

Preliminary
TECHNICAL DATASHEET #TDAX100270
UNIVERSAL MOTOR CONTROLLER, 100W

*Up to 4 Universal Signal Inputs
3 Encoder Inputs or PWM Outputs
2 +5V, 200 mA Reference Voltages
1 BLDC or 2 Bidirectional Brushed DC Motor Control Outputs up to 6A
Sensorless or Hall Effect Sensor Feedback
2 CAN (SAE J1939)
with Electronic Assistant®*

P/N: AX100270

Description: The universal motor controller, 100W, drives a brushed DC Motor up to 6A or a 3-phase BLDC motor up to 6A. It features two SAE J1939 ports. Interfacing with 12V or 24Vdc power, the controller accepts 4 universal inputs (voltage, current, Frequency, PWM, SENT or digital input types). Hall sensor feedback input is accepted. In addition, the controller interfaces with 3 standard A and B phase encoder inputs or can provide 3 PWM signal outputs. Settings are user configurable to suit many applications. Configuration is via a *Windows*-based Electronic Assistant® configuration tool and an USB-CAN converter. The controller is packaged in a TE Deutsch enclosure and 24-pin connector.



Applications:

Typical applications can include: test stands; and industrial automation.

Features:

- Drives up to 2 bidirectional brushed DC Motors up to 6A (2 bidirectional full bridge outputs)
- Or can drive a BLDC Motor, 3 Phase, up to 6A (a half-bridge output with sensorless or Hall Effect sensor operation)
- Four (4) Universal Signal Inputs are user selectable:
 - Analog (0-5V, 0-10V, 4-20 mA or 0-20 mA);
 - Digital;
 - SENT;
 - PWM;
 - or Frequency signal types.
- Provides 2 +5V, 200 mA reference voltages to power devices
- Three (3) encoder inputs accepted or 3 PWM outputs provided
- Robust 6...36Vdc power supply interface with reverse polarity protection
- Reverse polarity, under and overvoltage protection provided
- Operational from -40 to 85°C (-40 to 185°F)
- Two (2) CAN (SAE J1939) port permits networking
- **Electronic Assistant®** runs on a *Windows* operating system for user configuration. An Axiomatic USB-CAN converter links the PC to the CAN bus.
- TE Deutsch enclosure and connectors

Ordering Part Numbers:

| |
|--|
| SAE J1939 Controller: AX100270 |
| Accessories: |
| PL-DTM06-12SA-12SB Mating Plug Kit (1 DTM06-12S, DTM06-12SB, 2 W12S, 24 contacts) |
| Electronic Assistant® Configuration KIT: AX070502 |

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Block Diagram:

