10 Universal Signal Input CAN Controller

P/N: AX030100

CAN (SAE J1939)

with **Electronic Assistant®** 🔵

10 Universal Signal Inputs (Analog/Digital/PWM/Hz) and CAN bus permits connection to an HMI or networking of several devices for machine control applications in harsh environments.

- 10 user selectable inputs
  (0-5V, 0-20 mA, 4-20 mA, PWM, frequency or counter, digital)
- 12V, 24Vdc (nominal) power input accepted
- Standard control logic
- 1 CAN port (SAE J1939)
- CANopen® version P/N: AX030101
- Hardware is available as a platform for application-specific software or setpoints
- **Electronic Assistant®** 🔵 runs on a *Windows* operating system for user configuration. An Axiomatic USB-CAN converter links the PC to the CAN bus.
- Rugged IP67 packaging and connectors

Description:

The 10 Universal Signal Input Module measures up to 10 analog inputs (0-5V, 0-20 mA or 4-20 mA) for connection to a variety of analog machine sensors or levers and sends the data to a CAN network. The user can also select multiple PWM or frequency inputs as well as a counter input. An active high digital input is another user selectable input.

The module can be connected to several CAN devices as well as communicate with a Human Machine Interface (HMI). The sophisticated DSP microprocessor can accommodate complex control algorithms for advanced machine control applications. Standard embedded software is provided. Settings are user configurable via a *Windows*-based Electronic Assistant® configuration tool interfacing to the controller via an USB-CAN device.

Rugged IP67 rated packaging in addition to a wide-ranging power supply input section for 12V or 24Vdc power suits applications in the harsh environment of mobile equipment with on-board battery power.

Ordering Part Numbers:

Contact Axiomatic for a quotation to provide application-specific control logic or setpoints.

| SAE J1939 version	CANopen® version
Controller: **AX030100** Accessories: **PL-DTM06-12SA-12SB** Mating Plug Kit (The KIT is comprised of: DTM06-12S, DTM06-12SB, 2 W12S and 24 contacts. The Axiomatic stock # is FG-IOCTRL-19.)	Controller: **AX030101** EDS File: **EDS-AX030101**
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** AX070500 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.**	PC-based Configuration Tool: *Industry standard CANopen PC-based software*

