

BAC500

DESCRIPTION

ASI is a leader in the supply of industrial grade motor controllers with roots in electric vehicle technology dating back over 20 years.

The BAC™ 500 is a high power density electric bike controller that utilizes the latest in field oriented control to ensure smooth, quiet brushless DC motor operation and efficient vehicle operation.

SMOOTH

- pedelec or throttle control is responsive and jerk free
- excellent driver experience

SMALL

- compact footprint provides locational flexibility

SMART

- advanced field oriented control for maximum efficiency
- numerous programmable features and adjustments
- based on BAC product architecture
- protective and diagnostic features

SILENT

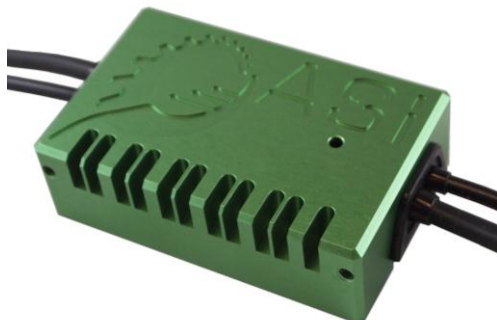
- Sinusoidal wave forms eliminate motor buzzing

CONNECTED

- ModBus network interface supports either standalone or slave module operation in vehicle applications requiring multiple drive or accessory motors
- Programmable update rates
- Real time controller status, battery voltage, motor currents and motor or controller temperature ensures safe vehicle operation
- Programmable through an optional display or PC connection
- LED status indicator makes trouble shooting a breeze

RUGGED

- Automotive quality Molex™ connectors, and rugged metal case
- Current and thermal limiting protects motor, controller and I/O



KEY FEATURES

- 21 to 48V operation
- 60A peak motor current capability
- 4 analog/digital and 4 digital only inputs supports multiple sensor configurations
- Configurable throttle, pedal torque, pedal speed and assist level select input functions
- Single pulse and quadrature pedal or wheel speed inputs
- HDQ, analog and voltage model based Battery Management System interfaces

BATTERY VOLTAGE

- 21 to 48V DC Input

OUTPUT CAPABILITY

- Up to 60A peak

APPLICATIONS

- Electric bikes
- Small electric scooters
- Small electric vehicles
- Small Recreational Vehicles

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FEATURES AND BENEFITS

Control

- Sinusoidal field oriented control offers exceptionally smooth operation and increased motor efficiency
- Optional field weakening facilitates higher speed motor operation
- 3-phase 20 KHz PWM for 95% efficient motor control
- Programmable headlight control turns the headlight automatically below a user programmable light threshold
- State of Charge (SOC) variable power output control prolongs battery and extends vehicle range
- Sensorless commutation mode minimizes wiring between motor and controller reducing implementation time and cost

Flexibility

- Programmable motor temperature fold back feature increases motor life span by reducing temperature related stress and magnet degradation
- Programmable battery voltage, motor/battery current and controller temperature faults increase controller and motor longevity
- Programmable performance mapping allows throttle and torque sensor inputs to specific performance requirements
- Fully programmable via optional vehicle display or ASI's BAC Door™ PC configuration software allows the user to match BAC series controllers exactly to the application requirements and the BLDC motor
- Multiple BMS communication protocols are supported (HDQ and analog) allowing flexibility in battery vendor selection
- Supports multiple pedal and torque sensor configurations for the ultimate in application flexibility

Communications

- Networkable as a slave module with ModBus address settable through the vehicle harness
- Controller and motor variables including battery voltage, motor current, etc. (see data sheet for specifics) and programmable update rates provide real time vehicle operation feed back
- LED display of fault codes for easy trouble shooting and fault diagnosis
- ModBus protocol is supported over standard RS 232, TTL level RS 232, and RS 485

Safety

- Protective enclosure makes the drive suitable for use in the most demanding vehicle environments
- Analog brake and throttle inputs with programmable dead band and broken wire detection prevents unintended vehicle runaway
- Short circuit and motor phase integrity protection continuously protects the 3 phase MOSFET bridge by testing motor drive componentry prior to application of current to the motor
- Compatible with EN 15194 EMC, ESD and safety requirements.
- Programmable Smart Pedal First™ feature adds a programmable delay to the engagement of the motor to prevent an unexpected lurch forward from occurring during start up.

