

Distributed I/O for Engine Control Systems

Features:

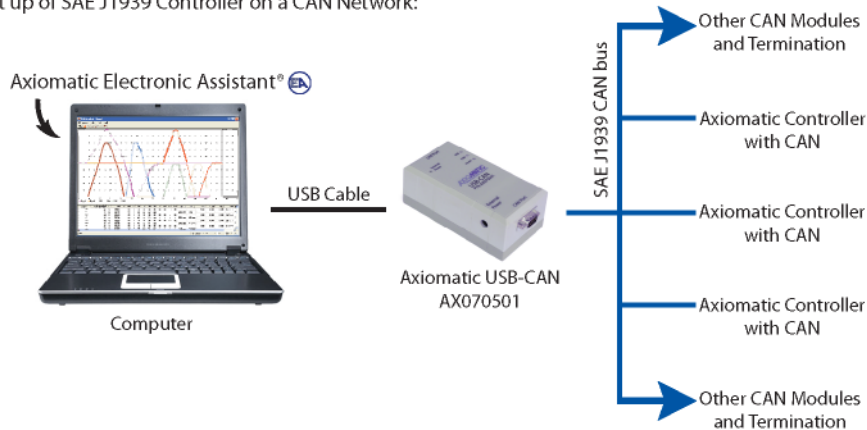
- 1 universal signal input (Voltage, Current, Resistive, Digital, Frequency or PWM)
- User selectable input range from: 0-1V; 0-2.5V; 0-5V; 0-10V; 0-20mA; 4-20 mA; 20 Ohm to 250 kOhm; 10Hz – 1 kHz; or 100 Hz – 10 kHz.
- 12V/24VDC input power (nominal) with transient and reverse polarity protection
- 1 CAN (SAE J1939), CANopen® on request
- Rugged packaging and connectors
- **Electronic Assistant®** runs on a Windows operating system for user configuration and programming. An Axiomatic USB-CAN links the PC to the CAN bus.



Applications:

- Distributed controls for power generation, co-generation, stationary power
- Distributed controls for commercial vehicles, off-highway equipment, industrial equipment, etc.

Set up of SAE J1939 Controller on a CAN Network:



The controller belongs to a family of Axiomatic smart controllers with programmable 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.

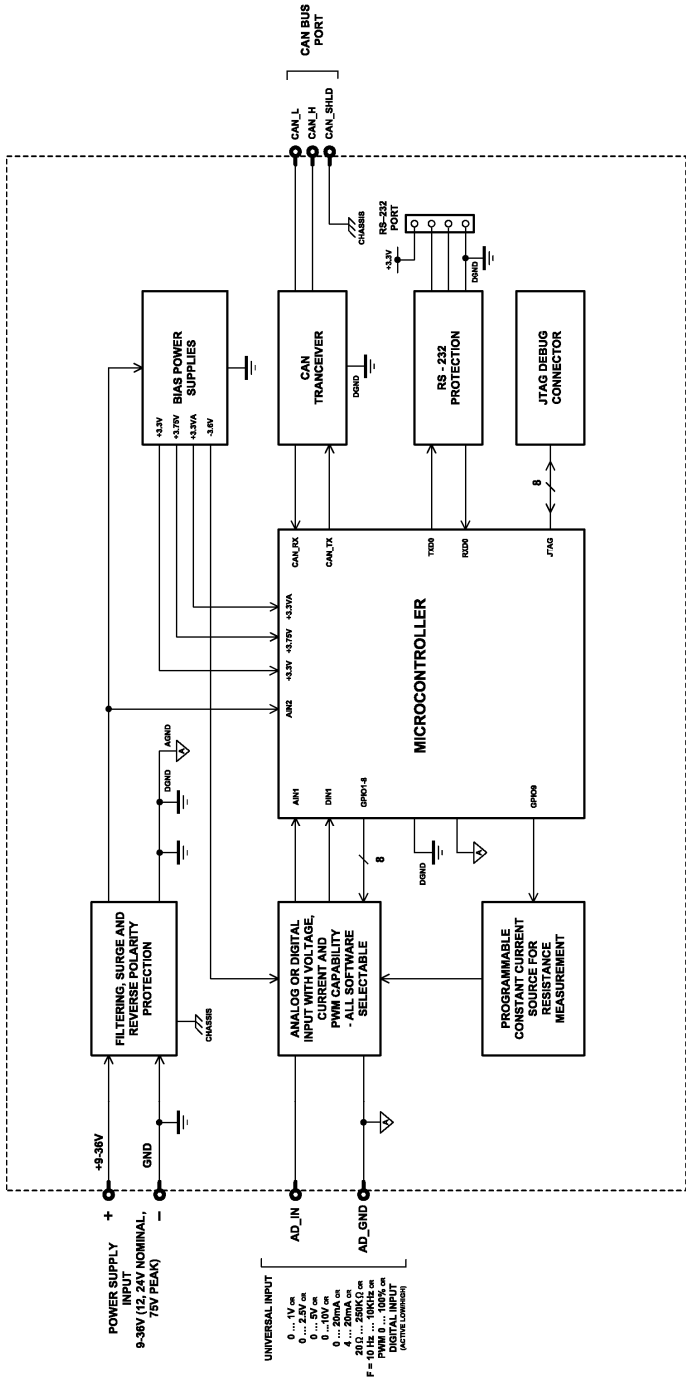
Ordering Part Numbers:

