


TECHNICAL DATASHEET #TDAX100000
150A DC MOTOR CONTROLLER

Speed, torque or PID control
Drives brushed DC motors up to 150A (200A overcurrent limit)
Onboard I/O controls accessories (valves and relays)
CAN SAE J1939
High efficiency, Rugged
with Electronic Assistant® 

P/N: AX100000

Features:

- Unidirectional or bi-directional brushed DC motor control
- Up to 150A continuous output current to the motor
- Overcurrent protection is provided in software at 120A (default) and is user configurable up to 200A.
- Flexible control provided by a variety of user configurable options, including:
 - Open loop speed; Closed loop speed; Setpoint speed; Torque control (setpoint or closed loop); or PID control (linear or setpoint).
- Forward and reverse drive are fully independent of one another
- Highly efficient and robust design with isolation between drive and processing circuits
- Motor can be disabled by a variety of methods for safety including software overcurrent shutdown
- Operation from 9 to 60VDC (12V, 24V or 48VDC nominal)
- 2 inputs are user configurable from the following: 0-5V or 0-20 mA.
- 2 frequency inputs are user configurable as Pulse (RPM) or PWM.
- 4 digital inputs are active high (+12V, +24V or +48V nominal).
- Digital inputs are user configurable as the control signal for an enable, override, motor direction select, motor lock, or for the digital outputs.
- The control input to drive the motor can be mapped to any of the inputs and/or the controller can respond to messages from a CAN bus.
- 3 configurable and independent ramps soften changes in motor voltage and current.
- Additional 2 current outputs (2A proportional or 2A hotshot digital) are available to drive accessories such as hydraulic valves or relays for machine control or safety interlock. Short circuit protection is provided.
- 2 digital outputs (3A) are configurable as standard on/off, inverse on/off, or as a latched output
- A frequency output provides a feedback signal of the duty cycle being applied to the motor.
- Outputs are configurable to send a feedback message to the bus.
- A +5V reference voltage is provided to power an external sensor or potentiometer.
- An output provides battery power for an auxiliary device.
- CAN (SAE J1939) is provided (CANopen on request)
- **Electronic Assistant®**  runs on a *Windows* operating system for user configuration during set-up. An Axiomatic USB-CAN converter links the PC to the CAN bus.
- RS-232 port for diagnostics with PC-based Tera Term (Pro)
- Easy mounting on a vehicle
- Rugged IP64 rating with corrosion resistant aluminum housing
- Suitable for harsh environments
- Operational from -40 to 85°C (-40 to 185°F)



Applications:

Mobile Equipment, Electric Vehicles for Material Handling, Lift Platforms

Description:

The motor controller can be operated as either a self-contained control system, driving the motor directly from the on-board inputs, or it can be integrated into a CAN J1939 network of controllers. It has two analog (voltage or current), two timer (frequency, RPM or PWM inputs) and 4 active high digital inputs that can be used to drive the motor or extra outputs.

In addition to the powerful motor drive, the motor controller has two sourcing outputs to drive two hydraulic proportional coils up to 2A each, and two high-side digital outputs for up to 3A loads. This allows the motor controller to be a fully integrated control platform for small machines using a combination of hydraulic actuators and a motor drive system.