SPECIFICATIONS

Controller Performance

Feature	Range	Units
Rated Voltage	21 to 48	Volts
Rated Output Power	150 to 500	Watts
Rated Battery Current	BMS Limited	Amps
Motor Control Method	Field Oriented Control (FOC)	
Safety	EN 15194 compliant	
Standby Power Consumption	< 3	Watts
Speed Limit	User programmable and limited by the motor	Km/h
Operating Modes	Speed, Torque and Combined	

System Protection Features

Protection	Description
Over/Under Voltage	If the battery voltages above/below the user programmable thresholds, the bridge is disabled
Motor Over current	If the instantaneous or averaged current above the user programmable thresholds, the bridge is disabled
Bridge On/Off Test	Tests the MOSFET bridge is operating properly prior to providing output power to motor
Motor Temperature	User programmable protection using either external thermistor mounted on the motor windings or motor nameplate based I ² T thermal model
Bridge Temperature	If the MOSFET tab temperature exceeds the factory programmed limit, the motor phase current will be folded back to protect the controller
Battery SOC Foldback	If battery SOC drops below the user programmable threshold, motor phase current will be folded back to protect the battery
Throttle/Brake Outside Range	If measured voltage is outside the user programmed throttle voltage + throttle fault range, the bridge is disabled
Internal Error	If the processor has detected an error in flash memory or the main clock signal, the bridge is disabled
Power On Self Test (POST)	If the phase current sensors have not calibrated properly, the bridge is disabled

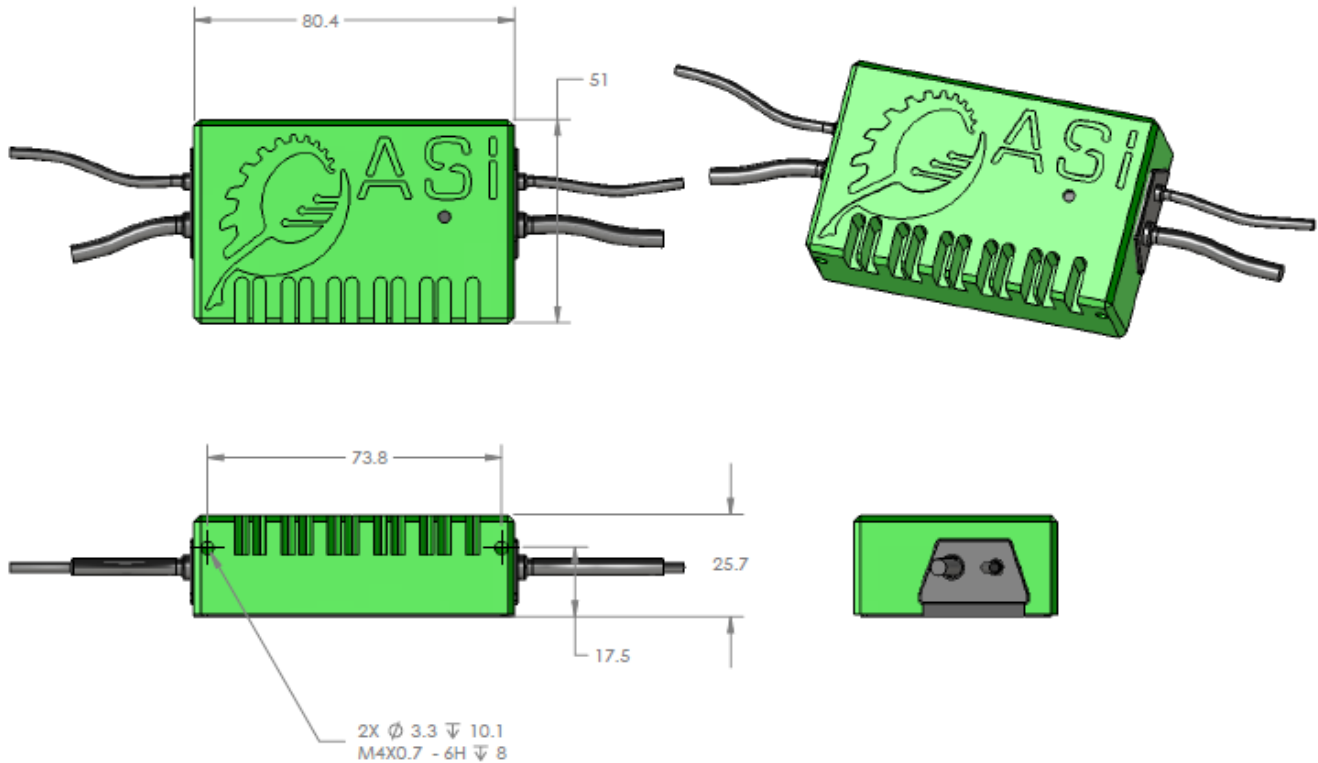
Additional Controller Features

Feature	Description
Optional field weakening	Field weakening algorithms facilitate over speed operation of the motor if required
Command Sensor Support	Thun torque, resistive, and Hall based throttles are supported
Headlight Control	Headlight can be programmed to turn on/off automatically, at user defined brightness thresholds
Sinusoidal Sensorless Commutation	For select applications, BLDC motor's can be commutated without the use of Hall sensors
Pedal Speed Sensor Support	FAG, single, and dual Hall based pedal speed sensors are supported
Vehicle Speed Sensor Support	Reed switch and Hall based speed sensors are supported
Networkable	Can be configured as a slave module on a ModBus network
Battery SOC Protocol Support	HDQ, analog, and voltage model based BMS communication protocols are supported

