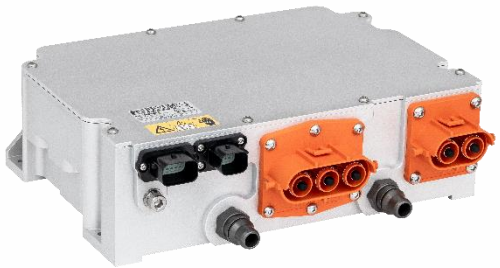
emDrive H20

HIGH VOLTAGE MOTOR CONTROLER
TRACTION, PROPULSION & WORK FUNCTION ELECTRIFICATION



PRODUCT DATASHEET

emDRIVE

PRODUCT OVERVIEW

emDrive electric Motor Controllers are designed for traction, propulsion, work functions, and electro-hydraulic systems.

Suitable for heavy duty off-highway machinery for construction, agriculture, mining, material handling, airport ground support as for electric boats and power-sports vehicles, it ensures reliable and efficient performance across various mobile applications.

emDrive shares common unique value propositions

- **Compactness** Unmatched continuous power density
- **Efficiency** Smart motor control unlocking full system performance and energy savings
- **Safety** Compliance with the latest electrical safety, environmental, EMC and functional safety
- **Modularity** One platform, multiple voltage options – Switch without system redesign

EMDRIVE MAIN FEATURES

emDrive are rugged motor controllers for mobile applications. Main features are:

- Advanced motor control algorithm for precise control of **AC, PM, and SyRM motors**
  - Torque and Velocity control for precise, smooth and responsive regulation
  - Generator mode to supply stable DC voltage - with PMSM motors
  - Overmodulation for full battery voltage utilization, enabling higher motor performances
  - Dynamic calculation of power stage and motor temperature for maximum performance
  - Dynamic switching frequency for optimal efficiency
  - Reliable system operation with linear derating and protection functions
  - Sensor or sensorless operation for reduced hardware
- Universal motor position sensor interface - supports digital and analogue sensors
- Configurable safe state behavior: Active Short Circuit (ASC) or open terminals
- Supports CAN communication protocols, including J1939 and UDS
- Advanced diagnostics and fast data acquisition
- HV voltage safety
  - Active and passive discharge
  - Isolated HVIL input (High voltage interlock loop)

Motor controllers can be supplied with emDrive Configurator PC software allowing real-time data acquisition, parameterization, diagnostics, firmware upgrading and application programming.

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SPECIFICATIONS

Key performances

emDrive	H20B-400-SD	H20B-800-SD	unit
Continuous current S1 (power loss)	260 (pending)	85 (pending)	A_{RMS} (W)
Peak current S2 -60sec (power loss)	400 (3040)	140 (2380)	A_{RMS} (W)

Operating conditions: Space vector modulation (SVM) at 80%, Load cos phi >0.98, Switching frequency 8 kHz

- **Liquid cooled:** Coolant temperature 60 °C, Ambient temperature 60 °C, Nominal flow, 50:50 water/glycol

Electrical characteristics

emDrive	H20B-400-SD	H20B-800-SD	unit
DC link operating voltage	12* to 420	12* to 800**	V
DC link capacitance	910 ±10%	280 ±10%	µF
Insulation to heatsink (basic)	1100	2000	V
Supply voltage (KL15/KL30 voltage)	9 to 36	9 to 36	V
Supply current (max. Ignition current)	pending	pending	A
Switching frequency (adjustable)	4-16	4-16	kHz

* In case of ASC functionality minimum voltage is 200V.

** on request up to 870 V. For further information see ordering chapter.

Environmental characteristics

emDrive	H20B-400-SD	H20B-800-SD	unit
Operating ambient temperature	-40 to 85		°C
Max. ambient temperature (no derating)	60		°C
Operating coolant temperature *	-40 to 85		°C
Max coolant temperature (no derating) *	60		°C
Nominal coolant flow *	pending		l/min
Max. operating pressure *	2		bar
Pressure drop @ nominal flow & 25 °C *	pending		bar

* LC variant. Note: 50/50 mixture of distilled water and glycol with glycol-tolerant hoses.

