

TECHNICAL DATASHEET #TDAX100250  
**40A BLDC MOTOR CONTROLLER, SAE J1939**

*Variable Speed Control, Onboard I/O  
CAN SAE J1939, Rugged Enclosure  
with the Axiomatic Electronic Assistant  
P/N: AX100250*

**Features:**

- Unidirectional or bi-directional BLDC motor control
- Up to 40A 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; digital (pull up - pull down); or Encoder.
- 1 Digital/Frequency/PWM input (pull up - pull down)
- The control inputs to drive the motor (speed, direction, enable) can be mapped to any of the 3 inputs or the controller can respond to messages from the CAN bus.
- 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 signal output is provided to follow the rotation speed of the motor (V or mA signal)
- Highly efficient and robust design with isolation for drive and processing circuits
- Operational from 9 to 65 Vdc (12, 24 or 48 Vdc nominal)
- 1 CAN port (SAE J1939)
- Configurable with the 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)



**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 Number:**

BLDC Motor Controller, SAE J1939 P/N: **AX100250**

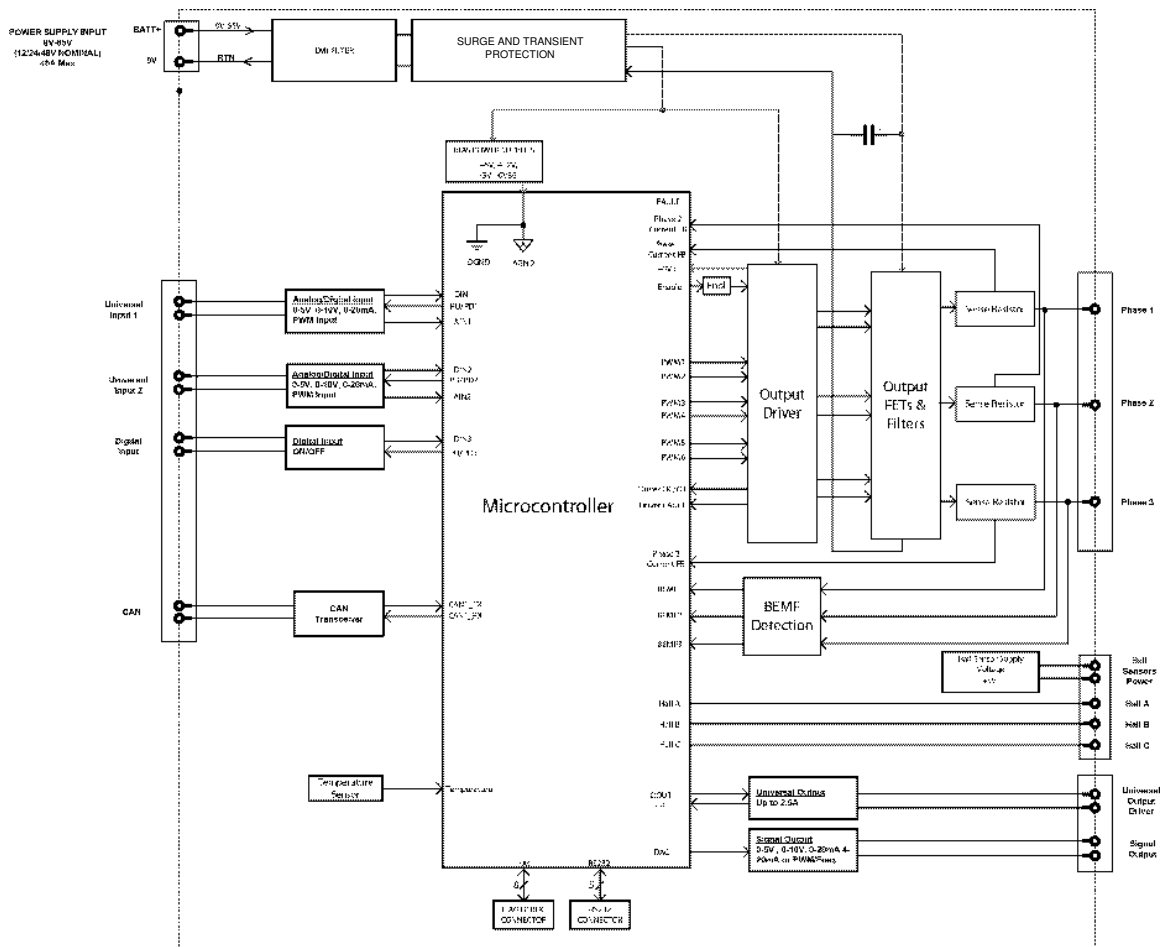
BLDC Motor Controller, CANopen® P/N: **AX100251**

Accessories:

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

Configuration Tool - Axiomatic Electronic Assistant KIT, P/Ns: **AX070502** or **AX070506K**

## Block Diagram



## Technical Specifications

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 <https://www.axiomatic.com/service/>.

