4 Analog Signal Outputs CANopen® Controller
P/N: AX030501

Distributed I/O for Engine Control Systems

The 4 Analog Signal Outputs CAN Controller belongs to a family of Axiomatic user-customizable smart controllers. The programmable internal architecture provides users with an ultimate flexibility, allowing them to build their own custom controller with a required functionality from a set of predefined internal functional blocks using any commercially available CANopen® tools.

Features:
- 4 independent analog signal outputs (voltage or current)
- User selectable output range from +/-10V or +/-20 mA, including: 0-5V; 0-10V; +/-5V; +/-10V; 0-20mA; 4-20 mA; and +/-20mA.
- 12V/24V/48VDC input power (nominal) with rugged surge protection
- Galvanic isolation between power supply and analog signal outputs
- 1 CANopen® port
- Rugged IP67 packaging and connectors
- Vibration compliant for engine applications
- CAN (SAE J1939) model is available as P/N: AX030500.
- User programmable functionality
- .EDS provided to interface to standard CANopen® tools

Applications:
- Distributed controls for power generation, co-generation, stationary power
- Distributed controls for commercial vehicles, off-highway equipment, industrial equipment, etc.
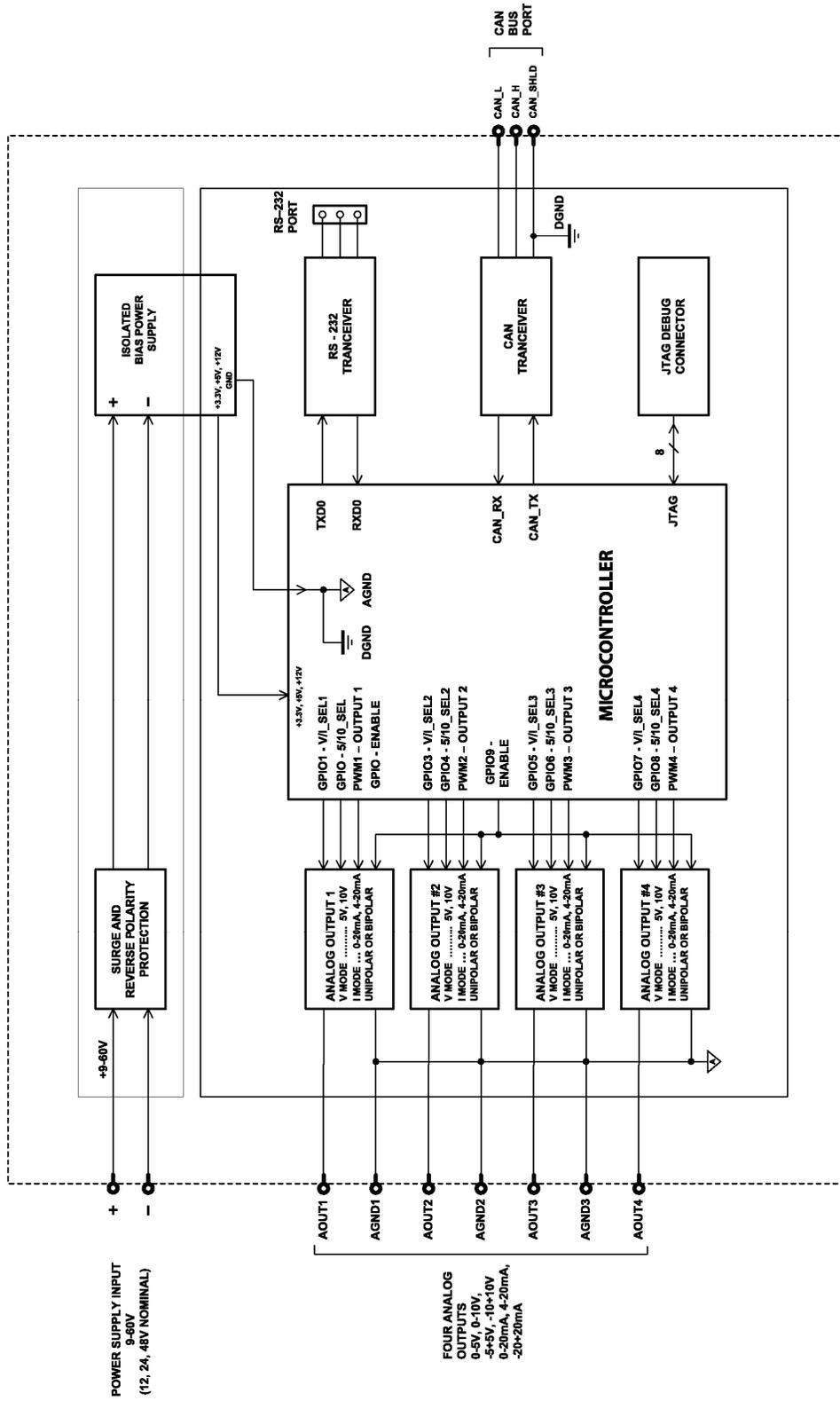
Ordering Part Numbers:

4 Analog Signal Outputs CANopen® Controller: **AX030501**

EDS File, UMAX030501: Download from the website www.axiomatic.com. Go to the Log-in tab and request the password from sales@axiomatic.com.

Accessories: Mating Plug Kit: **PL-DTM06-12SA**

Block Diagram

Technical Specifications:
Input Specifications

Power Supply Input - Nominal	12V, 24V or 48VDC nominal (9…60 VDC power supply range)
Protection	Surge and reverse polarity protection are provided.
Isolation	A transformer power supply provides galvanic isolation between the power supply input and the analog signal outputs.
Input	CAN Messages, CANopen® The CAN signal can be filtered to accept messages from a single address on the network permitting a link to a specific ECU. A CANopen tool is used to set up CAN signal acquisition and processing algorithms.

Output Specifications

CAN	The controller can send PDOs to the network continuously or on request. Using a CANopen tool, the user can configure this feature.
Analog Outputs	Up to 4 analog signal outputs are selectable by the user. Refer to Table 1.0.
Ground Connection	3 Analog GND connections are provided. They are connected together internally.
Protection for Output + Terminal	Fully protected against short circuit to ground and short circuit to power supply rail. Unit will fail safe in the case of a short circuit condition, self-recovering when the short is removed.

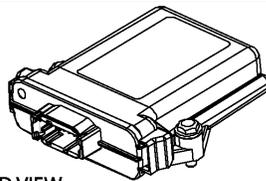| Table 1.0 - Outputs	
Analog Outputs	Up to 4 analog signal outputs are available. Using a CANopen® tool, the user selects: • the output mode (voltage or current); • and the minimum and maximum values for the output signal from the +/-10V or +/-20 mA range. Standard analog signal ranges are supported, including: 0-5V; 0-10V; +/-5V; +/-10V; 0-20mA; 4-20 mA; and +/-20mA. The outputs can be globally enabled or disabled.
Output Accuracy	0.5%
Output Resolution	0.015% (>12 bit)