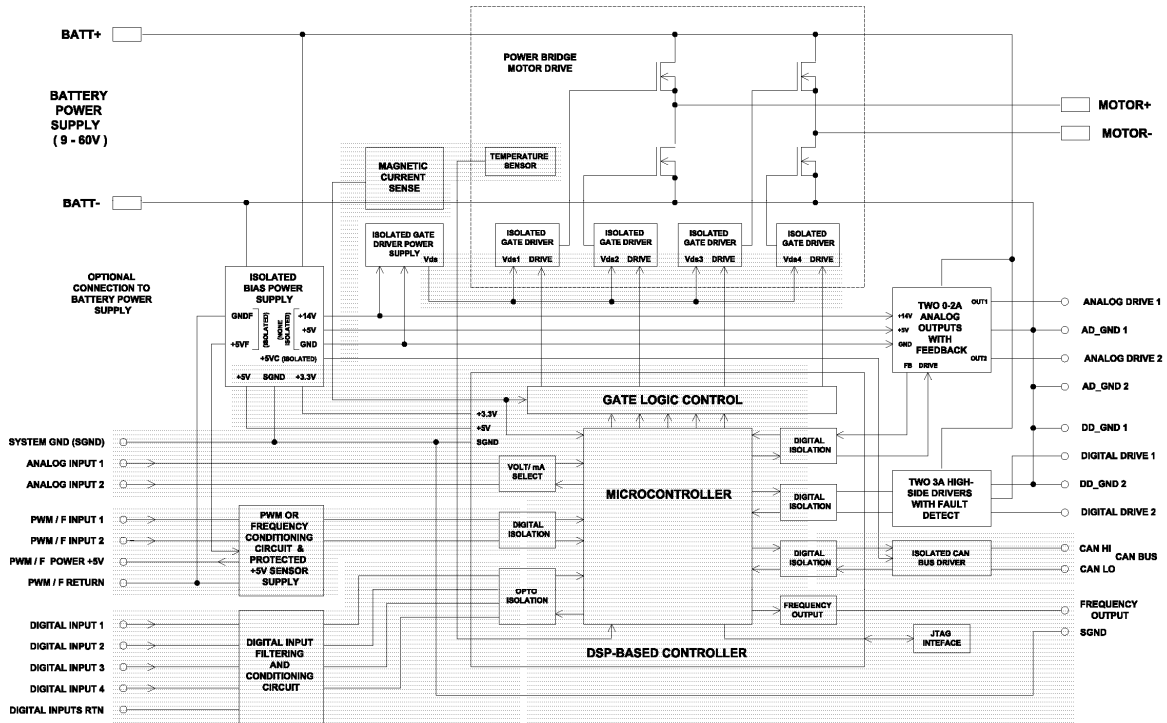
It uses full isolation to separate the inputs and the processor section of the controller from the motor power and output.

The motor controller has a number of built-in protection features that can shutoff the motor in adverse condition. These features include hardware shutoffs to protect the circuits from being damaged as well as software shutdown features that can be enabled in safety critical systems.

Ordering Part Numbers:

150A DC Motor Controller with CAN: AX100000		AX070502 Configuration KIT includes the following. USB-CAN Converter P/N: AX070501 1 ft. (0.3 m) USB Cable P/N: CBL-USB-AB-MM-1.5 12 in. (30 cm) CAN Cable with female DB-9 P/N: CAB-AX070501 AX070502IN CD P/N: CD-AX070502, includes: Electronic Assistant® software; EA & USB-CAN User Manual UMAX07050X; USB-CAN drivers & documentation; CAN Assistant (Scope and Visual) software & documentation; and the SDK Software Development Kit. NOTE: To order this kit, you need only to specify P/N: AX070502.
Accessories: A mating wire harness with DB-9 is available for the RS-232 connection. Ordering P/N: AX070101		
Mating Connector KITS available from Axiomatic:		
AX070104	Mating Plug Kit for the CAN connector (DT06-3S, W3S, 0462-201-16141)	
AX070105	Mating Plug Kit for 12-pin Connector (J26) (DT06-12SA, W12S, 0462-201-16141, 114017)	
AX070111	Mating Plug Kit for 12-pin Connector (J25) (DT06-12SB, W12S, 0462-201-16141, 114017)	
AX070112	Mating Plug Kit for 8-pin Connector (J27) (DT06-8SA, W8S, 0462-201-16141, 114017)	

Block Diagram:



NOTE:
COMMON (GND) IS ISOLATED FROM BATTERY POSITIVE AND NEGATIVE TERMINALS (SHADED AREAS).
RS-232 CONNECTIONS ARE NOT SHOWN.

Technical Specifications:

Input Specifications

Power Supply Input - Nominal	12V, 24V or 48VDC nominal 9...60 VDC
Surge Protection	Provided
Under-voltage Protection	Provided
Over-voltage Protection	Provided
Isolation	All inputs are isolated from the power supply driving the motor and current outputs.
Analog Inputs	2 analog inputs (0-5V, 0-20 mA) Inputs are sampled every 1 msec. Refer to the block diagram and the user manual for details.
Isolated Analog Ground	2 Provided NB. Do not connect Analog GND to BATTERY GND.
Frequency Inputs	2 Pulse or PWM (user configurable as 0.5 Hz to 50Hz, 10Hz to 1kHz or 100Hz to 10 kHz)
Isolated Frequency Ground	1 Provided NB. Do not connect frequency GND to Battery GND. If using +5V ref. to power the analog input(s), connect Frequency GND to Analog GND externally.
Input Impedance	0-5V @ 1M Ω 0-20 mA @ 250 Ohms Frequency @ 10 K Ω pullup
Digital Inputs	4 fully isolated Active High (>9V) Digital Input Type: (user selectable) <ul style="list-style-type: none"> • normal on/off • inverse logic • latched logic
Digital Common	Provided for connection to the digital input power supply's GND

