

Preliminary  
**TECHNICAL DATASHEET #TDAX102100**  
**40A DC MOTOR CONTROLLER**  
**P/N: AX102100**

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

**with Electronic Assistant**

**Features:**

- Unidirectional or bi-directional DC motor control (up to 40A), fully isolated output
- Flexible control
  - open loop speed control;
  - closed loop speed control;
  - or motor RPM or torque control via command inputs or CAN messages.
- 3 isolated digital inputs 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.
- 1 +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 isolated 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
- CAN (SAE J1939) is provided (CANopen on request)
- **Electronic Assistant** 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:**

**Motor Controller, 250 kbps SAE J1939 P/N: AX102100**  
**Motor Controller, 500 kbps SAE J1939 P/N: AX102100-01**  
**Motor Controller, 1 Mbps SAE J1939 P/N: AX102100-02**  
**Motor Controller, CANopen® P/N: AX102101**

**Accessories:**

Electronic Assistant Configuration KIT: **AX070502**  
Mating Plug Kit: **PL-DTM06-12SA**  
2m Wire Harness for Power and Motor Connector P/N: **AX070137**

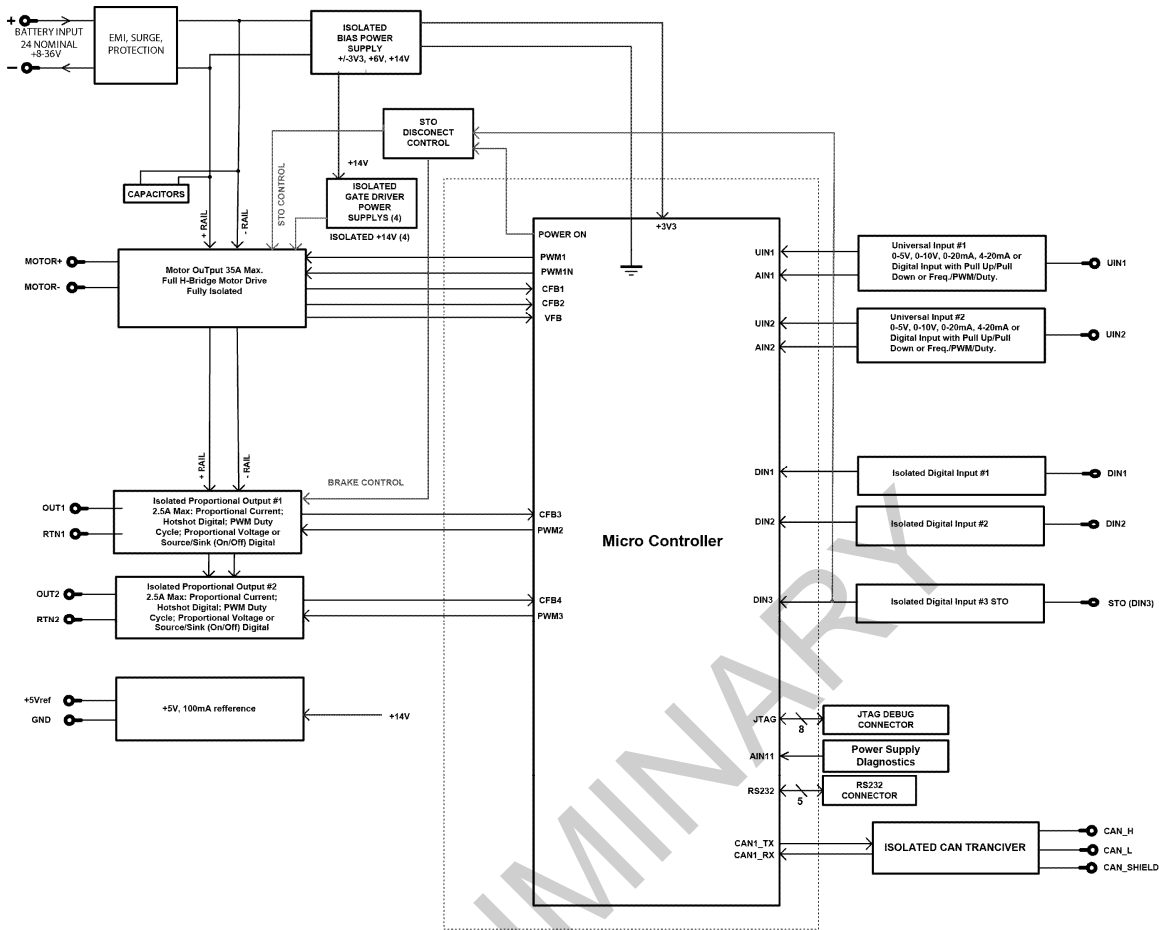


Figure 1 - Block Diagram

## 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 [www.axiomatic.com/service.html](http://www.axiomatic.com/service.html).