BLOCK DIAGRAM
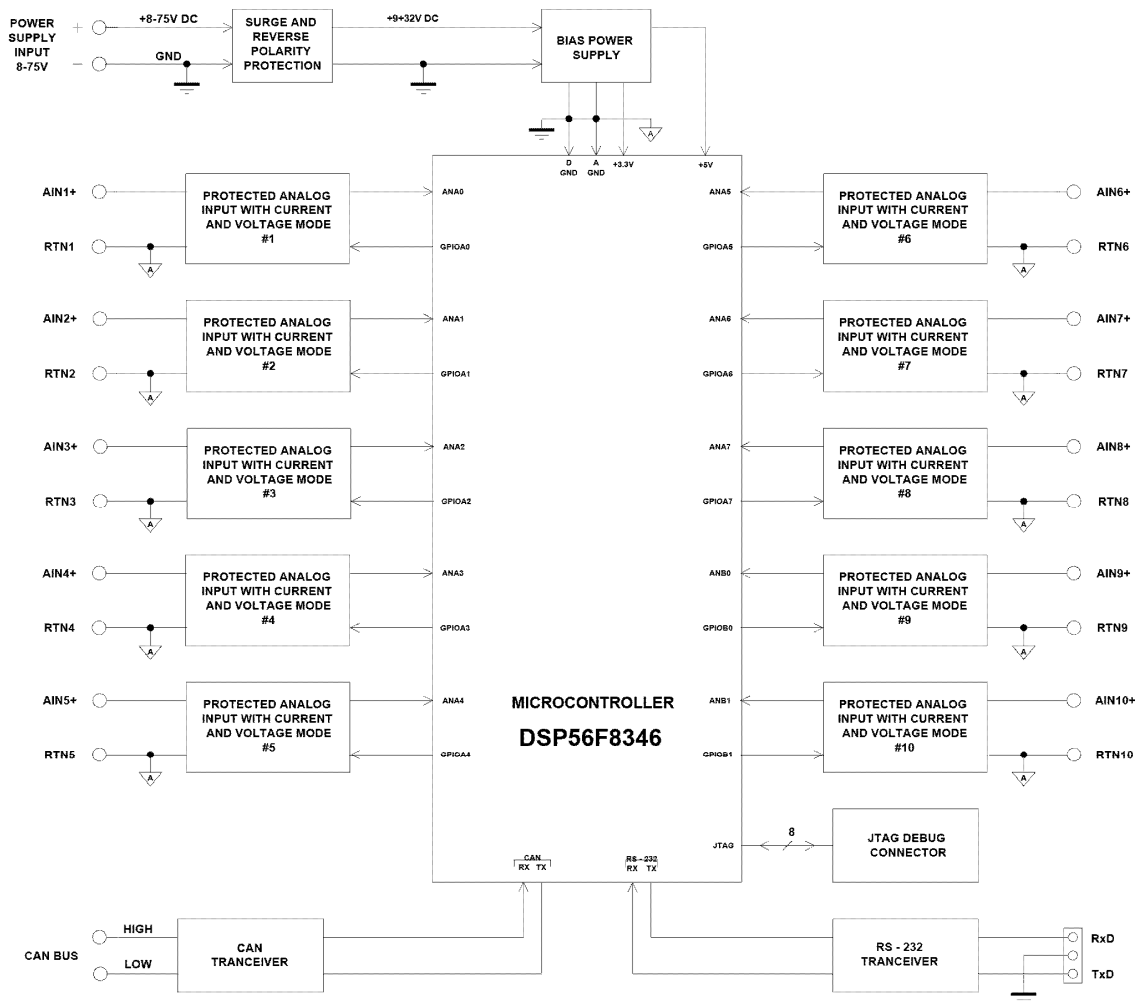
Set up of SAE J1939 Controller on a CAN Network:
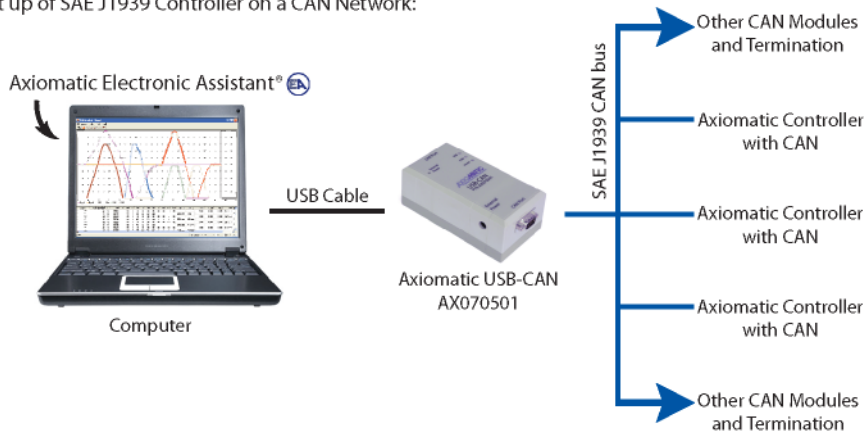
Technical Specifications:
Power Input Specifications

Power Supply Input - Nominal	12 or 24Vdc nominal operating voltage 8…75 Vdc power supply range for voltage transients
Surge Protection	Provided
Reverse Polarity Protection	Provided

Minimum and Maximum Operational Voltage and Current Intake

	Voltage Input [V]	Approximate Current Intake [mA]
Minimum	8	295
	12	144
	24	63
	48	31
Maximum	75	22

