Preliminary
TECHNICAL DATASHEET #TDAX100250

35A BLDC MOTOR CONTROLLER

P/N: AX100250

Variable Speed Control, Onboard I/O
CAN SAE J1939, Rugged Packaging
***with* Electronic Assistant**

Features:

- Unidirectional or bi-directional BLDC motor control
- Up to 35A continuous output current to the motor
- Hall Effect Sensor Feedback (Sensorless control using back EMF is also available in the standard model.)
- Flexible control of speed and torque
- 2 Universal signal inputs are user configurable from the following: 0-5V; 0-10V; 0-20 mA; 4-20 mA; frequency; PWM; or digital (pull up - pull down).
- The control input to drive the motor can be mapped to either of the 2 universal inputs or the controller can respond to messages from a CAN bus.
- 2 Digital/Frequency/PWM inputs (pull up - pull down)
- User configurable enable function can be mapped to any of the 2 digital inputs or a CAN message
- Direction control can be mapped to any of the 2 digital inputs or a CAN message
- 1 current output (2.5A proportional or hotshot digital) is available to drive accessories such as hydraulic valves or relays for machine control or safety interlock.
- Output can be coded as feedback messages sent to the CAN bus
- 1 output is provided to follow the rotation speed of the motor (V, mA, Hz or PWM signal)
- Highly efficient and robust design with isolation for drive and processing circuits
- Operational from 9 to 36 Vdc (12 or 24 Vdc nominal)
- 1 CAN port (SAE J1939) are provided (CANopen model AX100251)
- Configurable with Axiomatic Electronic Assistant
- Compact size for easy mounting on a vehicle
- Suitable for high shock and vibration environments
- Fully sealed with a rugged IP67 corrosion resistant aluminum housing
- Operational from -40 to 85°C (-40 to 185°F)
- Developed with Simulink®.

Applications: Motor variable speed, position and/or flow control in Lift Equipment, Electric Vehicles for Material Handling, Trucks, Cranes and Hoists, Hydraulic Tail Lifts and Winches, Golf Carts, Military Equipment, Mobile Pumps and Hydraulic Powerpacks

Ordering Part Numbers:

BLDC Motor Controller, SAE J1939 P/N: **AX100250**
Configuration Tool: Electronic Assistant P/N: **AX070502**

BLDC Motor Controller, CANopen P/N**: AX100251**

Accessories: Mating Plugs Kit P/N: **AX070450**

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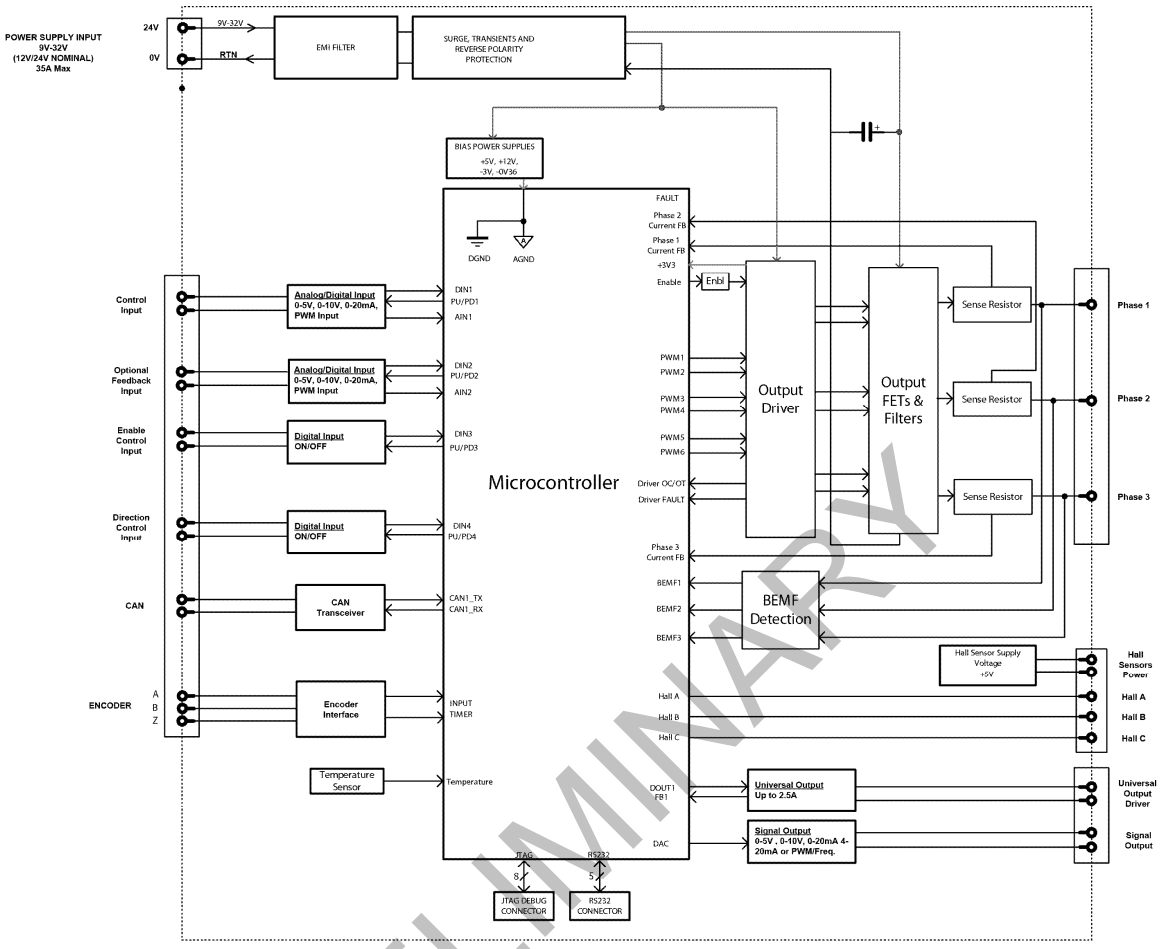