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

## Power

Power Supply Input	12, 24, or 48 VDC nominal (9 to 65 VDC)
Quiescent Current	61.49 mA @ 12Vdc; 32.29 mA @ 24Vdc typical
Surge Protection	120 VDC

## Input

Universal Signal Inputs	<p>2 universal signal input properties are user configurable. Refer to the block diagram and information below.</p> <p>Any input on the controller can be coded into a Proprietary B message that can be sent to the CAN network.</p> <p>12-bit analog to digital resolution Protected against shorts</p> <p><u>Voltage Input:</u> Range: 0-5 VDC or 0-10 VDC Resolution: 1 mV Accuracy: <math>\pm 1\%</math></p> <p><u>Current Input:</u> Range: 4-20 mA or 0-20 mA Resolution: 1 <math>\mu</math>A Accuracy: <math>\pm 1\%</math> Current sense resistor: 249 <math>\Omega</math></p> <p><u>Frequency Input:</u> Auto-Ranging: 0.1-10,000 Hz Resolution: 0.01% Accuracy: <math>\pm 1\%</math></p> <p><u>PWM Signal:</u> Range: 0.5-10,000 Hz Duty Cycle : 0 to 100% Resolution: 0.01% Accuracy: <math>\pm 1\%</math></p> <p><u>Digital Input:</u> Active high with 10 K<math>\Omega</math> pull-up resistor or active low with 10 K<math>\Omega</math> pull-down resistor Amplitude: up to +Vps</p> <p>These can be configured to act as an encoder input. Input 1 is the Encoder A and input 2 is the Encoder B interface.</p> <p>The control inputs to drive the motor (speed, direction, enable) can be mapped to any of the 2 inputs.</p>
Digital / PWM / Frequency Inputs	<p>1 input is provided</p> <p><u>Frequency Input:</u> Auto-Ranging: 0.1-10,000 Hz Resolution: 0.01% Accuracy: <math>\pm 1\%</math></p> <p><u>PWM Signal:</u> Range: 0.1-10,000 Hz Duty Cycle : 0 to 100% Resolution: 0.01% Accuracy: <math>\pm 1\%</math></p> <p><u>Digital Input:</u> Active high with 10 K<math>\Omega</math> pull-up resistor or active low with 10 K<math>\Omega</math> pull-down resistor Amplitude: up to +Vps</p> <p>The control inputs to drive the motor (speed, direction, enable) can be mapped to the digital input.</p>
Motor Feedback	<p>Hall effect sensor 10 K<math>\Omega</math> pull-up to +5 V per input A +5 V supply and ground connection is provided.</p> <p>Sensorless control using back EMF is also available in the standard model.</p>

## Output

Output to BLDC Motor	<p>H-bridge  40A @ 48VDC nominal continuous  40A @ 24VDC nominal continuous  40A @ 12VDC nominal continuous</p> <p>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.</p>
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	<p>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.</p>
Thermal Protection	Thermal protection is built-in and configurable.
Universal Output	<p>1 output is selectable as:</p> <p><u>Proportional Current:</u>  Range: 0-2.5 A  Resolution: 1 mA  Accuracy: <math>\pm 1\%</math></p> <p><u>Hotshot Digital:</u>  Current: 2.5 A</p> <p><u>PWM Duty Cycle:</u>  Current: 2.5 A  Resolution: 0.01%  Accuracy: <math>\pm 1\%</math></p> <p><u>On/Off Digital:</u>  Current: 2.5 A  Sourcing from power supply or output off</p> <p><u>Half-Bridge Output:</u>  Current sensing, grounded load.  High side sourcing up to 2.5 A  High frequency drive</p> <p>Load at supply voltage must not draw more than 2.5A  Ramp and dither setpoints are configurable.</p> <p>Overcurrent protection  Short circuit protection</p> <p><b>Hotshot Coil Saver Output:</b>  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. Refer to Proportional Output Hotshot Digital Profile.</p>
Signal Output	<p>1 voltage or current output is provided to follow the rotation speed of the motor.</p> <p>12-bit digital to analog (voltage, current)  Protected against short to GND or +Vcc  1 signal output GND is provided.</p> <p><u>Voltage Output:</u>  Range: 0-5 VDC or 0-10 VDC  Resolution: 1 mV  Accuracy: <math>\pm 1\%</math></p> <p><u>Current Output:</u>  Range: 4-20 mA or 0-20 mA  Resolution: 1 <math>\mu</math>A  Accuracy: <math>\pm 1\%</math>  Current sense resistor: 249 <math>\Omega</math></p>

