TECHNICAL DATASHEET #TDAX023200-01

Visctronic Device Controller

P/N: AX023200-01

Description: The AX023200-01 is a fan control unit designed in conjunction with BorgWarner Thermal Systems to control BorgWarner devices, such as Visctronic® fan drives or controlled coolant pumps. The hardware consists of two inputs and two outputs with a CAN communication port. The product is designed to work in harsh mobile equipment environments including engine compartments. Operating temperatures are designed for up 125°C. The software contains many advanced algorithms and features developed by BorgWarner and is specifically licensed to control BorgWarner devices only.

Features:

- Input speed sensor from BorgWarner device
- 3A current controlled output to control viscous clutch
- CAN communications, SAE J1939
- XCP features (during development phase) for calibration and accurate performance monitoring
- Configurable second input to read additional sensors such as A/C
- Configurable second current controlled output to control an additional solenoid or relay
- Software: Developed jointly with BorgWarner using a Simulink® development model. Its use is restricted to control BorgWarner devices.

Ordering Part Number:

Visctronic Device Controller P/N: **AX023200-01**

Accessories:

PL-DTM06-12SA Mating Plug Kit
Electronic Assistant® Configuration KIT: **AX070502**

Applications: This controller includes software algorithms developed together with BorgWarner and is intended to be used on BorgWarner cooling fans. It is anticipated that BorgWarner would calibrate the controller on the customer vehicle and the resulting calibration data would be supplied by them to Axiomatic for inclusion in the production series. The pre-calibration ordering part number is AX023200-01. Axiomatic would supply a post-calibration ordering part number after the calibration data is received.

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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.

Inputs

Power Supply Input - Nominal	12Vdc or 24Vdc nominal (9…36 Vdc power supply range)
Protection	Reverse polarity protection is provided. Surge protection up to 200V is provided. Overvoltage shutdown of the output load is provided. Undervoltage protection (hardware and software shutdown at 6V) is provided.
CAN	SAE J1939 Commands
Voltage Reference	One provided 5V +/- 0.5% error The control can source up to 100mA without derating.
Analog GND Reference	One provided
Input 1	1 PWM Input 4-700 Hz typical Accuracy +/-1% error 1MΩ Impedance, or 1 kΩ Pull-up typical
Universal Signal Input 2	0-5Vdc (Factory Default) to measure an AC pressure sensor. Mapped to a CAN message. The input is fully independent and universal. It is user selectable for use with other sensors. The input is user selectable as: • Voltage; • Current; • Resistive; • Frequency; • RPM; • PWM; • or Digital input type. Refer to Table 1.0. The input is protected against shorts to GND or +Vps (up to 36 Vdc). All input channels can handle negative voltage inputs down to -2Vdc due to voltage spikes or noise.

Outputs

CAN	SAE J1939 Messages
Output 1	One output fixed at 10Hz PWM Sourcing up to 3A Half-bridge output, current sensing, grounded load. High side sourcing (Another PWM frequency setting is available on request.)
Universal Output 2	Default: OFF (Not Used) One software controlled output is user selectable as: Proportional Current; PWM Duty Cycle; Proportional Voltage; or On/Off Digital type Half-bridge output, current sensing, grounded load. High side sourcing up to 3A All output types have configurable minimum and maximum output levels within the range for the type selected. Refer to Table 2.0.
Protection	Fully protected against short circuit to ground or +Vps Grounded short circuit protection will engage at 4.5A +/- 0.5A. Unit will fail safe in the case of a short-circuit condition, and is self-recovering when the short is removed.
Power GND Reference	One Provided