Signal Input Specifications

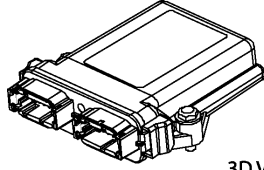|	
Inputs	10 user selectable inputs - Analog 12-bit (0-5V, 0-20mA) (4-20mA is user configurable from the 0-20 mA selection) - PWM 12-bit - Frequency - Counter input 16-bit - Digital (active high) [ON when input $\geq$ 1.5V] Broken wire detection is provided. With current inputs, short circuit protection is provided.
Analog GND	10 Analog GND connections are provided.
Short Circuit Protection To Ground and Battery +	Provided
Accuracy	See Input Accuracy section.

Absolute Maximum and Minimum Ratings

Characteristic	Min	Max	Units	Comments
Power Supply	8	75	V dc	
Voltage Input	0	12	V dc	
Current Input	0	21	mA	
PWM Duty Cycle	0	100	%	
PWM Frequency	50	10 000	Hz	
PWM Voltage pk - pk	0	12	V dc	
RPM Frequency	50	10 000	Hz	

Input Accuracy

Input Type	Accuracy	Comments
Voltage	+/- 7 mV (Minimum measurable input = 25 mV)	@ 0.001 V/ bit
Current	+/- 100 uA = +/- 0.1mA	@ 0.1 mA/bit
	+/- 70 uA = +/- 0.07 mA	@ 0.01 mA/bit
PWM	+/- 0.2 %	Freq <= 1 Khz
	+/- 1.0 %	Freq <= 7.5 Khz
	+/- 2.0 %	Freq <= 10 Khz
	+/- 2.0 %	When all inputs set are as PWM
RPM	+/- 0.3 %	

General Specifications
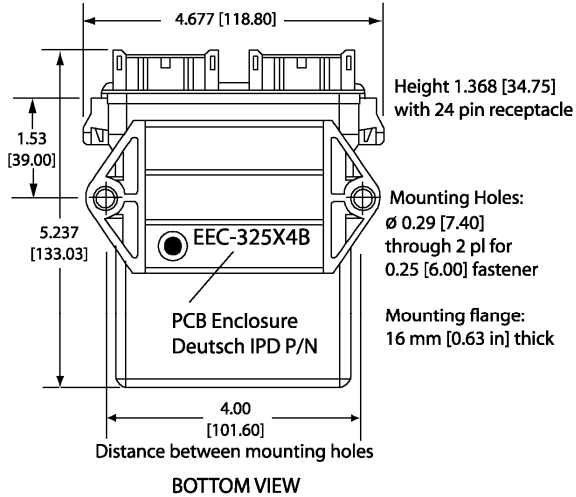
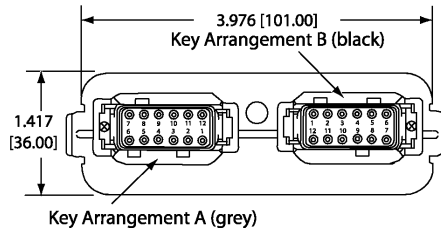|	
Microprocessor	DSP56F8346
Communications	1 CAN port (2.0B, SAE J1939) A CANopen® model, AX030101 is available. An on-board RS-232 port is used for factory programming only.
User Interface	User configuration and diagnostics are provided with the Axiomatic Electronic Assistant®. The Axiomatic Service Tool is a *Windows*-based graphical user interface that allows easy configuration of the controller setpoints.
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.
Control Logic	Refer to Control Logic (below) and the User Manual UMAX030100. For application-specific control logic, contact Axiomatic.
Update Time	All inputs, except for frequency and counter inputs, are sampled every 10ms. Frequency and counter inputs are measured based on the value in the 'Measuring Window' setpoint.
Electrical Connections	Deutsch DTM series 24 pin receptacle (DTM13-12PA-12PB-R008) Mating plug: Deutsch DTM06-12SA and DTM06-12SB with 2 wedgelocks (WM12S) and 24 contacts (0462-201-20141). 20 AWG wire is recommended for use with contacts 0462-201-20141. **Use dielectric grease on the pins when installing the controller.**
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)
Operating Conditions	-40 to 85°C (-40 to 185°F)
Weight	0.55 lbs. (0.25 kg)
Protection	IP67, Unit is conformal coated in the housing.
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).