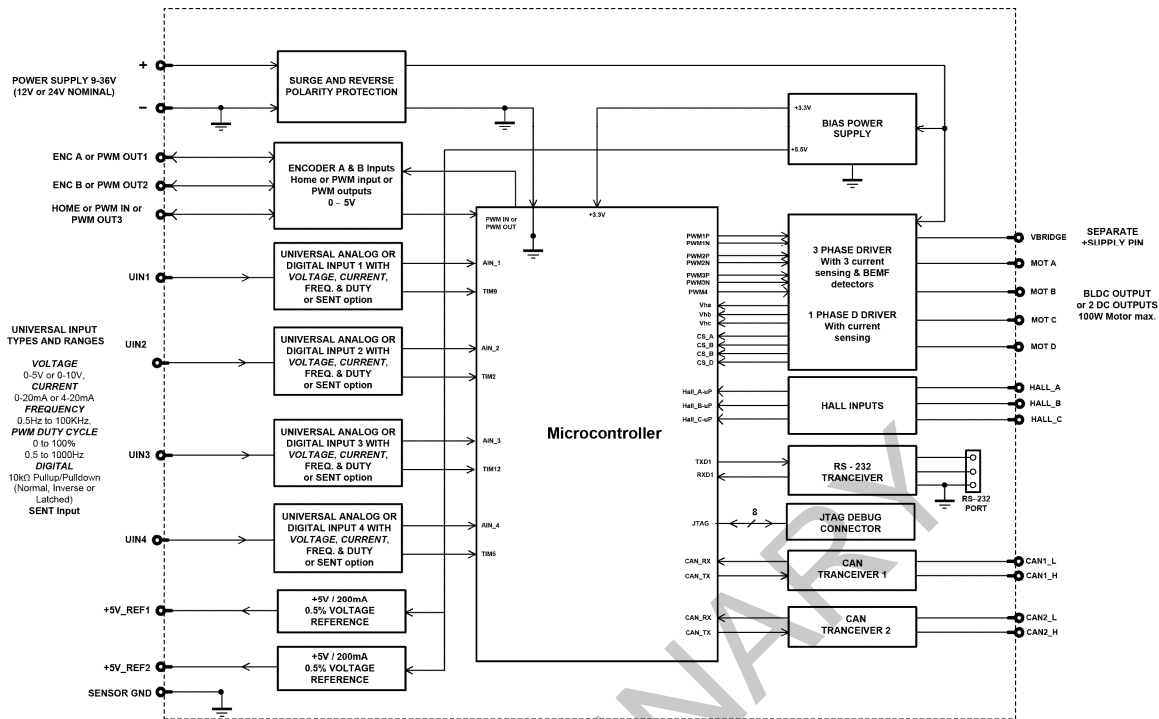


Figure 1.0 Block Diagram

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.

Input Specifications (Refer to the block diagram.)

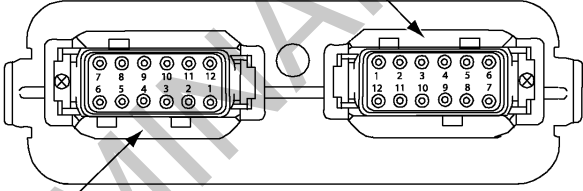
| | |
|--------------------------------|---|
| Power Supply Input | 12 or 24Vdc nominal (6...36 Vdc power supply range) NB. The maximum total current draw permitted on the power supply input pins is 7.5 Amps @ 24Vdc, at one time. |
| Reverse Polarity Protection | Provided up to -80Vdc |
| Surge and Transient Protection | Provided |
| Under-voltage Protection | Provided (hardware shutdown at 6V) |
| Overvoltage Protection | Provided (hardware shutdown at 41V) |
| Universal Signal Inputs | Up to 4 inputs are selectable by the user from the following. <ul style="list-style-type: none"> Analog Voltage (0-5V, 0-10V), Current (0-20 mA, 4-20mA, 249Ω current sense resistor) Frequency or PWM Inputs Digital Or SENT (option). 12-bit Analog to Digital resolution Amplitude up to +Vsupply Protected against shorts to GND. See Tables 1 and 2. NB.SAE J2716 SENT (Single Edge Nibble Transmission) protocol is a point-to-point scheme for transmitting signal values from a sensor to a controller. |

