

emDrive H20

HIGH VOLTAGE MOTOR CONTROLLER

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.

TABLE OF CONTENTS

Product overview	2
emDrive main features	2
Table of contents	2
Specifications	3
Safety and compliance	4
Mechanics	5
Wiring	6
Ecosystem and tools	7
Model code	8

SPECIFICATIONS

Key performances

emDrive	H20B-400-SD	H20B-800-SD	unit
Continuous current S1 (power loss)	210 (1500)	170 (2500)	A _{RMS} (W)
Peak current S2 -60sec (power loss)	400 (3500)	210 (3200)	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)	1,2	1,2	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 *	10		l/min
Max. operating pressure *	2		bar
Pressure drop @ nominal flow & 25 °C *	0,3		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 & IP67 (with mated connectors). Other IP ratings on request Random vibration ISO 16750-3:2023, Test XVI, 10 Hz – 2000 Hz, 31.9 m/s ² Shock ISO 16750-3:2023, Shock II, 500 m/s ² , 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

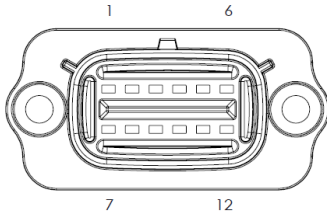
H2O Liquid Cooled – Slim system connector (EMDI-2-H2OB-xxx-xx-L0-x-x-S2-1)



WIRING

Feedback connector details

Molex MX 150, Keying option A, 12 pin (Mating part¹: 12 pin Molex PN 334721206)

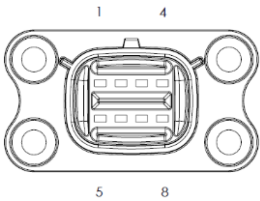


	1	2	3	4	5	6
Resolver	EXC +	EXC -	SIN +	SIN -	COS +	COS -
SIN/COS	5V supply	GND	SIN +	SIN -	COS +	COS -
SIN/COS single	5V supply	GND	SIN +	/	COS +	/
SSI	5V supply	GND	Data + (Rx)	Data - (Rx)	Clock + (Tx)	Clock - (Tx)
Hall	5V supply	GND	Hall U	Hall V	Hall W	Index
AB encoder	5V supply	GND	Enc A	Enc B	/	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 part¹: 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

Connector	Description	Mating connector*
Connector DC	UPC R 012A LS1 - UPC series from Amphenol 9.1mm, 2-pole contact	UPC IP 012A LS x C
Connector AC	UPC R 013A LS1 - UPC series from Amphenol 9.1mm, 3-pole contact	UPC IP 013A LS x C

* follow manufacturer assembly recommendations (wire diameter, ...)

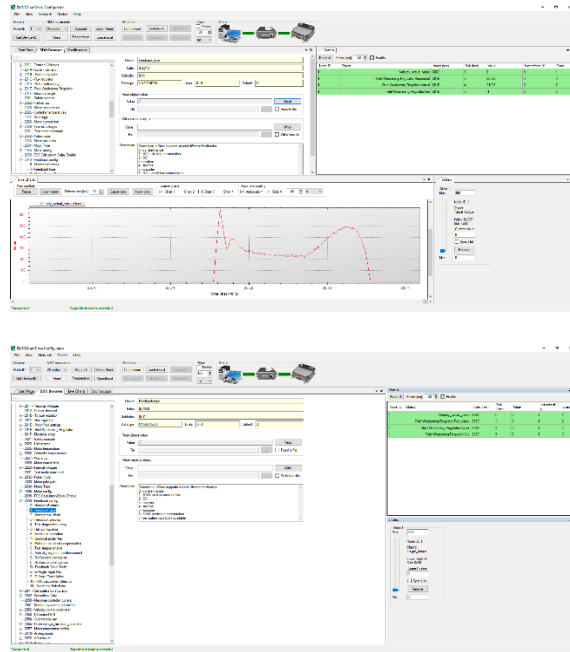
¹ For reliable vibration and galvanic corrosion protection recommended mating contacts shall be gold plated.

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

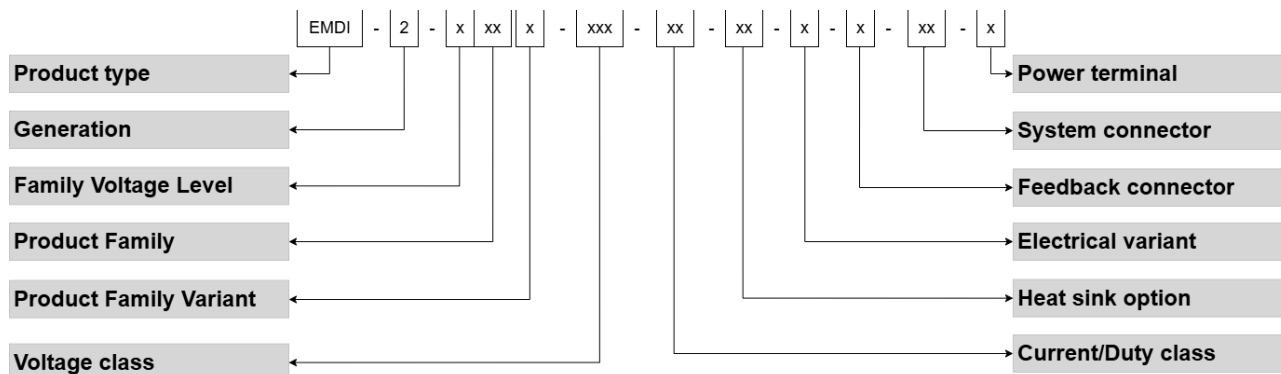
emDrive features **LUA high-level scripting language** used for **custom application programming** within the motor controller. It enables users to **tailor control logic**, implement **custom functionalities**, and optimize performance without modifying core firmware. Key Benefits:

- **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

The text and graphics included in this manual are for the purpose of illustration and reference only. The specifications on which they are based are subject to change without notice. Information in this document is subject to change without notice. Corporate and individual names and data used in examples herein are fictitious unless otherwise noted. This guide contains proprietary information belonging to Emsiso d.o.o.



www.emdrive-mobility.com