MAD
COMPONENTS

AMPX 160A HV

80~510V

PRODUCT SPECIFICATION

DISCLAIMER

Dear customers, thank you for choosing our products. To ensure safe and successful operation of your electronic speed controllers, please strictly follow the operating instructions and steps in this guide.

If the user does not abide by the safety operation instructions, MAD will not be responsible for any product damage or loss in use, whether direct or indirect, legal, special, accident or economic loss (including but not limited to loss of profit), and does not provide warranty service. Do not use incompatible parts or use any method that does not comply with the official instructions of MAD to modify the product.

Features

The Electronic Speed Controllers (ESC) have premium materials, rugged design, and take into account the thermal design, which could have good heat dissipation effect. The internal device layout is reasonable, strong and weak current isolation, which is safe and reliable. ESC can be widely used in UAV, underwater propeller, electric vehicle and other industries.

The ESC hardware adopts IGBT three-phase full bridge inverter topology, with the maximum allowable peak output current of 400A, which can drive DC brushless motor, permanent magnet synchronous motor, AC motor, etc. the hardware throttle control signal (P-wave, differential P-wave) and data communication signal (serial port, CAN) are isolated interfaces, and the isolation voltage is 1500vdc.

In terms of software, the core Sensor-less Field-oriented control (FOC) angle observer adopts our self-research and development feedforward PLL controller, which is self-controllable. This technology not only solves the problem that the Sensor-less FOC electric speed controller needs to match the parameters according to the motor, but also can accurately control the commutation of the brushless motor to realize efficient, safe and reliable driving.

SPECIFICATIONS

Name	AMPX 160A 80~510V
Application	UAV/underwater propeller ESC
Input Voltage	DC80V~DC510V，with overvoltage and undervoltage protection functions
Input Current	≤DC160A, with current limiting protection and working current limitation functions
Output Current	≤AC320A, with constant power protection and output power limitation functions
Output Frequency	≤1000Hz，the maximum output frequency can be changed
Modulation Mode	SVPWM，Carrier Frequency: 10KHz
Control Mode	Sensor-less FOC
Working Efficiency	≥98%
Controller Interface	PPM/PWM. Support frequency 50Hz to 400Hz
Communication Interface	TTL232、CAN. Upload temperature, voltage, current, speed, state and other data
Weight	≤3.0KG
Dimension	≤257mmx155mmx90.5mm
Cooling mode	External forced air cooling
Operating Temperature	-20℃ to 90℃，with temperature protection and output frequency limitation functions
Protection Degree	IP54

CONTROL SIGNAL STANDARD

Compatible with aircraft model remote controller, the cycle is 50Hz, the high-level time is 1150 to 1950us command, and the maximum input frequency can reach 400Hz.

The telecontrol input signal ground is isolated from the power supply ground, and the telecontrol signal is transmitted internally through optocoupler isolation.

It supports the calibration of throttle stroke. Please refer to content (VI) for specific operation.

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ESC PROTECTION MECHANISM

Undervoltage protection

When the power supply voltage of the ESC is lower than the set undervoltage value, the ESC will stop output, and enter the protection state. After the throttle is reset to zero for 5S, the Protection Mode can be cleared.

Overvoltage protection

When the power supply voltage of the ESC is higher than the set overvoltage value, if the motor is not running at this time, the ESC will enter the protection state, and exit the protection state when the voltage is normal; If the motor is running at this time, the ESC will not enter the protection state, but only indicate the alarm.
NOTE: The trigger condition of back EMF suppression algorithm is that the motor reaches overvoltage state during operation, so the overvoltage alarm caused by motor deceleration during motor operation is normal, and there is allowance for hardware.

Throttle detection

Throttle detection will be carried out after the ESC is powered on, including throttle loss detection and throttle non return to zero detection. When the above detection fault occurs, if the motor is connected, an audible alarm will appear.

Sensor zero-point detection

The phase current zero-point detection will be carried out after the ESC is powered on.

Overtemperature protection

When the temperature of the ESC module reaches 90 ℃, the ESC will automatically adjust the allowable maximum input current according to the temperature difference. When the temperature of the ESC module reaches 100 ℃, the ESC will automatically adjust the allowable maximum output throttle according to the temperature difference.

Overcurrent protection

Including CBC short circuit protection and software overcurrent protection. CBC short circuit protection time is 200 to 500us. The software overcurrent protection time is 10 to 100ms, which is the backup in case of CBC failure.

COMMUNICATION PROTOCOL

The ESC communication protocol is IG-UART_V1.2. The baud rate is 19200, and there is no verification for 8 bits. In this protocol, ESC broadcasts a frame of data to the outside every 255 Ms. The format and content of the data are as follows.

COMMUNICATION PROTOCOL

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TABLE 1
ESC COMMUNICATION PROTOCOL IG-UART_V1.2

Serial Number	Name	Start Bit	Byte	Datatype	Content	Explanation
1	Frame header 1	0	1	uint8	0*49	IG
2	Frame header 2	1	1	uint8	0*47	
3	Communication version number 1	2	1	uint8	0*01	The protocol version number is V1.2
4	Communication version number 2	3	1	uint8	0*02	
5	Function Code	4	1	uint8	0*01	0*01: ESC upward broadcasting
6	Data Length	5	1	uint8	0*16	0*16: The length of uploaded data is 22 bytes
7	Date Content	6	22	/	See Table 2	Uploaded data content
8	Frame time scale	28	1	uint8	0*XX	Increasing time scale
9	Data Verification	29	1	uint8	0*XX	Sum verification of items 1 to 8

