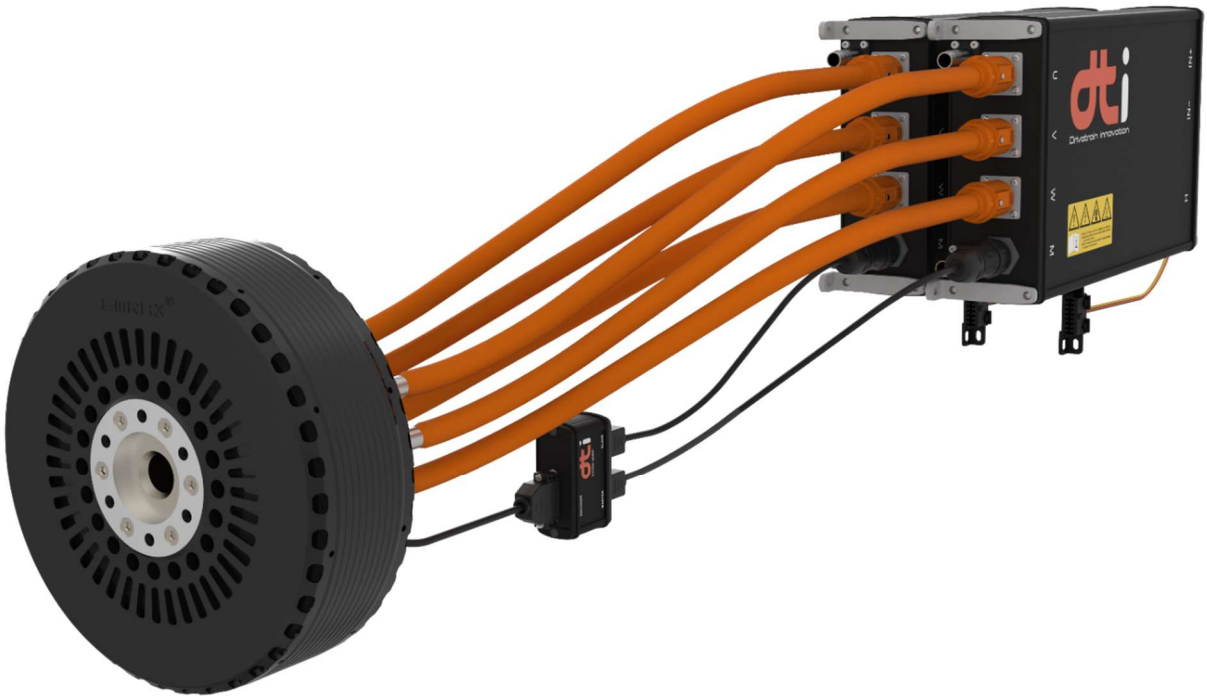
List of recommended controllers

V1.3 - 17. Oktober 2024

How to choose the correct controller for your EMRAX motors?

EMRAX motors/generators are axial flux synchronous three phase BLDC electric motors / generators, therefore, the controllers need to provide a three-phase PWM sinusoidal signal for optimal performance. It is recommended to run EMRAX motors in FOC mode.

Detailed instructions regarding the selection of the best controller are described on the next page.



Feel free to reach out to us at support@emrax.com for any questions that you may have.

1. DETERMINE YOUR REQUIRED POWER, TORQUE AND SPEED

Power, torque and speed are the most important requirements when choosing your electric motor. If you haven't determined all three values yet, please refer to the relationship between the variables below:

$$power\ [kW] = \frac{\text{torque[Nm]} \cdot \text{speed [RPM]}}{9549}$$

2. CALCULATE THE REQUIRED VOLTAGE AND CURRENT

It is important to match your EMRAX motor to your system voltage and available current output. Voltage is directly proportional to the motor's speed, while the controller's output current limitation will determine the maximum torque of your motor. If not constrained by requirements, we recommend increasing the voltage of your power supply as much as you can, as this will decrease the current, thus improving the efficiency of the system.

Each motor has its own speed constant K_v [RPM/V_{DC}],which tells us how fast the motor is going to spin at a given applied voltage. Similarly, motors can be described by the constant K_T [RPM/V_{DC}], which tells us how much current the motor requires to output a desired torque.

Voltage required:

$$voltage\ [Vdc] = \frac{\text{speed [RPM]}}{\text{Kv[RPM/Vdc]}}$$

Current required:

$$current\ [Arms] = \frac{\text{torque [Nm]}}{\text{Kt[Nm/Arms]}}$$

*When doing the calculations, please take the motor limits in consideration (peak torque values, maximum speeds, etc.)