Mechanical characteristics

emDrive	H20B-400-SD	H20B-800-SD	unit
Cooling	LC		/
Mass	7350		g
Dimensions (Height x Width x Length)	102 x 316 x 253		mm
Material (housing)	Aluminum		/

Communication and sensor connections

Communication	Motor feedback

• J1939, UDS, CANopen (DSP402 compatible)
• Proprietary CAN messaging based on DBC
• Optional
  ○ XCP
  ○ Secondary CAN interface
  ○ CAN FD
• Cybersecurity related features
  ○ Secure FW upgrade
  ○ Authorization algorithms for secure access to parameters and features
  ○ Use of CPU security features to prevent reading memory and changing content
	• Supports multiple position sensor types:
	  ○ Sin/Cos differential & single-ended
	  ○ Resolver
	  ○ SSI (Synchronous Serial Interface)
	  ○ Hall sensors
	  ○ AB encoders
	• One or two connections for temperature sensing
	  ○ Supported sensors PT100, PT1000, NTC and KTY

SAFETY AND COMPLIANCE

Functional safety

Development and design according to ISO25119, considered ISO19014 on system level and safety function aligned with EN1175 & IEC 61800. SAE J1939-76 Functional safety communication protocol. PL levels of machinery under ISO 13849 can be met following equivalence with ISO25119. Three core CPU compliant with ISO 26262 ASIL D.

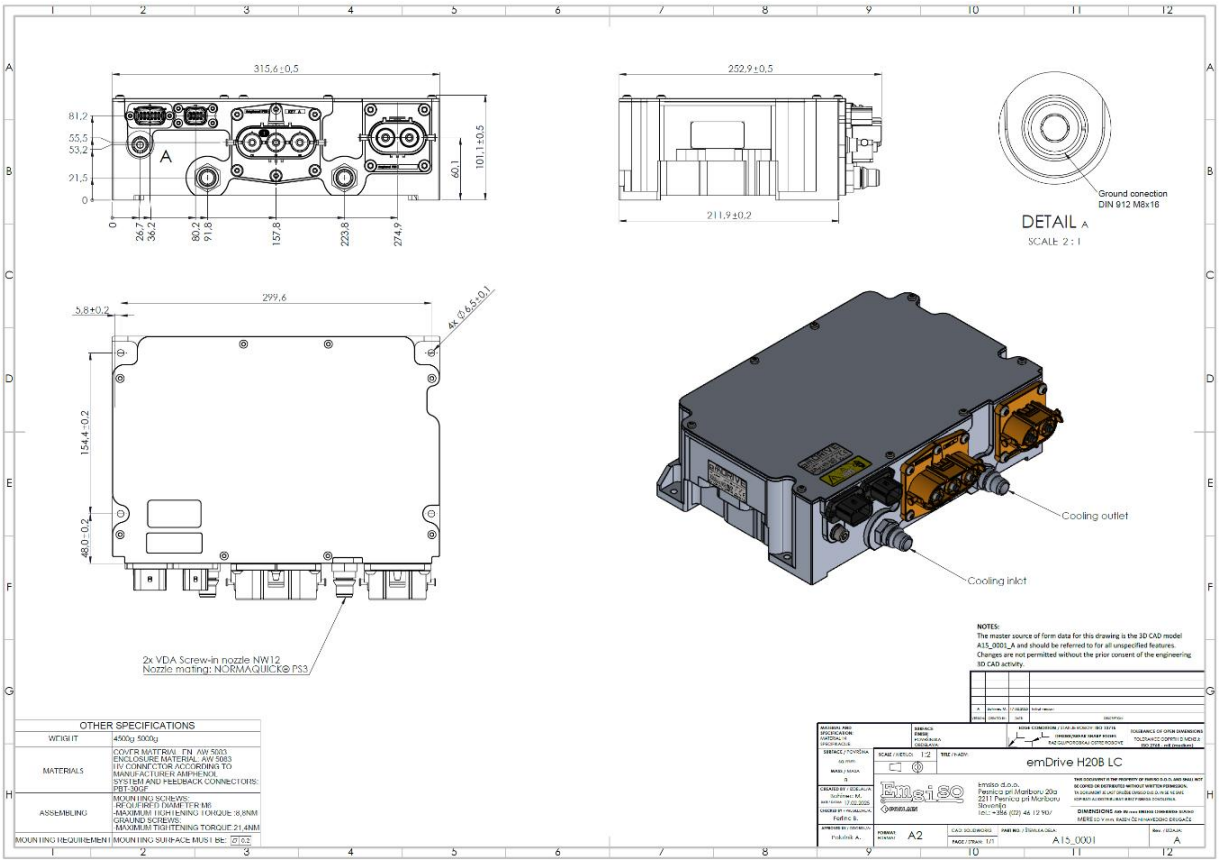
Supported safety functions – **AgPL-C performance level**		
Stopping	**Monitoring**	**Output**
Safe Torque Off (STO)	Safe Operating Stop (SOS)	
Safe Stop 1 (SS1)	Safely Limited Speed (SLS)	
Safe Stop 2 (SS2)	Safely Limited Acceleration (SLA)	
	Safe Speed Range (SSR)	
	Safe Limited Torque (SLT)	
	Safe Torque Range (STR)	
	Safe Direction (SDI)	
	Driver presence detection – CAN	
	Emergency stop detection - CAN	