Output Specifications

Output to Motor	<p>Full H-bridge @ 18 kHz 150A @ 24VDC nominal for >5 hours 100A @ 24VDC nominal continuous</p> <p>Overcurrent protection is provided in software at 120A (default). It is user configurable up to 200A. Hardware shutdown occurs at 200A (not configurable).</p> <p>3 user configurable, independent ramps soften changes in motor voltage and current, in either forward or reverse directions.</p> <p>The maximum rated speed is configurable to suit individual motor specifications.</p>																											
Motor Disable	<p>The motor can be disabled by a variety of methods beyond software overcurrent shutdown.</p> <table border="1" data-bbox="613 520 1349 814"> <thead> <tr> <th>Function Block</th> <th>Minimum Threshold</th> <th>Maximum Threshold</th> </tr> </thead> <tbody> <tr> <td>Motor [Direction] Drive</td> <td>Current Open Circuit Threshold</td> <td>Current Short Circuit Threshold</td> </tr> <tr> <td>[Continuous] Input</td> <td>Minimum Error</td> <td>Maximum Error</td> </tr> <tr> <td>Output Drive</td> <td>50mA (when ON)</td> <td>2250 mA (Software)</td> </tr> <tr> <td>Digital Output</td> <td>N/A</td> <td>Fault Feedback Signal (Hardware)</td> </tr> <tr> <td>Power Supply</td> <td>Power Undervoltage Threshold</td> <td>Power Overvoltage Threshold</td> </tr> <tr> <td>Hardware Shutdown</td> <td>N/A</td> <td>~150A (Hardware)</td> </tr> <tr> <td>Overtemperature</td> <td>N/A</td> <td>Over Temperature Shutdown</td> </tr> <tr> <td>Lost Communication</td> <td>N/A</td> <td>Received Message Timeout (any)</td> </tr> </tbody> </table> <p>Refer to the user manual for details.</p>	Function Block	Minimum Threshold	Maximum Threshold	Motor [Direction] Drive	Current Open Circuit Threshold	Current Short Circuit Threshold	[Continuous] Input	Minimum Error	Maximum Error	Output Drive	50mA (when ON)	2250 mA (Software)	Digital Output	N/A	Fault Feedback Signal (Hardware)	Power Supply	Power Undervoltage Threshold	Power Overvoltage Threshold	Hardware Shutdown	N/A	~150A (Hardware)	Overtemperature	N/A	Over Temperature Shutdown	Lost Communication	N/A	Received Message Timeout (any)
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Motor Direction	<p>Motor Direction can be user selected as follows.</p> <p><i>Forward Direction:</i> Motor + signal changes from 50-100% D.C. in a forward direction and 50-0% in a reverse direction</p> <p><i>Reverse Direction:</i> Motor - signal changes from 50-100% D.C. while decreasing and 50-0% in forward</p> <p>Refer to the user manual for details.</p>																											
Thermal Protection	<p>Thermal protection is built-in.</p> <p>Overtemperature shutdown is set at 75°C. (default)</p> <p>It is user configurable up to 125°C.</p>																											
Current Outputs	<p>2 proportional (0...2A) or hotshot digital (2A)</p> <p>The user can select the following options for output using the EA.</p> <ul style="list-style-type: none"> • Output Disable • Proportional Current • Digital Hotshot • PWM Duty Cycle • Proportional Voltage • Digital On/Off <p>To configure ramp and dither setpoints for proportional outputs, refer to the user manual. To enable PID control for one of these outputs, refer to the user manual.</p> <p>The 2 outputs are completely independent of each other.</p> <p>Short circuit to GND protection is provided.</p> <p>Hot Shot Coil Saver Outputs (Refer to Figure 1.): 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>																											
Signal Output	<p>1 Frequency signal provides feedback of the duty cycle being applied to the motor.</p> <p>PWM output @ 500 Hz (default) (user configurable)</p>																											