SAE J1939 version
Controller: AX030530
Mating Plug Kit: AX070112 (Comprised of DT06-8SA, W8S, 7 pcs. 0462-201-16141, 1 pc. 114017)
AX070502 Configuration KIT includes the following.
USB-CAN Converter P/N: AX070501
1 ft. (0.3 m) USB Cable P/N: CBL-USB-AB-MM-1.5
12 in. (30 cm) CAN Cable with female DB-9 P/N: CAB-AX070501
AX070502IN CD P/N: CD-AX070502, includes: Electronic Assistant® software; EA & USB-CAN User Manual UMAX07050X; USB-CAN drivers & documentation; CAN Assistant (Scope and Visual) software & documentation; and the SDK Software Development Kit. NOTE: To order this kit, you need only to specify P/N: AX070502.

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Block Diagram



Technical Specifications: Input Specifications

Power Supply Input - Nominal	12V or 24VDC nominal (9...36 VDC power supply range)
Protection	Transient and reverse polarity protection is provided.
Universal Signal Input	1 universal signal input (user selectable) (Voltage, Current, Resistive, Digital, Frequency or PWM) Refer to Table 1.0.
Ground Connection	1 Analog GND connection is provided.
Table 1.0 – Input – User Selectable Options	
Analog Input Functions	Voltage Input, Current Input or Resistive Input
Voltage Input	0-1V (Impedance 1 MOhm) 0-2.5V (Impedance 1 MOhm) 0-5V (Impedance 200 KOhm) 0-10V (Impedance 133 KOhm for 0-5V, 133 to 20 KOhm for 5-10V))
Current Input	0-20 mA (Impedance 124 Ohm) 4-20 mA (Impedance 124 Ohm)
Resistive Input	20Ω to 250 kΩ
Digital Input Functions	Discrete Input, PWM Input, Frequency Input
Digital Input Level	5V CMOS
PWM Input	0 to 100% 10 Hz to 1kHz 100 Hz to 10 kHz
Frequency Input	10 Hz to 1kHz 100 Hz to 10 kHz
Digital Input	Active High, Active Low
Input Impedance	1 MOhm high impedance, 10KOhm pull down, 10KOhm pull up to +5V
Input Accuracy	≤ 1%
Input Resolution	12-bit