HOUSING DIMENSIONS

Housing Material: High Temperature Nylon (Black)

3D VIEW
Housing with 24 Pin Receptacle

4.677 [118.80]

Height 1.368 [34.75]
with 24 pin receptacle

1.53 [39.00]

5.237 [133.03]

EEC-325X4B

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

PCB Enclosure
Deutsch IPD P/N

Mounting flange:
16 mm [0.63 in] thick

4.00 [101.60]
Distance between mounting holes

BOTTOM VIEW

FRONT VIEW 24-PIN RECEPTACLE (NOT TO SCALE)

3.976 [101.00]
Key Arrangement B (black)

1.417 [36.00]

Key Arrangement A (grey)
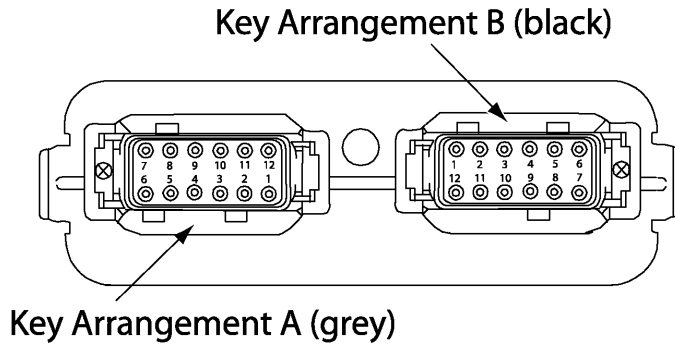
Mating Plug Assemblies for 24-pin receptacle:
Deutsch IPD P/N: DTM06-12SA and DTM06-12SB
with wedgelocks WM12S and contacts
(Contact factory for contact specification.)

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

Typical Connections:

Key Arrangement B (black)

Key Arrangement A (grey)

FRONT VIEW 24 PIN RECEPTACLE

Grey Connector		Black Connector	
Pin #	Function	Pin #	Function
1	Analog GND 5	1	Input 6
2	Analog GND 4	2	Input 7
3	Analog GND 3	3	Input 8
4	Analog GND 2	4	Input 9
5	Analog GND 1	5	Input 10
6	Batt -	6	CAN_H
7	Batt +	7	CAN_L
8	Input 1	8	Analog GND 10
9	Input 2	9	Analog GND 9
10	Input 3	10	Analog GND 8
11	Input 4	11	Analog GND 7
12	Input 5	12	Analog GND 6

Control Logic: Each input can be configured for any one of the following options, and the properties and behavior of the input in each mode is described below. There are five setpoints per channel that are associated with the input and how the data is measured.