Digital Outputs	<p>2 on/off (3A)</p> <p>The user can select the following options for output using the EA.</p> <p>Digital control responses</p> <ul style="list-style-type: none"> • Disabled • Blinking • Normal • Inverse • Latching <p>Enable control responses</p> <ul style="list-style-type: none"> • Dout ON if Control or Enable ON • Dout ON if Control and Enable ON • Dout ON when Motor Running • Dout ON when Motor Stopped • Dout ON if Pout1 or Pout2 ON • Dout ON if Pout1 and Pout2 ON
Reference Voltage	+5V, 10 mA is available to power a sensor or potentiometer and is referenced to Frequency GND

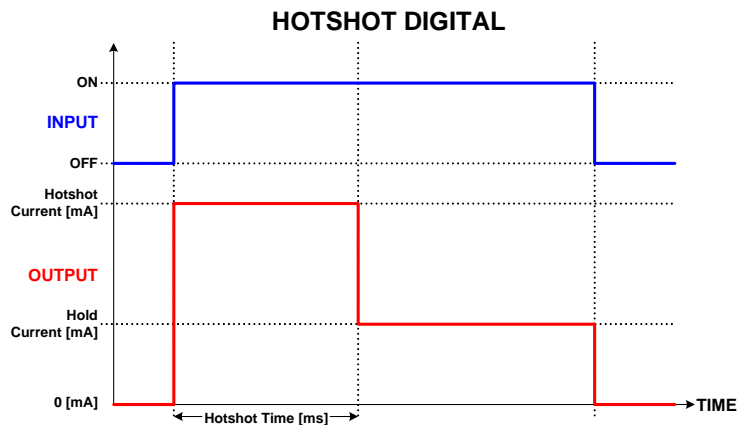


Figure 1 – Proportional Output Hotshot Digital Profile

General Specifications

Microprocessor	DSP56F8366
Efficiency	>95%
Motor Control Logic	<p>Standard embedded software is provided.</p> <p>The motor controller is a highly programmable controller, allowing the user to configure it for their application. Its sophisticated control algorithms allow for open or closed loop drive of the motor and proportional outputs. All I/O on the unit are inherently independent from one another, but can be programmed to interact in a large number of ways.</p> <p>All configurable parameters are user selectable using the Electronic Assistant®. Refer to the user manual for details.</p> <p>There are 2 types of function blocks associated with the motor control, logic and drive.</p> <p>Motor Control Method: Open loop speed, Closed loop speed, Setpoint speed, Torque control (setpoint or closed loop), PID control (linear or setpoint).</p> <p>Motor Drive (Direction): Forward and Reverse</p> <p>The control signal, whether an on-board input or a CAN message, will have a minimum and maximum value associated with it and the output will respond in a linear manner to the changes in input.</p> <p>Enable Input: 2 enable inputs can be setup as enable or disable inputs.</p> <p>Override and Lock: Override allows the user to have the motor controller go to a default value. The Lock command allows the user to use the motor as an electric brake.</p> <p>The enable, override, direction and lock commands can be mapped to either a CAN message or any input. The default assumption is a digital input will be used for all of these inputs.</p> <p>A variety of output values of the motor control can be mapped to a CAN transmit message for feedback and diagnostic purposes.</p>
Diagnostics	Each input and output channel can be configured to send diagnostic messages to the CAN network if the I/O goes out of range. Diagnostic data is stored in a non-volatile log. Refer to the user manual for details.
Additional Fault Feedback	There are several types of faults that the controller will detect and provide a response: unit over temperature; power supply undervoltage and overvoltage; hardware shutdown and lost communication.
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 an 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. Refer to Figure 2 and Table 1 for details.</p>

Set up of SAE J1939 Controller on a CAN Network:

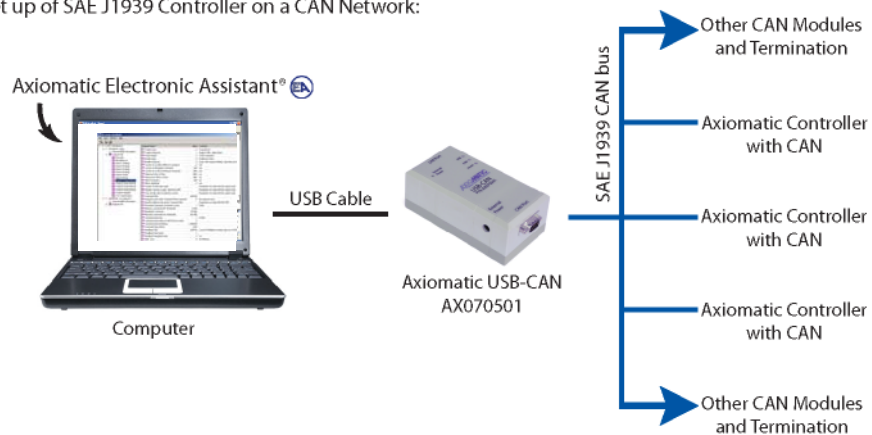



Figure 2 - User Configuration Using Electronic Assistant® (EA)