Communications

Feature	Description
Programming and Configuration	Controller can be programmed/debugged using ASI's Bac Door™ PC configuration software and a USB port
Status Display	Controller status/fault codes flashed on externally visible LED
Network	Proprietary ASI object dictionary over a variable baud rate ModBus network
Communication Hardware Protocols	RS-232, TTL Level 232, and RS-485 are all supported

DIMENSIONS

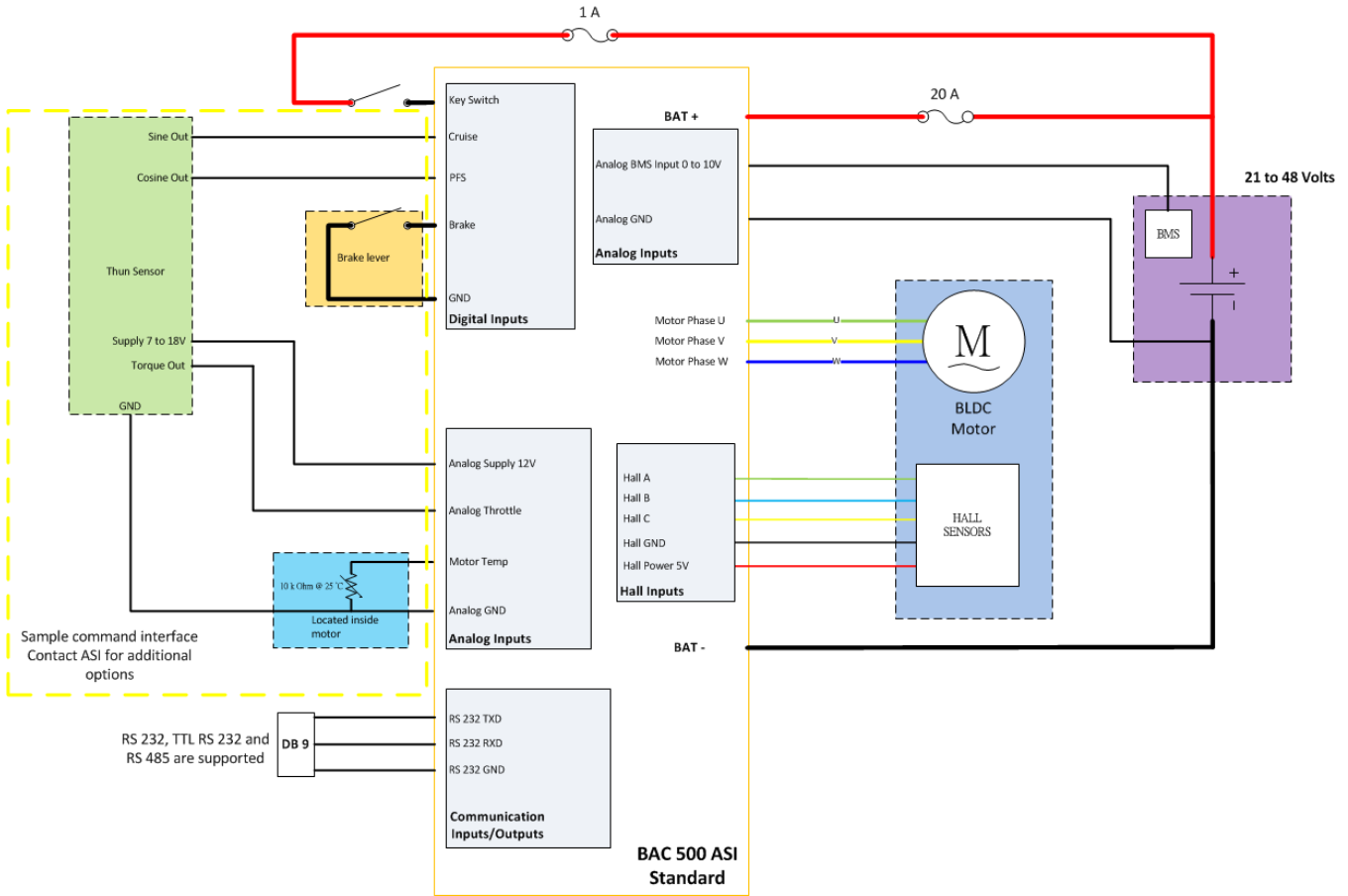


RECOMMENDED CONNECTOR SPECIFICATIONS

Part	Manufacturer Part Number
8 pin, Molex female	39-01-2080
8 pin, Molex male	39-01-2086
2 pin, Molex female	39-01-2020
Contact connector, Molex female	39-00-0047
Contact connector, Molex male	39-00-0049
Spade connector, male, insulated, 16-14AWG	72M-250-32-NL
Molex crimp tool	638191000A