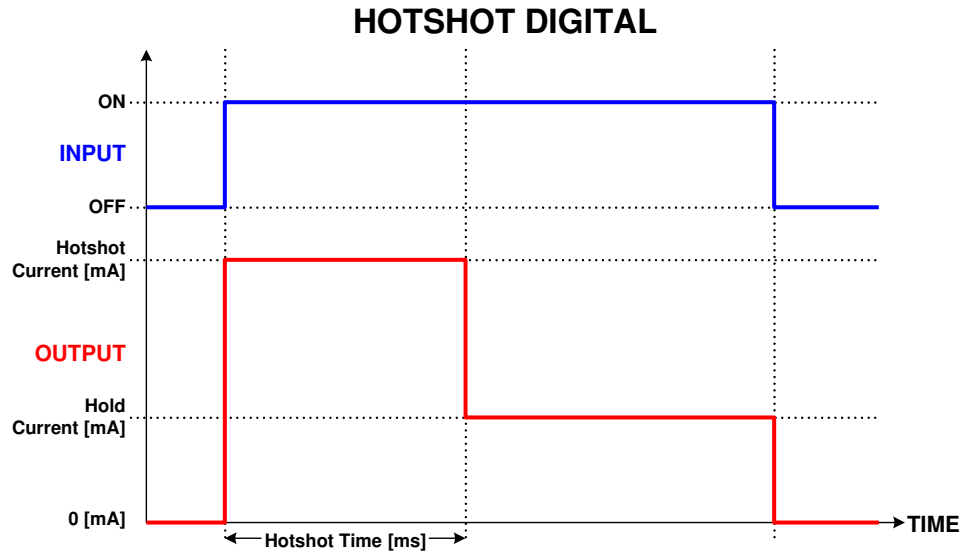


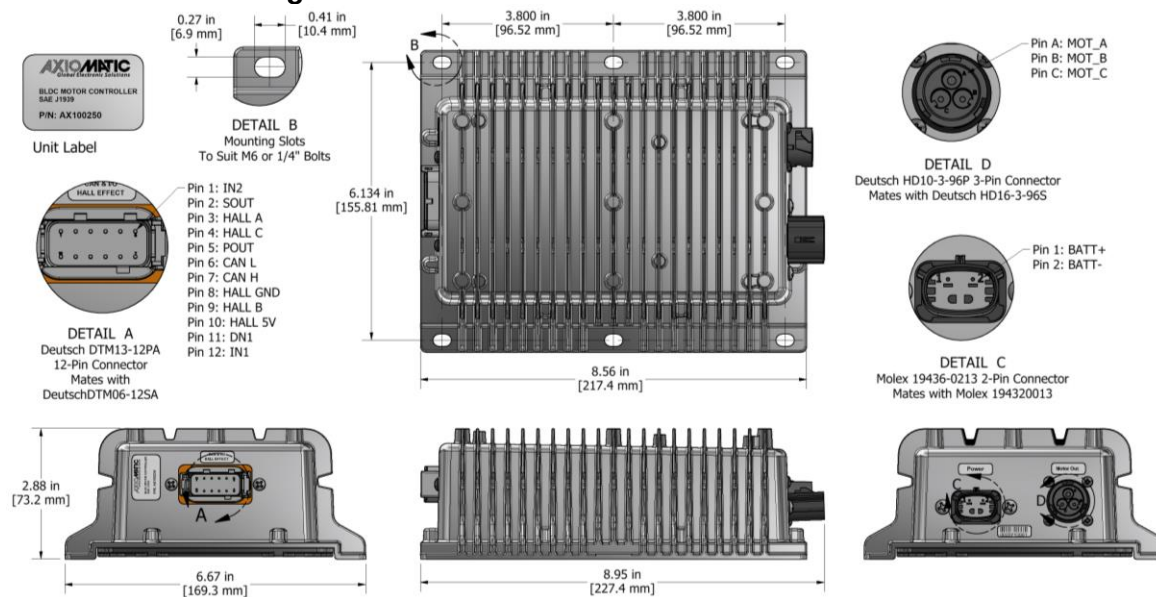
Figure 1 – Proportional Output Hotshot Digital Profile

