

Preliminary  
**TECHNICAL DATASHEET #TDAX024001**  
**4 INPUTS, 2 OUTPUTS SERVO VALVE CONTROLLER**

Four Signal Inputs  
Two Bi-directional 400 mA Outputs  
Two Signal Outputs  
Two Reference Voltages  
Isolated CANopen®

**P/N: AX024001**

**Features:**

The dual servo valve controller provides two bidirectional outputs from -400mA to +400 mA. The outputs will drive two servo valves independently. Two signal outputs are also provided for feedback to a PLC or other similar device.

An isolated CANopen® port is provided for networking.

Two analog signal inputs are selectable as the following voltage or current signals (Inputs 1 and 2).

- 0-5V, 0-10V, +/- 5V, +/- 10V
- 4-20mA, 0-20mA

Two analog/digital inputs are available as the following signals (Inputs 3 and 4).

- 0-5V, 0-10V
- 4-20 mA, 0-20 mA
- PWM
- Frequency
- or Digital (Active High or Active Low).

Two reference voltages (1 +5V and 1 +10V) are available to power sensors.

A rugged power supply interface accepts 8-36Vdc and is appropriate for battery powered machine applications. The circuitry is conformal coated and packaged in a rugged IP67 rated enclosure for harsh environments. It operates from -40 to 85°C (-40 to 185°F). It has CE marking.

**Applications:**

- servo valve control in motion control, automation
- off-highway and other machines for rugged environments

**Ordering Part Numbers:**

Valve Controller, CANopen®: **AX024001**

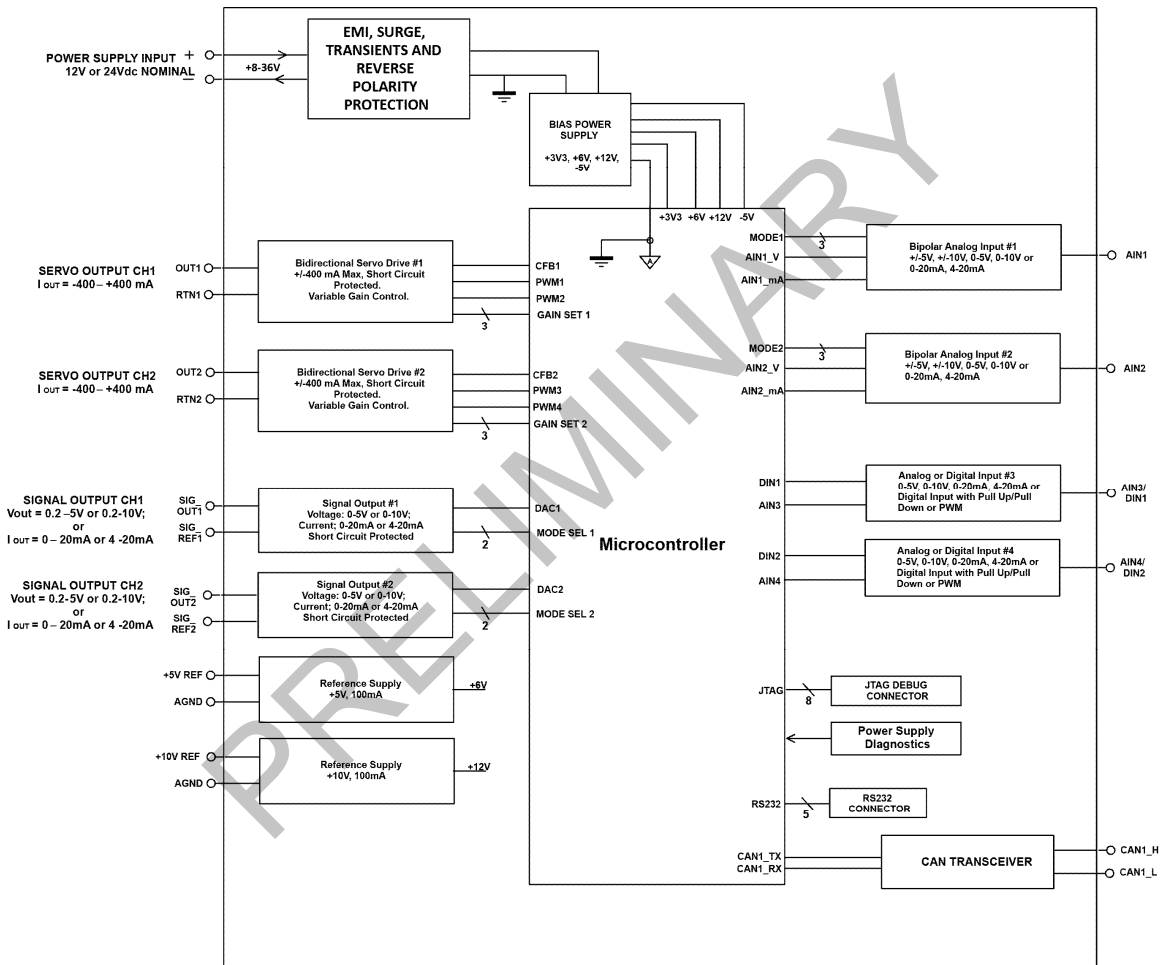
Valve Controller, SAE J1939 (250 kbps): **AX024000**