Compliance (pending)

Compliance	Standard
Electrical safety	EN 61800-5-1
Functional safety	ISO 25119 EN ISO 13849 EN ISO 19014 (considered for system level HARA) EN 61800-5-2 (safety functions) EN 1175 (safety functions)
Environment	IP rating IP66 & IP69K (with mated connectors) Random vibration ISO 16750-3:2023, Test XVI, 10 Hz – 2000 Hz, 31.9 m/s2 Shock ISO 16750-3:2023, Shock II, 500 m/s2, 6 ms, half-sine Free fall ISO 16750-3:2023, 0.25 m
EMC	UN ECE R10 Rev.6 EN ISO 13766-1 EN ISO 13766-2 EN ISO 14982 EN 12895
Compliance	CE

MECHANICS

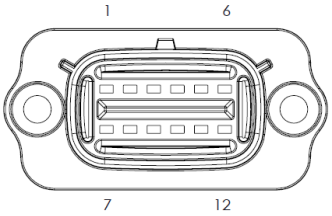
H20 Liquid Cooled – Slim system connector (EMDI-2-H20B-xxx-xx-L0-x-x-S2-1)



WIRING

Feedback connector details

Molex MX 150, Keying option A, 12 pin (Mating part[1]: 12 pin Molex PN 334721206)

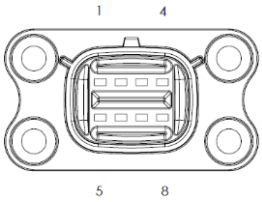


	1	2	3	4	5	6
Resolver	EXC +	EXC -	SIN +	SIN -	COS +	COS -
SIN/COS	5V supply	GND	SIN +	SIN -	COS +	COS -
SIN/COS single	5V supply	GND	SIN +	/	COS +	/
SSI	5V supply	GND	Data + (Rx)	Data - (Rx)	Clock + (Tx)	Clock - (Tx)
Hall	5V supply	GND	Hall U	Hall V	Hall W	Index
AB encoder	5V supply	GND	Enc A	Enc B	/	Enc Z
	TEMP 1 GND	TEMP 1	TEMP 2 GND (CAN2 L)*	TEMP 2 (CAN2 H)*	SHIELD (CAN2 GND)*	SHIELD
	7	8	9	10	11	12

* CAN 2 is optional HW configuration (see ordering information).

System connector details

Molex MX 150, Keying option A, 8 pin (Mating part[1]: 8 pin Molex PN 334724806)



1	2	3	4
GND (KL31)	CAN1 L	CAN1 GND	HVIL -
KL30	CAN1 H	KL15	HVIL +
5	6	7	8

KL30=Logic supply, KL15= Logic supply - Ignition, HVIL= High Voltage interlock

Power connection description

H20B-400-SD

Connector	Description	Mating connector
Connector DC	2-2141227-1 from TE Connectivity HVP800 2-pole contact	TE Connectivity
Connector AC	2-2141230-1 from TE Connectivity HVP800 3-pole contact	TE Connectivity

H20B-800-SD

Connector	Description	Mating connector
Connector DC	HVSL800 02 2 A 1 H6 - Excel|Mate S from Amphenol 2-pole contact	HVSL800 06 2 A 1 xx
Connector AC	HVSL800 02 3 A 1 H6 - Excel|Mate S from Amphenol 3-pole contact	HVSL800 06 3 A 1 xx

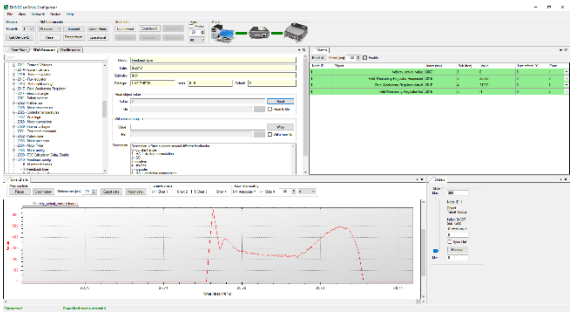
[1] For reliable vibration and galvanic corrosion protection recommended mating contacts shall be gold plated.