General Specifications

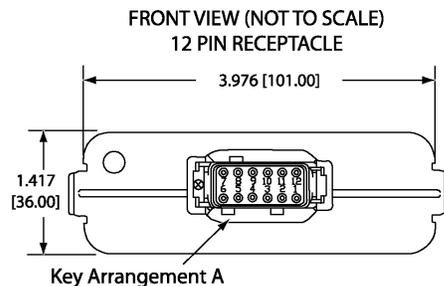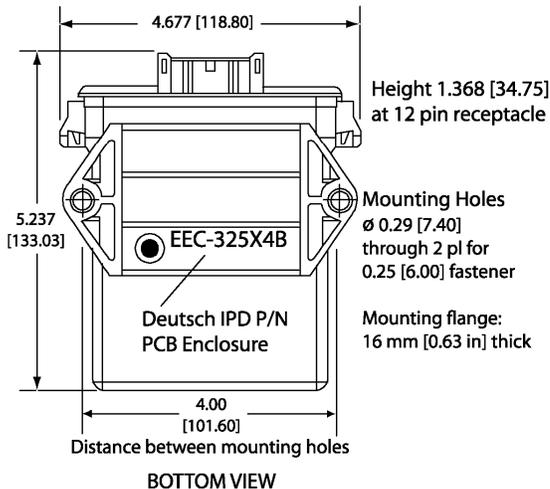| Microprocessor	32-bit, 128 KByte flash program memory
Control Logic	Standard embedded software is provided. Refer to the User Manual. (*Application-specific control logic or factory programmed setpoints are available on request.*)
Monitoring and Troubleshooting	The controller can also transmit a CAN application message carrying signals internally generated by the controller. This feature can be used for monitoring and debugging purposes.
CAN	1 CAN port (CANopen®) The controller's object dictionary is compatible with the CiA DS-404 device profile (Device profile for measurement devices and closed-loop controllers). In addition to the standard objects for this device profile, the controller also includes a number of manufacturer specific objects to extend the functionality beyond that of the basic profile. The Axiomatic AX030501 is compliant with the following CAN in Automation (CiA) standards. <table><tr><td>[DS-301]</td><td>CiA DS-301 V4.02 – CANopen® Application Layer and Communication Profile. CAN in Automation 2002</td></tr><tr><td>[DS-404]</td><td>CiA DS-404 V1.2 – Device Profile for Measurement Devices and Closed-Loop Controllers. CAN in Automation 2002</td></tr><tr><td>[DS-305]</td><td>CiA DS-305 V2.0 – Layer Setting Service (LSS) and Protocols. CAN in Automation 2006</td></tr></table>
User Interface	EDS File is provided. The controller architecture consists of a set of internal functional blocks, which can be individually programmed and arbitrarily connected together to achieve the required system functionality for a specific application. All objects are user configurable using standard commercially available tools that can interact with a CANopen® Object Dictionary via an .EDS file.

Quiescent Current Draw	< 340 mA @ 12V and full load < 160 mA @ 24V and full load < 90 mA @ 48V and full load
Response Time	10 mSec. max.
Weight	0.50 lbs. (0.23 kg)
Operating Conditions	-40 to 85 °C (-40 to 185 °F)
Storage Temperature	-55 to 125 °C (-67 to 257°F)
Vibration and Shock Compliance	MIL-STD-202G, Test 204D, 214A and 213B 7.68 Grms (Random) 10 g peak (Sine) 50 g (Shock)
Protection	IP67, PCB is conformal coated and protected by the housing.
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 plugs) Refer to housing dimensions drawing.
Mounting	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. If the module is mounted without an enclosure, it should be mounted vertically with connectors facing left and right to reduce likelihood of moisture entry. The CAN wiring is considered intrinsically safe. The power wires are not considered intrinsically safe and so in hazardous locations, they need to be located in conduit or conduit trays at all times. The module must be mounted in an enclosure in hazardous locations for this purpose. No wire or cable harness should exceed 30 meters in length. The power input wiring should be limited to 10 meters. All field wiring should be suitable for the operating temperature range. 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).
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.

HOUSING DIMENSIONS

Housing Material: High Temperature Nylon (Black)
Protection Rating: IP67

3D VIEW
12 Pin Receptacle

4.677 [118.80]

5.237 [133.03]

Height 1.368 [34.75] at 12 pin receptacle

EEC-325X4B

Deutsch IPD P/N PCB Enclosure

Mounting Holes
Ø 0.29 [7.40] through 2 pl for 0.25 [6.00] fastener

Mounting flange: 16 mm [0.63 in] thick

4.00 [101.60]
Distance between mounting holes

BOTTOM VIEW

FRONT VIEW (NOT TO SCALE)
12 PIN RECEPTACLE

3.976 [101.00]

1.417 [36.00]

Key Arrangement A

Mating Plug Assemblies:
12 pin receptacle – DTM06-12SA
 with wedgelock WM12S and contacts
24 pin receptacle – DTM06-12SA and DTM06-12SB
with wedgelocks WM12S and contacts
Contact factory for contact specification.