Mating Plug Kit: **PL-DTM06-12SA-12SB** (1 DTM06-12S, DTM06-12SB, 2 W12S, 24 contacts)

**Description:** The 4 Inputs 2 Outputs Servo Controller is designed for versatile control of two servo outputs to directly drive servos or other bidirectional loads. In addition to the two servo outputs, there are two signal outputs with voltage and current signal generation. The controller's flexible circuit design gives the user a wide range of configurable input types. The sophisticated control algorithms allow the user to program the controller for a wide range of applications without the need for custom software. The controller has two universal inputs that can be configured to measure analog voltage or current, frequency/PMW or digital signal and two analog inputs that can be configured to measure current and both positive and negative voltages. Measured input data can be sent to a CANopen® CAN Network or used to drive outputs directly or through the configurable control algorithms.

The servo outputs are full H-bridge types with the capability of driving up to 400mA through the load in both directions. The signal outputs can be configured to source voltage signals up to 10V and current signals up to 20mA. Any of the four outputs can be configured to use any of the onboard inputs as either a control signal or an enable signal as well as CANopen® Network data. Setpoint configuration can be saved in a file which can be used to easily program the same configuration into another controller. The configurable properties of the controller are divided into function blocks, namely the Input Function Block, the Output Function Block, the Diagnostic Function Block, the PID Control Function Block, the Lookup Table Function Block, the Programmable Logic Function Block, the Math Function Block, the DTC React Function Block, the CAN Transmit Message Function Block and the CAN Receive Message Function Block. Packaged for rugged environments, the controller has an IP67 rating and is suitable for high vibration applications. It has CE marking.

