

TECHNICAL DATASHEET #TDAX102101  
**40A DC MOTOR CONTROLLER, CANopen®**  
Variable Speed Control  
Onboard I/O  
Rugged Packaging  
P/N: AX102101

## Features

- Unidirectional or bi-directional DC motor control (up to 40A)
- Flexible control
  - open or closed loop speed control; command inputs or CAN messages.
  - open or closed loop current control; constant user configurable maximum command.
- 3 isolated digital inputs. Input 3 can act as STO (Safe Torque Off) or E-Brake safety interlock inputs
- 2 isolated universal signal inputs are user configurable from the following: 0-5V, 0-10V, 0-20 mA, 4-20 mA, PWM, or Digital.
- +5V Reference to power sensor inputs
- Map the control input to any of the command inputs or messages from a CAN bus.
- Configurable and independent ramps smooth motor rotation, protecting the controller and the system
- Additional 2 current outputs (2.5A proportional, hotshot digital, PWM D.C., Proportional Voltage, or On/Off Digital) drive accessories such as hydraulic valves or relays for machine control or safety interlock.
- Outputs can be coded as feedback messages sent to the CAN bus
- Highly efficient and robust design with isolation for drive and processing circuits
- 12V, 24V, or 48Vdc nominal
- CANopen® (SAE J1939 model available)
- EDS File for setpoint configuration
- Compact size for easy mounting on a vehicle
- Suitable for moist, high shock and vibration environments
- 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, Cranes and Hoists, Hydraulic Tail Lifts and Winches, Golf Carts, Military Equipment, Mobile Pumps and Hydraulic Powerpacks

