TECHNICAL DATASHEET #TDAX031200

11:9 CAN CONTROLLER

11 Inputs (Analog, Digital, Magnetic Pick Up, Universal Signal)
4 Relay, 4 Analog, 1 Valve Driver Outputs
2 CAN (SAE J1939)
***with* Electronic Assistant®**

P/N: AX031200

Features:

- 12V or 24Vdc nominal input power with surge and transient protection
- Reverse polarity, overvoltage, undervoltage and short circuit protections
- Input and output isolation

- 4 Isolated Analog (0-5V, 0-10V, 4-20 mA or 0-20 mA) or Digital inputs
- 2 Isolated Digital Inputs
- 1 Magnetic Pick Up Input (0.5 Hz to 10 kHz, 100 mV to 100 Vrms)
- 4 Universal Inputs (0-1V, 0-2.5V, 0-5V, 0-10V Voltage; 4-20 mA, 0-20 mA Current; 30Ω to 250 kΩ Resistive; 0.5 Hz to 10 kHz Frequency; RPM; PWM; or Digital)

- 4 Isolated Analog Outputs (0-5V or 0-10V Voltage; or 4-20 mA, 0-20 mA Current)
- 4 Relay Outputs (2A@250V NO)
- 1 Output (2A) to drive a proportional or ON/OFF hydraulic valve

- 2 SAE J1939 CAN bus ports
- -40 to +85 °C operating temperature
- Designed for EMC compliance, CE marking
- 48 pin Deutsch IPD housing and connectors
- IP67 rating, Suitable for moist and vibrating environments
- Configurable with Electronic Assistant®
- Standard control logic developed with Simulink®

Applications:

- power gen set engine control systems
- oil and gas equipment automation
- off-highway machine automation

Ordering Part Numbers:

SAE J1939 Controller: For baud rate, refer to the table below for the appropriate P/N.

Model P/N	*Baud Rate*	*Standard Reference*
AX031200	250 kBit/s	J1939/11, J1939/15.
AX031200-01	500 kBit/s	J1939/14. New standard
AX031200-02	1Mbit/s	Non-standard

