TECHNICAL DATASHEET #TDAX102100

40A DC MOTOR CONTROLLER

P/N: AX102100

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

***with the* Axiomatic Electronic Assistant**

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.
- 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 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 with auto-baud-rate detect is provided (CANopen® on request)
- **Axiomatic 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, SAE J1939 with auto-baud-rate detect P/N: **AX102100** **Motor Controller, CANopen®** P/N: **AX102101** **Accessories:** Axiomatic Electronic Assistant Configuration KIT, P/Ns: **AX070502, AX070505K,** or **AX070506K** Mating Plug Kit: **PL-DTM06-12SA** 2m Wire Harness for Power and Motor Connector P/N: **AX070137**

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Block Diagram

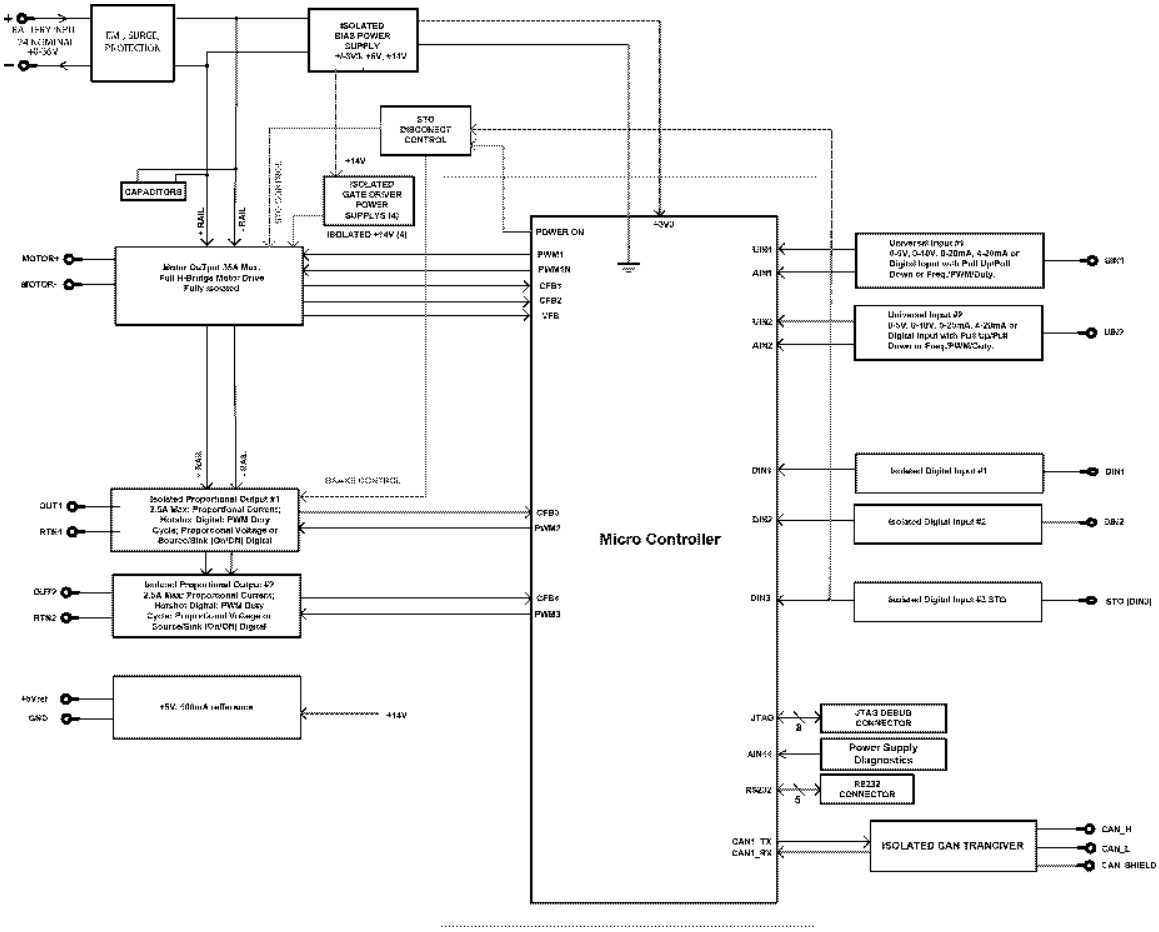

Figure 1 - Block Diagram

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/.

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

Table 1.0 Inputs to AX102100 (Up to 5 user selectable inputs)	
Input Type	**Description**
Universal Signal Inputs	Up to 2 universal signal inputs are available. Inputs are isolated from the power supply. 12-bit Analog to Digital Protected against shorts to GND or +V supply User selectable as: Voltage, Current, PWM or Digital types 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 124Ω PWM Signal Frequency: 1 – 20,000 Hz PWM Duty Cycle: 0 to 100% 0.01% resolution, accuracy +/- 1% error Digital Input: Active High to Vsupply or Active Low to GND Amplitude: 3.3V to +Vsupply
Digital Inputs	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. Amplitude: 14 Vdc. Input current maximum is 8 mA. 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 GND when ON).

Output Specifications

Output to Motor	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 Overcurrent protection is provided. Short circuit protection is provided. Current measurement is provided. Overcurrent protection is provided @ +/- 75A for each output leg. Supply voltage measurement 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 the following. ➢ open or closed loop speed control; variable target command ➢ open or closed loop current control; constant maximum command 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.
Thermal Protection	Thermal protection is built-in and configurable.
Universal Outputs	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) High side sourcing up to 2.5A High frequency drive Overcurrent protection Short circuit protection

	Ramp and dither setpoints are configurable. 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. **Hot Shot 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. 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.