## Input Specifications

Power Supply Input - Nominal	12V, 24V or 48Vdc nominal; 8...60 Vdc
Surge Protection	Provided
Overcurrent Protection	Provided up to 75A
Under-voltage 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	1 +5V, 100mA, +/-2% Reference Voltage Output

Input Type	Description
Universal Signal Inputs	<p>Up to 2 universal signal inputs are available. 12-bit Analog to Digital Protected against shorts to GND or +V supply</p> <p>User selectable as: Voltage, Current, PWM or Digital types</p> <p>Voltage: 0...5VDC or 0...10VDC 1 mV resolution, accuracy +/- 1% error</p> <p>Current: 4...20mA or 0...20mA 1 µA resolution, accuracy +/- 1% error Current sense resistor 124Ω</p> <p>PWM Signal Frequency: 1 – 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 GND Amplitude: 3.3V to +Vsupply</p>
Digital Inputs	<p>Up to 3 fully isolated digital inputs are available. Two inputs are dedicated as STO (Safe Torque Off) or E-Brake safety interlock inputs. Opto-isolated input is normally not active for safety reasons. A power connection is provided which will accept 9...36Vdc from an external power supply or from the battery. If this cable is disconnected, the MOTOR remains OFF.</p> <p>Amplitude: minimum 9 Vdc to maximum 36 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 high (switch is connected to a +V signal when ON).</p>

## Output Specifications

Output to Motor	<p>1 fully isolated 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 @ +/- 75A 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</p> <ul style="list-style-type: none"> <li>&gt; open loop speed control;</li> <li>&gt; closed loop speed control (on request); or</li> <li>&gt; external feedback control (on request).</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...2.5A), Hotshot Digital (2.5A), PWM Duty Cycle, Proportional Voltage or On/Off Digital (2.5A)</p> <p>High side sourcing up to 2.5A High frequency drive Overcurrent protection</p>

	<p>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 2.5A.</p> <p><b>Hot Shot Coil Saver Outputs</b> (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>
--	---

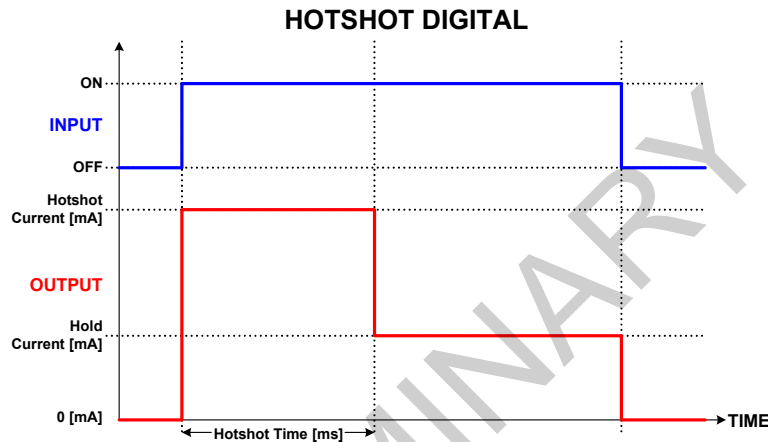
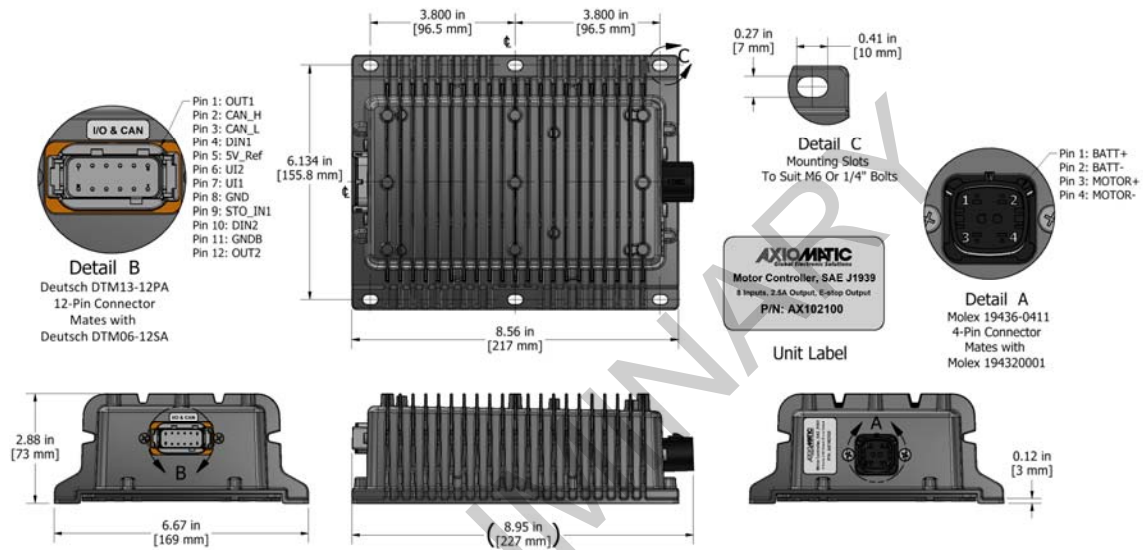