Mating Plug Kit: **AX070123**
Electronic Assistant®: **AX070502**

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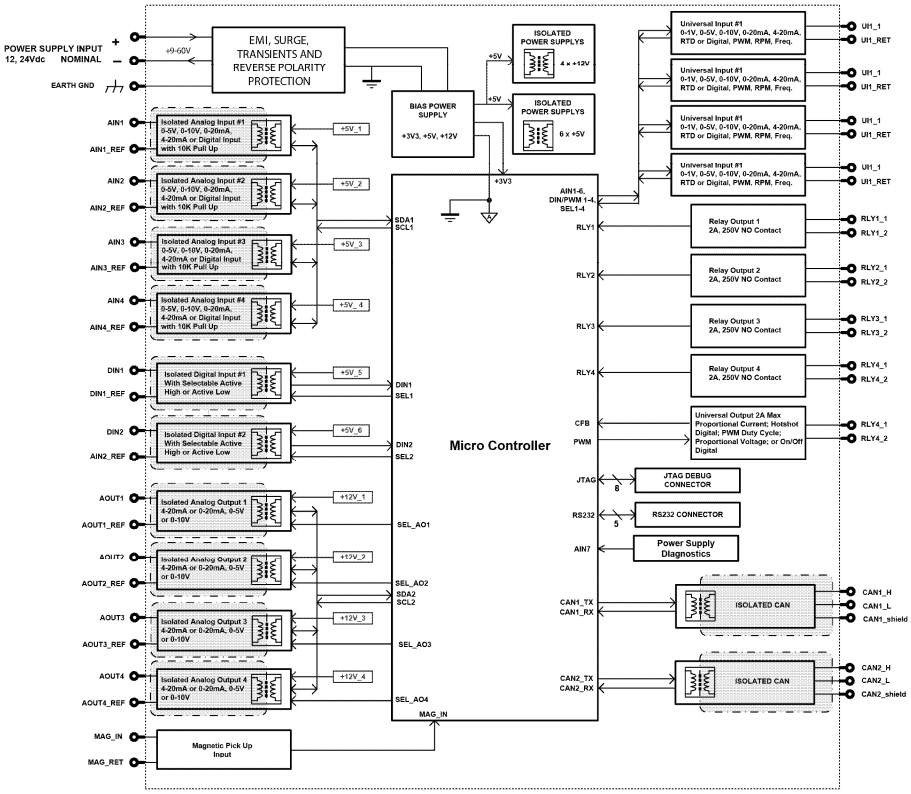
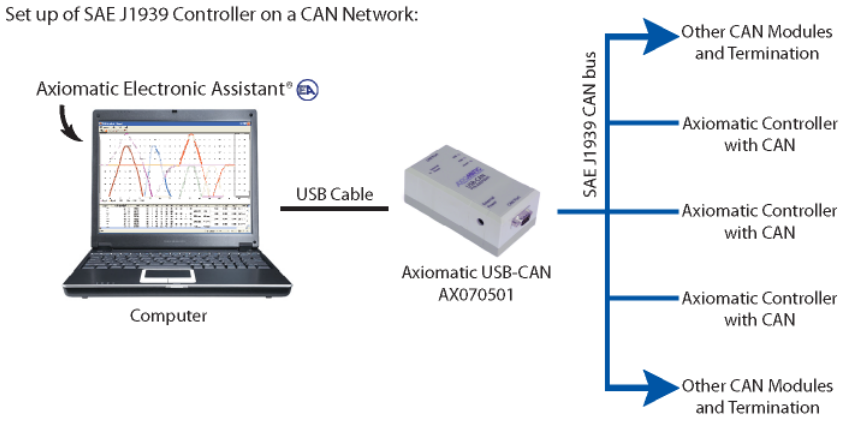
Technical Specifications:

Block Diagram



User Interface



The controller belongs to a family of Axiomatic smart controllers with configurable internal architecture. This provides users with flexibility, allowing them to build their own custom controller with a required functionality from a set of predefined internal functional blocks using the PC-based Axiomatic Electronic Assistant® software tool. Application programming is performed through the CAN interface, without disconnecting the controller from the user's system.

Inputs

Power Supply Input	12 Vdc or 24 Vdc nominal (9…60 Vdc power supply range) Shutdown voltage is 7.5 Vdc.
Protection	Surge and transient protection Reverse polarity protection Overvoltage protection is up to 80 V.
Inputs	11 Inputs, user selectable: 4 Isolated Analog Inputs 2 Isolated Digital Inputs 1 Magnetic Pick Up Input 4 Universal Inputs Refer to Table 1.0. Inputs and Power are isolated from the outputs and CAN.
Input Grounds	Provided