Output Specifications

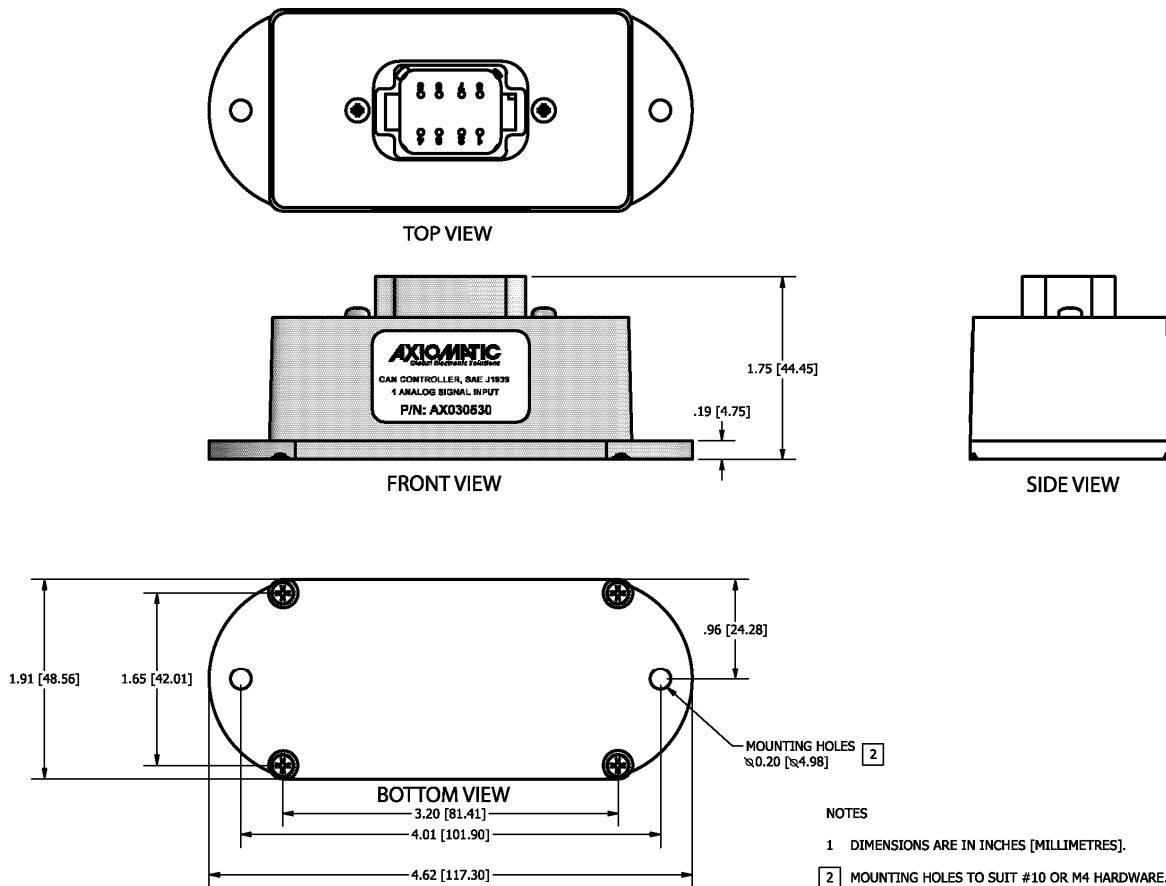
Output	CAN Messages, SAE J1939 {CANopen® available on request} Refer to Control Logic and Figure 1.0 as well as the user manual for details. The Electronic Assistant® (EA) is used to set up CAN signal acquisition and processing algorithms.
CAN	The controller can send a single frame application specific CAN message to the network continuously or on request. Using the EA, the user can configure this feature.

General Specifications

Microprocessor	32-bit, 128 KByte flash program memory
Control Logic	Standard embedded software is provided. Refer to Figure 1.0. (Application-specific control logic or factory programmed setpoints are available on request.) The controller belongs to a family of Axiomatic smart controllers with programmable internal architecture. This 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 the PC-based Axiomatic Electronic Assistant® software tool. Application programming is performed through CAN interface, without disconnecting the controller from the user's system.
CAN	1 CAN port (SAE J1939) (CANopen® on request)
Slew Rate	To adjust the controller to the CAN physical network, the slew rate can be configured as fast or slow. Refer to the User Manual for details.
User Interface (PC-based)	The controller setpoints can be viewed and programmed using the standard J1939 memory access protocol through the CAN port and the PC-based Axiomatic Electronic Assistant®. For default setpoints, refer to the User Manual. The EA can store all controller setpoints in one setpoint file and then flash them into the controller in one operation. The setpoint file is created and stored on disk using a command <i>Save Setpoint File</i> 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® for <i>Windows</i> operating systems comes with a royalty-free license for use on multiple computers. It requires an Axiomatic USB-CAN converter to link the device's CAN port to a <i>Windows</i> -based PC.