## Ordering Part Numbers

40A DC Motor Controller, CANopen® - P/N: **AX102101**

SAE J1939 model - P/N: **AX102100**

### Accessories:

EDS File

Mating Plug Kit - P/N: **PL-DTM06-12SA**

2m Wire Harness for Power and Motor Connector - P/N: **AX070137**

# Block Diagram

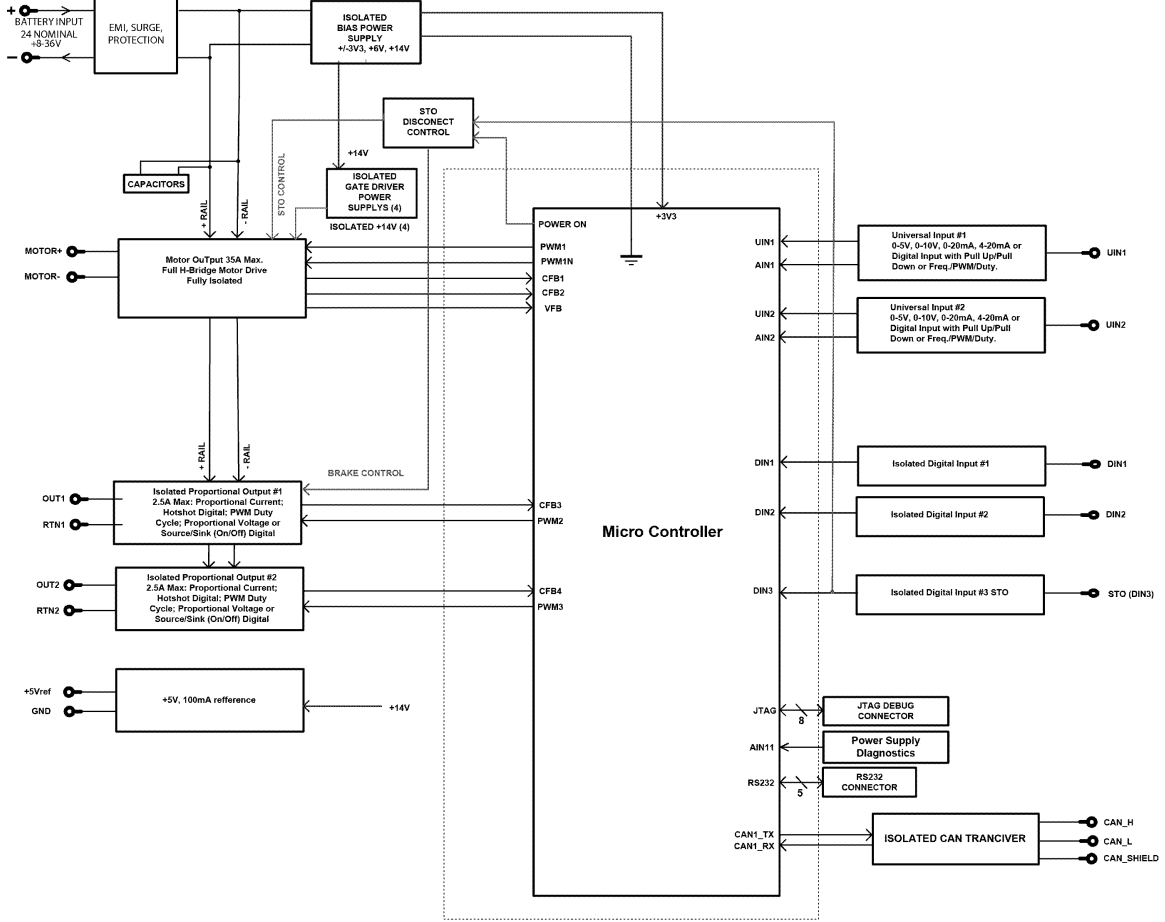


Figure 1 - Block Diagram

## 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/>.

### Inputs

Power Supply Input	12/ 24/ 48 Vdc nominal (8 to 60 Vdc range)
Surge Protection	Provided
Overcurrent Protection	Provided up to 75 A
Undervoltage Protection	Built-in
Isolation	All inputs are isolated from the power supply driving the motor and current outputs.
Command Inputs	5 isolated user selectable signal inputs (2 universal signal, 3 digital signal)  Refer to Table 1.0.  Any input on the controller can be coded into a Proprietary B message that can be sent to the CAN network.
Ground	1 Universal Input Ground
+5V Reference	One +5 V (100 mA) +/-2% Voltage output

**Table 1.0 Inputs to AX102100 (Up to 5 user selectable inputs)**

Input Type	Description
Universal Signal Inputs	<p>Up to 2 universal signal inputs are available. Inputs are isolated from the power supply. 12-bit Analog to Digital Protected against shorts to Ground or +V supply</p> <p>User selectable as: Voltage, Current, PWM or Digital types</p> <p>Voltage: 0 to 5 Vdc or 0 to 10 Vdc 1 mV resolution, accuracy +/-1% error</p> <p>Current: 4 to 20 mA or 0 to 20 mA 1 <math>\mu</math>A resolution, accuracy +/-1% error Current sense resistor 124 <math>\Omega</math></p> <p>PWM Signal Frequency: 1 to 20,000 Hz PWM Duty Cycle: 0 to 100% 0.01% resolution, accuracy +/-1% error</p> <p>Digital Input: Active High to Vsupply or Active Low to Ground Amplitude: 3.3 V to +Vsupply</p>
Digital Inputs	<p>Up to 3 fully isolated digital inputs are available. Input 3 is dedicated as STO (Safe Torque Off) or E-Brake safety interlock input. Opto-isolated input is normally not active for safety reasons. If this cable is disconnected, the MOTOR remains OFF.</p> <p>Amplitude: 14 Vdc Input current maximum is 8 mA.</p> <p>These inputs can be used as an enable or direction command for the controller. The input accepted is active low (input is connected to Power Ground when ON).</p>