Table 1.0 – Inputs – User Programmable Options

Analog Inputs	Four fully isolated inputs selectable as : Voltage, Current or Digital types 12-bit Analog to Digital (voltage, current) Inputs are sampled every 1 msec. Protected against shorts to GND or +Vcc
Voltage Type	0-5 V (Impedance 200 KOhm) 0-10 V (Impedance 150 KOhm) 1mV resolution, accuracy +/- 1% error
Current Type	0-20 mA (Impedance 125 Ohm) 4-20 mA (Impedance 125 Ohm) 6 uA resolution, accuracy +/- 1% error Current sense resistor 124Ω
Digital Type	Active High or Active Low
Digital Input	Two fully isolated Active High or Active Low Inputs Configurable 10kΩ pullup or pulldown resistor Pullup at 5VDC, pulldown to reference.
Magnetic Pick Up Input	One input Range: 0.5 Hz to 10 kHz 100mV to 100V RMS
Universal Inputs	Four fully independent inputs selectable as : Voltage; Current; Resistive; Frequency; RPM; PWM; or Digital types 12-bit Analog to Digital (voltage, current, resistive) 15-bit Timer (frequency, RPM, PWM) Protected against shorts to GND or +Vcc
Voltage Type	0-1V, 0-2.5V, 0--5V or 0-10V 1mV resolution, accuracy +/- 1% error
Current Type	0-20mA or 4-20mA 1uA resolution, accuracy +/- 2% error Current sense resistor 124Ω
Resistive Type	Self-calibrating for range of 30 Ω to 250 kΩ 1Ω resolution, accuracy +/- 1% error
PWM Input	1MΩ Impedance 0 to 100% 100 Hz to 10 kHz 0.01% resolution, accuracy +/- 1% error
Frequency/RPM Input	0.5 Hz to 50 Hz; 0.01 Hz resolution 10 Hz to 1 kHz; 0.1Hz resolution 100 Hz to 10 kHz; 1 Hz resolution Accuracy +/- 1% error
Digital Input	Active High or Active Low with 22 kOhm pull-up or pull-down

Outputs

<table>
<tr><td>Outputs</td><td>4 Isolated Analog Outputs
4 Relay Outputs
1 Valve Driver Output

The outputs are user selectable as follows. Refer to Table 2.0.
<table>
<tr><td colspan="2">Table 2.0: Outputs</td></tr>
<tr><td>Analog Outputs:</td><td>Four fully isolated analog outputs as : Voltage or Current
12-bit Digital to Analog (voltage, current)
Protected against shorts to GND or +Vcc

<u>Voltage Output:</u>
0-5 Vdc or 0-10 Vdc
1mV resolution, accuracy +/- 1% error
<table>
<tr><td>Output Range</td><td>Maximum load</td></tr>
<tr><td>0-5V</td><td>1kΩ</td></tr>
<tr><td>0-10V</td><td>10kΩ</td></tr>
</table>
<u>Current Output:</u>
0-20 mA or 4-20 mA
Max. load resistance is < 350 Ohms
Compliance Voltage is 7 V.
6.1 uA resolution, accuracy +/- 1% error</td></tr>
<tr><td>Relay Outputs</td><td>Four Relay Outputs
Max. 2A, 250V NO Contact</td></tr>
<tr><td>Valve Driver Output</td><td>One fully independent software controlled output selectable as:
• Proportional Current;
• Hotshot Digital;
• PWM Duty Cycle;
• Proportional Voltage;
• or On/Off Digital
Half-bridge output, current sensing, grounded load.
High side sourcing up to 2A

Current Outputs: 1mA resolution, accuracy +/- 2% error

Voltage Outputs: 0.1V resolution, accuracy +/- 5% error
Average output based on unit power supply
High frequency drive at 25kHz

