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eDrive 500 motor controller

Datasheet V2.0



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General

- Advanced motor controller for e-drive systems supporting
 - PMSM (permanent magnet synchronous motor)
 - PMSM with field weakening
 - Induction motor with field weakening
 - BLDC (driven with sinusoidal current)
- Optimized for up to 60 kW continuous motor drives
- Canopen compatible (profile DS402)
- Multiple rotor angle sensors supported
- Galvanic isolation between control and power stage
- Galvanic isolation between power supply and control

Motor control features

- True sinus mode motor currents with hall sensors (observer for rotor angle)
- Vector current control minimizes torque ripple and vibrations of motor. No motor audible noise.
- Vector current control with inexpensive hall sensors in motor.
- Four quadrant control (forward/backward with regeneration).
- Field weakening for PMSM and induction motors. Automatic entry into field weakening zone when synchronous RPM is reached.
- Integrated velocity & position regulator.
- Throttle input controls motor torque, motor velocity or combination of both. Latest option gives similar control response as internal combustion engine.
- Synchronous rectification, ultra low drop, fast PWM to achieve efficiency > 97 %.

Rotor angle sensors

- Supported rotor angle sensors
 - Standard three hall sensors with 60 or 120 degree configuration
 - Absolute digital SSI encoder with RS422 interface (recommended www.rls.si model RM44SC0013B20F2F10)
 - Resolver
 - 5V analogue sin/cos (not recommended for high pole count motors)
 - AB incremental encoder (only for induction motors)
- Auto tuning for measuring rotor angle sensor offset and direction

Protection functions

- Maximum motor current protection.
- Thermal protection of motors (input for temperature sensor in the motor). Gradual decrease of maximum motor current when motor temperature reaches limit.
- Controller thermal protection. Gradual decrease of maximum motor current.
- Rotor angle sensor failure detection.
- Low battery protection with battery voltage measurement. Gradual decrease of maximum current when battery voltage indicates empty battery.
- High voltage battery protection. Prevents over voltage situations when regenerating with full or damaged battery.
- Motor stall protection – limits motor current if motor is blocked for certain time.
- Motor maximum RPM protection. Decrease motor current if maximum is reached.
- Input for Emergency stop button
- Optional throttle out of range detection for detecting of damaged throttle or broken wire.

- Full self-test at start. Check all MOSFET-s, motor connection and battery connection

Logging functionality

- Internal FLASH memory for storing last 2 hours of all important values (battery voltage, battery current, motor current, speed, motor and controller temperature ...)
- Fast oscilloscope functionality. Used for current and velocity regulators tuning

Additional functions

- Optional control for magnetic brake.
- Output for brake light, active when regenerating.
- Spare analog inputs

Set up and customization

- All settings are stored as parameters and can be changed. No »hard-wired« limits and settings.
- RS232 / Canopen connection for adjustment of settings.
- Settings are adjusted with text commands or GUI configuration SW.
- Support any number of motor poles.

Electronic design

- All connections have automotive EMC protection.
- All control connections are protected against short circuit to ground or battery voltage.
- Reverse battery protection (main fuse will blown).
- Low EMC design, with proper cable wiring easily reaches class B EMC emission regulations.
- Integrated capacitor bank for reduced harmonic current in battery connection.
- Main contactor not required

Communication interfaces

- 1 x RS232 interface, 1 x CAN 2.0V interface
- CAN 2.0B interface with optional galvanic isolation
- Canopen protocol (full DS402 compatible)

Housing

- Aluminum base plate for heat sink with pipes for liquid cooling, plastic top cover
- High current screw terminals for battery connection and motor phases
- IP 65 protection

Specifications

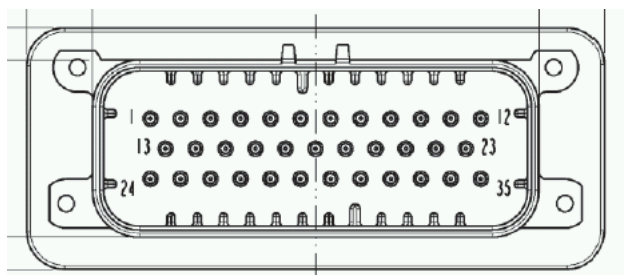
- Maximum battery voltage 120 V. Battery overvoltage protection at 125 V.
- Motor phase current (rms) continuous 500A, 1 minute up to 800 A.
- Switching frequency 16 kHz.
- Dimensions 280 x 205 x 65 mm , weight 5,2 kg
- Operating temperature -20/+65 °C. Maximum back plate temperature 50 °C.

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Connector

System connector AmpSeal 35 pin waterproof



Pin	Name	Description
1	GND Ignition	Internally connected with logic GND - pin 3.
2	Ignition	Power supply for controller logic (9-30V)
3	Logic GND	Used for throttle and other inputs
4	Throttle Vcc out	5 V for powering throttle. Max current 50 mA
5	Throttle input	Nominal range 0-5V
6	FW upgrade	Connect to GND for FW upgrade
7	RS232 Tx	
8	RS232 Rx	
9	SSI Clock +	
10	SSI Clock -	
11	SSI Data +	
12	SSI Data -	
13	Forward digital input	Switch to GND. Active Low
14	Reverse digital input	Switch to GND. Active Low
15	Brake in switch	Switch to GND. Polarity is programmable.
16	Open collector output 1	Digital output or PWM (10 kHz) output. Max current 3 A
17	Open collector output 2	Digital output or PWM (10 kHz) output. Max current 3 A
18	Aux input 1	Analogue (0-5V) input
19	CAN GND	In standard/non isolated version this pin is connected with logic GND - pin 3.
20	Resolver exc +	
21	Resolver exc -	
22	Sin/cos sin	Analogue sin/cos signal (5V range single ended)
23	Sin/cos cos	Analogue sin/cos signal (5V range single ended)
24	Hall GND	Used as GND reference for position feedbacks. Internally connected with logic GND - pin 3.
25	Hall phase 1	
26	Hall phase 2	
27	Hall phase 3	
28	Hall Vcc	
29	Motor temperature	Temperature sensor (KTY or NTC) is connected to this pin and Hall GND – pin 24.
30	CANL	
31	CANH	
32	Resolver sine +	
33	Resolver sine -	
34	Resolver cos +	
35	Resolver cos -	

LED diodes

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DIODE	OFF	BLINKING	ON
CAN Run	NMT state stopped	NMT state pre-operational	NMT state operational
Can Error	No CAN error	single flash - CAN state passive double flash - Heartbeat lost (error code 0x8130)	CAN bus off
Drive	Controller in preoperational mode, PWM disabled, Safety procedure not started, Break enabled	Controller in operational mode, Safety ok, PWM disabled, Break disabled	Controller in drive mode PWM enabled, break disabled
Warning	All protections are inactive		One ore more of protections active. Bit in status word set, warning description can be found in CO object 0x2027
Error	No drive error		Drive error