Figure 2 – Proportional Output Hotshot Digital Profile

### General Specifications

Microprocessor	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 or externally commanded motor RPM and torque control from an input or CAN message</p> <p><b>CAN:</b> CAN bus messages control the motor and/or auxiliary outputs instead of the analog or digital inputs</p>
CAN User Interface	<p>Electronic Assistant for <i>Windows</i> operating systems 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 EA and Axiomatic USB-CAN as a kit (P/N AX070502), which includes all interconnecting cables.</p>
CAN Interface	<p>1 SAE J1939 (AX102100 models) 1 CANopen (AX102101 model)</p>
Baud Rates	<p>Model AX102100: 250 kbps Model AX102100-01: 500 kbps Model AX102100-02: 1 Mbps</p>
Electrical Connections	<p>Refer to Table 2.0. Wires should be of the appropriate gauge to meet requirements of applicable electrical codes and suit the specifications of the connector(s).</p>

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.
Shielding & Grounding	Refer to the User Manual.
Enclosure and Dimensions	Encapsulated in an anodized cast aluminum enclosure with lid gasket 5.83 x 8.66 x 2.49 inches 148.00 x 220.00 x 63.25 mm (W x L x H including connectors, excluding mating connectors) <i>Refer to Figure 3.0.</i>



**Figure 3 - Dimensional Drawing**

Weight	<b>3.35 lb. (1.52 kg) preliminary</b>
Operating Conditions	Operating: -40 to 85°C (-40 to 185°F)
Protection Rating	IP67

**Table 2.0 - Electrical Pin Out Chart**

<p><u>Input, Output &amp; CAN Connector:</u>                  TE Deutsch DTM13-12PA                  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 (STO Power Input)                  Pin 8: Signal GND                  Pin 9: STO Input (Digital Input 3)                  Pin 10: Digital Input 2                  Pin 11: Power GND                  Pin 12: Universal Output 2</p>	<p><u>Mating Connector:</u> PL-DTM06-12SA</p>															
<p><u>Power &amp; Motor Connector:</u>                  4 pin Molex P/N: 19436-0411                  Pin 1: Battery +                  Pin 2: Battery -                  Pin 3: Motor +                  Pin 4: Motor -</p>	<p><u>Mating Connector:</u>                  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="837 814 1344 970"> <thead> <tr> <th>Pin#</th> <th>Colour</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>Fwd-/Rev+</td> </tr> <tr> <td>4</td> <td>White/Black</td> <td>Fwd+/Rev-</td> </tr> </tbody> </table>	Pin#	Colour	Function	1	Red	Batt+	2	Black	Batt-	3	White/Red	Fwd-/Rev+	4	White/Black	Fwd+/Rev-
Pin#	Colour	Function														
1	Red	Batt+														
2	Black	Batt-														
3	White/Red	Fwd-/Rev+														
4	White/Black	Fwd+/Rev-														

*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](http://www.axiomatic.com/service.html).*

Form: TDAX102100-08/21/20