Table 1.0 – Input 2 – User Selectable Options	
Analog Input Functions	Voltage Input, Current Input or Resistive Input 12-bit Analog to Digital
Voltage Input	0-1V (Impedance 1 MΩ) 0-2.5V (Impedance 1 MΩ) 0-5V (Impedance 135 kΩ) 0-10V (Impedance 127 kΩ) 1mV resolution, accuracy +/- 1% error
Current Input	0-20 mA (Current Sense Resistor 249 Ω) 4-20 mA (Current Sense Resistor 249 Ω) 1uA resolution, accuracy +/- 2% error
Resistive Input	Self-calibrating for range of 30 Ω to 250 kΩ 1Ω resolution, accuracy +/- 1% error Slower response time is due to the auto-calibration feature. It could take up to ~2 Sec. for the input reading to stabilize after a large change (i.e. 50Ω to 200kΩ) at the input, or to detect an open circuit.
Digital Input Functions	Discrete Input, PWM Input, Frequency Input 15-bit timer (PWM, Frequency)
Digital Input Level	5V CMOS, (12V)
PWM Input	0 to 100% Low Frequency (<1kHz) or High Frequency (>100 Hz) Accuracy +/- 1% error 1MΩ Impedance, or 1 kΩ Pull-up/ 10kΩ Pull-down *Response time is dependent on input frequency.*
Frequency Input	0.5 to 700 Hz Range: 0.01Hz resolution 10Hz to 1kHz Range: 0.1Hz resolution 100 Hz to 10kHz Range: 1Hz resolution Accuracy +/- 1% error 1 MΩ Impedance, or 1 kΩ Pull-up/ 10kΩ Pull-down *Response time is dependent on input frequency.*
Digital Input	Active High or Active Low Normal, Inverse or Latched (pushbutton) Configurable 1 kΩ Pull-up/ 10kΩ Pull-down 10kΩ pull-up or pull-down resistor which can also be disabled (floating input) Rising edge ON threshold 3.7V +/- 0.1V Falling edge OFF threshold 2.9V +/- 0.1V

Table 2.0 – Output 2 – User Selectable Options	
Current Outputs	Range 0 to 3000 mA Software controlled PI current Fully configurable dither superimposed on top of output current Configurable from 50 to 400Hz amplitude High frequency output drive at 25kHz. 1mA resolution, accuracy +/- 1% error Note: Output 2 has an independent selectable dither.
Voltage Outputs	High frequency drive at 25kHz Additional external filtering is required to create a DC voltage 0.1V resolution, accuracy +/- 5% error Average voltage output based on unit power supply
PWM Outputs	Range 0 to 100% Output Frequency: 1 Hz to 25 kHz 0.1% resolution, accuracy +/- 0.1% error
Digital On/Off Output:	Load at supply voltage must not draw more than 3A.

General Specifications

Quiescent Current	109 mA @ 12Vdc Typical; 66 mA @ 24Vdc Typical
Microprocessor	TI TMS320F2806x, 32-bit, 256 KB flash program memory, 100 KB RAM
Diagnostics	Diagnostics are available upon request. Diagnostic data is stored in a non-volatile log.
Additional Fault Feedback	There are several types of faults that the controller will detect and provide a response: unit power supply undervoltage and overvoltage, microprocessor over temperature and lost communication. They can be sent to the J1939 CAN bus.
Control Logic	Functional control logic is provided. It was developed jointly with BorgWarner using a Simulink® development model. Its use is restricted to controlling BorgWarner devices. Input 2 and Output 2 setpoints are user configurable using the Electronic Assistant®.
Communications	1 CAN port (SAE J1939) Compliant to SAE CAN J1939 Standard Some CAN parameters are user configurable including: PGN, transmission rate, data type, and data location.
CAN Transmit Rate	Per the J1939 standard, the maximum recommended transmit rate for any message is 10ms.
User Interface	The unit can interface with the Electronic Assistant® (EA), **P/N: AX070502.** It comes with a royalty-free license for use. The Axiomatic USB-CAN converter links the device's CAN port to a *Windows*-based PC with the EA installed.
Reflashing Software over CAN	Reflash software over the CAN bus per the SAE J1939 standard using the Electronic Assistant®.
Enclosure	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 plugs) Refer to the dimensional drawing, Figure 1.0.
Protection	IP67
Vibration	Random Vibration: 7.7 Grms peak Sinusoidal Component: 10 G peak Based on MIL-STD-202G, Methods 204G and 214A
Weight	0.50 lb. (0.23 kg)
Temperature Rating	-40°C to +125°C (-40°F to 257°F)