Figure 1 - Block Diagram

Technical Specifications:

All specifications are typical at nominal input voltage and 25 degrees C unless otherwise specified.

Input Specifications

Power Supply Input - Nominal	12 or 24Vdc nominal (9…36 Vdc)
Surge Protection	Provided
Under-voltage and Over-voltage Protections	Provided
Universal Signal Inputs	2 Universal Signal Inputs Input properties are user configurable. Refer to the block diagram and Table 1.0. Any input on the controller can be coded into a Proprietary B message that can be sent to the CAN network.
Digital/PWM/Frequency Inputs	Two (2) inputs are provided. Refer to Table 1.0.
Analog/Digital Ground	2 Provided

Motor Feedback	Hall Effect Sensor 1K pullup to +5V per input A +5V supply and ground connection is provided. Encoder Input 3 signals (0-5Vdc) - A Input - B Input - IND Input (Sensorless control using back EMF is also available in the standard model.)

Table 1.0 Inputs to AX100250 (Up to 4 user selectable inputs)	
Input Type	Description
Universal Signal Inputs	Up to 2 universal signal inputs are available. 12-bit Analog to Digital resolution Protected against shorts Voltage 0…5VDC or 0…10VDC 1 mV resolution; accuracy +/-1% error Current 4…20mA or 0…20mA 1 µA resolution; accuracy +/-1% error Current sense resistor 249Ω Frequency auto ranging 0.1 – 10,000 Hz 0.01% resolution; accuracy +/-1% error PWM Signal 0.1 – 10,000 Hz PWM Duty Cycle 0 to 100% 0.01% resolution; accuracy +/-1% error Digital: Active High with 10K pullup resistor or Active Low with 10K pulldown resistor Amplitude to +Vps supply
Digital/PWM/Frequency Inputs	Up to 2 inputs are available. Frequency auto ranging 0.1 – 10,000 Hz 0.01% resolution; accuracy +/-1% error PWM Signal 0.1 – 10,000 Hz PWM Duty Cycle 0 to 100% 0.01% resolution; accuracy +/-1% error Digital: Active High with 10K pullup resistor or Active Low with 10K pulldown resistor Amplitude to +Vps supply These inputs can be used as an enable or direction command for the controller.

Output Specifications

Output to Motor	H-bridge 35A @ 24VDC nominal continuous 35A @ 12VDC nominal continuous Overcurrent protection is provided at 50A. Short circuit protection is provided. The maximum rated speed and motor rated current are configurable to suit individual motor specifications.
Motor Stop	Shut off with or without ramping
Motor Direction	Motor direction command can be mapped to any input or come from the CAN bus.
Motor Control Mode	Flexible control is provided by user configurable parameters for speed and torque control loops. The control input to drive the motor can be mapped to either of the 2 universal inputs or the controller can respond to messages from a CAN bus.
Thermal Protection	Thermal protection is built-in and configurable.