	<p>P/N: AX070502, the Axiomatic Configuration KIT includes the following. USB-CAN Converter P/N: AX070501 1 ft. (0.3 m) USB Cable P/N: CBL-USB-AB-MM-1.5 12 in. (30 cm) CAN Cable with female DB-9 P/N: CAB-AX070501 AX070502IN CD P/N: CD-AX070502, includes: Electronic Assistant® software; EA & USB-CAN User Manual UMAX07050X; USB-CAN drivers & documentation; CAN Assistant (Scope and Visual) software & documentation; and the SDK Software Development Kit.</p>
Quiescent Current Draw	Contact Axiomatic.
Settling Time	≤ 5 mSec. (0...95%)
Weight	0.65 lbs. (0.29 kg)
Operating Conditions	-40 to 85 °C (-40 to 185 °F)
Protection	IP67 PCB is conformal coated and protected by the housing.
EMC Compliance	Emissions: CISPR 25:2002/EN 55025:2003, Class 2 Immunity: IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-6
Packaging and Dimensions	Encapsulated Cast Aluminum housing with mounting holes 4.62 x 1.91 x 1.76 inches (117.30 x 48.56 x 44.73 mm) L x W x H including integral connector

DIMENSIONAL DRAWING



Mounting	<p>Mounting holes – The controller accepts 2 #10 or M4 screws.</p> <p>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.</p> <p>No wire or cable harness should exceed 30 meters in length. The power input wiring should be limited to 10 meters.</p> <p>All field wiring should be suitable for the operating temperature range.</p>
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	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.																		
Electrical Connections	<div data-bbox="589 327 1377 657" data-label="Image"> </div> <p data-bbox="589 680 984 705">Deutsch DT series 8 pin plug (DT15-8PA)</p> <p data-bbox="589 730 1292 804">Mating plug KIT: Axiomatic P/N AX070112 (Comprised of Deutsch IPD P/n's: DT016-8SA socket, wedge W8S, 7 solid contact sockets 0462-201-16141 and 1 sealing plug 114017.)</p> <p data-bbox="589 829 1268 854">16-18 AWG wire is recommended for use with sockets 0462-201-16141.</p> <p data-bbox="589 879 1369 999">Use dielectric grease on the pins when installing the controller. 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.</p> <table border="1" data-bbox="589 1016 1102 1283"> <thead> <tr> <th>PIN #</th> <th>FUNCTION</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Power +</td> </tr> <tr> <td>8</td> <td>Power -</td> </tr> <tr> <td>2</td> <td>CAN Shield</td> </tr> <tr> <td>7</td> <td>NOT USED</td> </tr> <tr> <td>3</td> <td>CAN HI</td> </tr> <tr> <td>6</td> <td>AGND</td> </tr> <tr> <td>4</td> <td>CAN L</td> </tr> <tr> <td>5</td> <td>ANALOG SIGNAL INPUT</td> </tr> </tbody> </table>	PIN #	FUNCTION	1	Power +	8	Power -	2	CAN Shield	7	NOT USED	3	CAN HI	6	AGND	4	CAN L	5	ANALOG SIGNAL INPUT
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Control Logic

From the software prospective, 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.

Each functional block is absolutely independent and has its own set of programmable parameters, or setpoints. The setpoints can be viewed and changed through CAN using the Electronic Assistant®.

There are two types of the controller functional blocks. One type represents the controller hardware resources, for example the analog signal input 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.

Depending on the block functionality, a functional block can have: logical inputs, logical outputs or any combinations of them. The connection between logical inputs and outputs is defined by logical input setpoints. The following rules apply:

- A logical input can be connected to any logical output using a logical input setpoint.
- Two or more logical inputs can be connected to one logical output.
- Logical outputs do not have their own setpoints controlling their connectivity. They can only be chosen as signal sources by logical inputs.

Each functional block of the controller is presented by its own folder in the Setpoint File root folder in the Electronic Assistant®.

To provide the user with means to build generic closed loop PID regulators, two PID Control functional blocks are available.

