Technical Datasheet #TDAX100251A

# 40A BLDC Motor Controller, CANopen®

**P/N: AX100251A**

## 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; Hydraulic powerpacks

## Ordering Part Number

40A BLDC Motor Controller, CANopen® - P/N: **AX100251A**
SAE J1939, 250 kbps model - P/N**: AX100250**

Accessories:
**EDS File**
Mating Plugs Kit - P/N: **AX070450**

## Features

- Unidirectional or bi-directional control to run 1x BLDC motor (Up to 40 A continuous output current)
- Flexible control of speed and torque
- Hall effect sensor feedback (Sensorless control using back EMF is also available in the standard model.)
- 2x universal signal inputs are user selectable as voltage, current, resistive, frequency, PWM, or digital type (For encoder inputs, contact Axiomatic.)
- 1x digital, frequency, or PWM input
- Control inputs (speed, direction, enable) to drive the motor can be mapped to any of the 3x inputs or the controller can respond to messages from the CAN bus.
- 1x universal output (2.5 A proportional) to drive accessories such as hydraulic valves or relays for machine control or safety interlock
- 1x signal output is provided to follow the rotation speed of the motor (voltage or current signal)
- Output can be coded as feedback messages sent to the CAN bus
- Highly efficient and robust design with isolation for drive and processing circuits
- 1x CAN port (CANopen®)
- Operational from 9 to 65 $V_{DC}$ (12, 24, or 48 $V_{DC}$ nominal)
- Operational from -40 to 85 °C (-40 to 185 °F)
- Suitable for high shock and vibration environments
- Rugged and fully sealed IP67-rated corrosion resistant aluminum enclosure
- EDS file for configuration

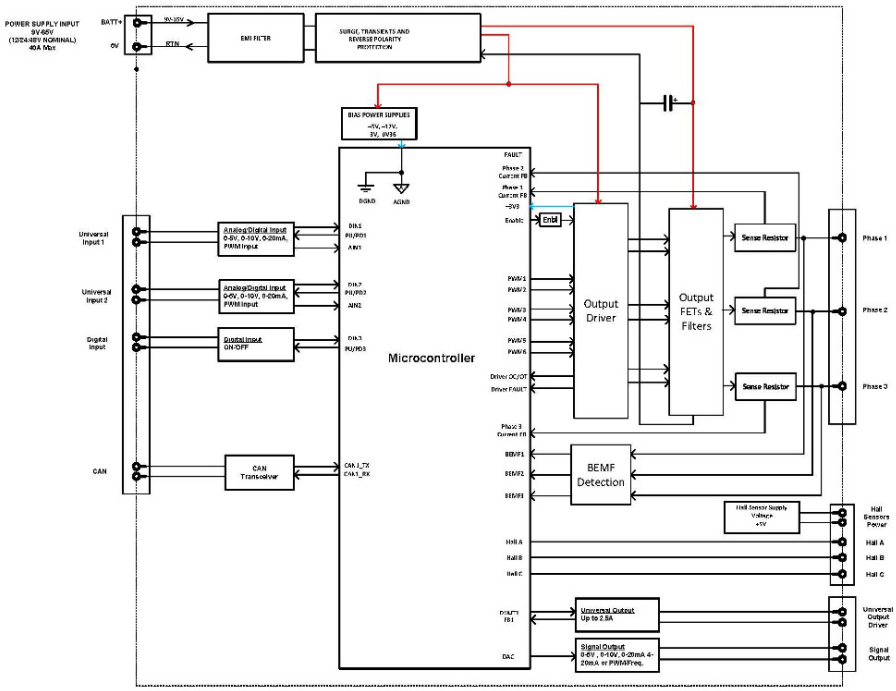


*Figure 1 – Block Diagram*


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# 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 Limitations & Return Materials Process as described on https://www.axiomatic.com/service/.*

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

## Power

| | |
|---|---|
| Power Input | 12, 24, or 48 $V_{DC}$ nominal (9 to 65 $V_{DC}$) |
| Quiescent Current | 70.2 mA @ 12 $V_{DC}$; 37.3 mA @ 24 $V_{DC}$; 18 mA @ 48 $V_{DC}$ typical |
| Surge Protection | 120 $V_{DC}$ |

## Inputs

**Universal /Resistive Inputs**

2x universal or resistive signal input properties are user configurable. (For encoder inputs, contact Axiomatic.)