Current Output	1 output is selectable as: proportional (0…2.5A); hotshot digital (2.5A); PWM Duty Cycle; Proportional Voltage; Or On/Off Digital (2.5A). Half-bridge output, current sensing, grounded load. High side sourcing up to 2.5A High frequency drive Overcurrent protection Short circuit protection Current output:1 mA resolution; accuracy +/-1% error Voltage output: 0.1V resolution; accuracy +/-5% error PWM output: 0.01% resolution; accuracy +/-1% error Digital On/Off: Sourcing from power supply or output off Load at supply voltage must not draw more than 2.5A Ramp and dither setpoints are configurable. **Hot Shot Coil Saver Outputs** (Refer to Figure 2.): The output is on/off with a hotshot current which keeps the load ON with a holding current. This is used as an energy saving method of load control. The output is configurable to send a feedback message to the CAN bus. The feedback is always sent as a word with a resolution of 1 mA/bit, and 0 mA offset.
Signal Output	1 Voltage, Current, Frequency or PWM Output is provided to follow the rotation speed of the motor. 12-bit Digital to Analog (voltage, current) or 15-bit (Frequency/PWM) Protected against short to GND or +Vcc Voltage Output: 0…5VDC or 0…10VDC 1 mV resolution; accuracy +/-1% error Current Output: 4…20mA or 0…20mA 1 µA resolution; accuracy +/-1% error Current sense resistor 249Ω Frequency and PWM output: 0.1 – 20,000 Hz 0.1% resolution; accuracy +/-1% error Amplitude 5V 1 Signal Output GND is provided.

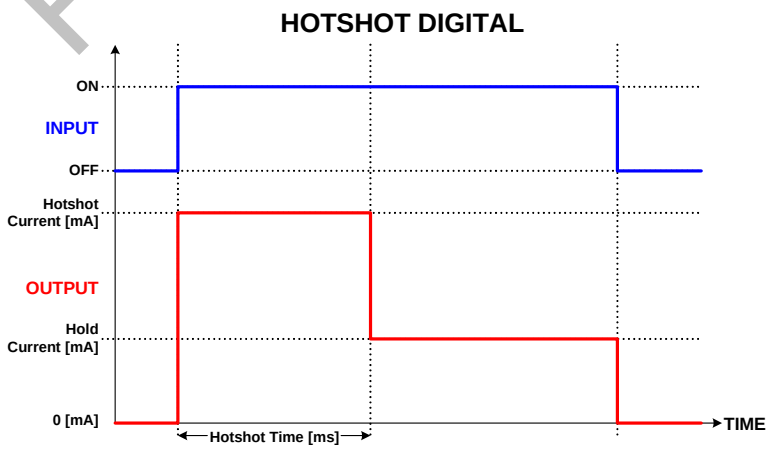

Figure 2 – Proportional Output Hotshot Digital Profile

General Specifications

Microprocessor	STM32F407VGT7
Motor Control	Standard embedded software is provided. The following parameters are user configurable. Motor Direction: Unidirectional or bi-directional control from an input or the CAN bus. The direction is also configurable. Enable: A universal input can be configured to enable the motor when on. A CAN message can also be used as an enable input. Control Mode: Open loop speed or closed loop speed, open loop torque or closed loop torque CAN: CAN bus messages control the motor and/or auxiliary outputs instead of the analog or digital inputs
Simulink® Block Library	The product was developed with Simulink®. **Simulink®** is a model-based design tool from Mathworks®. Refer to the User Manual *Axiomatic Hardware Interface Library for Mathworks Simulink* for details.
CAN User Interface	Electronic Assistant for *Windows* operating systems It comes with a royalty-free license for use. The Axiomatic Electronic Assistant requires an USB-CAN converter to link the device's CAN port to a *Windows*-based PC for initial configuration. Order the EA and Axiomatic USB-CAN as a kit (P/N AX070502), which includes all interconnecting cables. Refer to Figure 3.
CAN Interface	1 CAN port (SAE J1939) CANopen model is AX100251.
Electrical Connections	Refer to Table 4. Wires should be of the appropriate gauge to meet requirements of applicable electrical codes and suit the specifications of the connector(s).
Mounting	The motor controller should be mounted as close to the battery and/or the motor as possible. Install the unit with appropriate space available for servicing and for adequate wire harness access and strain relief. Mounting ledges include holes sized for M6 or ¼ inch bolts. The bolt length will be determined by the end-user's mounting plate thickness. Typically, 20 mm (3/4 inch) is adequate.
Packaging and Dimensions	Encapsulated in an anodized aluminum extrusion with gasket 5.83 x 8.93 x 2.49 inches 148.00 x 226.84 x 63.25 mm (W x L x H including connectors, excluding mating connectors) *Refer to Figure 3.0.*
Weight	2.25 lbs. (1.02 kg) (preliminary)
Operating Conditions	Operating: -40 to 85°C (-40 to 185°F)
Protection Rating	IP67

