# emDrive H20

HIGH VOLTAGE MOTOR CONTROLER TRACTION, PROPULSION & WORK FUNCTION ELECTRIFICATION



# **PRODUCT DATASHEET**



# **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
  - o Torque and Velocity control for precise, smooth and responsive regulation
  - o Generator mode to supply stable DC voltage with PMSM motors
  - o Overmodulation for full battery voltage utilization, enabling higher motor performances
  - o Dynamic calculation of power stage and motor temperature for maximum performance
  - o Dynamic switching frequency for optimal efficiency
  - $\circ$   $\;$  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
  - o 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 <sub>RMS</sub> (W)
Peak current S2 -60sec (power loss)	400 (3040)	140 (2380)	A <sub>RMS</sub> (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	Α
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**

H20B-400-SD	H20B-800-SD	unit
-40 t	:0 85	°C
6	0	°C
-40 t	:0 85	°C
6	0	°C
pen	ding	l/min
	2	bar
pen	ding	bar
	-40 t 6 -40 t 6 pen	H20B-400-SD     H20B-800-SD       -40 to 85       60       -40 to 85       60       pending       2       pending

\* 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

# 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.

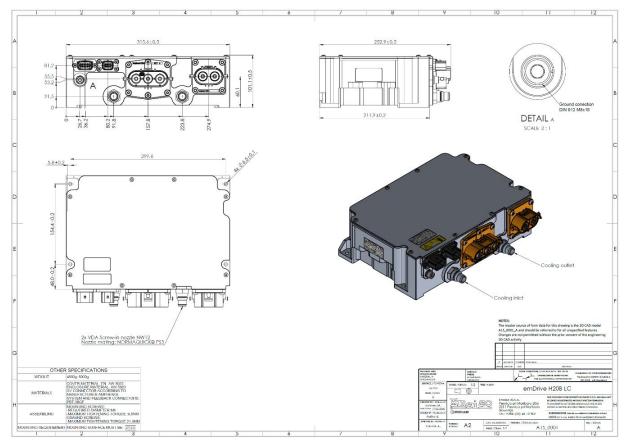
	Supported safety functions – AgPL-C performance level				
Stopping	Monitoring	Output			
Safe Torque Off (STO)	Safe Operating Stop (SOS)				
Safe Stop 1 (SS1)	Safely Limited Speed (SLS)				
Safe Stop 2 (SS2)	Safely Limited Acceleration (SLA)				
	Safe Speed Range (SSR)				
	Safe Limited Torque (SLT)				
	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**

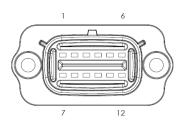
# H20 Liquid Cooled – Slim system connector (EMDI-2-H20B-xxx-xx-L0-x-x-S2-1)



# WIRING

### Feedback connector details

### Molex MX 150, Keying option A, 12 pin (Mating part<sup>1</sup>: 12 pin Molex PN 334721206)

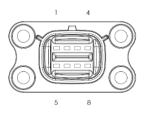


	1	2	3	4	5	6
Resolver	EXC +	EXC -	SIN +	SIN -	COS +	COS -
SIN/COS	5V supply	GND	SIN +	SIN -	COS +	COS -
SIN/COS single	5V supply	GND	SIN +	/	COS +	/
SSI	5V supply	GND	Data + (Rx)	Data - (Rx)	Clock + (Tx)	Clock - (Tx)
Hall	5V supply	GND	Hall U	Hall V	Hall W	Index
AB encoder	5V supply	GND	Enc A	Enc B	/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

 $<sup>^1</sup>$  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

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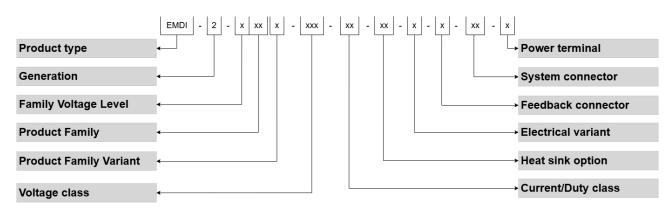
# Application Programming

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

Туре	Gen	Level	Product Family	Family Variant	Voltage class	Current class	Heat sink
EMDI	2	Н	20	В	400	SD	L0=liquid
EMDI	2	Н	20	В	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)	0=2x Motor temp.	S2=CAN1 + HVIL	1=Plug-in	
1*=nonASC	1*=1x Motor temp., 1x CAN2			

### Options/variants codes for voltage class 800

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

\* For further information please contact info@emsiso.com

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