| Encoder Inputs | <p>Three (3) Standard A and B phase encoder inputs Additional PWM input or Home Encoder input is provided. Frequency Range: 0-250 kHz Amplitude: 0-5Vdc</p> <p>This feature is user configurable as PWM Outputs (see Output section).</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|-------|--|------------|----------------|------------|---------|--------|--------------|---------|--------|--------|---------------|--------|---------|-----------|---------------|-----------|----|----|-------------------------------|---|----|-----|------------------------------------|---|----|-----|----------------|---|-----|---|---------------|----|-------|----|---------------------|---|----|------|-----------|----|--------|----|
| Hall Sensor | <p>Standard open collector/drain HALL EFFECT Sensor Input type (3) 1K Pull-up to +5V per input is provided.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Minimum and Maximum Ratings | <table border="1"> <thead> <tr> <th colspan="4">Table 1.0. Absolute Maximum and Minimum Ratings</th> </tr> <tr> <th>Characteristic</th> <th>Min</th> <th>Max</th> <th>Units</th> </tr> </thead> <tbody> <tr> <td>Power Supply</td> <td>6</td> <td>36</td> <td>V dc</td> </tr> <tr> <td>Voltage Input</td> <td>0</td> <td>36</td> <td>V dc</td> </tr> <tr> <td>Current Input</td> <td>0</td> <td>21</td> <td>mA</td> </tr> <tr> <td>Current Input – Voltage Level</td> <td>0</td> <td>12</td> <td>Vdc</td> </tr> <tr> <td>Digital Type Input – Voltage Level</td> <td>0</td> <td>36</td> <td>Vdc</td> </tr> <tr> <td>PWM Duty Cycle</td> <td>0</td> <td>100</td> <td>%</td> </tr> <tr> <td>PWM Frequency</td> <td>50</td> <td>1 000</td> <td>Hz</td> </tr> <tr> <td>PWM Voltage pk - pk</td> <td>0</td> <td>36</td> <td>V dc</td> </tr> <tr> <td>Frequency</td> <td>50</td> <td>10 000</td> <td>Hz</td> </tr> </tbody> </table> | Table 1.0. Absolute Maximum and Minimum Ratings | | | | Characteristic | Min | Max | Units | Power Supply | 6 | 36 | V dc | Voltage Input | 0 | 36 | V dc | Current Input | 0 | 21 | mA | Current Input – Voltage Level | 0 | 12 | Vdc | Digital Type Input – Voltage Level | 0 | 36 | Vdc | PWM Duty Cycle | 0 | 100 | % | PWM Frequency | 50 | 1 000 | Hz | PWM Voltage pk - pk | 0 | 36 | V dc | Frequency | 50 | 10 000 | Hz |
| Table 1.0. Absolute Maximum and Minimum Ratings | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Characteristic | Min | Max | Units | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Power Supply | 6 | 36 | V dc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Voltage Input | 0 | 36 | V dc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Current Input | 0 | 21 | mA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Current Input – Voltage Level | 0 | 12 | Vdc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Digital Type Input – Voltage Level | 0 | 36 | Vdc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PWM Duty Cycle | 0 | 100 | % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PWM Frequency | 50 | 1 000 | Hz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PWM Voltage pk - pk | 0 | 36 | V dc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Frequency | 50 | 10 000 | Hz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Input Accuracy and Resolution | <table border="1"> <thead> <tr> <th colspan="3">Table 2.0. Input Accuracy</th> </tr> <tr> <th>Input Type</th> <th>Accuracy</th> <th>Resolution</th> </tr> </thead> <tbody> <tr> <td>Voltage</td> <td>+/- 1%</td> <td>1 [mV]</td> </tr> <tr> <td>Current</td> <td>+/- 1%</td> <td>1 [uA]</td> </tr> <tr> <td>PWM</td> <td>+/- 1%</td> <td>0.1 [%]</td> </tr> <tr> <td>Frequency</td> <td>+/- 1%</td> <td>0.01 [Hz]</td> </tr> </tbody> </table> | Table 2.0. Input Accuracy | | | Input Type | Accuracy | Resolution | Voltage | +/- 1% | 1 [mV] | Current | +/- 1% | 1 [uA] | PWM | +/- 1% | 0.1 [%] | Frequency | +/- 1% | 0.01 [Hz] | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Table 2.0. Input Accuracy | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Input Type | Accuracy | Resolution | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Voltage | +/- 1% | 1 [mV] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Current | +/- 1% | 1 [uA] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PWM | +/- 1% | 0.1 [%] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Frequency | +/- 1% | 0.01 [Hz] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Analog Ground | One sensor ground connection is provided. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reference Voltages | 2 +5V, 200 mA maximum Regulation at +/-0.5% accuracy is provided. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Output Specifications

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|---------------------|---|
| Outputs | <p>Two outputs for a bidirectional Brushed DC Motor, up to 6A</p> <ul style="list-style-type: none"> Two bidirectional full bridge outputs <p>Or One output for a BLDC Motor, up to 6A</p> <ul style="list-style-type: none"> One 3-phase half-bridge output, current sensing per each phase Sensorless or HALL Effect Sensor operation <p>6A nominal current output (100W)</p> <p>NB. The maximum total current draw permitted on the power supply input pins is 7.5 Amps @ 24Vdc, at one time.</p> |
| V Bridge Connection | Separate +Vsupply connection for motor outputs |
| PWM Outputs | Up to 3 independent PWM outputs (available if encoder input option is not selected) PWM Frequency: 0-250 kHz Duty Cycle: 0 to 100% |
| Output Accuracy | PWM outputs +/-0.1% |
| Protection | Overcurrent protection is provided on all outputs. It is programmable. |