12-bit analog to digital resolution
Protected against shorts

| | |
|---|---|
| Voltage Input | Range: 0-5 or 0-10 $V_{DC}$<br>Resolution:1 mV<br>Accuracy: ±1 % error |
| Current Input | Range: 4-20 or 0-20 mA<br>Resolution:1 µA<br>Accuracy: ±1 % error<br>Current sense resistor: 249 Ω |
| Resistive Input | Range: 30 Ω to 250 kΩ<br>Accuracy: ±2 % error (up to 100 kΩ), ±10 % error (up to 250 kΩ) |
| Frequency Input | Auto-Ranging: 0.5 Hz to 10 kHz<br>Resolution: 1 Hz<br>Accuracy: ±1 % error |
| PWM Signal | Range: 0.5 Hz to 10 kHz<br>Duty Cycle: 0 to 100 %<br>Accuracy: ±1 % error |
| Digital Input | Active high with 10 kΩ pull-up resistor or active low with 10 kΩ pull-down resistor<br>Amplitude: up to +Vps |

**Digital Input**

1x input is provided

| | |
|---|---|
| Frequency Input | Auto-Ranging: 0.5 Hz to 10 kHz<br>Resolution: 0.01 %<br>Accuracy: ±1 % error |
| PWM Signal | Range: 0.5 Hz to 10 kHz<br>Duty Cycle: 0 to 100 %<br>Resolution: 0.01 %<br>Accuracy: ±1 % error |
| Digital Input | Active high with 10 kΩ pull-up resistor or active low with 10 kΩ pull-down resistor<br>Amplitude: up to +Vps |

These inputs can be used as an enable or direction command for the controller.

**Hall Sensor Inputs (for Motor Feedback)**

3x Hall effect sensor inputs
10 kΩ pull-up to +5 V per input

1x voltage supply (+5 V) is provided.
1x ground connection is provided.

Sensorless control using back EMF is also available in the standard model.

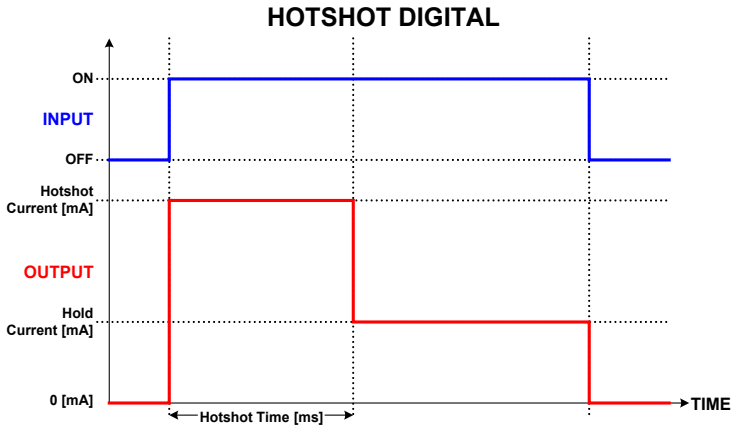


*Figure 2 – Hotshot Digital Output Profile*

## Outputs

<table>
<tr><td>Output to BLDC Motor</td><td>1x output (3x pins) to run 1x BLDC motor<br><br>40 A continuous current at 12, 24, or 48 $V_{DC}$ (nominal)<br>The maximum rated speed and motor rated current are configurable to suit individual motor specifications.<br><br>Overcurrent protection is provided at 50 A.<br>Short circuit protection is provided.</td></tr>
<tr><td>Motor Stop</td><td>Shut off with or without ramping</td></tr>
<tr><td>Motor Direction</td><td>Motor direction command can be mapped to any input or come from the CAN bus.</td></tr>
<tr><td>Motor Control Mode</td><td>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.</td></tr>
<tr><td>Thermal Protection</td><td>Thermal protection is built-in and configurable.</td></tr>
<tr><td>Universal Output</td><td>1x output is selectable as:<br><br>
<table>
<tr><th>Proportional Current</th><th>Hotshot Digital</th><th>PWM Duty Cycle</th><th>On/Off Digital</th></tr>
<tr><td>Range: 0-2.5 A<br>Resolution:1 mA<br>Accuracy: ±1 % error</td><td>Current: 2.5 A</td><td>Current: 2.5 A<br>Resolution: 0.01 %<br>Accuracy: ±1 % error</td><td>Current: 2.5 A<br>Sourcing from power supply or output off</td></tr>
</table>
Half-bridge output, current sensing, grounded load<br>High side sourcing up to 2.5 A<br>High frequency drive<br><br>Load at supply voltage must not draw more than 2.5 A<br>Ramp and dither setpoints are configurable.<br><br>Overcurrent protection; Short circuit protection<br><br>Hotshot Coil Saver Output:<br>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.<br>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.<br>Refer to Figure 2.</td></tr>
<tr><td>Analog Output</td><td>1x voltage or current output is provided to follow the rotation speed of the motor.<br><br>12-bit digital to analog (voltage, current)<br>Protected against short to Ground or +Vcc<br>1x signal output Ground is provided.
<table>
<tr><th>Voltage Output</th><th>Current Output</th></tr>
<tr><td>Range: 0-5 or 0-10 VDC<br>Resolution:1 mV<br>Accuracy: ±1 % error</td><td>Range: 4-20 or 0-20 mA<br>Resolution:1 µA<br>Accuracy: ±1 % error<br>Current sense resistor: 249 Ω</td></tr>
</table></td></tr>
<tr><td>Voltage Reference<br>(for Hall Sensors)</td><td>1x voltage supply (+5 V) is provided.<br>1x ground connection is provided.</td></tr>
</table>