3. CHECK THE AVAILABLE CONTROLLERS

Now it is important to match your EMRAX motor to your system voltage and available current output. Voltage is directly proportional to the motor's speed, while the controller's output current limitation will determine the maximum torque of your motor. If not constrained by requirements, we recommend increasing the voltage of your power supply as much as you can, as this will decrease the current, thus improving the efficiency of the system.

4. HIGH-POWER CURRENT LIMITATIONS

If you are designing a high-power electric drivetrain, there is a possibility that none of the recommended controllers can satisfy your current requirement. In this case, we offer a 2x UVW motor winding configuration that allows you to connect two motor controllers to a single EMRAX motor. This configuration splits the motor's internal windings in two halves, which allows you to feed the motor with two controllers and provide enough current for the motor. 2x UVW configuration is also used for safety critical applications, where redundancy is required.
Please note that in case you choose a 2x UVW winding solution, you will need to provide a position signal for both controllers. This can be achieved by using a signal splitter for your encoder, or using a tandem resolver configuration.

5. FURTHER QUESTIONS

Feel free to reach out to us at support@emrax.com for any additional questions that you may have

Please note, that all data collected in the table above are subject to change and should be checked for the latest updates with your favourite controller manufacturer!

Manufacturer	Model	Cooling	IP	Current peak [Arms]	Current cont. [Arms]	Voltage peak (V_{DC})	Recommended position sensor	Weigh t [kg]	Dimensions L x W x H [mm]
Embedded system solutions EmsiSO www.emsiso.com	H10	LC	69	150	100	420	Encoder RLS RM44SC	3,5	256 x 182 x 150
	H10	LC	69	75	50	800		3,5	256 x 182 x 150
	H20	LC	69	300	200	450		5	283 x 280 x 103
	H20	LC	69	150	120	800		5	283 x 280 x 103
	H40	LC	69	600	450	450		7	385 x 285 x 105
	H40	LC	69	450	300	800		7	385 x 285 x 105
	L30	LC	69	650	450	120		3	200 x 165 x 94
	L30	LC	69	450	300	120		3	200 x 165 x 94
NX Technologies nx-tech.com	R300	LC	68	560	450	840	5 pole pair Resolver (TS2620N1095E161)	7	340 x 220 x 95
	E150	LC	68	530	410	450		4,80	366 x 207 x 62
	E8150	LC	68	250	200	826		4,80	366 x 207 x 62
	W90	LC	68	410	325	450		3,50	270 x 160 x 65
dti drivetraininnovation.com	HV-850	LC	65	600	365	800	Encoder RLS RM44SI	6,80	420 x 213 x 77
	HV-550	LC	65	390	365	800		6,80	420 x 213 x 77
CASCADIA MOTION cascadiamotion.com	CM200DX	LC	67	740	300	480	5 pole pair resolver (TS2620N1095E161)	6,75	330 x 188 x 97
	CM200DZ	LC	67	400	200	840		6,75	330 x 188 x 97
	CM350DZ	LC	67	800	500	540		17,40	358 x 299 x 99
UNITEK Drives made in Germany unitek-industrie-elektronik.de	Bamocar 700-160	LC	65	120	80	700	5 pole pair resolver (TS2620N1095E161)	3,50	280 x 200 x 90
	Bamocar 400-400	LC	65	300	200	400		8,50	355 x 230 x 135
	Bamocar 700-250	LC	65	187	125	700		8,50	355 x 230 x 135
	Bamocar 700-400	LC	65	300	200	700		8,50	355 x 230 x 135
	Bamocar 700-900	LC	65	675	450	700		15,50	450 x 313 x 135
	Bamobil - IM 160-300	LC	65	225	150	120		6,80	280 x 200 x 90
SCOTT DRIVE scottdrive.co.nz	SD80LV	LC	65	800	600	140	Encoder RLS RM44IE	5,00	270 x 150 x 65
	SD100LV	LC	65	1000	800	140		5,00	270 x 150 x 65
	SD100	LC	65	770	400	500		9,00	385 x 320 x 100
	SD200	LC	65	900	450	500		10,00	385 x 320 x 100
	SD250	LC	65	800	700	450		16,50	460 x 350 x 108
	SD300	LC	65	600	450	800		16,50	460 x 350 x 108
	SD500	LC	65	900	700	800		16,50	460 x 350 x 108