## Outputs

Output to Motor	<p>1 output for a DC motor Full H-bridge for forward and reverse motor or brake operation 50A @ 24VDC nominal for 2 minutes at room temperature 40A @ 24VDC nominal for 1 hour minimum</p> <p>Overcurrent protection is provided. Short circuit protection is provided.</p> <p>Current measurement is provided. Overcurrent protection is provided @ +/-75 A for each output leg. Supply voltage measurement is provided.</p> <p>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 the following.</p> <ul style="list-style-type: none"> <li>open or closed loop speed control; variable target command</li> <li>open or closed loop current control; constant maximum command</li> </ul> <p>The control input to drive the motor can be mapped to either of the 6 inputs or the controller can respond to messages from a CAN bus.</p>
Thermal Protection	Thermal protection is built-in and configurable.
Universal Outputs	<p>2 outputs to drive solenoids or other devices User configurable as: Proportional Current (0 to 2.5 A), Hotshot Digital (2.5 A), PWM Duty Cycle, Proportional Voltage or On/Off Digital (2.5 A)</p> <p>High side sourcing up to 2.5 A High frequency drive Overcurrent protection Short circuit protection Ramp and dither setpoints are configurable.</p> <p>Current outputs: 1 mA resolution, accuracy +/-1% error Voltage outputs: 0.1 V resolution, accuracy +/-5% error PWM outputs: 0.1% resolution, accuracy +/-0.1% error Digital outputs: sourcing from power supply or output off Load at supply voltage must not draw more than 2.5 A.</p> <p>Hotshot Coil Saver Outputs (Refer to Figure 2.): The outputs are 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.</p> <p>Each 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.</p>

### HOTSHOT DIGITAL

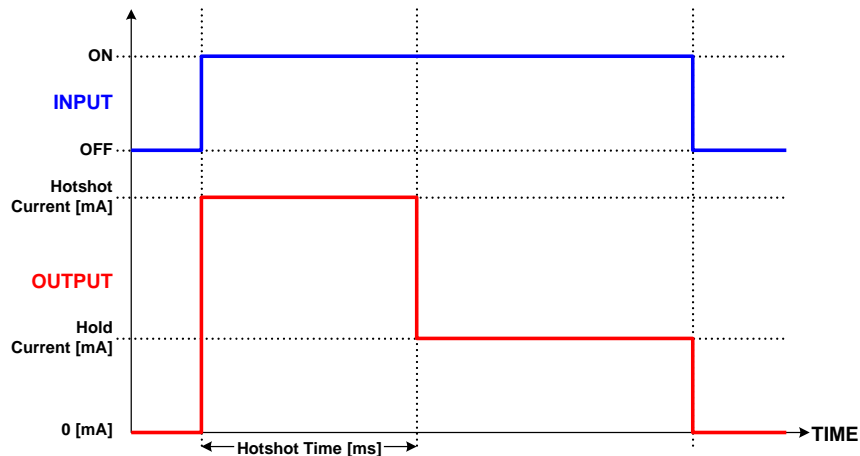


Figure 2 – Proportional Output Hotshot Digital Profile

## General Specifications

Microcontroller	STM32F405RGT7
Motor Control	<p>Standard embedded software is provided.</p> <p>The following parameters are user configurable.</p> <p><b>Motor Direction:</b> Unidirectional or bi-directional control from an input or the CAN bus. The direction is also configurable.</p> <p><b>Enable:</b> 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><b>Control Mode:</b> Open loop speed or closed loop speed control with externally commanded motor RPM control from an input or CAN message. Open loop current/torque or closed loop current/torque with constant user settable maximum value (Axiomatic EA).</p> <p><b>CAN:</b> CAN bus messages control the motor and/or auxiliary outputs instead of the analog or digital inputs.</p>
CAN Interface	<p>1 CANopen® port</p> <p>SAE J1939 model: AX102100</p>
Electrical Connections	<p>Refer to Table 2.0.</p> <p>Wires should be of the appropriate gauge to meet requirements of applicable electrical codes and suit the specifications of the connector(s).</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.</p> <p>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 (¾ inch) is adequate.</p>
Shielding & Grounding	Refer to the User Manual.
Enclosure and Dimensions	<p>Encapsulated in an anodized cast aluminum enclosure with lid gasket</p> <p>5.83 x 8.66 x 2.49 inches</p> <p>148.00 x 220.00 x 63.25 mm</p> <p>(W x L x H including connectors, excluding mating connectors)</p> <p>Refer to Figure 3.0.</p>
Weight	3.70 lb. (1.678 kg)
Operating Conditions	-40 to 85°C (-40 to 185°F)
Protection Rating	IP67