Table 1 - Electronic Assistant® and AX070501 USB-CAN

AX070502, Configuration KIT includes the following.
 USB-CAN Converter P/N: AX070501
 1 ft. (0.3 m) USB Cable P/N: CBL-USB-AB-MM-1.5
 12 in. (30 cm) CAN Cable with female DB-9
 P/N: CAB-AX070501
 AX070502IN CD P/N: CD-AX070502, includes: Electronic Assistant® software; EA & USB-CAN User Manual UMAX07050X; USB-CAN drivers & documentation; CAN Assistant (Scope and Visual) software & documentation; and the Software Development Kit.

NOTE: To order this kit, you need only to specify P/N: AX070502.

Electronic Assistant® 

The Electronic Assistant (EA) runs on any modern PC with the Microsoft Windows® 2000 operating system or higher. It comes with a royalty-free license for use.

System Requirements:
 Operating System: *Windows 2000* or higher including 64-bit editions
 Port: USB 1.1 or 2.0 full speed
 Display: VGA (XGA or better with 1024 x 768 recommended)
 Setup and Configuration:
 Refer to the User Manual UMAX07050X.

To order the EA software at the time of initial purchase, order the KIT AX070502 (see above) which includes the USB-CAN converter. For additional EA and USB-CAN software ONLY CD's, use ordering P/N: CD-AX070502.

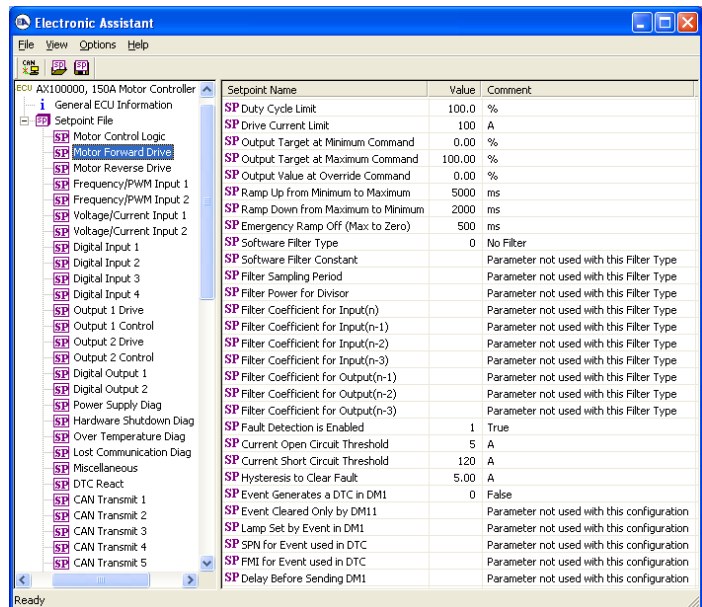





Figure 3 - Configuration screen from the Electronic Assistant®
 Upon being connected to the bus, the EA will find all the Electronic Control Units on the bus, and recognized those manufactured by Axiomatic. Using this tool, a user can quickly configure a controller.