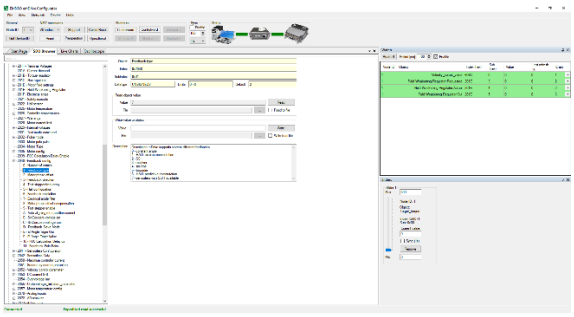
ECOSYSTEM AND TOOLS

emDrive Configurator

emDrive Configuration Tool is a powerful software application designed for the efficient setup, monitoring, and management of emDrive motor controllers. Key Features:

- **Comprehensive Parameter Configuration** to Easily adjust and fine-tune controller settings to match specific application requirements
- **Real-Time Data Acquisition** facilitating immediate analysis and informed decision-making.
- **Integrated Diagnostics**
- **Firmware Management:** Streamline firmware updates directly through the tool





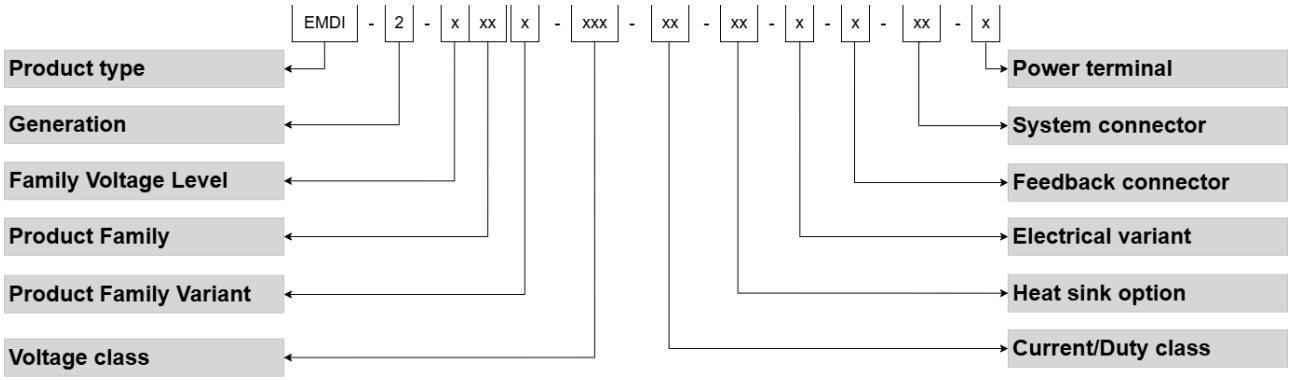
Application Programming

emDrive features **LUA high-level scripting language** used for **custom application programming** within the motor controller. It enables users to **tailor control logic**, implement **custom functionalities**, and optimize performance without modifying core firmware. Key Benefits:

- **Flexible control logic** for specific application needs
- **Real-time execution** for dynamic system adjustments
- **Seamless integration** with motor controller functions and CAN communication

MODEL CODE

Product code = Product base code + options/variants code
Example of product code: EMDI-2-H20B-400-SD-L0-0-0-S2-1 -> **EMDI2H20B400SDL000S21**



Product base code

Type	Gen	Level	Product Family	Family Variant	Voltage class	Current class	Heat sink
EMDI	2	H	20	B	400	SD	L0=liquid
EMDI	2	H	20	B	800	SD	L0=liquid

Options/variants codes for voltage class 400

Electrical variant	Feedback connector	System connector	Power terminal/connector
0=default (SW conf. ASC) 1*=nonASC	0=2x Motor temp. 1*=1x Motor temp., 1x CAN2	S2=CAN1 + HVIL	1=Plug-in

Options/variants codes for voltage class 800

Electrical variant	Feedback connector	System connector	Power terminal/connector
0=default (SW conf. ASC) 1*=nonASC 2*=870V, ASC 3*=870V, nonASC	0=2x Motor temp. 1*=1x Motor temp., 1x CAN2	S2=CAN1 + HVIL	1=Plug-in

* For further information please contact info@emsiso.com

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