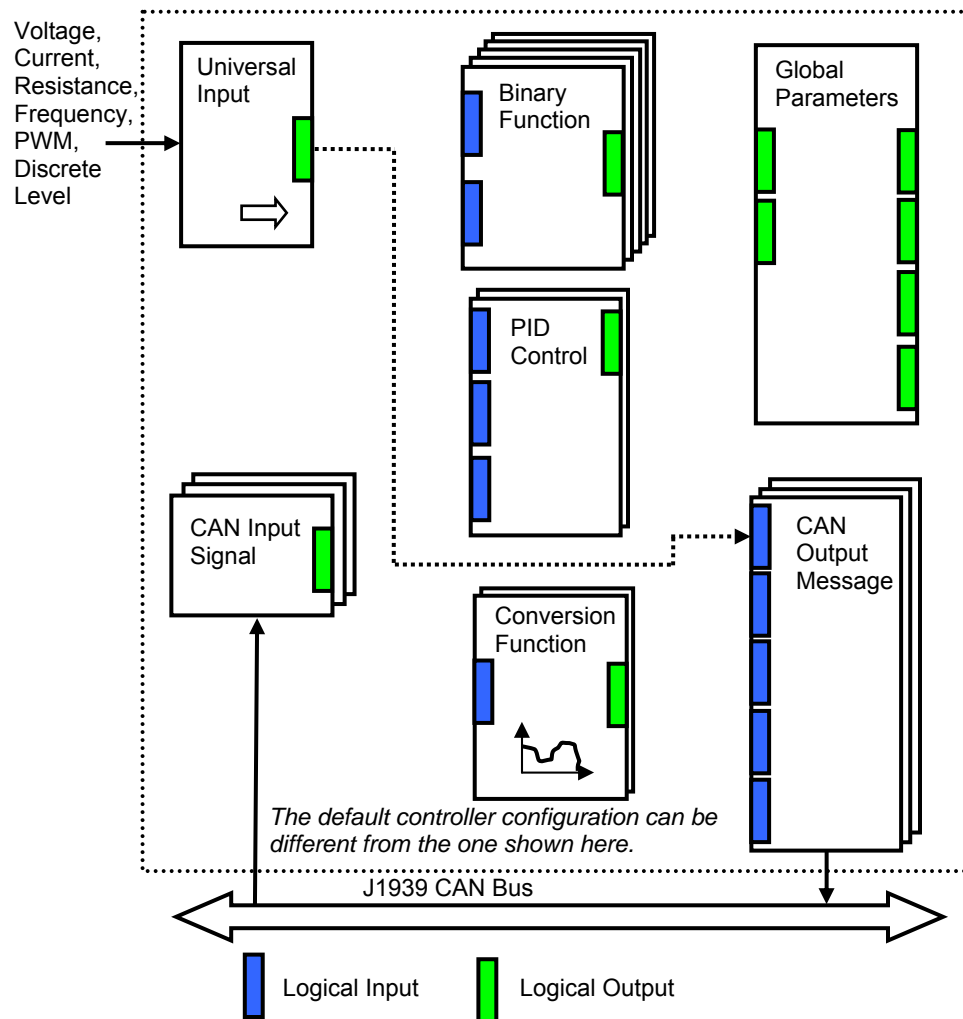
A PID Control functional block has: setpoint and feedback inputs, manual control mode and a reset input to bring the regulator into its initial state. The user can also adjust the time resolution for fast or slow responding closed loop systems.

There are five Binary Function functional blocks added to the controller to support advanced control algorithms. Each Binary Function functional block takes two logical input signals, scales them, and performs an arithmetic or logical operation. Then it outputs the result, which can be scaled as well.

There are three CAN Input Signal functional blocks supported by the controller. Each functional block can be programmed to read single-frame CAN messages and extract CAN signal data presented in virtually any user-defined signal data format. The functional block then outputs the signal data to its logical output for processing by other functional blocks of the controller.

By default, the output of the first CAN Input Signal functional block is connected to the input of the PWM Output #1 functional block. It provides the simplest controller configuration with a direct control of the signal output by the CAN input signal. The second and third CAN Input Signal functional blocks, not connected by default, can be engaged in more complicated CAN signal acquisition and processing algorithms involving Binary Function functional blocks and other controller resources.

According to the J1939/71 standard, CAN signals can carry not only signal values, but also special indicators, including: error indicator, "signal not available" indicator, etc. Refer to the User Manual for more details.



As an example, the logical output of the Universal Input functional block is connected to the logical input of the CAN Output Message functional block, providing a direct path for the input signal to the controller CAN output.

Figure 1. The Controller Internal Structure

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

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.

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