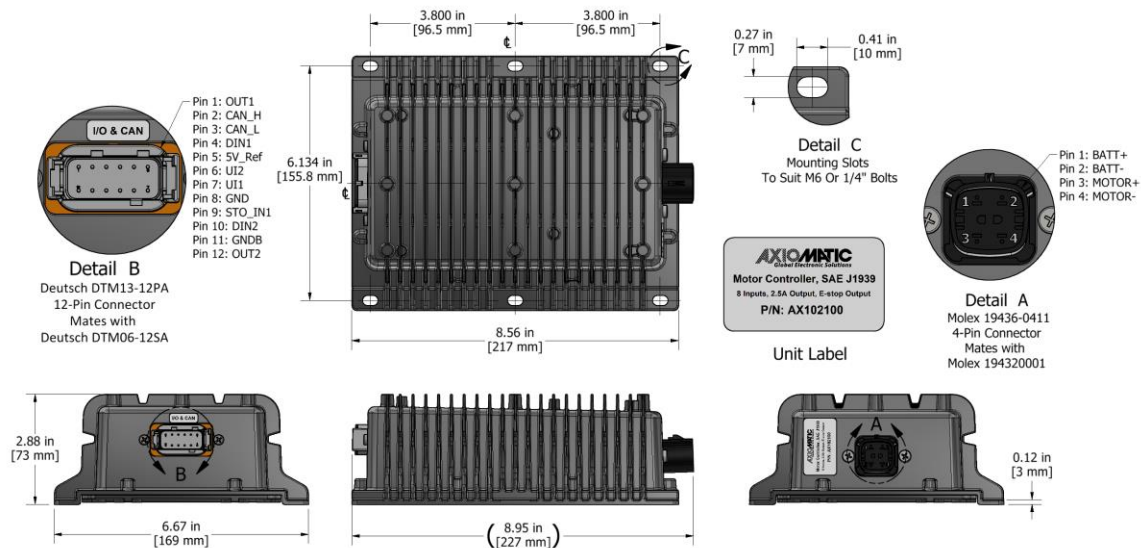


Figure 3 - Dimensional Drawing (Dimensions are same as AX102100)

**Table 2.0 - Electrical Pin Out Chart**

Connector	Mating Connector															
<p><u>Input, Output &amp; CAN Connector:</u> (TE Deutsch P/N: DTM13-12PA)</p> <p>Pin 1: Universal Output 1 (Brake Output)            Pin 2: CAN_H            Pin 3: CAN_L            Pin 4: Digital Input 1            Pin 5: +5V Reference            Pin 6: Universal Input 2            Pin 7: Universal Input 1            Pin 8: Signal Ground            Pin 9: STO Input (Digital Input 3, active low)            Pin 10: Digital Input 2            Pin 11: Power Ground            Pin 12: Universal Output 2</p>	<p>PL-DTM06-12SA</p>															
<p><u>Power &amp; Motor Connector:</u> 4 pin Molex P/N: 19436-0411</p> <p>Pin 1: Battery +            Pin 2: Battery -            Pin 3: Motor +            Pin 4: Motor -</p>	<p>A mating wire harness is available and includes 2 meters (6.5 ft.) of unterminated 12 AWG wires as well as the Molex 19432-0001 mating connector. Ordering P/N: <b>AX070137</b></p> <table border="1" data-bbox="818 793 1382 926"> <thead> <tr> <th>Pin #</th> <th>Color</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Red</td> <td>Batt+</td> </tr> <tr> <td>2</td> <td>Black</td> <td>Batt-</td> </tr> <tr> <td>3</td> <td>White/Red</td> <td>Forward - / Reverse +</td> </tr> <tr> <td>4</td> <td>White/Black</td> <td>Forward + / Reverse -</td> </tr> </tbody> </table>	Pin #	Color	Function	1	Red	Batt+	2	Black	Batt-	3	White/Red	Forward - / Reverse +	4	White/Black	Forward + / Reverse -
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