Dimensions: inches [mm]
 excluding mating plug(s)

Electrical Connections	Deutsch DTM series 12 pin receptacle (P/N: DTM13-12PA-R008) 20 AWG wire is recommended for use with contacts 0462-201-20141.	Mating plug KIT: Available from Axiomatic as 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). *If not all of the outputs are required for the application, use the sealing plugs to fill the mating connector pins.* Wiring to these mating plugs must be in accordance with all applicable local codes. Suitable field wiring for the rated voltage and current must be used. The rating of the connecting cables must be at least 70°C. Use field wiring suitable for both minimum and maximum ambient temperature.

PIN #	FUNCTION
1	Analog GND
12	Analog GND
2	Output 1+
11	CAN_L
3	Output 2+
10	CAN_H
4	Output 3+
9	CAN_Shield
5	Output 4+
8	Power -
6	Analog GND
7	Power +

Control Logic

From the software perspective, the controller consists of a set of internal functional blocks, which can be individually programmed and arbitrarily connected together to achieve the required system functionality, see Figure 1.
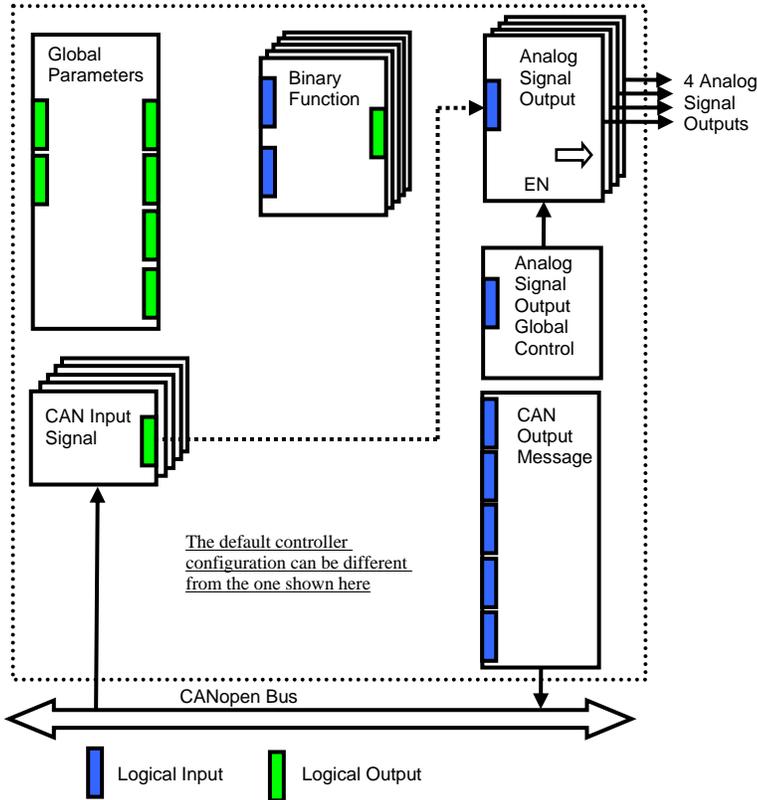
As an example, the logical output of the CAN Input Signal functional block is connected to the logical input of the Analog Signal Output functional block, providing a direct path for the CAN input signal to the controller signal output.

Figure 1. The Controller Internal Structure.

Each functional block is absolutely independent and has its own set of programmable parameters, or object dictionary entries. The parameters can be viewed and changed through CAN using any commercially available CANopen software.

There are two types of the controller functional blocks. One type represents the controller hardware resources, for example the analog signal output block. The other type is purely logical – these functional blocks are included to program the user defined functionality of the controller. The number and functional diversity of these functional blocks are only limited by the system resources of the internal microcontroller. They can be added or modified on the customer's request to accommodate user-specific requirements.

The user can build virtually any type of a custom control by logically connecting inputs and outputs of the functional blocks. This approach gives the user an absolute freedom of customization and an ability to fully utilize the controller hardware resources in a user's application.

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