CAN Interface	<p>1 CAN port (SAE J1939) (CANopen on request.)</p> <p>The software was designed to provide flexibility to the user with respect to messages sent to and from the motor controller (ECU) by providing:</p> <ul style="list-style-type: none"> • Configurable ECU Instance in the NAME (to allow multiple ECUs on the same network) • Configurable Transmit PGN and SPN Parameters • Configurable Receive PGN and SPN Parameters • Sending DM1 Diagnostic Message Parameters • Reading and reacting to DM1 messages sent by other ECUs • Diagnostic Log, maintained in non-volatile memory, for sending DM2 messages <p>The motor controller is compliant with the standard SAE J1939, and supports the following PGNs.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 5px;"><i>Table 2: J1939 Compliance</i></th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;"> <p>From J1939-21 - Data Link Layer</p> <ul style="list-style-type: none"> • Request 59904 (\$00EA00) • Acknowledgment 59392 (\$00E800) • Transport Protocol – Connection Management 60416 (\$00EC00) • Transport Protocol – Data Transfer Message 60160 (\$00EB00) • PropB Transmit, Default Motor State and Feedback Message 65280 (\$00FF00) • PropB Transmit, Default Motor Calculated Data Feedback Message 65281 (\$00FF01) • PropB Transmit, Default Measured Inputs Feedback 65296 (\$00FF10) • PropB Transmit, Default Digital I/O Feedback 65297 (\$00FF11) • PropB Transmit, Default Proportional Output Feedback 65298 (\$00FF12) • PropB Receive, Default Motor Control Messages 65520 (\$00FFF0) • PropB Receive, Default Output Command Messages 65521 (\$00FFF1) • PropB Receive, Default PID Feedback Messages 65528 (\$00FFF8) <p>Note: Any Proprietary B PGN in the range 65280 to 65535 (\$00FF00 to \$00FFFF) can be selected. Note: The Proprietary A PGN 61184 (\$00EF00) can also be selected for any of the messages.</p> <p>From J1939-73 - Diagnostics</p> <ul style="list-style-type: none"> • DM1 – Active Diagnostic Trouble Codes 65226 (\$00FECA) • DM2 – Previously Active Diagnostic Trouble Codes 65227 (\$00FECB) • DM3 – Diagnostic Data Clear/Reset for Previously Active DTCs 65228 (\$00FECC) • DM11- Diagnostic Data Clear/Reset for Active DTCs 65235 (\$00FED3) • DM14– Memory Access Request 55552 (\$00D900) • DM15 – Memory Access Response 55296 (\$00D800) • DM16 – Binary Data Transfer 55040 (\$00D700) <p>From J1939-81 - Network Management</p> <ul style="list-style-type: none"> • Address Claimed/Cannot Claim 60928 (\$00EE00) • Commanded Address 65240 (\$00FED8) <p>From J1939-71 – Vehicle Application Layer</p> <ul style="list-style-type: none"> • Software Identification 65242 (\$00FEDA) <p>None of the application layer PGNs are supported as part of the default configurations, but they can be selected as desired for either transmit or received function blocks.</p> <p>Setpoints are accessed using standard Memory Access Protocol (MAP) with proprietary addresses. 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RS-232	<p>1 RS-232 port interfaces to a serial port (i.e. COM1) on a PC (115200 Baud Rate, N81, Xon/Xoff Flow Control)</p> <p>Connect the RS-232 port from the controller to a PC with Tera Term (Pro) freeware. The user can use the RS-232 port for diagnostics or testing. Changing setpoints is not possible through RS-232. The CAN port and the Axiomatic Electronic Assistant® must be used to configure the motor controller. For further details refer to the user manual.</p> <p>NB. Tera Term (Pro) is freeware and is downloadable from http://hp.vector.co.jp/authors/VA002416/teraterm.html.</p> <p>The CAN baud rate is user configurable via RS-232 from the factory default baud rate of 250 kbps to 125, 500 or 1000 kbps.</p>
Electrical Connections	<p>Refer to Table 3.</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 controller has 4 mounting holes 0.281 H x 0.625 W inches (7.14 x 15.88 mm). The holes are sized for ¼ inch or M6 bolts. The bolt length will be determined by the end-user's mounting plate thickness. Typically 20 mm (3/4 inch) is adequate.</p> <p>A grounding stud is also provided. Ground the chassis for safety purposes and proper EMI shielding. Make this connection using one of the mounting bolts holding the controller to the machine.</p>
Packaging and Dimensions	<p>Aluminum extrusion with stainless steel end plates 8.50 x 12.22 x 3.82 inches (W X L X H including connectors) 215.9 x 310.3 x 97.2 mm Refer to Figure 4.</p>
Weight	12.30 lbs. (5.58 kg)
Operating Conditions	Operating: -40 to 85°C (-40 to 185°F)
Protection Rating	IP64
Regulatory Approvals	The motor controller is not CE marked, as it is not a self-contained system.