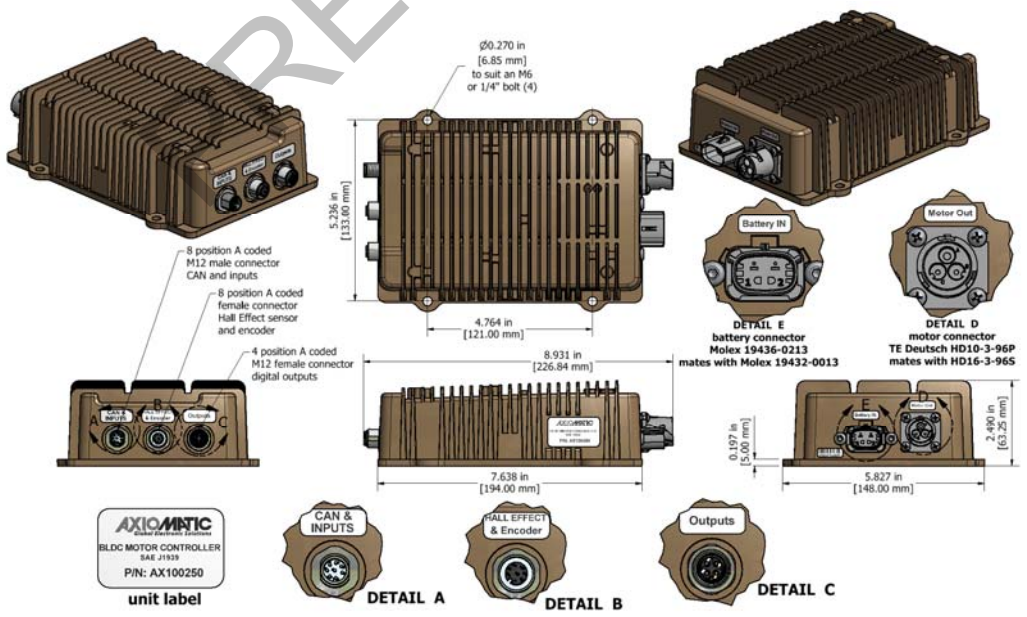

Figure 3 - Dimensional Drawing

Table 4 - Electrical Pin Out Chart

Power Connector (J8) :
Molex P/N: 19436-0213
Mates with Molex 19432-0013

Pin#	Function
1	**Batt+**
2	**Batt-**

Motor Connector:
TE Deutsch P/N: HD10-3-96P
Mates with TE Deutsch HD16-3-96S

Pin#	Function
1	**Phase A Out**
2	**Phase B Out**
3	**Phase C Out**

Hall Effect/Encoder Connector (J4):
M12, 8-pin, Female

Pin#	Function
1	**Hall C**
2	**Hall B**
3	**Encoder A**
4	**Encoder IND**
5	**Hall_5V**
6	**Hall A**
7	**HALL_GND**
8	**Encoder B**

Signal Inputs Connector (J2):
M12, 8-pin, Male

Pin#	Function
1	**CAN 1 L**
2	**CAN 1 SH**
3	**Analog GND**
4	**Universal Signal IN 2**
5	**CAN 1 H**
6	**Digital Input 2**
7	**Digital Input 1**
8	**Universal Signal IN 1**

Outputs Connector (J7):
M12, 4-pin, Female

Pin#	Function
1	**Signal Output GND**
2	**Proportional Output GND**
3	**Proportional Output 1**
4	**Signal Output**

Mating Plug Kit

A mating plug kit comprised of all mating connectors is available as P/N: **AX070450**.

Specifications are indicative and subject to change. Actual performance will vary depending on the application and operating conditions. Users should satisfy themselves that the product is suitable for use in the intended application. All our products carry a limited warranty against defects in material and workmanship. Please refer to our Warranty, Application Approvals/Limitations and Return Materials Process as described on www.axiomatic.com/service.html.

Form: TDAX100250-C-08/07/19