PWM Outputs: 0.1% resolution, accuracy +/- 0.1% error

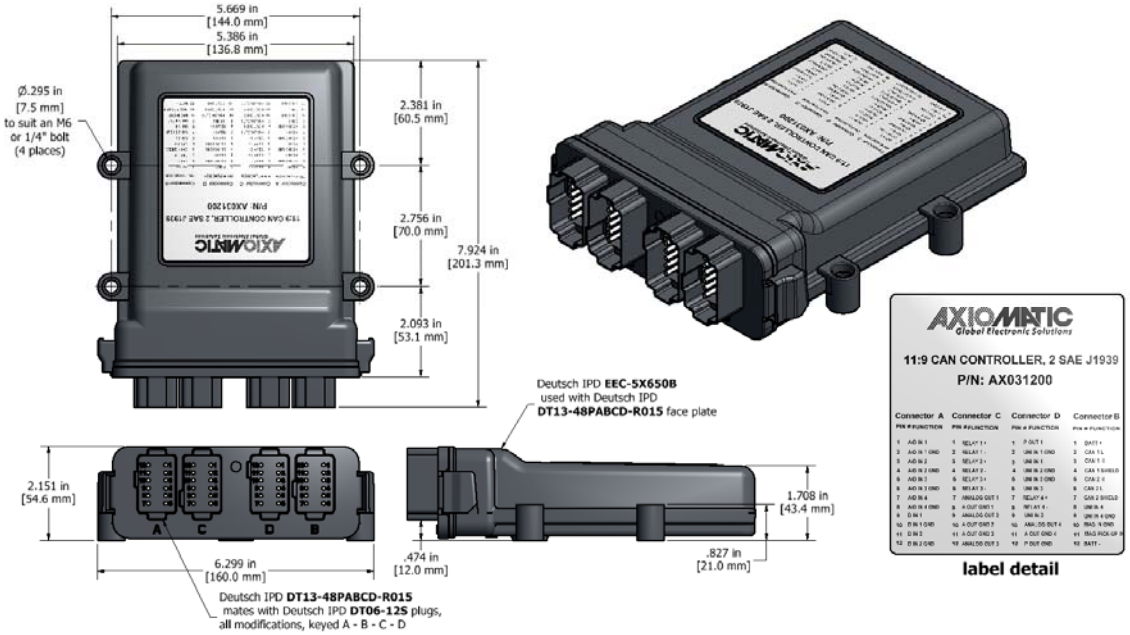
Digital On/Off:
Load at supply voltage must not draw more than 2A.</td></tr>
</table>
</td></tr>
<tr><td>Isolation</td><td>300 Vrms
The outputs are isolated from the inputs.
The CAN bus port is isolated from both inputs and outputs.</td></tr>
<tr><td>Protection for Output Terminals</td><td>Fully protected against short circuit to output ground and +Vcc.
Unit will fail safe in the case of a short circuit condition, self-recovering when the short is removed.</td></tr>
</table>

General Specifications

Microprocessor	STM32 32-bit, 512 kByte flash memory
Typical Quiescent Current	97 mA @ 24Vdc
Control Logic	Standard embedded software is provided. *(Application-specific control logic or factory programmed set point file on request)*
Communications	2 Isolated CAN ports (SAE J1939) (A CANopen® model is available as P/N: AX031201.) 250 kbps: Model AX031200 500 kbps: Model AX031200-01 1 Mbps: Model AX031200-02
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.

User Interface	Control setpoints can be viewed and programmed using the standard J1939 memory access protocol through the CAN port and the PC-based Axiomatic Electronic Assistant®. The EA can store all setpoints in one setpoint file and then flash them into the unit in one operation. The setpoint file is created and stored on disk using a command *Save Setpoint File* from the EA menu or toolbar. The user then can open the setpoint file, view or print it and flash the setpoint file into the controller. The Electronic Assistant®, P/N: **AX070502**, for *Windows* operating systems comes with a royalty-free license for use on multiple computers. It includes an Axiomatic USB-CAN converter to link the device's CAN port to a *Windows*-based PC.
Simulink®	The controller was designed using Simulink®. **Simulink®** is a model-based design tool from Mathworks®. Using Simulink®, the OEM machine designer is able to design the data conversion rules between the module interfaces using a Simulink library. Refer to the User Manual *Axiomatic Hardware Interface Library for Mathworks Simulink.*
EMC Compliance	CE marking
Vibration	Random Vibration: 7.68 Grms peak Sinusoidal Component: 10 g peak Based on MIL-STD-202G, Methods 204G, 214A and 213B
Operating Conditions	-40 to 85 °C (-40 to 185 °F)
Storage Temperature	-55 to 125 °C (-67 to 257°F)
Protection	IP67
Weight	1.35 lbs. (0.612 kg)
Packaging	High Temperature Nylon housing, Deutsch IPD P/N: EEC-5X650B 4.03 x 4.25 x 1.68 inches 102.44 x 107.96 x 42.67 mm L x W x H including integral connector Refer to the dimensional drawing.
Installation	For mounting information, refer to the dimensional drawing. 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 0.25 inches (6.35 mm) thick. If the module is mounted without an enclosure, it should be mounted to reduce the likelihood of moisture entry. 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). Wires should be of the appropriate gauge to meet requirements of applicable electrical codes and suit the specifications of the connector. The module must be mounted in an enclosure in hazardous locations. All field wiring should be suitable for the operating temperature range of the module. All chassis grounding should go to a single ground point designated for the machine and all related equipment.