TABLE 2
DATA CONTENT UPLOADED BY ESC

Serial Number	Name	Byte	Datatype	dimension	Range	Explanation
1	Input Voltage	2	int16	0.1V	–3276.7 to +3276.7	DC Input Voltage at Bus end
2	Input Current	2	int16	0.1A	–3276.7 to +3276.7	DC Input Current at Bus end
3	Output Current	2	int16	0.1A	–3276.7 to +3276.7	Peak value of AC Current at Motor end
4	Output Frequency	2	int16	0.1Hz	–3276.7 to +3276.7	AC Frequency at Motor end
5	Input Throttle	2	int16	–	0 to 4096	0 ~ 4096 corresponds to 0 ~ 100%
6	Output Throttle	2	int16	–	0 to 4096	0 ~ 4096 corresponds to 0 ~ 100%
7	Module Temperature	2	int16	℃	/	ESC power module temperature
8	Chip Temperature	2	int16	℃	/	ESC master chip temperature
9	External resistance	2	uin16	Ω	/	Feature retention
10	ESC State	4	uint32	/	See Table 3	Indicates ESC operation State

TABLE 3
ESC STATE (32–BIT STATE CODE TABLE)

	0	1
Bit0	/	CBC Overcurrent Protection Trigger
Bit1	Undetermined	
Bit2	/	Input Voltage Undervoltage Trigger
Bit3	Undetermined	
Bit4	/	Software Watchdog Trigger
Bit5	/	Input Current Overcurrent Trigger
Bit6	/	Motor locked rotor or Abnormal Hardware
Bit7 to 8		
Bit9	Input Voltage Overvoltage State Released	Input Voltage Overvoltage State
Bit10	Input/Output Current Limit State Released	Input/Output Current Limit State
Bit11	Overtemperature Current Limit State Released	Over temperature Current Limit Stat e
Bit12	The over temperature limit output throttle state is released	Over temperature Limit Output Throttle State
Bit13 to 14	Undetermined	
Bit15	/	Three–phase Current Detection Current bias error
Bit16	/	Output Throttle
Bit17	/	–
Bit18	/	The set maximum speed is reached.
Bit19	/	Indicates Input Throttle not zeroed
Bit20	/	Indicates Input P–wave Throttle Lost (If enabled)
Bit21	/	Indicates Input Serial Port Throttle Lost (If enabled)
Bit22	/	Indicates input CAN Throttle Lost (If enabled)
Bit23	/	Indicates Input Throttle Lost
Bit24	/	Indicates input P–wave Throttle Update (If enabled)
Bit25	/	Indicates Input Serial Port Throttle Update (If enabled)
Bit26	/	Indicates input CAN Throttle Update (If enabled)
Bit27	/	Indicates Input Throttle Update
Bit28	Undetermined	
Bit29	/	Excessive Frequency change Suppression
Bit30	/	Excessive Current change Suppression
Bit31	/	Excessive Voltage change Suppression

COMPATIBILITY

Electronic speed controllers are compatible with almost all DC Brushless Motors on the market. If there are compatibility problems, we can be debugged for customers' motors.

THROTTLE CALIBRATION STEPS

1Connect the ESC PWM signal to the direct channel of the receiver without connecting the power supply.

2. Turn on the remote control and place the rocker in the maximum throttle position.

3. Turn on the power. A rising tone "1–2–3" indicates power on, a deep flat tone "1–1–1" indicates that the signal is being detected, ⩾ 4 intervals of 1s short tone "4" indicates that the calibrated maximum throttle is being detected, and a rising tone "1–2–3–4" indicates that the calibrated maximum throttle is detected.

4. Place the throttle rocker at the preset starting position, when you hear the short prompt tone "1–1". ⩾ 4 short prompt tones "1–1" with an interval of 1s indicate that the starting position of throttle is being detected, and a falling tone prompt tone "4–3–2–1" indicates that the starting position of throttle is detected.

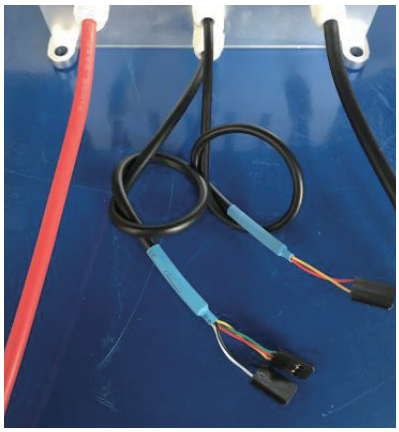
5. A rising tone "1–2–3–4" indicates that the maximum throttle and minimum throttle have been written into flash and saved.

6. Turn off the power.

Note:

The minimum starting throttle is 6% of the maximum throttle minus the minimum throttle.
When setting the throttle stroke, it is recommended that the power supply voltage be about DC200V.
Ensure that the Motor is in no–load (without blades) during throttle calibration.

CONNECTION DESCRIPTION



1. Power Cord: Power Positive Input
2. Throttle Signal Cable
3. Serial Communication Cable
4. CAN Communication Cable
5. Power Cord: Power Negative Input

Note:

In Cable , the black Cable is the Signal Ground Cable, and the white Cable is the PWM Signal Input Cable. The default throttle range is 1150 ~ 1950us.

In Cable , the brown Cable is the Signal Ground Cable, the red Cable is the Receiving Cable (RX) of the ESC Signal (TTL level), and the green Cable is the Output Cable (TX) of the ESC signal (TTL level). The output information includes communication protocol version, input voltage, input current, input throttle, chip temperature, external resistance, communication count, output frequency, output current, output throttle, module temperature, ESC state.

In Cable , the yellow Cable is CAN–H, and the blue Cable is CAN–L.

ESC Three–phase Output Cable

DIMENSION DRAWING