## General Specifications

| | |
|---|---|
| Microcontroller | TMS320F280049 |
| Motor Control | Standard embedded software is provided. The following parameters are user configurable.<br>**Motor Direction**: Uni-directional or bi-directional control from an input or the CAN bus. The direction is also configurable.<br>**Enable**: A universal input can be configured to enable the motor when on. A CAN message can also be used as an enable input.<br>**Control Mode**: Open loop speed or closed loop speed, open loop torque or closed loop torque.<br>**CAN**: CAN bus messages control the motor and/or auxiliary outputs instead of the analog or digital inputs. |
| Communication | 1x CAN port (CANopen®)<br>Supported baud-rates: 10 kbit/s, 20 kbit/s, 50 kbit/s, 125 kbit/s (default), 250 kbit/s, 500 kbit/, 800 kbit/s, and 1 Mbit/s<br>SAE J1939, 250 kbit/s model: AX100250 |
| User Interface | EDS file is provided to interface with the unit using standard CANopen® tools. |
| Operating Conditions | -40 to 85 °C (-40 to 185 °F) |
| Storage Temperature | -50 to 125 °C (-58 to 257 °F) |
| Vibration | MIL-STD-202H, method 204, test condition C:<br>10 g peak (Sine)<br>MIL-STD-202H, method 214A, test condition I/B:<br>7.56 Grms (Random) |
| Shock | MIL-STD-202H, method 213B, test condition A:<br>50 g peak |
| Weight | 3.75 lb. (1.695 kg) |
| Protection | IP67 |
| Enclosure | Encapsulated in an anodized aluminum extrusion with gasket 8.95 in. x 6.67 in. x 2.88 in. (227.4 mm x 169.3 mm x 73.2 mm), (W x L x H including connectors, excluding mating connectors). Refer to Dimensional Drawing. |

## Electrical Connections

**Electrical Connections**

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

| Pin | Function |
|---|---|
| 1 | Battery + |
| 2 | Battery - |

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

| Pin | Function |
|---|---|
| A | Motor A Output |
| B | Motor B Output |
| C | Motor C Output |

Signal, Hall Effect and CAN Connector:
TE Deutsch P/N: DTM13-12PA
Mates with TE Deutsch P/N: DTM06-12SA

| Pin | Function | Pin | Function |
|---|---|---|---|
| 1 | Universal / Resistive Input 2 | 7 | CAN High |
| 2 | Analog Output | 8 | Hall Sensor Ground |
| 3 | Hall Sensor A | 9 | Hall Sensor B |
| 4 | Hall Sensor C | 10 | Hall Sensor 5 V Supply |
| 5 | Universal Output | 11 | Digital Input 1 |
| 6 | CAN Low | 12 | Universal / Resistive Input 1 |

**Mating Connectors and Cables**

Wires should be of the appropriate gauge to meet requirements of applicable electrical codes and suit the specifications of the connector(s).

A mating plug kit comprised of all mating connectors is available under P/N: **AX070450** (includes 1x plug DTM06-12SA, 1x socket HD16-3-96S, 1x wedgelock WM12S, 12x contacts 0462-201-20141, 3x contacts 0462-201-16141, 1x wedgelock 19432-0013, and 2x terminals 19434-0003).

**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 in. bolts. The bolt length will be determined by the end-user's mounting plate thickness. Typically, 20 mm (3/4 in.) is adequate.