Dimensional Drawing



Electrical Connections	48 pin Deutsch IPD connector P/N: DT13-48PABCD-R015

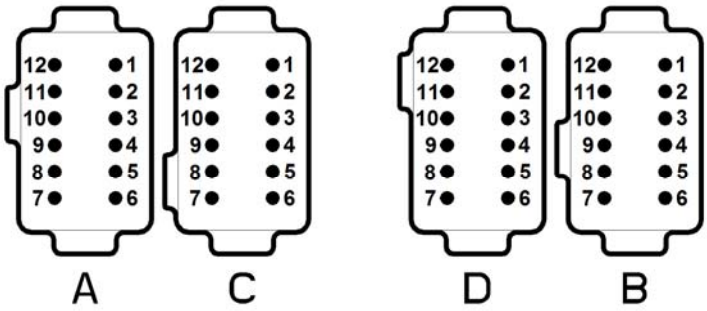


Table 3 - Electrical Pin Out

Connector A		Connector C		Connector D		Connector B	
Pin #	**Function**	**Pin #**	**Function**	**Pin #**	**Function**	**Pin #**	**Function**
1	A/D IN 1	1	RELAY 1 +	1	P OUT	1	BATT +
2	A/D IN 1 GND	2	RELAY 1 -	2	UNI IN 1 RTN	2	CAN 1 L
3	A/D IN 2	3	RELAY 2 +	3	UNI IN 1	3	CAN 1 H
4	A/D IN 2 GND	4	RELAY 2 -	4	UNI IN 2 RTN	4	CAN 1 SH
5	A/D IN 3	5	RELAY 3 +	5	UNI IN 3 RTN	5	CAN 2 H
6	A/D IN 3 GND	6	RELAY 3 -	6	UNI IN 3	6	CAN 2 L
7	A/D IN 4	7	A OUT 1	7	RELAY 4 +	7	CAN 2 SH
8	A/D IN 4 GND	8	A OUT GND 1	8	RELAY 4 -	8	UNI IN 4
9	D IN 1	9	A OUT 2	9	UNI IN 2	9	UNI IN 4 RTN
10	D IN 1 GND	10	A OUT GND 2	10	A OUT 4	10	MAG IN GND
11	D IN 2	11	A OUT GND 3	11	A OUT GND 4	11	MAG PICK-UP IN
12	D IN 2 GND	12	A OUT 3	12	P OUT GND	12	BATT -

Mating Plugs	Mates with the following Deutsch IPD P/N's. DT06-12SA Plug, DT 12 Way A Key DT06-12SB Plug, DT 12 Way B Key DT06-12SC Plug, DT 12 Way C Key DT06-12SD Plug, DT 12 Way D Key A set of these mating plugs is available, ordering P/N: AX070123.

Control Logic

From the software perspective, the AX031200 consists of a set of internal functional blocks, which can be individually programmed using the Simulink® model to achieve the required system functionality.

The model operates with Simulink® for easy graphical programming in a model based simulation and development environment. The functional blocks have been readily implemented into the Simulink model. With the Simulink model, it is possible for a customer to easily modify functional blocks to produce their own custom software. For example, input and CAN message connections can be altered, transfer functions can be added between inputs and CAN messages and initial values for functional block set points can be configured. The Axiomatic Hardware Interface Library (HWIL) is provided for this purpose. For simulating models using Axiomatic HWIL, licenses for Simulink® and Stateflow® are required. Code generation also requires the Simulink Coder™ license.

Notes:
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Form: TDAX031200-07/12/17