INPUT	DESCRIPTION
Input Disabled:	The input is not used, and no CAN messages associated with this channel will be sent to the network.
0 to 5 Volt:	The input is configured to accept a voltage input in the range of 0 to 5V. Signals above 5V will be rectified to 5V. The controller will interpret the offset in volts and the resolution setpoint as V/bit when sending the message. Error detection setpoints will be interpreted in volts.
0(4) to 20 Milliamp:	The input is configured to accept a current input in the range of 0 to 20 mA. Signals above 20mA will be rectified to 20mA. The controller will interpret the offset in milliamps and the resolution setpoint as mA/bit when sending the message. Error detection setpoints will be interpreted in milliamps.
PWM Duty Cycle:	The input is configured to measure the duty cycle of a pulse width modulated (PWM) signal in the range of 0 to 100%dc. The controller will interpret the offset in percent duty cycle (%dc) and the resolution setpoint as %dc/bit when sending the message. Error detection setpoints will be interpreted in %dc.
Frequency/RPM:	The input is configured to count the number of pulses that occur over the period of the Measuring Window setpoint, and calculate the frequency of the pulses. If the Pulse per Revolution setpoint is zero, the controller will interpret the offset in hertz and the resolution setpoint as Hz/bit when sending the message. Error detection setpoints will be interpreted in hertz. If the Pulse per Revolution setpoint is non-zero, the controller will interpret the offset in rotations per minute (RPM) and the resolution setpoint as RPM/bit, when sending the message. Error detection setpoints will be interpreted in RPM.
16-bit Counter:	The input is configured to count pulse on the input until the value in the Measuring Window setpoint is reached, at which point a message is sent to the network, and the counter is reset to zero. The controller will interpret the offset in pulses and the resolution setpoint as pulses/bit when sending the message. Error detection setpoints are not used, since error detection is not possible in this mode.
Digital (High):	The input is configured to read the state of an active high digital input. (Switch is connected to a +V signal when ON.) The controller will interpret the offset as a state (OFF=0 or ON=1) and the resolution setpoint as state/bit, when sending the message. Error detection setpoints are not used, since error detection is not possible in this mode.

The software was designed to provide flexibility to the user with respect to messages sent from the module (ECU) over the CAN bus, by providing:

- Configurable ECU Instance in the NAME (to allow multiple ECU's on the same network)
- Configurable Input Parameters
- Configurable PGN and Data Parameters
- Configurable Diagnostic Messaging Parameters, as required
- Diagnostic Log, maintained in non-volatile memory

There are nine setpoints per channel that are associated with the J1939 message that is sent to the network bus.

The Axiomatic 10 Analog Input Module, AX030100, is compliant with Bosch CAN protocol specification, Rev.2.0, Part B, and the following J1939 standards.

OSI Network Model Layer	J1939 Standard
Physical	J1939/11 – Physical Layer, 250K bit/s, Twisted Shielded Pair. J1939/15 - Reduced Physical Layer, 250K bits/sec, Un-Shielded Twisted Pair (UTP).
Data Link	J1939/21 – Data Link Layer
	The module supports Transport Protocol for Diagnostic DM1 and DM2 messages (PGN 65226 and 65227). It supports responses on PGN Requests (PGN 59904) and acknowledgements (PGN 59392). It also supports Proprietary B messaging (PGN 65280 to 65535), and uses a proprietary scheme.
Network Layer	J1939/81 – Network Management J1939, Appendix B – Address and Identity Assignments
	The module is an Arbitrary Address Capable ECU. It can dynamically change its network address in real time. The module supports: Address Claimed Messages (PGN 60928), Requests for Address Claimed Messages (PGN 59904) and Commanded Address Messages (PGN 65240).

Application Layer	J1939/71 – Vehicle Application Layer
	None of the application layer PGN's are supported as part of the default configurations. However, the module could be configured such that any of the input messages to be sent will use a PGN from this section. The data size, index, resolution and offset can all be configured for the appropriate SPN associated with the PGN. *It is the user's responsibility to configure the module such that it will not violate the J1939 standard.*
	J1939/73 – Application Layer – Diagnostics
	The module can be configured to send "Active Diagnostic Trouble Code" DM1 messages (PGN 65226) for any input. Warning and Protect diagnostics will automatically become previously active when cleared. "Previously Active Diagnostic Trouble Codes" DM2 messages (PGN 65227) are available on request. Shutdown diagnostics will be cleared upon receiving a "Diagnostic Data Clear/Reset for Active DTCs" DM11 message (PGN 65235). Occurrence counts in the diagnostic log will be cleared upon receiving a "Diagnostic Data Clear/Reset for Previously Active DTCs" DM3 message (PGN 65228).

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.

Form: TDAX030100-04/01/13