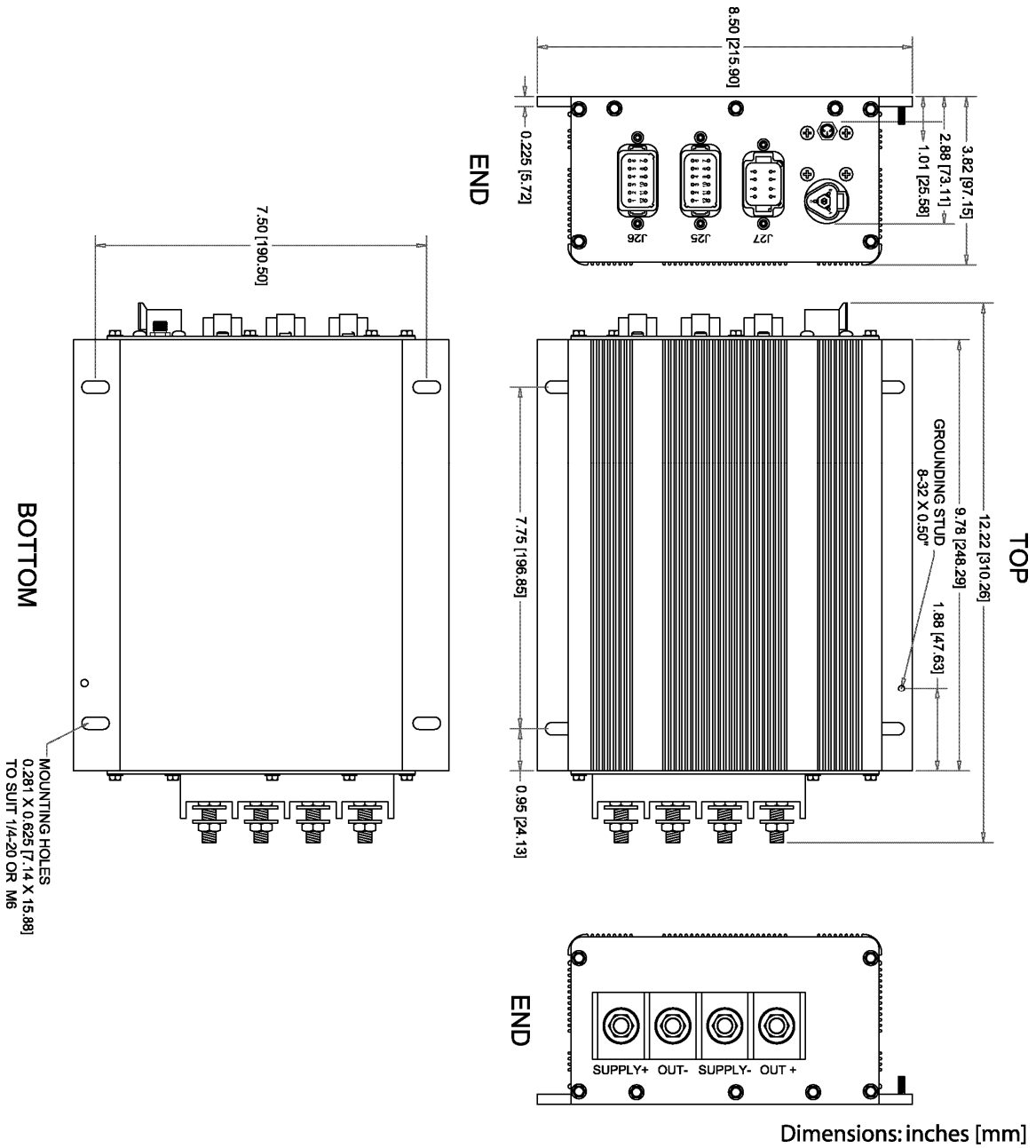
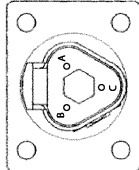