## 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).

### Inputs

| Power Supply Input                                 | 12V or 24Vdc nominal (8...36Vdc power supply range)   |   |       |  |  |                |     |     |       |              |   |    |      |               |   |    |      |               |   |    |    |                               |   |    |     |                                    |   |    |     |                |   |     |   |               |    |        |    |                     |   |    |      |               |    |        |    |
|--|---|---|-------|--|--|----------------|-----|-----|-------|--------------|---|----|------|---------------|---|----|------|---------------|---|----|----|-------------------------------|---|----|-----|------------------------------------|---|----|-----|----------------|---|-----|---|---------------|----|--------|----|---------------------|---|----|------|---------------|----|--------|----|
| Protection   | Reverse polarity protection<br>Overvoltage protection up to 150V<br>Overvoltage (undervoltage) shutdown   |   |       |  |  |                |     |     |       |              |   |    |      |               |   |    |      |               |   |    |    |                               |   |    |     |                                    |   |    |     |                |   |     |   |               |    |        |    |                     |   |    |      |               |    |        |    |
| Input Grounds                                      | Four common input GND connections are provided.   |   |       |  |  |                |     |     |       |              |   |    |      |               |   |    |      |               |   |    |    |                               |   |    |     |                                    |   |    |     |                |   |     |   |               |    |        |    |                     |   |    |      |               |    |        |    |
| Bipolar Analog Inputs                              | Two inputs (Input 1 and 2 in Table 2.0.)<br>User selectable as Bipolar or Unipolar Voltage or Current<br><br>12-bit Analog to Digital<br>Protected against shorts to GND or +Vsupply<br><br>Voltage Types: 1mV resolution, accuracy +/- 1% error<br>Ranges: +/-5V or +/-10V or 0-5V or 0-10V<br><br>Current Types: 1uA resolution, accuracy +/- 1% error<br>Ranges: 0-20mA or 4-20mA  |   |       |  |  |                |     |     |       |              |   |    |      |               |   |    |      |               |   |    |    |                               |   |    |     |                                    |   |    |     |                |   |     |   |               |    |        |    |                     |   |    |      |               |    |        |    |
| Analog or Digital Inputs (Voltage, Current or PWM) | Two inputs (Inputs 3 and 4 in Table 2.0.)<br>User selectable as : Voltage, Current, PWM or Digital<br><br>12-bit Analog to Digital (voltage, current)<br>Protected against shorts to GND or +Vsupply<br><br>Voltage Types:<br>1mV resolution, accuracy +/- 1% error<br>Ranges: 0-5V or 0-10V<br><br>Current Types:<br>1uA resolution, accuracy +/- 1% error<br>Ranges: 0-20mA or 4-20mA<br><br>PWM Signal Frequency:<br>1 – 10,000 Hz<br>PWM Duty Cycle: 0 to 100%<br>PWM Input: 0.01% resolution, accuracy +/- 1% error<br><br>Digital Input:<br>Active High or Active Low.<br>Amplitude: 3.3V to +Vsupply   |   |       |  |  |                |     |     |       |              |   |    |      |               |   |    |      |               |   |    |    |                               |   |    |     |                                    |   |    |     |                |   |     |   |               |    |        |    |                     |   |    |      |               |    |        |    |
| 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>8</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>10 000</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>RPM 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 | 8 | 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 | 10 000 | Hz | PWM Voltage pk - pk | 0 | 36 | V dc | RPM Frequency | 50 | 10 000 | Hz |
| Table 1.0. Absolute Maximum and Minimum Ratings    |   |   |       |  |  |                |     |     |       |              |   |    |      |               |   |    |      |               |   |    |    |                               |   |    |     |                                    |   |    |     |                |   |     |   |               |    |        |    |                     |   |    |      |               |    |        |    |
| Characteristic                                     | Min   | Max   | Units |  |  |                |     |     |       |              |   |    |      |               |   |    |      |               |   |    |    |                               |   |    |     |                                    |   |    |     |                |   |     |   |               |    |        |    |                     |   |    |      |               |    |        |    |
| Power Supply                                       | 8   | 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  | 10 000  | Hz    |  |  |                |     |     |       |              |   |    |      |               |   |    |      |               |   |    |    |                               |   |    |     |                                    |   |    |     |                |   |     |   |               |    |        |    |                     |   |    |      |               |    |        |    |
| PWM Voltage pk - pk                                | 0   | 36  | V dc  |  |  |                |     |     |       |              |   |    |      |               |   |    |      |               |   |    |    |                               |   |    |     |                                    |   |    |     |                |   |     |   |               |    |        |    |                     |   |    |      |               |    |        |    |
| RPM Frequency                                      | 50  | 10 000  | Hz    |  |  |                |     |     |       |              |   |    |      |               |   |    |      |               |   |    |    |                               |   |    |     |                                    |   |    |     |                |   |     |   |               |    |        |    |                     |   |    |      |               |    |        |    |