## General Specifications

Microcontroller	TMS320F280049						
Motor Control	<p>Standard embedded software is provided.</p> <p>The following parameters are user configurable.</p> <p><u>Motor Direction:</u> Uni-directional or bi-directional control from an input or the CAN bus. The direction is also configurable.</p> <p><u>Enable:</u> A universal input can be configured to enable the motor when on. A CAN message can also be used as an enable input.</p> <p><u>Control Mode:</u> Open loop speed or closed loop speed, open loop torque or closed loop torque</p> <p><u>CAN:</u> CAN bus messages control the motor and/or auxiliary outputs instead of the analog or digital inputs</p>						
Communication	<p>1 CAN port (SAE J1939)</p> <p>Baud-rate: 250 kb/s</p> <p>CANopen® model: <b>AX100251</b></p>						
User Interface	<p>The Axiomatic Electronic Assistant for <i>Windows</i> operating systems</p> <p>It comes with a royalty-free license for use.</p> <p>The Axiomatic Electronic Assistant requires a USB-CAN converter to link the device's CAN port to a <i>Windows</i>-based PC for initial configuration. Order the Axiomatic EA and Axiomatic USB-CAN as a kit (P/Ns: <b>AX070502</b> or <b>AX070506K</b>), which includes all interconnecting cables.</p>						
Operating Conditions	-40°C to 85°C (-40°F to 185°F)						
Storage Temperature	-50°C to 125°C (-58°F to 257°F)						
Weight	3.75 lb. (1.695 kg)						
Protection	IP67						
Enclosure and Dimensions	<p>Encapsulated in an anodized aluminum extrusion with gasket</p> <p>8.95 in x 6.67 in x 2.88 in (227.4 mm x 169.3 mm x 73.2 mm)</p> <p>(W x L x H including connectors, excluding mating connectors)</p> <p>Refer to Dimensional Drawing.</p>						
Electrical Connections	<p><u>Power Connector:</u></p> <p>Molex equivalent P/N: 19436-0213</p> <p>Mates with Molex P/N: 19432-0013</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Pin #</th><th>Function</th></tr> </thead> <tbody> <tr> <td>1</td><td>BATT+</td></tr> <tr> <td>2</td><td>BATT-</td></tr> </tbody> </table>	Pin #	Function	1	BATT+	2	BATT-
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	<p><b>Motor Connector:</b> TE Deutsch equivalent P/N: HD10-3-96P Mates with TE Deutsch equivalent P/N: HD16-3-96S</p> <table border="1"> <thead> <tr> <th>Pin #</th><th>Function</th></tr> </thead> <tbody> <tr> <td>1</td><td>MOTOR A OUT</td></tr> <tr> <td>2</td><td>MOTOR B OUT</td></tr> <tr> <td>3</td><td>MOTOR C OUT</td></tr> </tbody> </table> <p><b>Signal, Hall Effect and CAN Connector:</b> TE Deutsch equivalent P/N: DTM13-12PA Mates with TE Deutsch equivalent P/N: DTM06-12SA</p> <table border="1"> <thead> <tr> <th>Pin #</th><th>Function</th></tr> </thead> <tbody> <tr> <td>1</td><td>INPUT 2</td></tr> <tr> <td>2</td><td>SIGNAL OUT</td></tr> <tr> <td>3</td><td>HALL A</td></tr> <tr> <td>4</td><td>HALL C</td></tr> <tr> <td>5</td><td>POUT</td></tr> <tr> <td>6</td><td>CAN L</td></tr> <tr> <td>7</td><td>CAN H</td></tr> <tr> <td>8</td><td>HALL GND</td></tr> <tr> <td>9</td><td>HALL B</td></tr> <tr> <td>10</td><td>HALL 5V</td></tr> <tr> <td>11</td><td>DIGITAL IN1</td></tr> <tr> <td>12</td><td>INPUT 1</td></tr> </tbody> </table> <p>Wires should be of the appropriate gauge to meet requirements of applicable electrical codes and suit the specifications of the connector(s).</p>	Pin #	Function	1	MOTOR A OUT	2	MOTOR B OUT	3	MOTOR C OUT	Pin #	Function	1	INPUT 2	2	SIGNAL OUT	3	HALL A	4	HALL C	5	POUT	6	CAN L	7	CAN H	8	HALL GND	9	HALL B	10	HALL 5V	11	DIGITAL IN1	12	INPUT 1
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Mating Cables	<p>A mating plug kit comprised of all mating connectors is available as P/N: <b>AX070450</b> (includes 1 plug DTM06-12SA, 1 socket HD16-3-96S, 1 wedgelock WM12S, 12 contacts 0462-201-20141, 3 contacts 0462-201-16141, 1 wedgelock 19432-0013, 2 terminals 19434-0003).</p>																																		
Mounting	<p>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 1/4 inch bolts. The bolt length will be determined by the end-user's mounting plate thickness. Typically, 20 mm (3/4 inch) is adequate.</p>																																		

## Dimensional Drawing



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Form: TDAX100250-05/10/2024