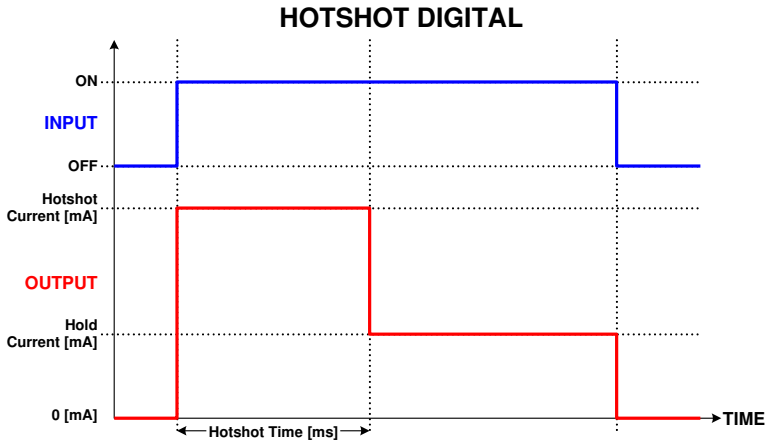

Figure 2 – Proportional Output Hotshot Digital Profile

General Specifications

Microprocessor	STM32F405RGT7
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 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). CAN: CAN bus messages control the motor and/or auxiliary outputs instead of the analog or digital inputs.
CAN User Interface	The Axiomatic Electronic Assistant for *Windows* operating systems It comes with a royalty-free license for use. The Axiomatic Electronic Assistant requires a USB-CAN converter to link the device's CAN port to a *Windows*-based PC for initial configuration. Order the Axiomatic EA and Axiomatic USB-CAN as a kit (P/N AX070502), which includes all interconnecting cables.
CAN Interface	1 SAE J1939 (AX102100 models) 1 CANopen® (AX102101 model)
Baud Rates	CAN Baud rate: 250, 500, 667 kbit/s, 1 Mbit/s. Automatic baud rate detection.
Electrical Connections	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).

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) *Refer to Figure 3.0.*

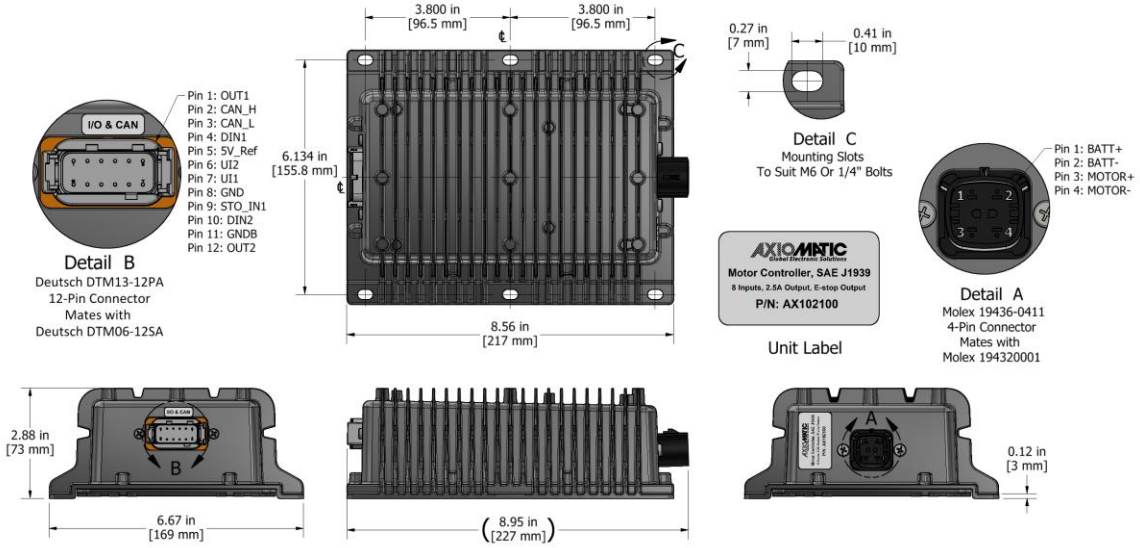

Figure 3 - Dimensional Drawing

Weight	3.70 lb. (1.678 kg)
Operating Conditions	Operating: -40 to 85°C (-40 to 185°F)
Protection Rating	IP67

Table 2.0 - Electrical Pin Out Chart

<table>
<tr>
<td>Input, Output & CAN Connector:
(equivalent TE Deutsch P/N: 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
Pin 8: Signal GND
Pin 9: STO Input (Digital Input 3, active low)
Pin 10: Digital Input 2
Pin 11: Power GND
Pin 12: Universal Output 2</td>
<td>Mating Connector: PL-DTM06-12SA</td>
</tr>
<tr>
<td>Power & Motor Connector:
4 pin Molex P/N: 19436-0411
Pin 1: Battery +
Pin 2: Battery –
Pin 3: Motor +
Pin 4: Motor -</td>
<td>Mating Connector;

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: AX070137

<table>
<tr><th>Pin#</th><th>Colour</th><th>Function</th></tr>
<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>
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Form: TDAX102100-06/26/23