## Outputs

|                                 |  |
|---------------------------------|--|
| Outputs                         | <p>Two +/- 400 mA bidirectional outputs, independent<br/>           User selectable as:<br/>           Servo Valve Control or Proportional Current<br/>           Selectable current ranges from +/- 10mA to +/-400 mA<br/>           Accuracy: +/- 1%</p> <p>Output voltage up to 12V</p> <p>Full bridge output<br/>           Current sensing resistor</p> <p>Overcurrent protection is provided.<br/>           Short circuit protection is provided.</p> |
| Signal Outputs                  | <p>Two signal outputs<br/>           User selectable as voltage or current:<br/>           Voltage: 0.2 - 5Vdc or 0.2 - 10Vdc, 1% accuracy,<br/>           Current: 0-20mA or 4-20mA, 1% accuracy.<br/>           Short circuit protected.</p>   |
| Reference Voltages              | <p>One 5V, 100mA, 1% reference voltage<br/>           One 10V, 100mA, 1% reference voltage</p>   |
| Protection for Output Terminals | <p>Fully protected against short circuit to ground and short circuit to power supply rail.<br/>           Unit will fail safe in the case of a short circuit condition, self-recovering when the short is removed.</p>   |

## General Specifications

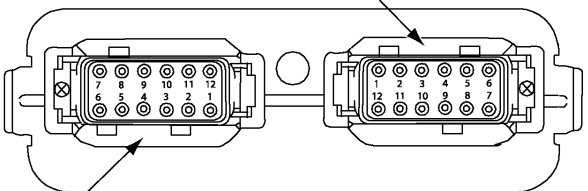
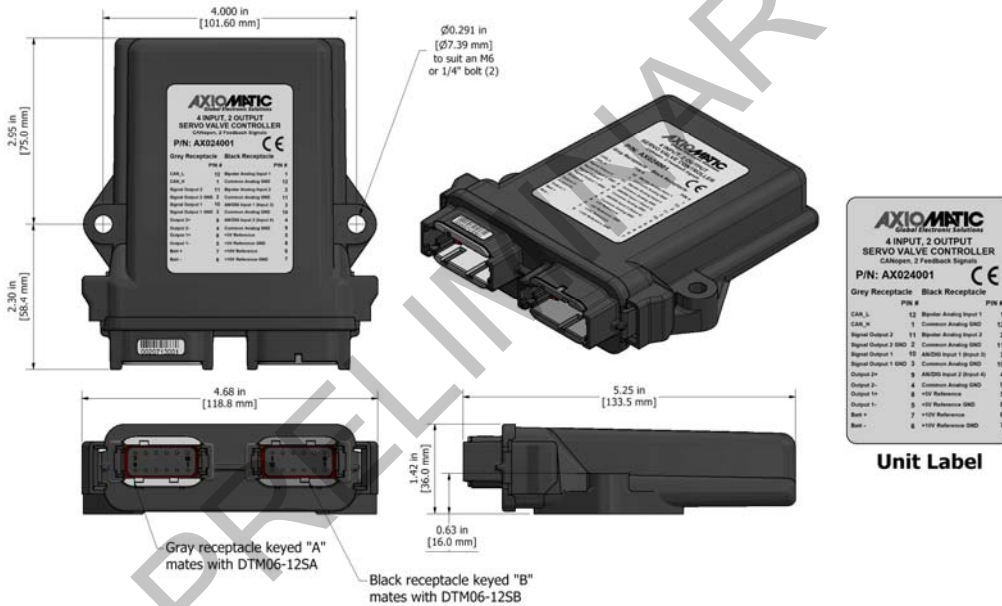
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|---------------------------|--|
| Microprocessor            | <p>STM32F205<br/>           32-bit, 1MByte flash memory</p>  |
| Typical Quiescent Current | 87mA @ 12Vdc; 56mA @ 24Vdc   |
| Response Time             | 70 ms for 0-400 mA current change  |
| Control Logic             | <p>Standard embedded software is provided.<br/>           (Application-specific control logic or factory programmed setpoints on request)<br/>           Refer to the User Manual for details.</p>   |
| Communications            | 1 Isolated CAN port (CANopen®)   |
| Network Termination       | <p>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.</p>  |
| User Interface            | Electronic Assistant P/N: AX070502   |
| Operating Conditions      | -40 to 85 °C (-40 to 185 °F)   |
| Electrical Connections    | <p>Refer to Table 2.0.<br/>           Deutsch DTM series 24 pin receptacle (DTM13-12PA-12PB-R008)<br/>           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).<br/>           20 AWG wire is recommended for use with contacts 0462-201-20141.</p> <p style="text-align: center;"><b>Key Arrangement B (black)</b></p>  <p style="text-align: center;"><b>Key Arrangement A (grey)</b></p> <p style="text-align: center;"><b>FRONT VIEW 24 PIN RECEPTACLE</b></p> |