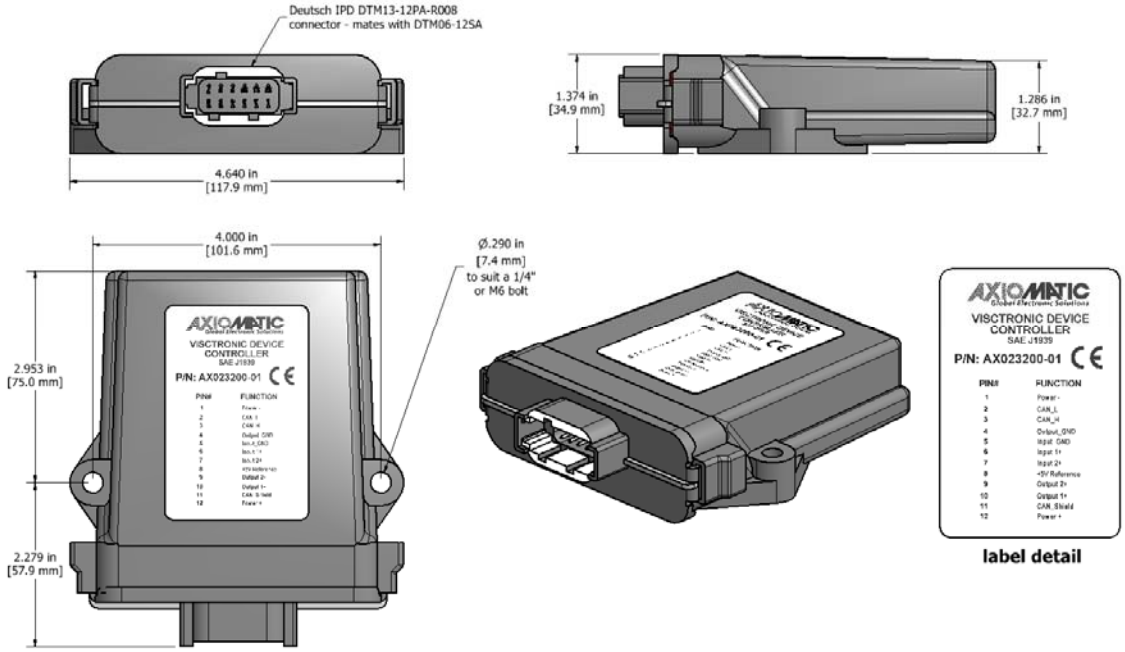

Figure 1.0 - Dimensional Drawing

<table>
<tr><td>Electrical Connections</td><td>12 pin Deutsch IPD connector P/N: DTM13-12PA-R008
20 AWG wire is recommended for use with contacts 0462-201-20141.
<table><tr><th colspan="2">CAN and I/O Connector</th></tr><tr><th>Pin #</th><th>Description (Notes)</th></tr><tr><td>1</td><td>BATT -</td></tr><tr><td>2</td><td>CAN_L</td></tr><tr><td>3</td><td>CAN_H</td></tr><tr><td>4</td><td>P_GND (Out 1 and Out 2)</td></tr><tr><td>5</td><td>Analog _GND (Input 1 and Input 2)</td></tr><tr><td>6</td><td>Input 1+</td></tr><tr><td>7</td><td>Input 2+</td></tr><tr><td>8</td><td>+5V Ref</td></tr><tr><td>9</td><td>Output 2+ (Default: Not Used)</td></tr><tr><td>10</td><td>Output 1+</td></tr><tr><td>11</td><td>CAN_Shield</td></tr><tr><td>12</td><td>BATT +</td></tr></table></td></tr>
<tr><td>Mating Plug Kit</td><td>Axiomatic P/N: PL-DTM06-12SA. It is comprised of the following Deutsch IPD parts: plug (DTM06-12SA); wedgelock (WM12S); and 12 contacts (0462-201-20141) as well as 6 sealing plugs (0413-204-2005).</td></tr>
<tr><td>Network Termination</td><td>External termination resistors, 120 Ohm, 0.25W minimum, metal film or similar type, should be placed between CAN_H and CAN_L terminals at both ends.</td></tr>
<tr><td>Installation</td><td>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 inches or 30 cm).</td></tr>
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Form: TDAX023200-04/12/16