General Specifications

| | |
|--------------------------|---|
| Operating Conditions | -40 to 85°C (-40 to 185°F) |
| Weight | 0.60 lb. (0.272 kg) |
| Protection | IP65; Unit is conformal coated within the housing. |
| Microprocessor | STM32F407VGT7 |
| Quiescent Current Draw | 45 mA @ 24Vdc Typical; 73 mA @ 12Vdc Typical |
| CAN Interface | 2 CAN ports (SAE J1939) 250 kbps baud rate |
| Network Termination | It is necessary to terminate the network with external termination resistors. The resistors are 120 Ohm, 0.25W minimum, metal film or similar type. They should be placed between CAN_H and CAN_L terminals at both ends of the network. |
| Control Logic | Standard embedded software is provided and is configurable using the Electronic Assistant |
| Simulink® | The firmware as developed using Simulink®. |
| User Interface | User configuration and diagnostics are provided with the Axiomatic Electronic Assistant®, p/n AX070502. |
| Electrical Connections | <p>Refer to Table 3.0. Deutsch DTM series 24 pin receptacle (DTM13-12PA-12PB-R008) Mating plugs kits are available on request and include Deutsch DTM06-12SA and DTM06-12SB with 2 wedgelocks (WM12S) and 24 contacts (0462-201-20141). 20 AWG wire is recommended for use with contacts 0462-201-20141.</p> <p style="text-align: center;">Key Arrangement B (black)</p>  <p style="text-align: center;">Key Arrangement A (grey)</p> <p style="text-align: center;">FRONT VIEW 24 PIN RECEPTACLE</p> |
| Packaging and Dimensions | High Temperature Nylon housing, Deutsch IPD PCB Enclosure (EEC-325X4B) 4.62 x 5.24 x 1.43 inches 117.42 x 133.09 x 36.36 mm (W x L x H excluding mating plug) Refer to Figure 2.0. |

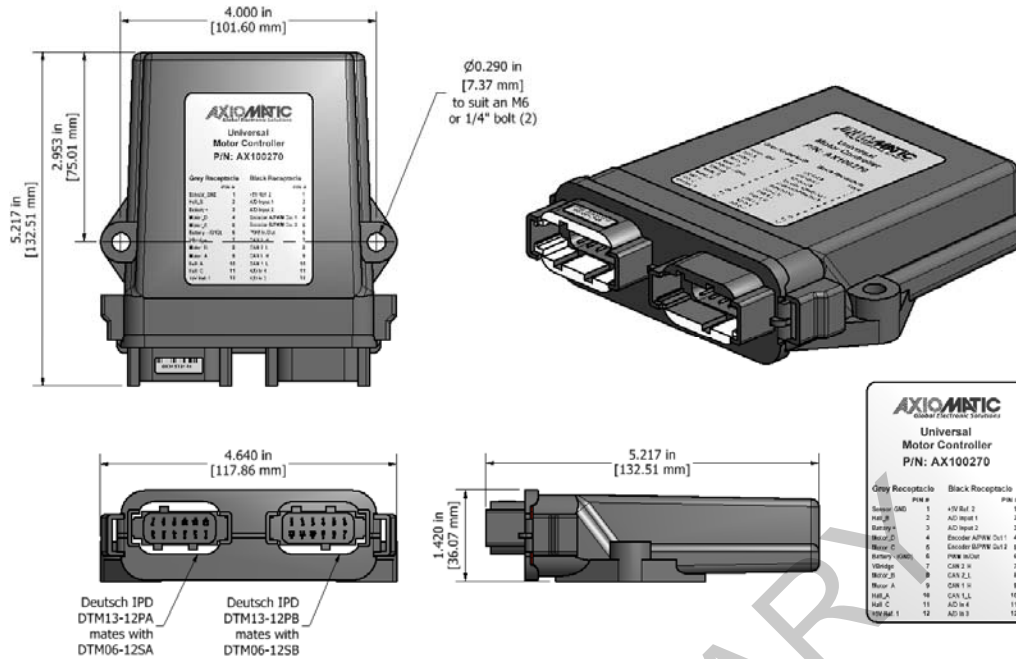


Figure 2.0 - Dimensional Drawing

Table 3.0 – Pin out: AX100270

| Grey Connector PIN # | Function | Black Connector PIN # | Function |
|----------------------|-----------------|-----------------------|---------------------|
| 1 | Sensor GND | 1 | +5V Reference 2 |
| 2 | Hall B | 2 | A/D Input 1 |
| 3 | Battery + | 3 | A/D Input 2 |
| 4 | Motor D | 4 | Encoder A/PWM Out 1 |
| 5 | Motor C | 5 | Encoder B/PWM Out 2 |
| 6 | Battery - (GND) | 6 | PWM In/Out |
| 7 | V Bridge | 7 | CAN 2_H |
| 8 | Motor B | 8 | CAN 2_L |
| 9 | Motor A | 9 | CAN 1_H |
| 10 | Hall A | 10 | CAN 1_L |
| 11 | Hall C | 11 | A/D Input 4 |
| 12 | +5V Reference 1 | 12 | A/D Input 3 |

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Form: TDAX100270-11/29/17