TYPICAL WIRING DIAGRAM

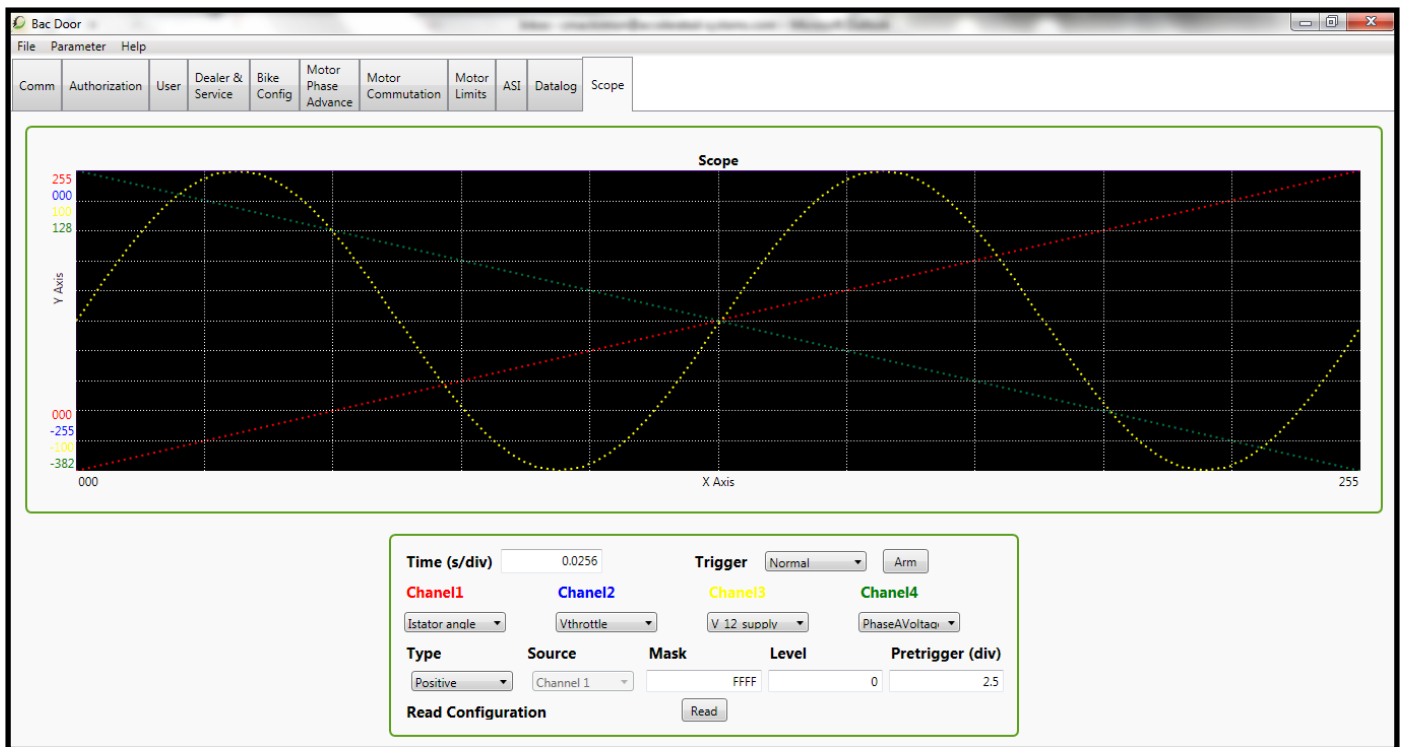
BAC 500 Standard BLDC Controller
Wiring Diagram Rev 1.00



BAC Door™ CONFIGURATION SOFTWARE

ASI's BAC Door™ software is a robust software tool that can configure, optimize, and troubleshoot the BAC series of controllers.

- Provides real time updates of controller status, battery voltage, motor currents and other critical application parameters
- Supports firmware and application parameter updates
- Built in oscilloscope facilitates motor, I/O, and sensor tuning



BAC Door™ screen view

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