## Dimensional Drawing

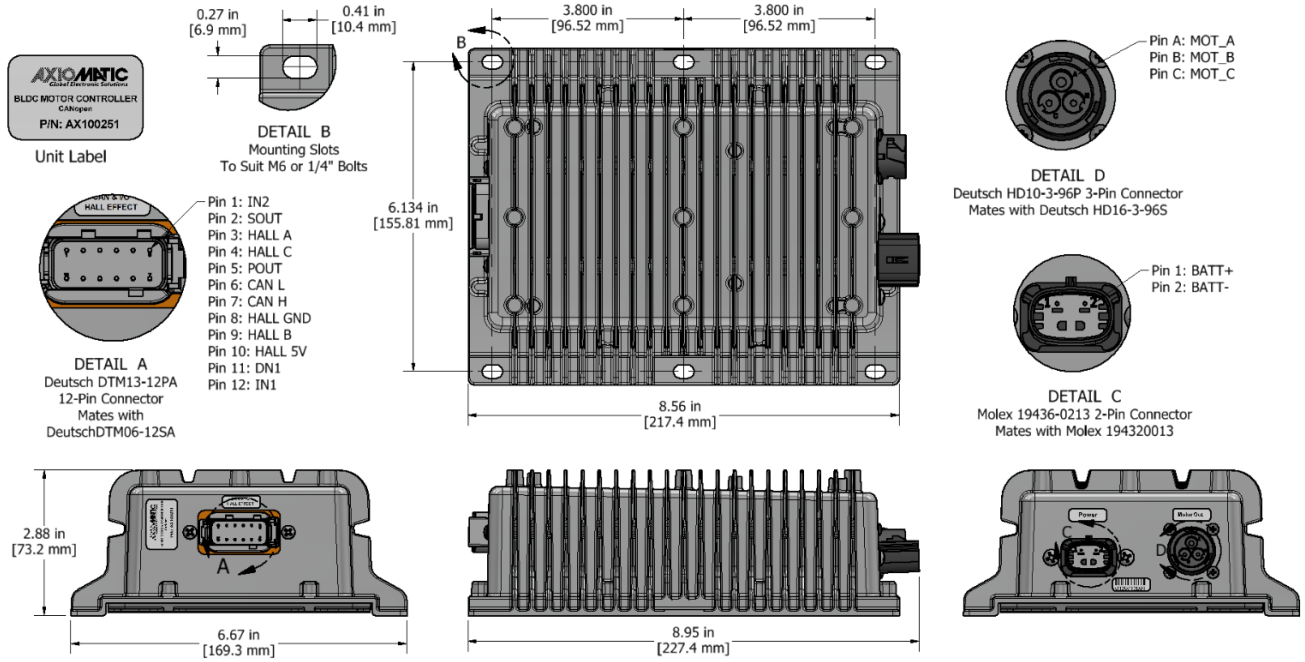


*Figure 3 – Dimensional Drawing (dimensions of AX100251A are same as those of AX100251)*

Note: CANopen® is a registered community trademark of CAN in Automation e.V.

Form: TDAX100251A-08/19/2026

## OUR PRODUCTS

AC/DC Power Supplies
Actuator Controls/Interfaces
Automotive Ethernet Switches
Battery Chargers
CAN Controls, Routers, Repeaters
CAN/WiFi
CAN/Bluetooth (Classic, BLE)
CAN bus Routers
CANopen I/O Modules
Current/Voltage/PWM Converters
DC/DC Power Converters
Engine Temperature Scanners
Ethernet/CAN Converters, Gateways
Ethernet Switches
Fan Drive Controllers
Gateways, CAN/Modbus, RS-232
Gyroscopes, Inclinometers
Hydraulic Valve Controllers
Inclinometers, Triaxial
I/O Controls
LVDT Signal Converters
Machine Controls
Media Converters
Modbus, RS-422, RS-485 Controls
Motor Controls, Inverters
Power Supplies, DC/DC, AC/DC
PWM Signal Converters/Isolators
Resolver Signal Conditioners
SAE J1939 I/O Modules
Service Tools
Signal Conditioners, Converters
Strain Gauge CAN Controls
Surge Suppressors

## OUR COMPANY

Axiomatic provides electronic machine control components to the off-highway, commercial vehicle, electric vehicle, power generator set, material handling, renewable energy and industrial OEM markets. ***We innovate with engineered and off-the-shelf machine controls that add value for our customers.***

## QUALITY DESIGN AND MANUFACTURING

We have an ISO9001 registered R&D, electronics design and manufacturing facility in Canada.

Sales offices are in Canada, USA, Australia and Finland.

## COMPLIANCE

Product compliance details can be found in the product literature and/or on axiomatic.com. Any inquiries should be sent to sales@axiomatic.com.

## SAFE USE

All products should be serviced by Axiomatic. Do not open the product and perform the service yourself.

This product can expose you to chemicals which are known in the State of California, USA to cause cancer and reproductive harm. For more information go to www.P65Warnings.ca.gov.

## TECHNICAL SUPPORT

Contact technical support by emailing support@axiomatic.com.

## WARRANTY, APPLICATION APPROVALS/LIMITATIONS

Axiomatic Technologies Corporation reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. 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 at https://www.axiomatic.com/service/.

## SERVICE

All products to be returned to Axiomatic require a Return Materials Authorization Number (RMA#) from rma@axiomatic.com. Please provide the following information when requesting an RMA number:

- Serial number, part number, Runtime hours, description of problem
- Wiring set up diagram, application and other comments as needed

## DISPOSAL

Axiomatic products are electronic waste. Please follow your local environmental waste and recycling laws, regulations and policies for safe disposal or recycling of electronic waste.

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