Figure 4 - Dimensions

Table 3 - Electrical Pin Out Chart

<p>(J26) OUTPUT CONNECTOR 12 pin Deutsch P/N: DT15-12PA-G003 Pin 1: Output 1 (2A Proportional) Pin 2: Output 2 (2A Proportional) Pin 3: Digital Output 1 Pin 4: Digital Output 2 Pin 5: Battery + (for reference only) Pin 6: Battery + (for reference only) Pin 7: Power GND Pin 8: Power GND Pin 9: Power GND (for Digital Output 2) Pin 10: Power GND (for Digital Output 1) Pin 11: Power GND (for 2A Output 2) Pin 12: Power GND (for 2A Output 1)</p> <p>Mating Connector KITS are available from Axiomatic.</p> <table border="1" data-bbox="250 625 782 703"> <tr> <td>AX070105</td> <td>Mating Plug Kit for 12-pin Connector (J26) (DT06-12SA, W12S, 0462-201-16141, 114017)</td> </tr> </table>	AX070105	Mating Plug Kit for 12-pin Connector (J26) (DT06-12SA, W12S, 0462-201-16141, 114017)	<p>CAN port: 3 pin Deutsch IPD P/N: DT04-3P-L012</p>  <p>A: CAN_H B: CAN_L C: CAN Shield</p>		
AX070105	Mating Plug Kit for 12-pin Connector (J26) (DT06-12SA, W12S, 0462-201-16141, 114017)				
<p>(J25) INPUT CONNECTOR A 12 pin Deutsch P/N: DT15-12PB-G003 Pin 1: F_GND (for Frequency Inputs) Pin 2: +5Vref_F (for Frequency Inputs) Pin 3: Power GND (for Digital Input 4) Pin 4: Power GND (for Digital Input 3) Pin 5: Power GND (for Digital Input 2) Pin 6: Power GND (for Digital Input 1) Pin 7: Digital Input 1 Pin 8: Digital Input 2 Pin 9: Digital Input 3 Pin 10: Digital Input 4 Pin 11: Frequency Input 1 Pin 12: Frequency Input 2</p> <p>Mating Connector KITS are available from Axiomatic.</p> <table border="1" data-bbox="250 1108 782 1186"> <tr> <td>AX070111</td> <td>Mating Plug Kit for 12-pin Connector (J25) (DT06-12SB, W12S, 0462-201-16141, 114017)</td> </tr> </table>	AX070111	Mating Plug Kit for 12-pin Connector (J25) (DT06-12SB, W12S, 0462-201-16141, 114017)	<p>Mating Connector KITS available from Axiomatic:</p> <table border="1" data-bbox="808 514 1286 592"> <tr> <td>AX070104</td> <td>Mating Plug Kit for CAN Connector (DT06-3S, W3S, 0462-201-16141)</td> </tr> </table> <p>RS-232 port: 3 pin M8 P/N: NAN-T-3MR-M8</p>  <p>1. TXD 3. RXD 4. GND</p>	AX070104	Mating Plug Kit for CAN Connector (DT06-3S, W3S, 0462-201-16141)
AX070111	Mating Plug Kit for 12-pin Connector (J25) (DT06-12SB, W12S, 0462-201-16141, 114017)				
AX070104	Mating Plug Kit for CAN Connector (DT06-3S, W3S, 0462-201-16141)				
<p>(J27) INPUT CONNECTOR B 8 pin Deutsch P/N: DT15-6P-G003 Pin 1: Frequency Output Pin 2: Analog Input 2 Pin 3: Analog Input 1 Pin 4: +5V Reference_F (Referenced to F_GND) Pin 5: Frequency GND Pin 6: Analog GND (for Analog Input 1) Pin 7: Analog GND (for Analog Input 2) Pin 8: Frequency GND (for Frequency Output)</p> <p>Mating Connector KITS are available from Axiomatic.</p> <table border="1" data-bbox="250 1495 782 1612"> <tr> <td>AX070112</td> <td>Mating Plug Kit for 8-pin Connector (J27) (DT06-8SA socket, W8S wedge, 7 pcs. 0462-201-16141 solid contact sockets, 1 pc. 114017 sealing plug)</td> </tr> </table>	AX070112	Mating Plug Kit for 8-pin Connector (J27) (DT06-8SA socket, W8S wedge, 7 pcs. 0462-201-16141 solid contact sockets, 1 pc. 114017 sealing plug)	<p>Mates with NAN-T-3FP-2M. A mating wire harness, P/N: AX070101 is available with DB-9.</p> <p>Power and Motor Control: 4 Threaded Copper Rods – 5/16-18 inches Refer to Figure 4 for orientation of rods.</p> <p>Battery + Motor + Battery - Motor -</p> <table border="1" data-bbox="808 1054 1382 1150"> <tr> <td>WARNING: Wiring the motor in upside down (i.e. all connections backwards) will result in the motor running in full forward with NO control from the processor!</td> </tr> </table>	WARNING: Wiring the motor in upside down (i.e. all connections backwards) will result in the motor running in full forward with NO control from the processor!	
AX070112	Mating Plug Kit for 8-pin Connector (J27) (DT06-8SA socket, W8S wedge, 7 pcs. 0462-201-16141 solid contact sockets, 1 pc. 114017 sealing plug)				
WARNING: Wiring the motor in upside down (i.e. all connections backwards) will result in the motor running in full forward with NO control from the processor!					

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.

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