Table 2.0 – Pin out: AX024000

| Grey Connector<br>PIN # | Function            | Black Connector<br>PIN # | Function                         |
|-------------------------|---------------------|--------------------------|----------------------------------|
| 12                      | CAN_L               | 6                        | +10V Reference                   |
| 1                       | CAN_H               | 7                        | +10V Reference GND               |
| 11                      | Signal Output 2     | 5                        | +5V Reference                    |
| 2                       | Signal Output 2 GND | 8                        | +5V Reference GND                |
| 10                      | Signal Output 1     | 4                        | Analog/Digital Input 2 (Input 4) |
| 3                       | Signal Output 1 GND | 9                        | Common Analog GND                |
| 9                       | Output 2+ -         | 3                        | Analog/Digital Input 1 (Input 3) |
| 4                       | Output 2-           | 10                       | Common Analog GND                |
| 8                       | Output 1+           | 2                        | Bipolar Analog Input 2 (Input 2) |
| 5                       | Output 1-           | 11                       | Common Analog GND                |
| 7                       | Batt+               | 1                        | Bipolar Analog Input 1 (Input 1) |
| 6                       | Batt-               | 12                       | Common Analog GND                |

Dimensional Drawing



|                          |  |
|--------------------------|--|
| Enclosure and Dimensions | High Temperature Nylon housing, Deutsch IPD PCB Enclosure (EEC-325X4B)<br>4.68 x 5.25 x 1.42 inches 118.80 x 133.50 x 36.00 mm (W x L x H excluding mating plug)   |
| Protection               | IP67   |
| Vibration                | MIL-STD-202G, Method 204D test condition C (Sine) and Method 214A, test condition B (Random)<br>10 g peak (Sine); 7.68 Grms peak (Random)  |
| Shock                    | MIL-STD-202G, Method 213B, test condition A<br>50g (half sine pulse, 9ms long, 8 per axis)   |
| Compliance               | CE marking   |
| Weight                   | 0.55 lb. (0.25 kg)   |
| Installation             | Mounting holes sized for ¼ inch or M6 bolts. The bolt length will be determined by the end-user's mounting plate thickness. The mounting flange of the controller is 0.63 inches (16 mm) thick. All field wiring should be suitable for the operating temperature range, rated voltage and current. Wiring to the product must be in accordance with all applicable local codes. Install the unit with appropriate space available for servicing and for adequate wire harness access (6 inches or 15 cm) and strain relief (12 in. or 30 cm). |

Note: CANopen® is a registered community trademark of CAN in Automation e.V.

Form: TDAX024001-04/13/20